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Although science is widely accepted as a fundamental source of information underlying decisions about forest management and conservation, considerably less attention has been paid to the inevitable role that normative values and beliefs play in such decisions. This thesis highlights the normative dimensions of "ecological forestry," a strategy of forest management that uses silviculture to mimic the effects of non-anthropogenic processes of disturbance and succession in order to meet multiple objectives on a single piece of land. Although its scientific foundations and silvicultural applications are relatively well developed in the literature, a conceptual analysis of ecological forestry reveals that it fails to coalesce into a discrete philosophy of forest management due to persistent metaphysical, normative, and ethical ambiguities, which allow for problematic philosophical and practical inconsistencies. Even once it has been tailored to a specific context, e.g. current proposals to use ecological forestry to manage the O&C lands in western Oregon, without clear answers to normative and ultimately ethical questions about objectives, values, and beliefs, ecological forestry might still be applied in variable and potentially incommensurable ways. An analysis of the arguments made about ecological forestry, both broadly theoretical and pertaining specifically to western Oregon, shows that empirical uncertainties and normative gaps need to be

addressed before we can make a clear, well-reasoned decision about whether ecological forestry is a viable and appropriate strategy for forest management and conservation.

Ecological Forestry: A Critical Analysis

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Chelsea Batavia, Author

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INTRODUCTION

What is the future of forest management? Humans have managed forests for centuries, with objectives ranging from a steady supply of game to a clean supply of drinking water (Sands, 2005). However, only in the late 20th and early 21st centuries have concerns for the long-term sustainability and conservation of forests become prevalent (Puettmann, Coates, & Messier, 2009). The pressures of a growing human population, coupled with uncertainties about a changing global climate, lend urgency to questions about how forests should be managed now and into the future, whether for resilience (e.g. Benson & Garmestani, 2011), adaptability (e.g. Bolte et al.), some amalgamation of the two (e.g. Stephens, Millar, & Collins, 2010) or something else entirely. In this complex and dynamic context, the decisions we make about forest management need to reflect not only the most current scientific information, but also an appropriate ethical view of forests and how humans ought to interact with them. And yet, although natural resource management is inherently linked to ethics (Cornett & Thomas, 1996; Murie, 1954; Nelson & Vucetich, 2012a), the ethical dimensions of forest management rarely seem to receive the same care and attention as its ecological, social, economic, or political dimensions (Dietz, 2003). In this thesis I will highlight some of the implications of this inattention, and also emphasize the absolute criticality of its remediation.

"Ecological forestry" has been proposed as a philosophy of forest management and conservation suited to the demands of the 21st century. As a form of disturbance-based management, ecological forestry is quite explicitly informed by scientific knowledge. However, underlying ecological forestry are also normative ideas about how forests ought to be, and how humans ought to be managing them. These normative ideas in turn reflect deeper ethical and metaphysical beliefs. Although they are critical both for understanding what ecological forestry entails and deciding whether it should be put into practice, the normative underpinnings of ecological forestry are rarely if ever overtly discussed in the literature. Therefore, the objective of this thesis is to begin bringing the normative dimensions of ecological forestry to light. Chapter One is comprised of a conceptual analysis and critique of ecological forestry, based on an extensive review and synthesis of literature on the topic. In this first chapter, after explaining the theoretical and applied principles of ecological forestry, I will discuss its metaphysical, normative, and ethical ambiguities, arguing that they undermine its consistency and practical value as a philosophy of forest management. Echoing these same themes, in the second chapter I will systematically analyze arguments being made for and against ecological forestry, highlighting both empirical gaps and normative ambiguities that weaken and obscure the arguments. While the analysis in Chapter Two is most immediately relevant to the current discourse surrounding ecological forestry, particularly in the Pacific Northwest, my larger purpose is to demonstrate the value of argument analysis as a tool of transparency that can reveal hidden assumptions, beliefs, and uncertainties, facilitating communication and contributing to open and informed decision-making processes.

By focusing on the example of ecological forestry, I will hopefully demonstrate that, while science is undeniably integral to forest management and conservation, ethics are far from tangential, and deserve far more attention than they currently receive. As we move forward, dealing with socio-ecological systems of a complexity that we are only beginning to fully appreciate (Funtowicz, Martinez-Alier, Munda, & Ravetz, 1999), ethics needs to be seen as an endogenous variable that shapes how humans perceive problems, form opinions, and ultimately make decisions about how they will interact with the world and all of its constituent parts (Dietz, Fitzgerald, & Shwom, 2005). Whether we want to understand, change, or even possibly improve the nature of those interactions, ethics are a critical, if critically neglected, force shaping the future of forests.

CHAPTER ONE: WHAT IS ECOLOGICAL FORESTRY?

Introduction

A 1942 article published in the *Journal of Forestry,* entitled "Ecological Forestry in Central New England," suggested that managing forests on short rotations of early-successional species was an untenable model of forestry (Spurr & Cline, 1942). The authors described a "threefold evil" resulting from such practices, including site degradation, recruitment of inferior species of trees, and vulnerability to extreme weather and insect damage. They proposed that forest management would be improved by, "correlate[ing] our forest practices with the natural factors operative in the forest" (Spurr & Cline, 1942, p. 418). Although Spurr and Cline may not have been the first to suggest that the dominant methods of forestry were problematic, or that forestry practices should be better aligned with natural forest processes, they were the first authors to suggest these ideas under what has now become a common label: "ecological forestry."

Forestry has a long history, and ecological forestry is but one of many forms of alternative silviculture (Perevolotsky & Sheffer, 2009; Pommerening & Murphy, 2004; Puettmann et al., 2009). However, these alternatives have not been as widely adopted as clearcutting, part of the so-called efficiency model of forestry, characterized by even-aged stands of trees managed for maximum growth potential and harvested on short rotations (Puettmann et al., 2009). Because of its utility to industrial forestry operations, the efficiency model prevailed throughout most of the 20th century (Puettmann et al., 2009). Interest in alternative methods of forest management increased in the late 20th century, with growing concerns about biodiversity loss and ecosystem degradation leading to a broad push for ecological sustainability (e.g., Aber et al., 2000; Pommerening & Murphy, 2004; Puettmann et al., 2009; Spence, 2001; Swanson & Franklin, 1992). Ecological forestry is situated squarely in this context, in which it could be described quite simply as a tool of sustainable forest management and conservation.

However, such a generic description of ecological forestry is overly simplified, and even somewhat misleading. Embedded in ecological forestry are normative concepts that do not have any single or broadly agreed upon meaning, and can refer to a range of ideas. Although different interpretations of these normative concepts could lead to different, and potentially conflicting, understandings and implementations of ecological forestry, it seems that some may have become so ubiquitous as to pass largely without critical examination, at least in the ecological forestry literature. For example, as noted above, ecological forestry is sometimes framed as a strategy for sustainability (Johnson & Franklin, 2009; Lindenmayer et al., 2012; Stoneman, 2007) or conservation (Gustafsson et al., 2012; Johnson & Franklin, 2009). Without a concomitant inquiry into what quantity and quality of life, human or non-human, should be sustained or conserved for a particular period of time, these words do not themselves clarify the purpose or intent that ecological forestry stands to serve. Similarly, components of ecological forestry are sometimes framed as a strategy for climate change adaptation (Spies et al., 2010) or resilience (Franklin & Johnson, 2012; Johnson & Franklin, 2009), concepts that are both open to a wide range of interpretations (Bolte et al., 2009; Brand & Jax, 2007; Meyers & Bull, 2002) and could convey conflicting ideas about how forests would be managed under an ecological forestry approach. For example, a resilient forest may be considered one that maintains species valued by and desirable to society, even though they may not be adapted to a future warmer climate. When the concepts of adaptation and resilience seem to point in different directions, how could ecological forestry manage for both? Alternatively, a resilient forest might be considered one that is able to adapt without losing certain key functions and processes. In this case, resilience and adaptation appear to be mutually compatible, and may in fact both be achieved by ecological forestry. Although ambiguous normative concepts are undeniably challenging, and often beyond the scope or, understandably, agenda of any given paper, the overall dearth of scholarship addressing these more philosophical dimensions of ecological forestry becomes problematic when the time comes to take specific management actions.

The objective of this first chapter of my thesis is to answer the question, what is ecological forestry? Ecological forestry has been given many labels. At times it is described as an "approach" (Franklin et al., 2007; North & Keeton, 2008; Palik et al., 2002), or as "concepts" (Franklin & Johnson, 2012; *Challenges and Opportunities*, 2013b). It has been called a form of "active management," (Corace, Goebel, Hix, Casselman, & Seefelt, 2009), and it has also been called a "philosophical basis" (Franklin & Johnson, 2013), or a "philosophy," for forest management (*S.1784: The O&C Land Grant Act*, 2014). Often, however, it is not given a broad label (Franklin & Johnson, 2013; Johnson & Franklin, 2009; Johnson & Franklin, 2013; Seymour & Hunter, 1999; Stoneman, 2007), which allows readers to classify it and interpret its role as they will. Paraphrasing and synthesizing an extensive review on the literature about ecological forestry, I offer the following definition: ecological forestry is a strategy for forest management, which attempts to model anthropogenic activities in forests on historic non-anthropogenic patterns of succession and disturbance in order to meet multiple social and ecological objectives. The same ideas are proposed under a variety of other labels (see Table 1.1).[1] Although each may convey slightly different nuances, the core concepts, as well as the ambiguities, of all of these practices are similar, and they are cited interchangeably in support of one another in the literature. [2]

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[1] Although there has been a development from new forestry to ecological forestry, which I will discuss below, authors of some more recent publications continue to use the phrase "new forestry" to

[2] Throughout this chapter and the next, I will refer to "the ecological forestry literature." By this phrase I mean to indicate 1) literature specifically about (and labeled as) "ecological forestry;" 2) literature about ideas and practices that fall under the labels displayed in Table 1.1; and 3) literature used to support all of these practices. Although some may take exception to my decision to use the phrase "ecological forestry literature" so loosely, I would argue, on the basis of my review, that new forestry, retention forestry, and many forms of disturbance-based management (particularly the ones using silviculture to mimic natural disturbance) are quite accurately considered forms of "ecological forestry."

In this chapter I will argue that without an established normative, and ultimately ethical, framework, the ideas encompassed in the phrase "ecological forestry," as defined above, are not united by a vision of how forests ought to be managed, and so fail to coalesce into a consistent, clearly-defined strategy for forest management. I will first briefly outline the historical context in which ecological forestry has emerged, describing the methods and associated worldview of traditional forestry, and tracing the development of alternative approaches. I will then turn my attention to ecological forestry in earnest, showing that, while its foundations in forestry and forest ecology are relatively well established, it has no clearly defined and consistent normative foundation. I will argue that failing to clarify critical metaphysical, normative, and ethical ambiguities allows a wide range of dramatically different management practices to be accurately called "ecological forestry," even though they may be practically inconsistent with and even ideologically opposed to one another. Throughout the chapter I will demonstrate how the amount of variation permitted under the umbrella of "ecological forestry" limits the usefulness of the term to describe a clear and distinct management strategy. I will conclude by arguing that a clear ethical framework would allow ecological forestry to serve as a flexible yet cohesive philosophy of forest management and conservation, and one representing a true departure from the traditional forestry paradigm. Throughout the chapter I will rely on the applied example of ecological forestry in western Oregon, to demonstrate how management actions proposed for implementation are obscured and undermined by normative and ethical ambiguities.

Methods

The ideas I advance throughout this chapter were developed in a process best described as a conceptual analysis of ecological forestry. Concept analysis is defined by Machado and Silva (2007) as, "the actions researchers engage in when they evaluate the language of their science" (p. 671). A key tool of disciplinary self-reflection, concept analysis is used to define, examine, and critically assess concepts such as ecological forestry, which may be widely adopted even though their meaning is not broadly agreed upon or understood (Machado & Silva, 2007; Sandin, 2006). For this chapter I reviewed over one hundred scientific publications, governmental and non-governmental reports, and books or book chapters related to the topics of new and ecological forestry, disturbance-based management, and retention forestry, along with an extensive body of related and supporting literature in the fields of forestry, ecology, natural resource policy, and social psychology, among others. Based on this review, I synthesized the literature to offer a clear definition of ecological forestry, first and foremost, and then to critique the concept based on ambiguities and inconsistencies that emerged from my research.

Background and Context

Forestry and Forest Ecology

Humans have a complex relationship with many parts of the natural world, and forests are no exception. Forests cover 30% of the terrestrial globe (Gustafsson et al., 2012). They are repositories of much of the world's biodiversity that not only support life, human and non-human alike, but also occupy rich symbolic space in human cultures (Blicharska & Mikusinski, 2013). The pilgrim Dante embarked upon his journey of self-realization through Hell, Purgatory, and Paradise "per una selva oscura," in the midst of a dark wood (Dante, 1317/2000). Western theology tells us that Adam and Eve fell into sin and suffering by consuming forbidden fruits of the Tree of Knowledge, while Eastern theology tells us that Siddhartha Gautama came to bliss and enlightenment in the shade of the Bodhi tree. In modern times forests are still important spiritual sites, to the extent that the Oxford Biodiversity Institute and the Alliance of Religion and Conservation have identified "religious forests," as loci of conservation (Massey, Bhagwat, & Willis, n.d.). At once life-giving, life-sustaining, and life-enriching, forests have historically been simultaneously sanctified and exploited by human populations (Cronon, 1996; Merchant, 2003).

The history of forests in Western civilization has been extensively recounted elsewhere (e.g., Curtis et al., 2007; Puettmann et al., 2009; Sands, 2005), and so needs only minimal recitation here. In the early ages of Western history, the forests of Europe were prized primarily for their game species, and set aside as preserves for the sport of the upper classes (Sands, 2005). As time passed, trees became an important source of fuel for growing populations, as well as lumber for a ship-building industry being spurred by the explosive expansion of trade and colonization in the middle of the first millennium C.E. (Curtis et al., 2007). With the dawn of the Industrial Revolution, new sources of energy and building material actually eased some of the demands on timber resources in Europe (Sands, 2005). However, forestry did not escape the modern industrial push for efficient and maximized production, with an increase in silvicultural research building toward the development of a streamlined model of forest management (Curtis et al., 2007; Puettmann et al., 2009). This is the model that was eventually transplanted across the sea to North America (Puettmann et al., 2009).

In the New World, large tracts of land were originally cleared for development and agriculture, eradicating many of the pre-settlement forests in favor of pastures and grasslands (Curtis et al., 2007). Forests were considered wild, defiant, messy, and dangerous, lands best tamed and otherwise wasted (Cronon, 1996; Merchant, 2003). This ideology took hold and spread westward with the aid of policies such as the Homestead Act of 1862, which encouraged the rapid cultivation of lands west of the Mississippi, ultimately leading the burgeoning population of the United States to the end of the frontier at the Pacific Coast (Curtis et al., 2007). It is there, in the Pacific Northwest, that forestry became famous and infamous, not only as an epicenter of the North American forest industry and a hub for forestry research (Curtis et al., 2007), but also for the social controversy that would erupt over a century later (Davis, 2001; Hays, 2007).

The forests of the Pacific Northwest were logged without restraint in the early years of westward expansion, in a process known as “liquidation” that harvested trees as quickly as possible in order to satisfy the growing society’s insatiable demand for timber (Curtis et al., 2007). However, passage of the National Forest Management Act in 1897 identified a “continuous supply of timber” as a primary objective of forests reserved under the Forest Reserve Act of 1891, establishing the need to replenish the nation’s forests by moving from a strategy of plunder and pillage to one of controlled cultivation (Curtis et al., 2007; Hays, 2007). The 20th century therefore saw a rapid increase in North American silvicultural research, particularly in the Pacific Northwest, with experimentation beginning on a series of long-term research sites, including the Wind River Experiment Station in 1913, the Pacific Northwest Forest and Range Experiment Station (now the PNW Research Station) in 1924, and the H.J. Andrews Experimental Forest in 1948 (Curtis et al., 2007). Research through universities accompanied work sponsored by federal agencies to push forestry further in the direction of efficiency, with revolutionary findings that allowed foresters to streamline regeneration and increase tree growth using thinning, fertilization, pesticides, and genetic manipulation, as well as innovations in harvesting equipment (Curtis et al., 2007).

Overwhelmingly, forestry in the Pacific Northwest was gravitating toward the management of an ideal type of forest. This model entailed “stands” of trees, defined as “homogeneous vegetation unit[s]” (Puettmann et al., 2009, p. 18), which were characterized by uniformity and efficient growth (Seymour, Guldin, Marshall, & Palik, 2006). Stands were generally planted in a single age cohort of tree species prized for their wood quality (Puettmann et al., 2009). Following a clearcut, in which all trees in the stand were felled and removed, most remaining detritus would be gathered and cleared, generally by burning it in slash piles (Swanson & Franklin, 1992). The stand might have been chemically or mechanically treated to optimize soil conditions for cultivating young tree growth, and also to eliminate any remnant vegetation that might have competed with the newly establishing crop (Curtis et al., 2007). A high density of trees would then be planted, with competing vegetation controlled by herbicide application (Maguire & Chambers, 2005). The stand may have been thinned before the trees were large enough to be sold (i.e. a precommercial thin) in order to reduce competition for resources and promote the vitality of the rest of the trees (Landsberg Waring, 2014). At a later time there could also be a commercial thin, in which select trees of merchantable size would be harvested and sold, again to encourage growth in the rest of the stand (Landsberg & Waring, 2014). When the stand reached the point of mean annual increment (i.e. the point in time when trees' growth rates cease to accelerate), the remaining trees would be cut and the process repeated, generally after 60 to 80 years in short rotation forestry in the Pacific Northwest (Busing & Garman, 2002), although in some forests rotations can be as short as seven years (Landsberg & Waring, 2014). Regardless of the precise rotation length, stands were harvested well before the onset of senescence and the development of complex forest structure (Franklin et al., 2007).[3]

As forestry assumed an increasingly regimented form, often called the "command and control" or "agricultural model" of forestry, the science of ecology was simultaneously undergoing its own conceptual revolutions (Puettmann et al., 2009). The word "ecosystem," coined in 1935 by Alfred George Tansley, came to convey an understanding of the integrated components of biotic and abiotic factors functioning in concert to constitute the living systems of the earth (Golley, 1993). Aldo Leopold, one of the pioneers and visionaries of modern conservation, wrote eloquently of the various parts of the land that come together like so many cogs and wheels in an intricately crafted piece of machinery, a poetic expression of the growing scientific understanding of complexity in the natural world (Leopold, 1949/1966). Forest ecology in particular emerged as a distinctive field, with growing awareness that, contrary to the view embraced by traditional forestry,

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[3] Throughout this chapter, I will refer to forestry practices of the sort described here as "traditional" or "intensive" forestry, or the "traditional management paradigm."

forests contain a far greater range of life forms than trees, and perform many more processes and functions than tree growth (Puettmann et al., 2009). The ecosystem concept entered the policy scene in the 1980s after F.C. Craighead (1979) asserted the importance of managing across jurisdictional boundaries, largely on the basis of his work studying the range of the grizzly bear in the American West (Clark & Zaunbrecher, 1987). The prevailing agricultural model of forest management, with its understanding of a forest as a simplified crop of trees, would soon be challenged when the concept of forests as ecosystems, constituted by and dependent upon the interactions of all their related parts, was appropriated into a new push for "ecosystem management" (discussed below).

The two branches of silviculture and traditional forestry, on the one hand, and forest ecology, on the other, largely developed along separate but mutually compatible trajectories until the latter part of the 20th century. While the circumstances behind their eventual collision are complex and multifaceted (Bengston, 1994), they were certainly rooted at least in part in a broader social impetus for change. The post-World War II era saw a rise in recreation, as the booming middle class reveled in the then alive and well American dream, which included ample leisure time and expendable income to allot to it (Hays, 2007). As Americans spent more time recreating in forests, they began to disdain the unsightly spectacle of seemingly war-ravaged clearcuts, spaced throughout the otherwise picturesque forest landscapes of the West in a system known as "staggered setting" (Curtis et al., 2007). In this system, originally developed to ensure that cutover areas would be close enough to seed sources to naturally regenerate, harvests were dispersed in approximately 15-hectare units, punctuated by strips or blocks of uncut forest (Halpern & Spies, 1995). Not only was the effect unattractive, but it also fragmented the landscape, disrupting ecosystem processes and cycles and putting countless species dependent upon interior forest conditions at risk of habitat loss (Aber et al., 2000; Baker et al., 2013; Bender, Contreras, & Fahrig, 1998).

Although watershed protection was established as one of the main agendas of the National Forest Service at its inception, the agency's primary objective throughout most of the 20th century was timber (Hays, 2007). The Multiple Use-Sustained Yield Act of 1960 *de jure* identified recreation, water, wildlife, grazing, and wood production as objectives of the National Forests, but *de facto* the act oriented the agency first and foremost toward timber production (Hays, 2007; Seymour & Hunter, 1999; Winkel, 2014). However, the Forest Service found itself increasingly misaligned with public values in the final decades of the 20th century. The 1970s saw the rise of the environmental movement, as new concerns about air and water safety catalyzed broad social awareness about the impacts of development and industry on the environment (Dunlap & Mertig, 1992). With the passage of the 1976 National Forest Management Act, the Forest Service was forced to contend with growing public interest in and concern for the overall state of the environment through a new obligatory process of stakeholder input into forest management plans (Hays, 2007). Silviculture and forest ecology therefore became more integrated with one another, as forest management came to be seen (and studied) not just as a method for extracting a resource, but also as a variable affecting forest ecosystems' functions and processes (e.g. Spies et al., 2007).

Ecosystem Management and New Forestry

A new type of forest management, incorporating aspects of the latest advanced knowledge of forest ecology and fueled by public support for the non-timber values of forests, crystallized in the early 1990s in the form of ecosystem management. Grumbine (1994) defines ecosystem management as a system that "integrates scientific knowledge of ecological relationships within a certain complex sociopolitical and value framework toward the general goal of protecting native ecosystem integrity over the long term" (p. 31). In contrast to traditional systems of management that sought to create simplified, uniform stands of trees, under ecosystem management, forests were supposed to be managed as complex and multifaceted systems embedded in larger interconnected socio-ecological landscapes (Grumbine, 1994). The U.S. Forest Service officially adopted this new model of management in 1992 (Bengston, Xu, & Fan, 2001), and the 1990s witnessed a dramatic shift in the mission of the agency (Hays, 2007). Management of the National Forests, historically focused primarily on timber production, now also tried to account for all the interacting parts of forest ecosystems, including their soils, waters, and biodiversity (Aber et al., 2000; Hays, 2007).

This brief and rather simplified description does not do justice to the complex topic of ecosystem management, which has generated wide discussion (see, for example, Christensen et al., 1996; Johnson, Malk, Szaro, & Sexton, 1999; Mori, Spies, Sudmeier-Rieux, & Andrade, 2013; Simberloff, 1999; Swanson & Franklin, 1992). A full examination of ecosystem management is beyond the scope of this project, and for the purposes of this chapter it will suffice to highlight just one of its goals: preserving "ecological integrity" (Grumbine, 1994). Increasingly there was agreement that traditional intensive forestry practices were antithetical to the agenda of preserving ecological integrity (Aber et al., 2000; Hays, 2007), and that in order to maintain ecological integrity without entirely precluding the possibility of any and all timber harvest, a new type of forestry needed to be found. One particular solution arrived in the form of new forestry.

The phrase "new forestry" was effectively coined by ecologist Jerry Franklin in 1989 (Franklin, 1989a, 1989b). [4] New forestry called for the retention of structural and compositional elements of harvested stands, in order to perpetuate the complex conditions that sustain biodiversity and maintain functioning ecosystems (Franklin 1989a, 1989b; Franklin et al., 2000; Franklin & MacMahon, 2000). This supposedly "kindler, gentler forestry" (Franklin, 1989a, p. 549) stimulated considerable conversation in the forestry world, with numerous publications discussing the merits, deficiencies, applications, and implications of

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[4] However, the first appearance of the phrase "new forestry" is actually dated to early 19th century Europe (Simpson, 1900, as cited in Spies, Tappeiner, Pojar, & Coates, 1991).

new forestry (see, for example, DeBell & Curtis, 1993; Gillis, 1990; Hansen, Spies, Swanson, & Ohmann, 1991; McQuillan, 1993; O'Keefe, 1990; Wood, 1990). As such, it is interesting to note that there was nothing particularly "new" about the silvicultural practices underlying new (and, ultimately, ecological) forestry. Silviculture has always been theoretically based on an understanding of disturbance and forest succession (Franklin et al., 2007; Seymour & Hunter, 1999), and even clearcuts were at one time considered the silvicultural analogues to natural stand-replacing disturbances, such as catastrophic wildfires (Franklin, 1993; Franklin & MacMahon, 2000; Swanson & Franklin, 1992). Other forms of silvicultural "alternatives" to clearcutting have been practiced for over a century all over the world, entailing the selective harvest and strategic retention of various elements of the forest stand, much like new forestry (O'Hara, 2002; Pommerening & Murphy, 2004; Puettmann et al., 2009). And yet, based on the degree of interest that it generated in the academic community, new forestry was clearly perceived as more than merely the latest variation on existing silvicultural systems.

To a certain extent the buzz about new forestry can be understood as the cultivation of a forestry zeitgeist in the storm of public turmoil raging around Pacific Northwest forestry in the early 1990s (Hays, 2007). Foresters have been using jargon within the profession for decades (Hays, 2007; O'Keefe, 1990; Shindler & Mallon, 2009), and arguably jargon is an integral tool of forest management, capturing the attention an swaying the affections of stakeholders, who have become so central to natural resource decision-making in the context of ecosystem management (Christensen et al., 1996). However, even though "new forestry" indubitably represents such a feat of catchy rhetoric, designed to spark the public imagination, there was also a degree of genuine novelty that seemed to distinguish it, not on the basis of the practices it entailed and the methods it employed, but in its basic assumptions about forests and how they should be managed. New forestry was premised on an understanding of forests as complex ecosystems, with an ostensible attentiveness to ecosystem health and biodiversity that had not been widely seen in forest management prior to the late 20th century (Franklin & Swanson, 2010; Puettmann et al., 2009). Because it seemed to embrace a different perspective on forests as dynamic living systems, rather than mines of extractable resources for human use (Franklin, 1989b), the shift represented by new forestry appeared to be not one of practice, but one of values.

Despite the rhetoric suggesting a veritable transformation of forestry's metaphysical and ethical foundations, it is not altogether clear how dramatic of a shift has actually occurred, even as new forestry has morphed into ecological forestry over the past twenty years. As I will argue, the profundity of the shift will depend, in large part, on whether these "new" and "ecological" types of forestry are merely responses to changing views on the range of services and functions that forests provide, or a more subtle but far more fundamental shift in how forests are perceived and attributed value. I will return to this point in th final section of the chapter.

From New Forestry to Ecological Forestry

New forestry was largely a response to increasing societal appreciation for old-growth forests (Spies & Duncan, 2009). A number of studies in the late 1980s and early 1990s sought to better understand old-growth by defining it quantitatively (see, for example, Franklin & Spies, 1991; Spies & Franklin, 1991; Spies, Franklin, & Klopsch, 1990). In the Pacific Northwest old-growth had historically been seen as a prime resource, and over 50% of extant old-growth was converted to even-aged stands by the mid-20th century (Halpern & Spies, 1995). However, in light of new and increasing recognition of the complexity and heterogeneity of old-growth conditions, and their critical role in maintaining desirable ecosystem functions and biodiversity (Spies & Duncan, 2009), the process of clearcutting and regenerating a single-species tree crop on short rotations began to seem inappropriate (Franklin, 1989b; Franklin, 1993; Seymour et al., 2006; Spies & Franklin, 1991). New forestry was a strategy to accommodate the protection of these unique old-growth forests and their associated species, such as the Northern Spotted Owl, into active forest management (Swanson & Franklin, 1992). As ecologists developed an increasingly sophisticated understanding of old-growth, there was a gradual shift in emphasis from old-growth, per se, to old-growth as a symbol for a host of ideas that it embodied, including complexity, heterogeneity, and the sustenance of biodiversity, hydrology, nutrient cycling, and various other ecosystem processes (Franklin, 1998; Spies, 2004). These "ecological values" (Franklin, 1989a), originally recognized through their association with old-growth, have become values in themselves over the past two decades, with better science describing how they work, and fostering a deeper appreciation of the role they play in sustaining the critical functions of forest ecosystems (Gustafsson et al., 2012; Lindenmayer et al., 2012; Wu, 2006).

In many ways, ecological forestry merely elaborates on the silvicultural methods advanced rudimentarily in the new forestry literature, such as green tree retention and the incorporation of biological legacies into harvest plans (both described in depth below). The substantive difference between new and ecological forestry is not the silvicultural practices themselves, but the more extensive understanding of forest ecosystems now being used to guide those practices. New forestry was the early champion of the break from traditional forestry. Ecological forestry, now informed by a far larger body of knowledge about complex forest ecosystem processes and functions (Spies & Duncan, 2009), is the most recent and fully-realized version of new forestry. For example, in the Pacific Northwest, ecological forestry is often proposed to create early seral conditions on the landscape (e.g., Franklin & Johnson, 2012, 2013), a concern that was not evident in the days of new forestry, because only recently has the early seral stage garnered significant attention from the scientific community (Swanson et al., 2011). Thus, ecological forestry is no longer distinguished from conventional forest practices by its novelty (suggested in the label "*new* forestry"), but rather by its allegedly scientific underpinnings (hence, "*ecological* forestry"). In the years after 1989, when "new forestry" was coined, various publications began referring to "ecological forestry," (Seymour & Hunter, 1999; Hansen, McComb, Vega, Raphael, & Hunter, 1995; Simberloff, 1999; Seymour, White, & deMaynadier, 2002), and by the onset of the second millennium the label "new forestry" had been more or less replaced.

The other consideration to bear in mind is that new forestry arose as a potential solution to social tensions in the Pacific Northwest in 1989. A different type of solution arrived in 1994, by way of the Northwest Forest Plan (NWFP), which reserved expanses of forest from harvest, to be maintained in or set on a trajectory toward old-growth conditions that would support viable populations of the Northern Spotted Owl (Thomas, Franklin, Gordon, & Johnson, 2006). With a policy in place that was devised specifically to protect old-growth and spotted owls, new forestry lost its urgency, and perhaps some of its momentum. Intended as a compromise, the NWFP attempted to meet multiple goals by allocating some areas to preservation, and other areas to timber harvest (Thomas et al., 2006). Twenty years after its implementation, the NWFP is largely perceived as a conservationist strategy, failing to achieve the anticipated level of harvest due to legal actions enacted by citizens in the name of endangered species conservation, which have successfully prevented timber harvest on large tracts of lands where it was supposed to have occurred (Thomas et al., 2006).

In 1989 forestry was deeply implicated in increasingly heated social debates over the future of forest management in the Pacific Northwest, even as the most recent science seemed to be pointing it in a new direction, leading Jerry Franklin (1989b) to declare that forestry was "at a crossroads" (para. 1). Franklin was subsequently involved in the development of the NWFP, which was designed to relieve the social and environmental pressures to which he had alluded, and which has guided public forest management in the Pacific Northwest for the past 20 years (Thomas et al., 2006). Now it seems that social tensions are again building and another crossroads may be immanent, based on the recent words of Franklin and fellow NWFP author Norm Johnson:

> The management direction laid down for federal forest lands in the Northwest Forest Plan has not fully achieved either the ecological or economic goals originally envisioned in the plan, even while it dramatically altered our expectations for these lands…we believe that it is time to be moving…toward an integrated approach. (Johnson & Franklin, 2012, p. 77)

Thus, ecological forestry should perhaps be understood as a "New Forestry 2.0," responding to tensions inherited from the late 20th century, updated with the most current knowledge, and repackaged as "ecological" to capitalize on the credibility and caché of sound, and seemingly objective, science (Klenk et al., 2009; Winkel, 2014). However, as I will argue, although ecological forestry draws upon and purports to be aligned with what is ostensibly objective knowledge, it is in fact equally, if not more, reflective of normative, and ultimately ethical, judgments.

Theoretical Principles

The idea at the core of ecological forestry is that non-anthropogenic processes of forest development and disturbance should be used as a reference and a guide for humans to selectively take and leave elements of the harvested forest (Franklin et al., 2007; Long, 2009; Seymour & Hunter, 1999). The tools of ecological forestry are age-old silvicultural concepts and practices: selection, thinning, regeneration, and rotation length (Puettmann et al., 2009), re-imagined and described anew as legacies, variable density thinning, variable retention harvest, and extended rotations, or recovery periods (Franklin et al., 1997; Franklin et al., 2007). Historically, silvicultural practices often aimed to achieve a single goal, namely, the efficient harvest of trees for human use (Puettmann et al., 2009; Seymour & Hunter, 1999). In ecological forestry, by contrast, the goal is to manage forests to achieve multiple economic *and* non-economic objectives.

Although ecological forestry can be distilled to a set of silvicultural methods and management practices, these practical aspects can best be explained with reference to underlying scientific ideas. Two scientific pillars inform applied practices in ecological forestry: disturbance and succession. The theory in ecological forestry is that anthropogenic disturbances can be designed to mimic the effects of these two ecosystem processes, by translating information about disturbance and succession into the strategic retention and harvest of forest biomass. In later sections I will discuss at length the challenges and ambiguities of this translation process, but first, in this section, I will outline the two key concepts from forest ecology, disturbance and succession, and explain how they inform forest management practices in ecological forestry.

Forest Ecology

Disturbance

In two major works on ecological disturbance, Grime (1977) and Sousa (1984) both described disturbance as a mechanism of damage or destruction in biological communities. These community-centered definitions have persisted through time, with a recent paper by Hughes (2010) succinctly defining disturbance as, “any process that removes biomass from the community” (“Disturbance Affects Species Diversity,” para. 1). Rykiel (1985), by contrast, did not take a community-centered approach, instead defining disturbance as an agent or process acting upon the entire ecosystem. It is this more expansive definition of disturbance that seems to have been adopted in ecological forestry. Although an explicit definition of disturbance is rarely offered in the ecological forestry literature, a rare exception is the definition made by Pickett and White (1985), advanced by Seymour and Hunter (1999) in their oft-cited work on ecological forestry: “any relatively discrete event in time that disrupts ecosystem, community, or population structure and changes resources, substrate availability or the physical environment” (p. 30).

Agents of disturbance include natural disasters, such as wind or fire, anthropogenic impacts, herbivore browsing, decomposition, and disease (Grime, 1977). Disturbances vary in size, frequency, and intensity. In general, large-scale disturbances occur infrequently and at high intensities, although any given disturbance event can have spatially variable degrees of intensity (Turner, Baker, Peterson, & Peet, 1998). In the western parts of the Pacific Northwest, fire is a primary agent of disturbance (Franklin & Agee, 2003). Fires are generally large and stand-replacing in wet coastal forests, where the moist, temperate climate limits fire frequency, permitting accumulation of heavy fuel loads that eventually burn at high intensity and at broad extents (Spies, Hemstrom, Youngblood, & Hummel, 2006). Still, even in these so-called catastrophic fires, some areas of the forest will be less disturbed and retain more remnants from the pre-disturbance stand, depending on various factors such as topography, soil moisture, wind activity, and fuel supply (DeLong & Kessler, 2000) In other, drier Pacific Northwest forest types, such as ponderosa pine and mixed conifer and evergreen forests, fire has historically occurred with much higher frequency (Spies et al., 2006). In these forests, fires were generally of low- to mixed- severity (Spies et al., 2006), leaving behind relatively open woodlands punctuated with large, fire-resistant trees, and intermittent patches of denser, unburned vegetation (Larson & Churchill, 2011). These denser patches would accumulate higher fuel loads, which would subsequently burn at higher intensities in future fires (Spies et al., 2006). Fire suppression has largely altered the disturbance regime in these historically fire-frequented forest ecosystems (Franklin & Agee, 2003), resulting in uncharacteristically dense stands of dry forest that are at high risk of intense and uncontrollable wildfire (Spies et al., 2006).

The study of disturbance increased following the 1980 eruption of Mount Saint Helen in Washington, as well as the catastrophic wildfires in Yellowstone in the late 1980s (Franklin & MacMahon, 2000). These events offered unprecedented opportunities for ecologists to study how disturbances affect ecosystems, and how ecosystems respond both immediately and over time following catastrophic disturbance. A parallel interest arose in the impacts of small–scale disturbance events, which create gaps and enhance structural diversity within a stand (e.g., Franklin et al., 2002; Franklin & Van Pelt, 2004; Gray & Spies, 1996; Spies et al., 1990; Van Pelt & Franklin, 1999). With better understanding, disturbance has come to be seen as an organic element of forest dynamics, contributing to stand development by creating heterogeneous patches and gaps (Franklin et al., 2002; Wiens, 2008), which in turn provide habitat for a wide range of biodiversity (Spies, 1998). This role of disturbances as "editors…selectively remov[ing] or modify[ing] elements of an ecosystem while leaving others intact" (Franklin et al., 2000, "Disturbance as Editors," para. 1) is the key property of non-anthropogenic disturbance that ecological forestry seeks to emulate.

The ecological forestry concept of managing to mimic natural disturbance is premised on the idea that, if human disturbance more closely resembles non-human, or "natural" disturbance, threats to ecosystem processes, functions, and life forms can be minimized (Aber et al., 2000; Attiwill, 1994; Landres, Morgan, & Swanson, 1999; Long, 2009). This belief in turn rests on the assumption that organisms are adapted to the disturbance regime characteristic of their ecosystem, so keeping a site within that particular range of conditions will be more likely to sustain its organisms (Hunter, 1993; Landres et al, 1999). Natural disturbances also create high levels of spatial heterogeneity, which is considered essential to maintaining complex forest ecosystems (Landres et al., 1999; Wu, 2006). The emphasis on heterogeneity stands in stark contrast to the traditional management paradigm favoring uniform, even-spaced forests, whose homogeneous structure and composition provide a much narrower range of habitats and resources for forest organisms (Larson & Churchill, 2011).

The notion of disturbance is closely related to the belief that ecosystems exist in a baseline equilibrium or steady state (Connell, 1978), concepts that have been questioned and, if not rejected, largely reconfigured to align with a dynamic view of ecosystems (Rykiel, 1985; Sousa, 1984; Wu & Loucks, 1995). As such, it is important to bear in mind that the word "disturbance" does not indicate that there is a "true" or "proper" ecosystem state being derailed or disrupted by an external disturbance. "Disturbance" is a metaphor, employed to structure our understanding of how change occurs in ecosystems. The use of metaphor is neither novel to science, particularly ecology (Keulartz, 2007; Kuddington, 2001; Proctor & Larson, 2005), nor is it necessarily problematic. However, because this particular metaphor occupies such a central role in ecological forestry, it is important to keep in mind that "disturbance-based management" can have different meanings for different people, which may in turn be used to ground a broad range of different, and potentially conflicting, management actions.

Rykiel (1985) discussed some of the ambiguities of the word "disturbance," pointing out that the concept is only meaningful in relation to a reference state, and that it is subject to variation depending on how the "normal range of ecological stimuli" is defined (p. 363). In ecological forestry, the reference state for non-anthropogenic disturbance is the historic or natural range of variability. Disturbances are believed to have historically occurred within a certain "normal" range of possibilities, which scientists can estimate using a number of methods, including paleoreconstruction, dendrochronology, land survey records, and pollen records (Landres et al., 1999; Seymour et al., 2002). The natural range of variability concept is useful because it captures the dynamic nature of ecosystems, but also conceptualizes them in a way that allows for relative predictability (Landres et al., 1999). However, "normality" and "naturalness" are not empirical properties of the biophysical world, but instead lie in normative conceptual territory (Callicott, Crowder, & Mumford, 1999). Although the normative underpinnings of the concept of "naturalness" have been acknowledged by some (Klenk et al., 2009; Landres et al., 1999; Noss, Franklin, Baker, Schoennagel, & Moyle, 2006), in much of the ecological forestry literature they are not so explicitly addressed. As such, it is important to keep in mind that in any instance where the authority of "natural" or "historic" conditions is invoked, as it often is in the ecological forestry literature, a value judgment is also being made, one that has identified a specific reference condition as an appropriate model for desirable present and future conditions. I will return to this point later.

Rykiel (1985) also noted that "disturbance" could be defined either as a cause or as an effect. To avoid potential ambiguity, he suggested that "disturbance" should refer exclusively to a causal agent or process, and its effects should be called "perturbation" or "stress" (Rykiel, 1985). Bearing in mind Rykiel's distinction, it is interesting to note that ecological forestry is concerned with the effects of disturbance, not the process of disturbance per se (Long, 2009). While some researchers do suggest using active management to re-institute historic non-anthropogenic disturbance regimes (Drever, Peterson, Messier, Bergeron, & Flannigan, 2006; Mitchell, Hiers, O'Brien, & Starr, 2009; Noss et al., 2006), in general the idea is to use silviculture to mimic the aftermath of a disturbance (Franklin & Agee, 2003; Franklin et al., 2000; Perevolotsky & Sheffer, 2009; Spies, 1998), not to restore historic non-anthropogenic disturbance regimes. Although restoring non-anthropogenic disturbance regimes would in many cases require an initial human intervention, based upon a normative judgment about which historic regime should be restored (Noss et al., 2006), a forest would be largely self-regulating if the management philosophy were to allow natural processes to occur as they will. By emphasizing effect over process, however, ecological forestry necessitates that humans make ongoing, deliberate decisions about when, where, how, and, critically, why to emulate management activities on a chosen model of historic disturbance (Long, 2009). I will return to this point later as well.

Succession

Although disturbance is a focal concept for ecological forestry, it is primarily of interest for the role it plays in forest development. This process is often referred to as "succession," a concept embraced even in the earliest days of forestry (Spurr, 1952), and popularized by Clements (1916) as a progression toward a "climax" condition (Clements, 1916, p. 3). The notion of the climax state has since been contested (Connell & Slayter, 1977) and, some suggest, largely dismissed (Wu & Loucks, 1995), but the idea of succession has remained prevalent in forest ecology.

Connell and Slayter (1977) defined succession as, “the changes observed in an ecological community following a perturbation that opens up a relatively large space” (p. 1119). Finegan (1984) offered a definition specific to forests: “the directional change with time of the species composition and vegetation physiognomy of a single site where climate remains effectively constant” (p. 109). Like “disturbance,” the meaning of “succession” is open to variable interpretations (Finegan, 1984; Wilson, Gitay, Roxburgh, King, & Tangney, 1992), and yet the concept is still widely used to characterize and understand how change occurs in ecosystems (see, for example, Donato, Campbell, & Franklin, 2012; Franklin, Shugart, & Harmon, 1987; Spies et al., 1990; Swanson et al., 2011;)

Oliver (1981) categorized the major structural changes that typically occur over the course of succession into four main phases: stand initiation, stem exclusion, understory re-initiation, and old-growth, or structural complexity. Franklin et al. (2002) added four intermediate steps, resulting in an eight-phase process of succession: disturbance and creation of legacies, cohort establishment, canopy closure, biomass accumulation and competitive exclusion, vertical diversification, pioneer cohort loss, and structural endpoint of development. These models are highly simplified, and because they assume relatively open initial conditions, such as would occur following a stand-replacing disturbance, they may not accurately represent successional processes in stands that do not characteristically experience catastrophic disturbance (Franklin et al., 2002). Still, these conceptual models offer useful templates for understanding the changes a forest is likely to experience in both structure and composition over time. Equipped with this understanding, ecological forestry proposes that harvest should imitate conditions found along developmental pathways that occur over the course of succession, and which enhance spatial heterogeneity in the forest, both vertically and horizontally (Franklin et al., 2007).

Historically in the Pacific Northwest the primary successional stage of interest has been late succession, often called “old-growth.” In 1986 the Old-Growth

Definition Task Group was commissioned to develop a working definition by which old-growth forest could be recognized and differentiated from other successional stages (Franklin & Spies, 1991). The group formulated a definition of old-growth, which specified certain levels of large old trees, snags, logs, and a multilayered canopy (Franklin & Spies, 1991). Spies and Franklin (1991) also discussed the characteristic structure of old-growth, distinguishing it by a low tree density with a high degree of size variation, high mean diameter of trees at breast height, and high basal area, as well as an abundance of large snags and logs. In Douglas fir stands these characteristics are generally present by the time trees are roughly 200 years old (Spies et al., 1990), although it has been argued that a "true" climax state, in which western hemlock has replaced Douglas fir as the dominant species, can take up to 1000 years to develop (Spies & Franklin, 1991). In the past two decades, there has also been considerable interest in using silviculture to accelerate the development of old-growth conditions in relatively young forests (e.g., Acker, Sabin, Ganio, & McKee, 1998; Bailey & Tappeiner, 1998; Barbour, Johnston, Hayes, & Tucker, 1997; Busing & Garman, 2002; McComb et al., 1993; Zenner, 2000).

To reach a condition of old-growth, a young forest undergoes a series of minor disturbances that effectively cull individuals or groups of individuals from the forest (Oliver, 1981). Over time, as the "pioneering" overstory dominants are lost to mortality, the forest becomes structurally and compositionally more diverse, with a range of shade tolerant and intolerant species populating the overstory, as well as an understory of mixed species, which respond to changes in the canopy and the surrounding forest (Franklin et al., 2002; Wilson & Puettmann, 2007). Old-growth is also characterized by a wealth of unique structures, including logs and snags in varying conditions of decay, which provide important habitats and microhabitats for biodiversity (Franklin et al., 1997; Hansen et al., 1991; Michel & Winter, 2009). Finally, there are of course old trees in old-growth, which are unique not only for their advanced age and generally large size, but also because of their imperfections and signs of senescence, including branch breakage, wood rot, and bark scars

(Franklin et al., 2002). In summary, old-growth is marked by diverse, spatially heterogeneous conditions, both at the level of individual organisms and in the structural complexity of the stand itself (Franklin et al., 2002).

In the Pacific Northwest, the social value of late-successional (mature or old-growth) forests has been hugely influential in forest politics since the 1980s (Hays, 2007; Spies et al., 2007; Thomas et al., 2006). Old-growth was extensively harvested throughout most of the 20th century, leaving a far smaller proportion of late-successional forests on the landscape than would have occurred in the absence of westward European expansion (Franklin & Johnson, 2012). To protect old-growth, the Northwest Forest Plan set an age threshold of 80 years, past which forests in reserves were not to be harvested, even for thinning (USDA Forest Service & USDI Bureau of Land Management, 1994), a decision that Franklin and Johnson (2012) have re-evaluated by proposing that 80, 120, or 160 years of age may all be appropriate cutoffs for old-growth, depending on "ecological thresholds, management objectives, and ease of implementation" (p. 433). The issue remains contentious because "old-growth" is not a clearly definable, empirical property of a forest (Spies, 2004). Ultimately, any resolution of what counts or does not count as old-growth will be context-specific. Different forest types are characterized by different species compositions and shaped by different environmental conditions, which affect how a forest develops over the course of succession and, consequently, lead to different types of "old-growth" (Spies, 2004). An old-growth coastal rainforest in the Pacific Northwest (Franklin & Spies, 1991) is decidedly different from, for example, a subalpine forest in the Rocky Mountains (Veblen, Hadley, & Reid, 1991). But even past the biophysical and ecological differences between forest types, the perception of old-growth is linked to social beliefs about anthropogenic impacts in forests, and the extent to which they are "tolerated" in the concept of old-growth (Spies, 2004). As such, the definition of old-growth will also differ according to different metaphysical assumptions about the relationship between humans and nature, which shape how and in what capacity people understand and value "old-growth" forests.

In the Pacific Northwest, there has also been recent interest in the value of early successional, or early seral, ecosystems (Donato et al., 2012; Franklin & Johnson, 2012; Franklin & Johnson, 2013; Swanson et al., 2011). These seral predecessors to closed canopy forests are believed to be essential for maintaining desirable ecosystem properties, including high levels of biodiversity (Swanson et al., 2011). In particular, early seral ecosystems support a wide range of shade-intolerant plant species, as well as the animals who feed on them (Swanson et al., 2011). Because early seral ecosystems precede canopy closure, they are characterized by bright, open conditions that are favorable for a broad spectrum of herbs, shrubs, and eventually small trees (Swanson et al., 2011). Like late-successional forests, early seral ecosystems are also thought, by some, to be underrepresented in the Pacific Northwest landscape, relative to the mosaic of stand ages that occurred prior to European settlement (Franklin & Johnson, 2012). Wimberly (2002) tentatively suggested that early seral ecosystems would have historically constituted roughly 15% of the landscape in the Oregon Coast Range, but there is still considerable uncertainty surrounding the question of how much of the landscape has historically been in an early seral stage, along with questions about what levels and compositions of biodiversity it supports (Johnson & Franklin, 2013; Spies et al., 2007; Swanson et al., 2011). In addition, unlike old-growth, public perceptions about the value of an early seral ecosystem are far from unilateral. In particular, some environmentalists argue that non-anthropogenic disturbances and clearcutting on private lands create adequate habitat for early seral associate species, and that management of public lands would therefore be better focused on old-growth restoration and conservation (Dellasala et al., 2013; Heiken, 2011) As such, the idea that early seral conditions need to be restored to the Pacific Northwest landscape remains controversial (Johnson & Franklin, 2012; Swanson et al., 2012).

In the ecological forestry literature, the descriptors “high quality” (e.g. Franklin & Johnson, 2013), “diverse” (e.g. Johnson & Franklin, 2012), and “complex” (e.g. DellaSala et al., 2013) are used to differentiate early successional ecosystems from conditions following a clearcut or traditional harvest (Franklin & Johnson, 2012). In the Pacific Northwest, early seral conditions, largely occurring on private industrial lands, are generally overridden by intensive site preparation, fertilization, and suppression of competing vegetation, which enable quick and efficient growth of regenerating tree crops (Swanson et al., 2011). Proponents of ecological forestry in the Pacific Northwest suggest that these measures undercut and simplify the early pre-forest stage (Franklin & Johnson, 2012), which would likely be more prolonged following non-anthropogenic disturbance, as well as compositionally and structurally more diverse (Swanson et al., 2011). Spies et al. (2007) suggest that early seral conditions will actually become increasingly depleted in coming years, under current policy frameworks. As such, in the Pacific Northwest ecological forestry is often proposed as a harvest strategy to raise the amount of complex early seral terrain on the landscape back to historic levels (Franklin & Johnson, 2012).

Forestry

Retention

With better understanding of disturbance ecology, it has become evident that natural disturbances always leave something behind, and forest succession never starts with a completely clean slate (Franklin & MacMahon, 2000). Ecological forestry suggests that, based on the model provided by natural processes, harvests should be designed to leave behind, or “retain,” various structural and compositional elements of the pre-harvest stand (Franklin et al., 2007). All the components of a forest ecosystem are interrelated, and removing a significant proportion of the biomass (i.e. trees) inevitably impacts the rest of the system. For example, harvesting trees decreases the amount of woody material and leaf litter, depleting nutrients such as nitrogen, potassium, and calcium, as well as carbon

(Aber et al., 2000). These depletions in turn effect changes in soil properties and water cycles, which may subsequently affect species assemblages if the availability of suitable resources or habitat decreases (Aber et al., 2000). Timber harvest invariably alters the structure and composition of a given piece of land, but retention is proposed as a way to remove trees without causing more fundamental changes in the forest ecosystem functions.

Retention is defined as, “the concept of retaining structural elements of the harvested stand for at least the next rotation in order to achieve specific management objectives” (Franklin et al., 1997, p. 115). Retention purportedly maintains the ecological integrity of forests by serving three purposes: it maintains and enhances structural heterogeneity; it ensures continuity of species assemblages from the pre- to the post-harvest stand (a process known as “lifeboating”); and it fosters landscape connectivity (Franklin et al., 1997; Franklin et al., 2007; Vahna-Majamaa & Jalonen, 2001). Because it is believed that organisms are adapted to the disturbance regime characteristic of the ecosystem they inhabit (Landres et al., 1999), it is also believed that the essential elements of the ecosystem, i.e. its processes, functions, and biodiversity, will not be critically disrupted and altered as long as the effects of anthropogenic disturbances are comparable to those that would result following non-anthropogenic disturbances (Long, 2009; Seymour & Hunter, 1999).

While “retention” can refer to species compositions (Franklin et al., 2007), it most generally refers to structures, such as snags, old trees, and logs (Franklin et al., 1997). These structures serve as critical habitat for a wide variety of forest organisms (Franklin et al., 1997), and also play important roles in various ecosystem processes, such as providing coarse woody debris for soil and nutrient cycling (Marshall, 2000). Such structures are often referred to as “legacies,” defined as, “the organisms, organic matter (including structures) and biologically created patterns that persist from the pre-disturbance ecosystem and influence recovery processes in the post-disturbance ecosystem” (Franklin et al., 2000, “Biological

Legacies," para. 1). Thus, legacies are supposed to carry over functional traits and structural characteristics from the pre-harvest stand to the post-harvest stand, effectively softening the blow of harvest to allow for continuity of desirable ecological processes and functions, as well as fo biodiversity (Franklin et al., 2000; Franklin et al., 2007; Franklin & MacMahon, 2000; Gustafsson et al., 2012).

Along with specific structural legacy elements, "retention" also refers to some proportion of live trees that are not cut at the time of harvest (Franklin, 1989a; Franklin et al., 1997; Franklin et al., 2007; Vahna-Majamaa & Jalonen, 2001).[5] There are two general options for spatial configuration of retained green trees: dispersal and aggregation. Dispersal is when retained trees are spaced throughout a harvested area, whereas in aggregates trees are left in clusters (Franklin et al., 1997). The consideration of pattern is not new to forest management, and is in fact a central concern in landscape ecology and conservation biology (Lindenmayer & Franklin 2002; Turner, 2005). For example, Franklin & Forman (1987) outlined the pros and cons of dispersed versus aggregated cuts in selection forestry (defined below), noting that the "best" option is entirely dependent upon context, including economic constraints and goals, characteristic disturbances of the location, and the extent to which various elements of biodiversity are desired in the forest. Franklin et al. (1997) noted that dispersed and aggregated configurations of retained trees serve different ends. Dispersal may be better for new growth, because it shelters young plants from the most extreme gradients of light and temperature (Baker et al., 2013). Aggregation, on the other hand, may more effectively maintain intact forest conditions, such as multilayered canopy composition, which in turn support a fuller range of pre-harvest species assemblages (Franklin et al., 1997). In either case, live trees are supposed to be retained at least through a full harvest cycle, distinguishing ecological forestry from shelterwood or seed tree methods, in which unharvested trees are removed after they have ensured the propagation and survival of the new generation of trees (Franklin et al., 2007; Mitchell & Beese, 2002).

[5] Some of these live trees, however, are left to later be turned into snags (Franklin & Johnson, 2012).

The retention literature highlights three questions that must be answered before an ecological forestry prescription is set: what to retain, how much to retain, and in what spatial configuration to retain it (Franklin et al., 1997; Franklin et al., 2000; Franklin et al., 2007; Lindenmayer & Franklin, 2002; Vahna-Majamaa & Jalonen, 2001). While these decisions are supposed to be informed by scientific knowledge (e.g. knowledge of how ecosystem processes work, or of the habitat requirements for a species of concern), the theoretical literature leaves the specifics of retention to be settled at the level of application. In other words, retention can be guided by an understanding of disturbance and succession, but it is ultimately determined by management objectives for the land, or desired future conditions. I will later address this point at length.

A number of long-term studies have begun to investigate various responses to the different levels of structural and green tree retention, including effects on biodiversity and vegetation growth, economic impacts, and social acceptability (e.g., Aubry, Halpern & Peterson, 2009; Seidl, Rammer, & Spies, 2014; Seymour et al., 2006; Shindler & Mallon, 2009; Vanha-Majamaa & Jalonen, 2001). There has been a particular focus on how retention affects biodiversity loss (e.g., Gustafsson et al., 2012; Mori & Kitagawa, 2014; Rosenvald & Löhmus, 2008), although several authors have pointed out the challenges of evaluating the effectiveness of retention to protect biodiversity. Hansen et al. (1991), for example, noted that population viability needs to be defined before it is possible to determine how much habitat must be retained across a harvest cycle for a given species. McComb et al. (1993) echoed the sentiment, discussing the need for a more precise understanding of what constitutes "sufficient" habitat for any given species, before it is possible to make prescriptions aimed at conservation. After examining bird species diversity under five different management regimes, Hansen et al. (1995) concluded that different species thrive in different habitat conditions, so the objective of "managing for biodiversity" is basically meaningless without clear definitions of target species and specific population goals. More recently, Baker et al. (2013) pointed out that there is a need to study how retention affects colonizing species, which may be either aided or hindered by retained forest patches or structural elements. Synthesizing all the various studies in retention and biodiversity conducted over the past two and a half decades, a recent meta-analysis by Mori and Kitagawa (2014) tentatively concluded that retention does successfully conserve more biodiversity than traditional forestry, although results were mixed for certain taxa of species, particularly epiphytes, and were conducted over relatively short time periods. It should also be noted that Mori and Kitagawa reported effects on species richness, not composition. Thus, it is not clear whether the number of species in the post-harvest stand is being held constant by colonizers taking advantage of the new, open conditions after harvest, or if pre-harvest species assemblages are in fact maintained by retention (Mori & Kitagawa, 2014).

A final important point to note is that retention has associated financial costs (Busing & Garman, 2002; Carey, Lippke, & Sessions, 1999; Hanson, Lorimer, Halpin, & Palik, 2012; Maguire & Chambers, 2005). Between increased planning and harvest expenditures, as well as the loss of profit to green trees that are not cut for sale, retention is surely less cost effective than traditional models of forestry. As such, the financial viability of retention, as well its social acceptability from an economic standpoint, remain uncertain.

Harvest

The necessary complement to retention is the methodical and deliberate removal of biomass from the forest. Generally, the word "selection" is used in silviculture to refer to trees chosen for removal at harvest, either individually or in groups (Nyland, 1998; O'Hara, 2002). Ecological forestry essentially reverses this dynamic, shifting the emphasis onto the selection of what to retain (Franklin et al., 1997; Gillis, 1990; Gustafsson et al., 2012; Kirkman & Mitchell, 2006; Lindenmayer et al, 2012). To avoid semantic confusions, I will use the word "harvest" to refer to elements of the forest that are removed in ecological forestry. Harvest takes two primary forms. The first is thinning, sometimes referred to in the ecological forestry literature as "variable density thinning," and the second is regeneration harvest, or "variable retention harvest" (Franklin et al., 2007).

In ecological forestry, variable density thinning is prescribed to mimic the effects of small-scale, non-anthropogenic mortality events that occur over the course of forest succession (Franklin et al., 2007). The word "variable" in "variable density thinning" refers to the practice of thinning to different densities of remaining trees (Franklin et al., 2007), resulting in stands with both horizontal and vertical spatial, as well as compositional, heterogeneity (Franklin et al., 2007). As in traditional forestry, thinning in ecological forestry can be precommercial or commercial (Franklin & Johnson, 2012; Johnson & Franklin, 2012). However, in contrast to traditional forestry, ecological forestry implements thinning not just to produce high-quality, economically profitable wood, but also with the intention of enhancing forest complexity (Franklin et al., 2007). Certain methods of thinning have been found to increase forest complexity (Barbour et al., 1997; Keeton & Franklin, 2005), and in ecological forestry such methods are often employed to accelerate the development of young stands toward late-successional conditions (Franklin et al., 2007). Certainly, in some cases trees are removed to stimulate growth of larger dominant trees, but in other cases trees are removed to promote the growth of less competitive tree species and understory vegetation (Franklin et al., 2007). Heavy thinning is also used to reduc the risk of stand-replacing fire in densely populated stands (Larson & Churchill, 2011), a strategy that is proposed for disturbance-prone forest ecosystem types (Franklin & Johnson, 2012; Mitchell et al., 2009).

The other form of harvest is regeneration harvest, in which trees are removed with the intention of re-growing, or "regenerating," a new cohort of trees. In traditional forestry, the vast majority of the biomass aboveground is removed from the stand, either at once, as in the clearcut system, or after the new generation has been established, as in the seed-tree or shelterwood systems (Seymour &

Hunter, 1999). After cutting, intensive site preparation, either chemical or mechanical or both, is often used to create optimal conditions for a new generation of trees (Maguire & Chambers, 2005; Puettmann et al., 2009), a process that homogenizes forest structure and composition (Franklin et al., 2007). Under an ecological forestry prescription, by contrast, a certain amount of biomass, in both individual "legacy" structures and live trees, is left behind in the harvested area (Franklin et al., 1997). The trees not selected for retention are removed, opening the land up for regeneration, either from natural seeding or planting (Franklin et al., 1997).

The other main distinction between ecological forestry regeneration harvests and traditional regeneration harvests is that rotations, sometimes described as "recovery periods," are generally longer, theoretically to allow stands to develop the heterogeneous conditions that would emerge under non-anthropogenic disturbance regimes (Franklin et al., 1997; Franklin et al., 2007). Stands are supposed to be maintained until they reach "acceptable levels" of complexity (Franklin et al., 2007, p. 33). Based on the ecological forestry literature, it is not clear whether, once these "acceptable levels" have been achieved, the stands are supposed to be left for some amount of time or immediately harvested. Presumably they will not be reserved indefinitely, since they are very clearly being put on "rotations" (Franklin et al., 2007; Franklin & Johnson, 2012). However, without defined criteria of "acceptability" in the current literature, managers a hundred years into the future will have no guidance for deciding when to harvest a stand, rather than leaving it to further age and diversify.

Because the phrase "regeneration harvest" has traditionally been associated with clearcuts, it may have negative connotations among certain social demographics, especially in the Pacific Northwest (Johnson & Franklin, 2012). As such, Johnson and Franklin (2012) have suggested the term "early successional regeneration harvest" to imply that the benefits of such a method are not merely financial, but also partially or even primarily justified as a way of harvesting that restores and prolongs the persistence of complex early seral ecosystems on the landscape. Regeneration harvest in ecological forestry is also often referred to as "variable retention harvesting" (Franklin et al., 2000; Franklin et al., 2007; Franklin & Johnson, 2012; Johnson & Franklin, 2012). The word "variable" here refers to the combination of dispersed and aggregated methods, with retention of both individual legacy elements as well as intact groups of live trees (Franklin et al., 2007; Gustafsson et al., 2012). In addition, as with "variable density thinning," "variable" may refer to different proportions of green tree retention. At the landscape scale, the combined effect of forest stands harvested with different amounts of retention will be a "mosaic" of both more open and more densely forested conditions (Franklin et al., 2002; Franklin et al., 2007; Mitchell & Beese, 2002). Ecological forestry aims to create and maintain this diverse landscape mosaic, based on the premise that all naturally-occurring seral stages are important to ecosystem function and biodiversity, and that the full range of forest age classes should be properly represented on the landscape (Donato, et al., 2012; Hansen et al., 1991; Lindenmayer et al., 2012; Swanson et al., 2011).

Application in Western Oregon

Ecological forestry is not an official silvicultural system, such as clearcutting or shelterwood (Puettmann et al., 2009). It is, rather, intended to be a guiding philosophy, coherent enough to be universally applicable (Gustafsson et al., 2012), yet flexible enough for applications that suit varying, site-specific conditions (Franklin et al., 2007; North & Keeton, 2008). The ideas and practices outlined in the previous section have been put into application, or discussed for potential application, in various regions of the country and around the world (see, for example, Corace et al., 2009; Mitchell et al., 2009; Montgomery, Palik, Boyden, & Reich, 2013; Perevolotsky & Sheffer, 2009; Seymour et al., 2002; Stoneman, 2007). By examining these various cases, it becomes clear that "ecological forestry" can refer to a variety of on the ground practices. For example, Corace et al. (2009) describe how ecological forestry contributes to restoration of Kirtland's Warbler in Michigan by using clearcuts to shift tree composition to the species and age class favored by the birds. Perevolotsky and Sheffer (2009), on the other hand, describe how ecological forestry is implemented in Israel as a process of planting and thinning to achieve forests of mixed non-native conifer and deciduous species, as well as native Mediterranean trees and shrubs. In all cases, the general principles outlined in the previous section are, as intended, adapted to specific site conditions to meet desired ends.

The example that I will examine more closely in this chapter is ecological forestry in the Pacific Northwest, as advanced by Drs. Jerry Franklin and Norm Johnson. I have chosen to focus on this case for two reasons. First, the Pacific Northwest has been a historic locus of forest management activity and controversy, at least in the United States (Davis, 2001; Hays, 2007), and there is a considerable body of work documenting a rich history of silvicultural practice, forest ecology, and management from which to draw. Second, there has recently been legislation moving through Congress, proposing to implement ecological forestry on the BLM lands in western Oregon (S.132, 2015; S.1784, 2013). The bill adopts an ecological forestry plan based on Franklin and Johnson's recommendations, and so provides a good example of how the theoretical ideas discussed above may be translated into applied management actions. In addition, regardless of whether the bill passes, Johnson and Franklin's ecological forestry plan, or parts of it, could quite feasibly be proposed for implementation in other similar regions of the Pacific Northwest. I will therefore use this example to illustrate how the theoretical concepts outlined in the previous section might be applied, and also to reveal ambiguities and deficiencies that may not be evident until theory is put to the test in practice. Specifically, I will argue that, because the theoretical literature fails to establish a clear normative or ethical framework, the aims and intentions of ecological forestry remain problematically ambiguous, allowing "ecological forestry" to be interpreted in a wide range of different, and possibly incommensurable, ways. As I will show using the case of western Oregon, this ambiguity may not always be clarified at the level of application, leaving pressing questions both about how ecological forestry would be applied, and whether it should be applied.

Before discussing the ecological forestry plan for western Oregon, I will provide a brief outline of the relevant policy framing Franklin and Johnson's strategy. I will then describe the major points of the Johnson and Franklin plan, as it was developed and reported on beginning in 2009, ultimately leading up to the recent (2013-2015) O&C legislation.

Background

Northwest Forest Plan

The Northwest Forest Plan (NWFP) has governed federal forest management in the Pacific Northwest since 1994. The story of the NWFP has been chronicled in various sources (Franklin, 1995; Hays, 2007; Thomas, et al., 2006; Winkel, 2014), so I will only make a brief account of it here. In short, years of turmoil between industry advocates and environmentalists in the Pacific Northwest came to a head over the issue of the Northern Spotted Owl, whose habitat was threatened by harvest in old-growth forests (Thomas et al., 2006). Following President Clinton's Forest Summit in 1993, the Forest Ecosystem Management Assessment Team (FEMAT) was convened to devise a series of alternative management strategies, based upon sound science and the objective of managing for multiple values, including a timber yield that would be predictable and sustainable, without degrading the environment (Thomas et al., 2006). The alternative selected for implementation was a system of federal lands designated as late successional reserves (LSRs), matrix, riparian reserves, adaptive management areas, and other lands restricted from harvest (such as designated roadless areas and federal wilderness areas) (USDA Forest Service & USDI Bureau of Land Management, 1994).

LSRs are areas restricted from harvest, constituting approximately 30% of the area under the Northwest Forest Plan (USDA Forest Service & USDI Bureau of Land Management, 1994). LSRs were largely determined according to the habitat needs of the Northern Spotted Owl (Johnson & Franklin, 2013; Thomas et al., 2006). It should be noted, however, that LSRs are not entirely composed of late successional forests, and encompass large tracts of younger and mature forests. The intention was that these younger forests in LSR would be thinned to accelerate their development toward diverse late successional habitat (Johnson & Franklin, 2013; Thomas et al., 2006). No thinning is permitted on LSR stands over 80 years old (USDA Forest Service & USDI Bureau of Land Management, 1994).

Although the word “matrix” has a very particular use in landscape ecology (Driscoll et al., 2013), it is also sometimes used in forestry to refer to areas designated neither as preserves nor as intensive timber management areas, which are subject to various degrees of human use (Lindenmayer & Franklin, 2002). Sixteen percent of the lands under the jurisdiction of the NWFP were designated as matrix forests, to supply a sustained yield of timber (Thomas et al., 2006; USDA Forest Service & USDI Bureau of Land Management, 1994). And yet, even on these lands whose primary objective is timber production, clearcutting is not permitted. Instead, 15% of the green trees must be retained, at least 70% in aggregates and the remaining dispersed, in order to “assure appropriate conservation of ecosystems as well as provide habitat for rare and lesser-known species” (USDA Forest Service & USDI Bureau of Land Management, 1994, p. 10). Although much of the matrix is comprised of younger stands regenerated after previous harvest, there are also late successional forests in matrix allocations (Johnson & Franklin, 2012). In other words, the Northwest Forest Plan did not rule out the possibility of any and all harvest in old-growth forests. In spite of the “”matrix” designation, however, harvest in these older forests has largely been prevented by environmentalist litigation (Thomas et al., 2006).

Additionally, a survey and manage clause in the NWFP requires that managers survey for rare species in the matrix before harvesting (USDA Forest Service & USDI Bureau of Land Management, 1994). Buffers must be left around areas that are found to be of potential importance to any of 427 species, which were identified for survey and manage because they might not be adequately protected in LSRs (Johnson & Franklin, 2013). The original FEMAT team has since written, "In our eyes, this addition [survey and manage] unfortunately shifted the NWFP from a coarse-filter approach (the occurrence of species is predicted by the occurrence of habitat) to an intense, fine-filter approach (based on actual site-specific data)" (Thomas et al., 2006, p. 281). The shift is problematic, they argue, because the measure has been used extensively to litigate against the vast majority of harvest on matrix lands, severely reducing the yield of timber extracted in comparison to the amount anticipated under the NWFP, and restricting management activity primarily to thinning in young stands to accelerate development toward old-growth (Johnson & Franklin 2012; Johnson & Franklin, 2013; Thomas et al., 2006).

Along with survey and manage buffers, within the matrix there are also riparian reserves, constituting approximately 11% of total NWFP lands (USDA Forest Service & USDI Bureau of Land Management, 1994). Riparian reserves are one of four components of the NWFP Aquatic Conservation Strategy (ACS), which also includes the designation of key watersheds (identified for their use by at-risk salmonids and other water quality concerns), watershed analysis, and restoration of degraded watersheds (USDA Forest Service & USDI Bureau of Land Management, 1994). Initially, the riparian reserves were set somewhat arbitrarily (Johnson & Franklin, 2013; Thomas et al., 2006) at the length of two tree heights around fish-bearing streams, or one tree height around non-fish-bearing streams, with the intention that alterations and adjustments would be made as appropriate, based on the best available science (USDA Forest Service & USDI Bureau of Land Management, 1994). Such changes by and large have not been made, and only recently have new reports begun to offer alternatives, such as variable width buffers (Reeves, Pickard, & Johnson, 2013).

Ten adaptive management areas, comprising about 6% of NWFP lands, are designated as areas to be used for scientific work and experimentation, to test various management strategies, and to measure outcomes (USDA Forest Service & USDI Bureau of Land Management, 1994). However, due to budgetary constraints, very limited research has been done in these areas, which have been managed similarly to matrix lands (Thomas et al., 2006).

Finally, 36% of the NWFP region is in either congressionally (30%) or administratively (6%) withdrawn lands that lie outside the purview of NWFP jurisdiction (USDA Forest Service & USDI Bureau of Land Management, 1994).

Recent Activity: Northern Spotted Owl

2011 witnessed two new developments related to the status of the Northern Spotted Owl, with potentially significant implications for land use within the region governed by the NWFP. The first was a revision of critical habitat for the Northern Spotted Owl, designated under the Endangered Species Act (US Fish and Wildlife Service, 2011a). These ne designations are largely misaligned with current NWFP land allocations, with areas of critical habitat located on matrix lands, where timber harvest is permitted under NWFP guidelines, as well as areas of non-critical habitat in LSRs, which, as noted above, were originally allocated specifically to protect owl habitat (Johnson & Franklin, 2013). As I will discuss below, the Johnson and Franklin plan attempts to better align land designations made under these two policy frameworks, the NWFP and ESA critical habitat (Johnson & Franklin, 2013).

The second development is the Revised Recovery Plan for the Northern Spotted Owl, which outlines a 30-year plan for spotted owl conservation in the Pacific Northwest, with the goal of de-listing the species from its current ESA status of “threatened” (US Fish and Wildlife Service, 2011b). As of 2014, owl populations are still declining, with threats not only from habitat loss and fragmentation, but also from the increased competition of barred owls, whose roosting and foraging needs are similar to those of the spotted owl (US Fish and Wildlife Service, 2011b). Although its emphasis is the spotted owl *per se*, the report also highlights the need to place the needs of the spotted owl in a larger ecosystem context, where spotted owls are protected by protecting the overall ecological health and resilience of their range (US Fish and Wildlife Service, 2011b). The plan explicitly endorses ecological forestry, as proposed by Franklin and Johnson, for this purpose (US Fish and Wildlife Service, 2011b, p. III-11), noting that while some measures, such as the creation of early seral conditions, may in the short term be detrimental to spotted owl populations, in the long term the landscape heterogeneity and ecosystem resilience will benefit the species (US Fish and Wildlife Service, 2011b).[6]

O&C Lands

The final element of the policy infrastructure relevant to the Johnson and Franklin plan is the 1937 O&C Land Grant Act, which stated that the BLM lands along the area of the Oregon and California railroad would be used primarily to provide timber as a source of income and employment for local communities, with secondary objectives of securing watershed health and providing recreation (H.R.7618, 1937). This bill is the basis for the more recent O&C legislation, currently moving through Congress at the time of writing. The latest (2015) bill purportedly meets the stipulations of sustained yield in the original act, without forfeiting adherence to the conservation principles underlying the Northwest Forest Plan (S.132, 2015; S.1784, 2013). The bill proposes to achieve these goals by re-designating lands as either "conservation emphasis areas," managed for land health

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[6] The nature and extent of both short- and long-term effects on spotted owls are quite uncertain: "When considering a potential restoration treatment project, it will be necessary for land managers working with the Service and other interested stakeholders to weigh the potential tradeoffs between short-term impacts to spotted owl habitat versus long-term ecosystem restoration outcomes. While our understanding of short- and long-term effects of ecosystem restoration actions on spotted owls is limited at this time, research on the effects of more traditional forest management practices on spotted owls and their prey has been conducted…These studies provide data that should inform development to restoration projects to develop desired future conditions while best maintaining existing spotted owls on the landscape" (US Fish and Wildlife Service, 2011b, pp. III-14-III-15).

and conservation goals, or "forestry emphasis areas," managed to supply a sustained yield of timber (S.132, 2015). All of these lands have been largely protected by policy and litigation since the passage of the NWFP, but the 2015 O&C Land Grant Act would mandate that harvest be carried out in forestry emphasis areas, using the Johnson and Franklin plan for ecological forestry (S.132, 2015).

The Johnson and Franklin Plan

Franklin and Johnson devised a strategy for the O&C lands in western Oregon, managed by the BLM, which is meant to "provide ecological benefits and a sustained yield of timber harvest and revenue" (*S.1784: The O&C Land Grant Act*, 2014). They outlined their plan in a number of scholarly articles (Franklin & Johnson, 2012, 2013) and less formal reports (Johnson & Franklin, 2009, 2012, 2013), as well as in two testimonies before the Senate Committee on Energy and Natural Resources (*Challenges and Opportunities*, 2013b*; S.1784: The O&C Land Grant Act*, 2014). In this section I will outline the major components of the Johnson and Franklin plan, drawing upon all of these works. In particular, leading up to the plan advanced in the bill, Johnson and Franklin led a series of pilot projects in Roseburg, Coos Bay, and Medford, designed to demonstrate the principles of ecological forestry for stakeholder and decision-maker assessment (Johnson & Franklin, 2012). Even these early and relatively contained pilots were highly controversial (DellaSala et al., 2013).[7] However, the two reports made on the pilot projects (Johnson and Franklin, 2012, 2013) provide detailed information about how, if it were to be adopted as a regional strategy, Johnson and Franklin envision ecological forestry being implemented across the western Oregon landscape.[8]

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[7] Buck Rising in Roseburg and Pilot Joe in Medford are sold and complete (DellaSala et al., 2013). White Castle is currently on hold and under appeal, after a lawsuit was filed by two environmental non-profit organizations (*Oregon Wild & Cascadia Wildlands v. USDI Bureau of Land Management,* 2014).

[8] I am basing my analysis of ecological forestry in western Oregon on the plan Franklin and Johnson have outlined in their written works over the past six years. The strategy written into the latest version of the O&C Act moving through Congress (S.132, 2015), though aligned with the plan outlined by Franklin and Johnson, is more specific, and indeed clarifies many of the points of

Franklin and Johnson classify forest ecosystems in western Oregon into two main categories: Moist Forests and Dry Forests (Franklin & Johnson, 2012; Johnson & Franklin, 2013). Moist Forests have historically been characterized by high intensity fires at return intervals of roughly two hundred years, sometimes longer and sometimes shorter (McComb et al., 1993) and they are highly productive sites (Foster, Knight, & Franklin, 1998; Johnson & Franklin, 2012). Dry forests, on the other hand, have historically experienced relatively frequent, low or mixed-intensity fires at fairly short (~5-25 year) return intervals (Spies et al., 2006). They occur on less productive sites, and are generally characterized by large, old (300-500 year) trees in otherwise relatively open stands (Spies et al., 2006). Johnson and Franklin (2009) categorize areas with historically mixed severity fires as Dry Forests, with the anticipation that in a future drier, warmer climate they will experience more frequent and severe fires. Different strategies are employed for each type of forest, to reflect the characteristic disturbance regime that will, hypothetically, sustain their respective ecosystem processes and functions (Franklin & Johnson, 2012).

Moist Forest strategy

Ecological forestry prescriptions in Moist Forests take consideration of three variables: whether the land is designated as critical habitat for the Northern Spotted Owl, the NWFP allocation of the land, and the age of the stand (Johnson & Franklin, 2013). Over 75% of the BLM lands classified by Johnson and Franklin as Moist Forests are situated on NWFP reserves (i.e. they are currently restricted from harvest), including over 60% of the total young (under 80 year old) Moist Forest stands (Johnson & Franklin, 2012). Only 15% of all BLM Moist Forests are both under 80 years of age and outside of reserves. These are the areas identified as least

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uncertainty that I will discuss in the upcoming sections. I believe I am justified in focusing on the Johnson and Franklin plan rather than the O&C Act itself since, even if the Act fails, the Johnson and Franklin plan might still be proposed for implementation elsewhere, and therefore has broader applicability and relevance. I will also point out that the version of ecological forestry adopted in the bill is one but certainly not the only version that could have been designed on the basis of Franklin and Johnson's writings. I will discuss this issue at length below.

controversial, and therefore most readily available for variable retention harvest (Johnson & Franklin, 2012). The major points of the strategy for Moist Forests are described below.

Regeneration harvest. "Early successional harvests," "early successional regeneration harvests," (Johnson & Franklin, 2012) or "variable retention regeneration harvests" (Johnson & Franklin, 2013) would be carried out on matrix lands outside of critical habitat for the Northern Spotted Owl. The purpose of these treatments is to create high-quality early seral habitat on the landscape (emphasized in Franklin & Johnson, 2012; Johnson & Franklin, 2012; less emphasis in Johnson & Franklin, 2013, see pp. 7-8, but defended in Franklin & Johnson, 2013) and to provide for a sustained yield of timber (Franklin & Johnson, 2012 (see p. 436), Johnson & Franklin, 2012; emphasized in Johnson & Franklin, 2013). The level of harvest predicted is approximately two-thirds of the quantity anticipated under the NWFP (Johnson & Franklin, 2012).

Variable retention harvests would leave 30-40% of the green trees, as well as other specific legacy elements such as old trees, snags, and downed logs (Johnson & Franklin, 2012, 2013).[9] Trees retained on riparian reserves would be factored into the total retention in the harvest unit. In other words, riparian reserves would be part of, rather than additional to, the 30-40% green tree retention (Johnson & Franklin, 2013).[10] The case would not be the same with survey and manage buffers. Green tree retention may be strategically designed to include survey and manage buffers, but if wildlife surveys suggested that additional buffers were required in

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[9] The latest version of the O&C Act describes approximately green tree retention 30% as "ecological forestry principles" (S.132, 2015, p. 63). However, the bill then stipulates that 25%, but no less than 15%, green tree retention will be left on 50,000 acres designated toward variable retention regeneration harvest (S.132, 2015, p. 66).

[10] Estimates suggest that riparian buffers would comprise approximately 10% of the total retention, so another 20-30% of the stand not allocated to reserves under the NWFP would be retained (Johnson & Franklin, 2013). I will note, however, that the O&C Act of 2015 stipulates that riparian reserves around non-fish bearing streams count toward the total live tree retention, but riparian reserves around fish bearing streams do not count toward total live tree retention (S.132, 2015).

addition to the 30-40% retention, retention levels would have to be higher, in order to conform to current policy stipulations (Johnson & Franklin, 2012).

Green tree retention in early successional (variable retention) regeneration harvests would be mostly aggregated, with dispersed individual legacy elements (Johnson & Franklin, 2012). The resulting complex early seral conditions would be allowed to persist for 25-30 years before canopy closure (Johnson & Franklin, 2012). After canopy closure, stands would be managed for a mixture of age classes and species, on rotations of 100-160 years (Franklin & Johnson, 2012; Johnson & Franklin, 2013). It is not clear how the social tensions of harvesting a stand over 100 years of age would be resolved, beyond the recognition that it i bound to be controversial (Franklin & Johnson, 2012).[11]

Regeneration harvests on O&C lands would occur mostly on stands under 80 years old, although Johnson and Franklin entertain the possibility of harvesting in stands up to 120 or 160 years of age, depending on site conditions and management objectives (Franklin & Johnson, 2012; Johnson & Franklin, 2012; 2013).[12] For example, Johnson and Franklin (2013) propose to harvest some stands between 80 and 120 years of age. Although harvesting forests in this age range "may be difficult to justify from an NSO recovery perspective" (Johnson & Franklin, 2013, p. 20),

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[11] At present a very limited amount of empirical work has been done to understand social acceptability of ecological forestry methods (for a few exceptions, see Ribe 1999, 2009; Ribe & Matteson, 2002; Ribe, Ford, & Williams, 2013; Shindler & Mallon, 2009), but it is generally believed that public opinion in the Pacific Northwest is opposed to harvesting old-growth forests (Shindler & Mallon, 2009; Spies & Duncan, 2009). As such, it seems a critical oversight not to address the social challenges of future cutting in older forest, even in a stand that is intentionally placed on a 160-year rotation for eventual harvest. If one of Franklin and Johnson's goals is to secure a long-term sustained yield of timber, their plan needs to include a strategy for increasing the social acceptability of harvesting older forests in the future. Otherwise, future harvests are likely to meet the same opposition and litigation used to curtail harvests under the current NWFP policy framework.

[12] The latest version of the O&C Bill specifies that no forests over an 80 year age class (75 to 85 years old) will be harvested for regeneration (S.132, 2015). Although this would be the operative age threshold on O&C lands if the bill passes, I will continue to discuss the age thresholds suggested in Johnson and Franklin's earlier reports. They represent a significant part of the planning process leading up to the O&C Bill, and potentially offer important insight into the values underlying Johnson and Franklin's ecological forestry philosophy. In addition, it is possible that different age thresholds would be considered in the future on other lands proposed for ecological forestry management, so the implications are worth exploring.

Johnson and Franklin note that it may be important from an economic perspective, since most of the stands under 80 are also under 50 years old (Johnson & Franklin, 2013). According to the NFMA planning rule (2012), such young stands cannot be harvested for timber before they reach the culmination of mean annual increment USDA Forest Service, 2012). However, the Planning Rule provides an exception to this clause, stipulating that harvests can be enacted prior to the culmination of mean annual increment where the "primary purpose of the harvest is something other than timber" (Franklin & Johnson, 2012, p. 436). Thus, variable retention regeneration harvests could plausibly be conducted in very young (e.g. under 50 year old) forests, if they were justified primarily by restoration of early seral conditions to the landscape.

Johnson and Franklin (2013) also propose transferring some of the younger stands that are outside of critical habitat for the spotted owl, but currently in either riparian reserves or LSRs under the NWFP, to matrix allocations, so that they can be actively managed with regeneration harvest (Johnson & Franklin, 2013). They justify this proposal based on the assertion that older forests in the matrix will be designated as critical habitat of the spotted owl, and therefore effectively reserved, so the transfer of young non-critical habitat on LSR lands to matrix would amount to a fair exchange (Johnson & Franklin, 2012).[13]

Thinning. Variable density thinning would be used to accelerate the development of complexity and heterogeneity in young, relatively uniform forests that originated from previous harvest, but are currently in reserves (Franklin &

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[13] Two important points pertaining to this proposed tradeoff remain uncertain. First, Johnson and Franklin (2012) outlined a hypothetical scenario, in which matrix forest over 120 years of age would be traded for LSR forest under 120 years of age (p. 73). However, in their report the following year, Johnson and Franklin (2013) suggested that the cutoff age for re-designating LSR lands as matrix lands would be "generally less than 80 years" (p. 23). Thus, the age cutoff used to parcel and swap lands is not clear. Second, it is not evident that Johnson and Franklin propose actually re-designating matrix lands as LSRs. In the hypothetical case just described, they very clearly implied a reclassification (p. 73). However, later in their 2012 report (p. 74) they justified the trade based on the assumption that older forests, as potential owl habitat, would effectively be reserved, possibly (although, again, it is not clear) suggesting that there is no need to actually re-classify older matrix lands as reserves. Re-designating matrix to reserves is not even mentioned in the 2013 report.

Johnson, 2012; Johnson & Franklin, 2009, 2012, 2013). Certain young stands in the matrix would also be thinned for accelerated old-growth conditions (Johnson & Franklin, 2012, 2013). Thinning prescriptions are not extensively addressed in the Johnson and Franklin planning documents, leaving several points unclear. For example, how and why would young matrix forests be sorted into stands appropriated to variable retention regeneration harvest, as opposed to stands treated only with variable density thinning? Would stands being managed for harvest on 100 to 160 year rotations also receive variable density thinning treatments? If the "swap" of old forest for young LSR forest were carried out, would variable density thinning still be used at all? None of these questions are clearly answered in Johnson and Franklin's written reports.

Riparian reserve revision. Revised guidelines for riparian reserves would allow limited harvest within riparian zones*.* 35-50% of current riparian reserves "would still be devoted solely to achieving the ecological goals of the ACS [Aquatic Conservation Strategy], with this amount dependent on watershed characteristics and alternative [referring to the specific alternative selected from among the different proposed revised riparian strategies] (Johnson & Franklin, 2013, pp. 24-25). Johnson and Franklin suggest that ecological forestry could be used on younger stands in the remaining 50-65% of remaining riparian reserves, "to achieve both ecological goals and sustained yield goals" (Johnson & Franklin, 2013, p. 25). Buffers would be reduced on low-priority or non-fish bearing segments of streams in the matrix, and also selectively harvested (thinned), with tree tipping to secure ample supply of woody material to streams (Johnson & Franklin, 2013).

Table 2.1 provides a basic layout of areas that are intended for harvest under the Johnson and Franklin strategy for Moist Forests (adapted from Johnson & Franklin, 2013, p. 19).[14] For the most part, Johnson and Franklin's designations

[14] It appears that Johnson and Franklin do not use "ecological forestry" to refer to areas that are not harvested (Johnson & Franklin, 2013), which are shown as having no "potential role for ecological forestry" (Johnson & Franklin, 2013, p. 19). This point is somewhat vague. Although it appears that "ecological forestry" refers only to active management, as opposed to reserved lands, a later section

conform to current policies, but they do suggest several notable deviations from the existing social and political framework. First, they propose allowing regeneration harvest in matrix forests under 80 years within critical habitat, which may be controversial and arguably detracts from the goal of restoring spotted owls to viable population levels.[15] Second, transferring some NWFP reserved lands to the matrix for harvest would diverge from the current NWFP, as would selectively harvesting within riparian reserves, although, to be clear, when the NWFP was written, the plan was to eventually, with better information, revise riparian reserves (Thomas et al., 2006). Third, the proposal to consider harvest in stands between 80 and 120 years of age on matrix lands, while technically in line with all current policy, is controversial in light of the demonstrated public aversion to harvest in older forests over the past twenty years (Spies & Duncan, 2009).

Under current land allocations and following these prescriptions, Franklin and Johnson estimate that 7-10% of the total BLM western Oregon Moist Forests would be available for sustained yield timber production (Johnson & Franklin, 2013). However, revisions of survey and manage protocol, late-successional reserves, and riparian reserves may increase this percentage to 15-20% (Johnson & Franklin, 2013). Controverted Lands (U.S. Forest Service lands that have historically provided profit to O&C counties) could also contribute some Moist Forest stands under 120 years of age outside of NSO critical habitat, adding a relatively small additional amount of acreage to the sustained-yield land base (Johnson & Franklin, 2013). Thinning for late successional structure and composition is not considered a reliable input to a sustained yield of timber, but is instead regarded as "bonus wood" (Johnson & Franklin, 2013).

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notes that the potential role of ecological forestry on reserves over 120 years of age is "unclear" (Johnson & Franklin, 2013, p. 20). Whether this implies that Johnson and Franklin are considering extending active management to these regions, or that older forests are considered part of a landscape-scale ecological forestry management plan that includes areas of reserves, remains uncertain.

[15] The actual 2015 O&C Land Grant Act specifies that harvests will *not* occur in critical habitat (S.132, 2015, p. 65). This is a marked changed from the 2013 version of the bill, which stipulated only that known nest trees would not be cut (S.1784, 2013, p. 31).

Dry Forest strategy

Dry Forests are not expected to contribute significantly to the agenda of sustained yield (Johnson & Franklin, 2012, 2013), with a focus instead on building forest and landscape resilience. After years of fire suppression, fuel loadings currently exceed historic levels, increasing the danger of catastrophic wildfire and insect epidemics (Franklin & Johnson, 2012; Johnson & Franklin, 2009). Under the NWFP, Dry Forests in LSRs were supposed to have been thinned to reduce fuel loadings and restore the open conditions that would have characterized these forests under historic fire regimes (Franklin & Johnson, 2012). However, thinning has largely been prevented by environmentalist litigation against active management in older forests (Johnson & Franklin, 2012).

Unlike in Moist Forests, Johnson and Franklin do not consider land allocations in setting Dry Forest prescriptions. Instead, they propose that ecological forestry in Dry Forests should be implemented across the Dry Forest landscape, replacing the system of NWFP land allocations, NSO designations, and age classes (Johnson & Franklin, 2013). The major points of the Dry Forest strategy are as follows.

Density treatments*.* Density reductions of approximately 40% would be achieved by extensive thinning, with retention of trees over 150 years of age (Johnson & Franklin, 2012). The age threshold of 150 was chosen because it is indicative of the point at which old-growth characteristics develop in individual trees, and it also corresponds to the time period (mid-1800s) when European fire suppression started altering the historic disturbance regime (Franklin & Johnson, 2012; Johnson & Franklin, 2012). In addition, all trees over 30 inches dbh, as well as all larger hardwoods, would be retained (Johnson & Franklin, 2012). Johnson and Franklin (2009) note that historically these forests would have had 10 to 20 old, dominant trees, but some denser stands also would have had up to 50. It is not clear what criteria would be used to establish target densities, beyond that "detailed prescriptions should be keyed to plant associations and the landscape context" (Johnson & Franklin, 2009, p. 5). Density treatments would be variable, including heavily thinned patches, or gaps, and unthinned patches, or skips (Johnson & Franklin, 2012), resulting in a heterogeneous landscape with patches of more and less disturbed forest, such as would have occurred under a historic frequent fire regime (Johnson & Franklin, 2009; Spies et al., 2006).

Unlike the Moist Forest strategy, regeneration harvest does not constitute a major component of the Dry Forest strategy.[16] There would, however, be active management in older stands, in the form of both mechanical silvicultural treatments and prescribed fires (Johnson & Franklin, 2009). In other words, there is no "old-growth" or "late-successional forest" that is absolutely off-limits to management in the Dry Forest strategy (Johnson & Franklin, 2013, p. 30). The justification for actively managing older stands is that "these actions will help sustain and restore these older tree populations in the face of enhanced current threats from fire and insects, the latter the result of increased competition in the unnaturally dense stands" (Johnson & Franklin, 2009, p. 6).

Late successional emphasis areas. Denser patches of forests, known as late successional emphasis areas (LSEAs), would be left in approximately one third of the Dry Forest landscape (Franklin & Johnson, 2012).[17] The objective of these areas is to continue providing habitat for the spotted owl and its associated prey species (Johnson & Franklin, 2009). LSEAs would be selected according to four criteria: 1) evidence of use by the spotted owl; 2) complex forest structure; 3) evidence that it was historically a less-frequently burned area, and 4) relatively low risk of severe

[16] The phrase "regeneration harvest" is not actually used to describe any part of the plan for Dry Forests. However, Johnson and Franklin (2013) do note that one component of the Dry Forest strategy is to "[e]stablish new tree cohorts of shade-intolerant species in openings" (p. 9), indicating that some regeneration harvest will take place.

[17] Unlike the Moist Forest retention strategies, it appears that critical habitat and riparian reserves are additional to these LSEAs, and would hypothetically increase the proportion of the landscape not undergoing density treatment to 40-50%. However, since this Dry Forest strategy is intended to replace current land allocation schemes, it is not clear that current reserves and set-asides would be considered separately under the Dry Forest plan. Most likely, the goal is to have, in total, a third of the Dry Forest landscape in LSEAs.

fire and other threats (Johnson & Franklin, 2012, p. 66).[18] Johnson and Franklin are explicit that these areas are not reserves, and can be actively managed to serve the overarching goal of Dry Forest landscape resilience (Johnson & Franklin, 2013). The hope is that the overall landscape can be managed to divert fire away from these denser patches, increasing the "hang time" in which LSEAs would be able to survive unburned (Johnson & Franklin, 2012). However, Johnson and Franklin also note that fires would inevitably consume some LSEAs, at which point the density-treated areas of forests, which would still have their largest, oldest trees, would be available to readily "be regrown into denser suitable NSO habitat when replacement habitat is needed" (Franklin & Johnson, 2012, p. 66).

The Missing Pieces

Ideally, decisions about how to manage forests are guided by the best information available about forest ecosystem processes and functions (Dietz, 2003; Simberloff, 1999). However, even with perfect knowledge, a body of empirical information does not in itself indicate what should be done. Decisions in natural resource management and conservation require both empirical knowledge and normative judgments (Murie, 1954; Shelby, Vaske, & Donnelly, 1996; Vucetich & Nelson, 2013). It is not possible to say what is good or right merely on the basis of what is empirically observed (Moore, 1903). In other words, knowing how the world *is* does not necessarily equate to how it *ought* to be. To arrive at "ought" requires an idea about how the world should be, which in turn requires a normative judgment (Curry, 2011; Nelson & Vucetich, 2012a).[19] In the case of natural resource

[18] It is not clear whether evidence of owl activity in areas selected for density reduction treatments would be grounds to halt the proposed treatment.

[19] Keulartz (2007) suggested that the use of metaphor can close this gap between "is" and "ought," effectively lending normative valence- a sense of "rightness" or "wrongness," "goodness" or "badness"- to ideas that would otherwise appear morally neutral. Perhaps this is a strategy implemented and, indeed, capitalized on in ecological forestry. However, as we will see, the rhetorical sleight of hand attempted in using seemingly empirical but decidedly normative language such as "natural," "integrity," "resilience" and "ecological" is not skilled enough to conceal significant

management, normative judgments will also be ethical (Vucetich & Nelson, 2013), because they reflect ideas about how we (as individuals, as societies, and as a species) believe we ought to interact with our environment.

Ecological forestry is proposed as a philosophy of forest management and a strategy for conservation, both of which require that normative and ethical decisions be made about how human communities should interact with forests. I will argue that normative and ethical judgments are as essential to the theory and application of ecological forestry as its scientific and logistical elements, and that they should therefore be treated with equal urgency and communicated with equal transparency. However, the current literature largely fails to address the normative and ethical dimensions of ecological forestry, a critical omission that results in significant, pervasive, and ultimately problematic ambiguities.

Metaphysical Ambiguities

To fully understand the normative underpinnings of ecological forestry, it will be useful to first consider the metaphysical framework in which it is situated.

A human-nature dualism

One of the core tenets in ecological forestry is that anthropogenic disturbances should mimic the effects of non-anthropogenic disturbances in the natural range of variability. The model for management action at any given site is the disturbance regime considered to be "natural," i.e. characteristic of the site prior to significant human impacts, which in North America is pre-European settlement (Aber et al., 2000; Corace et al., 2009; Franklin & Johnson, 2012; Seymour et al., 2002). This idea, so central to ecological forestry, invokes a dichotomized metaphysic, in which humans and nature are perceived as separate and distinct from one another.

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ambiguities that undermine ecological forestry as a clear and consistent philosophy of forest management.

Klenk and her colleagues (2008, 2009) looked in depth at a close Canadian associate of ecological forestry, "emulating natural disturbance," or END. Conceptual analysis by Klenk, Bull, and Cohen (2008) revealed considerable inconsistencies in how forest scientists interpreted the strategy, particularly related to how they perceived its metaphysical underpinnings and implications. In a later work, Klenk et al. (2009) made a critique of END, stemming from the observation that END, like ecological forestry, operates on and indeed perpetuates a dualistic metaphysic. END is predicated on the view that humans and nature are ontologically distinct, a non-empirical assumption that introduces a very basic element of subjectivity into the theory. A second element of subjectivity is introduced in the selection of an appropriate reference for natural disturbance, which requires selection of a certain threshold of human impact, past which there has been a deviation from the "natural" order of the world. Klenk et al. pointed out that the most basic idea underlying END, i.e "naturalness," is in fact normative, based on a belief that what is "natural" is also good and right. As such, they asserted that it is both deceptive and errant to rely on the putative objectivity and credibility of science to legitimate END, when management decisions are in fact made on the basis of largely normative judgments. This, I will show, is also the case with ecological forestry.

Klenk et al. (2009) also suggested that the dualism of humans and nature is problematic because it discourages innovative and creative management options for climate change adaptation. They believe that historic reference conditions, particularly disturbance regimes, are inappropriate models for forest management, based on the possibility that the conditions best suited to the future have no analogue in the past (Klenk et al., 2009). This position, I will note, has considerable scholarly support (see, for example, Crutzen & Steffen, 2003; Haywood et al., 2011; Jerneck et al., 2011; Keulartz, 2012; Steffen et al., 2004). Klenk et al. (2009) believe that, to enable more proactive management interventions such as assisted migration, as well as more flexible and innovative conservation strategies in the face of global climate change, management needs to relinquish its "conservative" commitment to a separate, idealized, and increasingly rarified notion of "nature" (Klenk et al., 2009, p. 443).

Long standing discussions about the concept of naturalness that stems from a dichotomized human-nature metaphysic (for example, Callicott, 1989; Naess, 1973; Plumwood, 1993), have reverberated in a number of applied fields, including forest conservation, management, and restoration (for example, Callicott et al., 1999; Elliott, 1997; Gómez -Pompa & Kaus, 1992; Heller & Hobbs, 2014; Hobbs et al., 2010; Purdon, 2003). It is beyond the scope of this project to make a worthy contribution to that conversation. Ecological forestry adopts a metaphysical framework separating humans and nature, and removing this framework would fundamentally alter the characteristics of ecological forestry as it is currently being advanced, which is the topic at hand. As such, I will refrain from further commentary on the questionability of upholding a distinction between "humans" and "nature." However, because it does so fundamentally draw upon a metaphysical dichotomization of humans and nature, there is certainly some onus on ecological forestry to justify, or at least point out, the ideas and decisions that are informed by it. The selection of "natural" qualities is, if not arbitrary, in no way definitive (Anderson, 1991; Callicott et al., 1999; Noss et al., 2006). "Natural" is a normative concept, one that assigns value, or "goodness," to an object, idea, or entity (such as the non-human biophysical world) that is not itself, objectively, good or bad.

The inherent normativity of ideas like "emulating natural disturbance," which draw upon the concept of naturalness, should be openly acknowledged when management strategies are formulated and communicated (Landres et al., 1999). Johnson and Franklin (2012) provide an example of how such normative management decisions might be made transparent. They acknowledge that they decided to characterize the current density of Dry Forests as a divergence from "natural" conditions resulting from anthropogenic fire suppression, rather than adopting a different hypothesis, which suggests that current dense conditions reflect a "natural" shift in an ecosystem that did in fact historically experience stand-replacing fires.[20] Unfortunately, such open explanation is anomalous. By and large, the word "natural" is used casually and without questioning or elaboration in the ecological forestry literature, even though disagreements over the interpretation of "naturalness" could result in profoundly different and even conflicting conceptualizations of how a forest should be managed under an ecological forestry approach.

Nonetheless, across the ecological forestry literature, whether by virtue of genuine consensus or simply as a byproduct of non-reflective acceptance of the concept, reference conditions for "natural" disturbance do not appear to be controversial. Most of the ecological forestry and supporting literature refers non-specifically to "natural disturbance" or "historic conditions," but whenever a more specific reference point is set, all point to the era of pre-European settlement (Aber et al., 2000; Corace et al., 2009; Franklin & Agee, 2003; Franklin & Johnson, 2012; Johnson & Franklin, 2012; Maguire & Chambers, 2005; Seymour et al., 2002; Seymour & Hunter, 1999).[21] Thus, although the word "natural" is generally controversial, since its meaning is contingent upon a deeper metaphysical understanding of how humans and nature relate to one another (Callicott et al., 1999), within ecological forestry the meaning of "natural" is essentially calibrated by consistent use. And yet, as I will explain below, the reference of "pre-European settlement" is still very general, leaving considerable room for interpretation and requiring additional normative decisions about which of nature's processes management should emulate.

"Ecological"

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[20] "Although there are continuing debates about the historic state of many southwest Oregon Dry Forest stands, treatment of these forests so as to reduce the potential for stand-replacement wildfires and insect epidemics is consistent with current management objectives" (p. 66). Here Johnson and Franklin tell us that they have decided to adopt a certain version of "natural" over another, because it is more aligned with the chosen management objectives (fire resistance and resilience). What they fail to articulate, however, is how the "current management objectives" dictating the selection of reference conditions were themselves developed.

[21] For a notable exception, see Attiwill (1994), who conceptualizes a range of natural variability encompassing both anthropogenic and non-anthropogenic disturbances.

Although the dualism separating humans from nature is itself relatively easy to discern in ecological forestry, within this framework there are still difficult nuances to navigate. As the era of climate change has set in, shifting and contentious understandings of what is natural (see, for example, Denevan, 1992; Cole & Landres, 1996; Hobbs et al., 2010; Gillson & Willis, 2004; Gómez-Pompa & Kaus, 1992) have perhaps induced a shift away from the defense and advancement of "the natural" as the focus of conservation efforts. Even though, as discussed above, the natural range of variability serves as a reference for management emulating natural disturbance, ecological forestry does not aim to create, maintain, or restore "natural" conditions per se. It purports, rather, to create, maintain, or restore "ecological" conditions. Unlike the word "natural," which has been exposed, so to speak, and is widely understood to rest on subjective, normative judgments, the word "ecological" would seem to reflect biophysical properties and functions of the systems themselves. However, this word, presumably selected quite intentionally to characterize *ecological* forestry, is riddled with ambiguity, a primary source of uncertainty that undermines ecological forestry from theory to application. Perhaps because of its deep tethers to "the natural," "ecological," I would argue, is an ambiguous and highly problematic concept in ecological forestry, carrying the same normative baggage as "natural," but also cloaked in language that invokes the authority of science (Klenk et al., 2009; Winkel, 2014).

The vagaries of the multiple interpretations possible with the word "ecological" will be discussed further below, but I will note here that in many cases "ecological" appears to be shorthand for "ecological integrity,"[22] a concept that is itself vague, controversial, and difficult to disentangle from the idea of "naturalness" (Callicott, et al., 1999; Noss, 1990). In common usage, the word "integrity" refers to the condition of being whole or intact, and internally harmonious (Cox, La Caze, &

[22] This observation, while not grounded in any quantitative or qualitative analysis, results from an extensive review of literature concerning ecological forestry and its conceptual associates. In the name of transparency, however, I will openly acknowledge that I am offering an informed but ultimately subjective impression that is certainly open to dispute.

Levine, 2013). It is the connotation o *functional* wholeness that seems to subtly distinguish the concept of ecological integrity from the concept of naturalness, which implies *ontological* wholeness, i.e. lack of human interference. Grumbine (1994) defines ecological integrity according to five criteria, including viable populations of native species; representation of all native ecosystem types in the normal range of variability; maintenance of evolutionary and ecological processes; maintenance of species' evolutionary potential; and human activity, as long as it is harmonious with the previous four criteria (p. 31).[23] Lindenmayer et al. (2012) take a similar if somewhat more succinct approach, defining ecosystem integrity as, "maintenance of structural complexity, species diversity and composition, and ecological processes and functions, within the bounds of normal disturbance regimes." (p. 422). Spence (2001) equates ecosystem integrity with biodiversity, while Drever et al. (2006) link it with resilience. Based on the variability of definitions, it becomes clear that there is no unilaterally accepted, "true" definition of ecological integrity. And yet, in the literature on ecological forestry, ecological integrity appears to be a fairly well established, even if highly abstracted, goal.

Although it is clear that being "ecological" is a desirable condition, a precise meaning of the word remains elusive. We know that ecological forestry is proposed not to introduce active management into "natural" forests, such as unmanaged forests in reserves, but rather to manage multiple-use forests in such a way that, even though they are not "natural," they remain ecologically intact (Lindenmayer & Franklin; North & Keeton, 2008). The question is, what core or subset of "natural" properties must these forests possess, and what threshold of humanization can they not exceed, in order to still be considered "ecological?" Does "ecological" refer to the conditions that have harbored life o earth up to and including the current point in time, or does it refer to the conditions that will be best suited to a future warmer,

[23] Note that Grumbine also draws upon a dichotomized metaphysic, suggesting that ecological integrity is intact as long as human activity does not cause the system to diverge from a "natural" state. And yet his concept of "ecological integrity" does not actually preclude human activity, i.e. an ecosystem can "accommodate human use and occupancy" without losing its ecological integrity (Grumbine, 1994, p. 31).

less predictable climate? Is it referring to biodiversity, hydrology, nutrient cycling, productivity, or some other ecosystem function or process? What happens when "ecological" objectives conflict with one another? In some cases multiple "ecological" benefits may be mutually compatible (for example, Henson, Thrailkill, Glenn, Woodbridge, & White, 2013), but in other cases multiple "ecological" benefits may not be so amenable to one another (for example, Burton, Ares, Olson, & Puettmann, 2013). The matter becomes further complicated when, as is increasingly common, humans are considered part of socio-ecological systems (Currie, 2010), which raises difficult questions about whether human social objectives can rightfully be called, to any degree, "ecological."

In ecological forestry, management actions are justified as a way to achieve "ecological" goals, or suit "ecological" objectives. Such use of the word "ecological" is problematic for two reasons. First, as pointed out earlier, it is impossible to derive an "ought" from an "is." Even if "ecological" were a physical property of the material world, in the same way that oxygen is a physical element of air, the observation that an ecosystem process, function, or property is "ecological" would not in itself offer any information about how that process, function, or property should be managed. A culture of bacteria may be "ecological," but that does not mean it should be encouraged to grow on the surface of a kitchen table. But the second and more important reason why use of the word "ecological" is problematic is that "ecological" is not a physical property of the world in the first place. "Ecological" is a normative concept, which carries with it value judgments about what is important (e.g. ecosystem functions) or right (e.g. ecosystem integrity), or how the world ought to be (e.g. self-sustaining and existing in perpetuity in conditions that support a variety of life forms). As such, it is not enough to justify a proposed measure by claiming it is "ecological." From a carbon storage standpoint an old-growth forest may be "ecological," whereas from a butterfly conservation standpoint an early seral meadow replacing that old-growth forest may be "ecological." Both positions could be based on credible science, but because they reflect different values, they would lead to conflicting ideas about what management for "ecological" goals or objectives would entail. Because there is so much variation in how "ecological" can be interpreted, it only becomes meaningful with further clarification, not only of the scientific angle it reflects, but also, critically, of the agenda it serves and the values it represents.

The metaphysics of "ecological"

I have been arguing that "ecological" is a normative concept, just as "natural" is a normative concept. The important difference between them is that "ecological" is also ostensibly a highly scientific concept, which describes properties of the biophysical world that have been empirically observed by ecologists. Because it appears both untethered from the normative muddle of the human-nature metaphysic, and grounded in the authority of science, "ecological" can quite easily be misconstrued as an objective property of the biophysical world. If this were the case, ecological forestry would be relatively straightforward: just as water polo is nothing more than polo in the water, ecological forestry would be nothing more than forestry that is ecological. Unfortunately, knowing how to conduct forestry "ecologically" becomes a less straightforward proposition with the realization that "ecological" is not, in fact, an objective property of the material world. Practitioners of ecological forestry model management actions on processes that are considered "natural," because they result in certain "ecological" outcomes that are believed to be good, right, and desirable (for example, a diversity of habitats, high productivity, or clean water). Although such outcomes are described as being "ecological," it is in fact the positive value ascribed to these outcomes, rather than the outcomes themselves, that is conveyed in the word "ecological." To illustrate, consider a city park composed of open lawns, tree-lined sidewalks, manicured hedges, and public restrooms. The park is a functioning ecosystem, cycling matter and energy and supporting a community of organisms (Evans, 1956; Pickett & Cadenasso, 2002). Is this system "ecological?" No amount of empirical knowledge about the properties of the system will answer the question. The answer can just as easily be "yes" as "no," but either way, it will be made on the basis of a normative judgment that assesses the system for its alignment with the values associated with, and indeed embedded within, the concept of "ecological." [24]

Ecological forestry is based upon a central premise that the natural world is a reference for "ecological" conditions. This premise is not stated explicitly, but if "natural" forests (i.e. forests with no significant human impacts) are used as reference conditions for how forestry can be practiced in an "ecological" manner, the implication is that "natural" conditions must also be "ecological." A second central premise of ecological forestry is that non-intervention is not a tenable broad-scale strategy for forest management, i.e. the majority of the world's forestlands must be actively managed by humans (Franklin et al., 1997; Franklin et al., 2007; Gustafsson et al., 2012; Lindenmayer et al., 2012; Lindenmayer & Franklin, 2002; North & Keeton, 2008; Seymour & Hunter, 1999). As Franklin and Johnson (2004) noted, "various human activities have radically altered the structure and function of forests, to the point where it's inconceivable that Mother Nature alone can restore them to their desired conditions" (p. 40). And yet, a third central premise in ecological forestry is that forests can be managed *by humans,* without losing their ecological qualities (Aber et al., 2000; Lindenmayer et al., 2006; Lindenmayer et al., 2012). Although such forests may no longer be natural, they can still be ecological. Thus, "natural" ecosystems are used to define "ecological" conditions, but "ecological" conditions do not necessarily have to be "natural."

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[24] In a narrow technical sense, "ecological" can mean, "of or pertaining to ecology," or, slightly more broadly, "of or pertaining to an ecosystem." These two conceptualizations could be considered value-neutral. However, the first is merely descriptive of a scientific discipline, and the second is highly generalized. If the entire biosphere can be considered an ecosystem, then truly any part of or interactions within it could rightly be called "ecological" (as could any part of, or interactions within, an intensively managed, recently harvested ecosystem). A word so generalized would seem to have little practical descriptive value. For a simple example, if, as is increasingly the case, ecosystems are considered to include humans, then any human activity, such as producing emissions from coal-fired power plants, could be called "ecological" because it pertains to the interaction of organisms (humans) with their environment (the planet). I should also add that this second conceptualization ("of or pertaining to an ecosystem") would not be value-neutral in the frequent case in which "ecosystem" is itself used as a value-laden, metaphorical term (Pickett & Cadenasso, 2002).

Stated differently, even though "human" and "natural" are ontologically distinct in ecological forestry, "ecological" and "human" are not. As such, "ecological" occupies the metaphysically ambivalent territory between humans and nature, touching both sides of the dualism, but not clearly belonging to either. As a result, ecological forestry is situated in the conceptually ambiguous territory between a dualistic and a non-dualistic metaphysic. Although ecological forestry makes reference to a "nature" that is separate from humans, it simultaneously suggests that a world both human and natural, i.e. "ecological," can, and indeed should, be achieved. So paradoxically, ecological forestry is dualistic in its roots, but non-dualistic in its reach. This metaphysical paradox underlies an obscure and undefined ethical understanding of how humans ought to relate with nature, particularly forests, the implications of which I will explore throughout the remainder of this chapter.

The challenge of emulating nature

Humans may emulate nature's processes and effects, but they must do so both deliberately and selectively, based upon decisions about the meaning of "ecological" and what course of actions will bring forests to this "ecological" state. Ecology has provided a limited, if constantly increasing, body of knowledge about the patterns of disturbance and forest development that characterized natural (i.e. pre-European settlement) forest ecosystems, and the functions, processes, and biodiversity that they sustained. Humans can understand some of the empirical properties of an ecosystem, including their biophysical mechanisms and the effects of interactions within the system. Equipped with this knowledge, anthropogenic disturbance can be designed to imitate non-anthropogenic processes. However, emulating natural processes is not a simple matter of mimicking or replicating their biophysical effects. It also requires that humans decide which processes and properties will occur in forests, along with when, where, to what extent, and why.

The word "emulate," derived from the Latin *aemulus*, "rivaling," is defined by the Merriam-Webster dictionary as, "to strive to equal or excel." To "equal" natural disturbance, humans must fully occupy the role that natural disturbance plays in forest ecosystems. A critical point, which is not made in the ecological forestry literature, is that empirical knowledge of ecosystems and their historic reference conditions only provides partial guidance for emulating natural disturbance. To emulate nature, humans must also take on the deterministic role of nature. To say that nature operates deterministically is not to imply that "everything happens for a reason," but rather that, out of an infinite range of possibilities within any given set of biophysical constraints, a very specific course of events unfolds at every moment across space (Crissman, 1945). Without human management, the world would arrange and re-arrange in a particular way, according to the laws and logic of nature. As managers, humans assume this responsibility for arranging and re-arranging the world in some particular fashion, in some cases (such as with ecological forestry) by attempting to emulate nature. This task is complex because emulating nature requires more than a mechanistic understanding of how the natural world works. Consider the analogy of a wise king and his son, the prince. The young prince might study the king's every move, in hopes that when he inherits the throne he can emulate his father. However, emulating the king will require not merely mimicking the king's speech and actions, but also understanding the king's reasoning, and channeling it through his own decisions. Similarly, to emulate natural disturbance, management would need to not only mimic nature's effects, but also understand nature's "reasoning" i.e. how nature determines whether and when to maintain, destroy, re-configure, o change each of the various parts and interactions in the world.

Science can study nature's processes and their effects, but it can only describe nature's reasoning in broad strokes, as inferred from the past. For example, science could tell us that a historic range of variability for a given landscape was characterized by a disturbance regime of mixed-severity fire every 50 to 75 years. Under the natural (non-anthropogenic) regime, fire would have burned at higher and lower intensities, leaving patches of early seral, open woodland, and denser forest. If a manager were trying to imitate these effects using forestry practices, he would need to decide when, in the 50 to 75 year interval, he should harvest. He would have to choose where, out of the entire landscape, to place the early seral patches, the open woodland, and the denser forests, and at what extents. He would need to select which logs to leave, which snags, and which trees. Each of these details, which would be so organically determined if nature were in charge, represents a choice for a human manager, and each choice has repercussions, not only for humans, but also for the forest's processes and functions, as well as all of its associated biodiversity.

To play nature's deterministic role without scientific understanding of nature's reasoning, humans must find a different way to reason through management decisions. Making decisions about how to emulate natural disturbance requires humans to make the leap from discerning how the world *is* or *has been*, to deciding how the world *ought* to be. These decisions therefore employ normative, or ethical reasoning (Nelson & Vucetich, 2012a). Ecological forestry operates on natural law theory, the belief that what is "natural" is right or good (Nelson & Vucetich, 2012a).[25] The problem is that humans can only infer what is right and good based on the historical record, which presents an extensive range of options (Seymour & Hunter, 1999). Nature offers no guidance for what, out of this extensive range, humans should imitate, because natural law theory would tell us that it is all good. It therefore becomes necessary to add human values to the moral calculus, in order to determine which version of natural disturbance we should emulate, to serve and uphold the values we believe should be met. This is the topic of the next two sections.

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[25] This might be read as a contradiction of my earlier observation that ecological forestry does not explicitly seek to achieve "naturalness." To answer to this perceived contradiction, I will reiterate that "ecological" is a derivative of "natural." Specifically, the positive normative value attached to "ecological" is rooted in the understanding that, although humans can create non-natural "ecological" conditions, the reference for "ecological" conditions is how they occurred (supposedly) without human influence in the past. If "naturalness" is not adopted as an explicit goal of ecological forestry, it is still an implicit goal, since it is embedded in the concept of "ecological."

Normative Ambiguities

The latter half of the 20th century ushered in a new era for forestry in North America, one defined by multiple, often competing societal objectives for forests (Grumbine, 1994; Hays, 2007). Such objectives include access to recreation; a supply of wood and non-wood resources, and the jobs that are produced when they are harvested from forests; habitat for wildlife; and regulation of hydrologic and geomorphic processes that have historically maintained stable environments that allow living communities, including human societies, to thrive (Christensen et al., 1996; Grumbine, 1994). With the recognition that forests represent a plurality of values, rather than the singular value of timber production, comes the difficulty of knowing how to weigh, balance, and prioritize among these various values. One solution that has historically been advanced is zoning, sometimes described as a triad approach (Seymour & Hunter, 1999) or "land sparing" (Lindenmayer et al., 2012). This approach allocates different uses, e.g. resource extraction and biodiversity conservation, to different pieces of land, achieving multiple objectives at the landscape level, but not combining them at the stand level (Lindenmayer et al., 2012; Phalan, Onial, Balmford, & Green, 2011). Although the land sparing approach has its own challenges, often related to finding adequate amounts of land to set aside for conservation (Lindenmayer et al., 2012), it does, at least theoretically, allow for optimization of individual objectives by separating them to their own tracts of land, thereby largely eliminating competition between them (Fischer et al., 2008). An alternative approach, sometimes called "land-sharing," attempts to meet multiple, and often conflicting, management objectives simultaneously, i.e. on the same piece of land (Gustafsson et al., 2012; Lindenmayer et al., 2012; Phalan et al., 2011). Ecological forestry is purportedly one such land-sharing strategy (see Table 3.1).[26] I will explore some of the conceptual challenges of this approach later.

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[26] Ecological forestry is still embedded in at least a partial triad approach as a management strategy for the third portion of the landscape, "the matrix," where forests are appropriated to neither intensive management nor biodiversity conservation (Franklin et al., 1997; Gustafsson et al., 2012; Lindenmayer et al., 2012; Lindenmayer & Franklin, 1999; Seymour & Hunter, 1999). While it is made

The scientific concepts employed in ecological forestry, and their application to forestry practices (see “Theoretical Principles” above), are discussed extensively in the literature (e.g., Franklin et al., 1997; Franklin et al., 2007; Gustafsson et al., 2012; Lindenmayer et al., 2012; Long, 2009; North & Keeton, 2008; Seymour & Hunter, 1999; Vanha-Majamaa & Jalonen, 2001). However, as I will show in this section, normative decisions are far less extensively addressed, and by and large are not treated as a critical component of ecological forestry. The resulting normative ambiguity of ecological forestry is problematic because it permits a vast range of variability in how ecological forestry can be interpreted and, eventually, applied.

The importance of normative clarity

Before continuing with the discussion of ecological forestry in particular, I will briefly discuss the importance of normative clarity in general. Normative clarity is essential to forest management, including ecological forestry, and should be clearly and explicitly addressed in three main forums: as part of an informed decision-making process; in communications, to build social acceptability; and in the planning phase, to establish goals and criteria of success.

Decision-making. Forests are important, both to humans and to the planet at large, and decisions about how to manage them should not be made lightly (Nelson & Vucetich, 2012a). Good decisions will be informed not only by the best available science, but also by open discussion of values (Dietz, 2003). Failure to account for the full range of values at stake, and the tradeoffs being proposed, may lead to a course of management action that is not actually based on decisions about what the appropriate course of action is, or what the course of action *should* be, but instead is determined by political expediency, ease of execution, or some other logistical consideration. Management actions should result from clear-eyed and well-reasoned decisions about how the forest ought to be managed, not arbitrary or

clear that reserves are still necessary to maintain in conjunction with ecological forestry (Lindenmayer et al., 2012), it is not clear whether ecological forestry is meant to replace intensive management (for a brief discussion, see Seymour & Hunter, 1999).

haphazard decisions made to satisfy whichever values happened to be most strongly represented or forcefully advanced at the decision-making table. In short, good decisions are made on the basis of careful and explicit normative discourse about how the different values associated with forests should be appropriately accounted for in management actions (Nelson & Vucetich, 2012a).

As a proposed strategy of forest management, ecological forestry has normative and ethical underpinnings that need to be openly acknowledged and incorporated into decision-making processes. It could be argued that normative and ethical matters are too complex, or perhaps too esoteric, for consideration in practical decision-making forums, and yet, it is revealing to observe that the three primary questions guiding retention (i.e. what to leave, how much, and in what configuration) are actually normative questions. An answer to these questions depends, of course, on the objective being pursued, but what is perhaps less widely acknowledged, and therefore must be clearly stated, is that the choice of objectives to pursue is based on a normative, and ultimately ethical, judgment, i.e. of what the objective *should* be, or how the land *should be* managed. This normative decision, far from extraneous or peripheral, quite critically determines the course of management action. For a very simple illustration, consider the difference between a management prescription made with the objective of enhancing spotted owl habitat, and a management prescription made with the objective of increasing timber yield.

Thus, the choice of objectives is one critical normative decision that must be made in ecological forestry. A second comes in deciding how to manage the chosen objectives. Consider, for example, how a management decision would be made if the sole objective were spotted owl conservation. After deciding to pursue this objective singularly (the first normative decision), further decisions would have to be made about how to meet this objective. A certain amount of scientific knowledge would be necessary, e.g. what amount of habitat is needed to support a certain population size of the species over a given area for a given amount of time (Shaffer, 1981).

Assuming momentarily that such figures could be scientifically ascertained, it would be relatively straightforward to design a prescription: leave what and as much as would be maximally beneficial to the single objective, spotted owl conservation. But ecological forestry is purportedly a form of multiple-use management, and management decisions become far more complex when they must account for multiple objectives. With a spectrum of different values to serve, some of which conflict with one another, the path from knowledge to decision becomes far less linear, requiring not only scientific information, but also normative decisions, made openly and non-arbitrarily, about how objectives should be weighted and prioritized (Figure 1.1).

Social acceptability. In addition to making non-arbitrary normative decisions, it is also essential to clearly explain these decisions, and the values underlying them, to build public acceptance for management actions. Various studies have suggested that sharing values is important to win support for management actions. Shared value similarity, or the sense that one's values are shared by the person or agency in charge of a decision, has been linked to trust (Earle & Siegrist, 2008; Vaske, Absher, & Bright, 2007; Visschers & Siegrist, 2008). Trust, in turn, is critical to modern natural resource management because it is a keystone for social acceptance of management actions (Cvetkovich & Winter, 2003), which is in turn essential to management success (Shindler, Brunson, & Aldred Cheek, 2004). Visschers and Siegrist (2008) suggested that, particularly in high-risk scenarios, communicating about the values underlying management decisions may be even more important than providing factual information, if managers want to inspire trust. Arguably, by openly communicating its values, a management strategy might stand to lose trust among social groups who do not feel their values are represented by the proposed actions. However, it also stands to reason that, while open communication of values may in fact alienate certain groups of people, the outright absence of information about values precludes trust-building altogether, and so may prove a greater hindrance to social acceptability than the loss of trust or support among select demographics.[27] In addition, Shindler and Mallon (2009) found that people are more likely to support management actions when they understand the objectives behind the proposed measure, and also when they understand how a decision has been made. This corroborates more general findings in social psychology, which identify openness and communication in general as pillars of trust (Whitener, Brodt, Korsgaard, & Werner, 1998). The implications for ecological forestry are that, in order to build trust and gain public acceptance, management decisions need to be made carefully and deliberately, and the values underlying those decisions need to be clearly and openly communicated with stakeholders.

Criteria of success. Normative judgments are also used to establish goals, and only by establishing clear goals can management be assessed for success or failure. It is, admittedly, exceptionally challenging to set goals without good information about likely outcomes. Ecology is inherently less precise than other sciences (Dietz, 2003), and forests are increasingly understood to be complex, dynamic systems with emergent and adaptive properties, which reduce certainty even further (Christensen et al., 1996; Messier, Puettmann, & Coates, 2013; Spies et al., 2010). While we can certainly envision ideal versions of how we want forests to look, be, and function, the state of science is far from a position in which it can describe the conditions under which these idealized forests would occur (Spies et al., 2010). Even agreeing on an ideal can be challenging, especially with a plurality of values at stake and the inevitability of difficult tradeoffs (Dietz, 2003; McShane et al., 2011; Polasky et al., 2008; Salafsky, 2011). In ecological forestry, the challenges of decision-making in the face of uncertainty are often answered by making recourse to adaptive management (Franklin, 1998; Franklin & Johnson, 2012; Henson et al., 2013; Johnson & Franklin, 2012; Swanson & Franklin, 1992), or, even more basically,

[27] This is a speculation about the relationship between salient value similarity, openness, trust, and social acceptability, a hypothesis that, to my knowledge, has not been tested. I must also note that acceptance of management and trust are both complex, multi-faceted concepts, which are informed by many other factors beyond openness and value similarity (see, for example, Mayer, Davis, & Schoorman 1995; Stern & Coleman, 2015).

monitoring outcomes (Christensen et al., 1999; Henson et al., 2013; Johnson & Franklin, 2012; Lindenmayer et al., 2012; Simberloff, 1999).[28] In other words, because of the high degree of uncertainty, monitoring is incorporated as an integral part of the ecological forestry strategy, hypothetically so that any unforeseen negative or undesirable outcomes can be contained, and management activities can be revised.

Certainly, monitoring and assessment of outcomes are a necessary component of not only ecological forestry but natural resource management in general (Franklin, Harmon, & Swanson, 1999; Lindenmayer & Likens, 2009; Nichols & Williams, 2006). However, evaluation of outcomes does not effectively substitute for defining goals and targets. Indeed, assessment is not even theoretically possible without criteria for success or failure (Raison, Flinn, & Brown, 1999). For example, is a retention harvest on a 60-year-old matrix stand in critical habitat successful if it supports an increase in a certain species of hummingbird? Or if it produces 20% more profit for a certain county compared to the previous year? Or if it simply does not adversely affect the spotted owls known to inhabit the area? Assessment of outcomes against any of these measures requires that goals and expectations be established at the beginning of the process. As such, adaptive management and monitoring cannot substitute for setting explicit goals through an open process of normative deliberation.

Management objectives and desired future conditions

In spite of the critical importance of normative clarity in forest management, ecological forestry does not have a clear normative framework that can be used to address complex questions about competing values and tradeoffs, or to explain how they are factored into management decisions. Instead, two mechanisms are employed, which seemingly remove the need for such a framework. First, as

[28] Adaptive management is an integral element of ecosystem management, entailing a dialectical process by which management actions are implemented, but treated as hypotheses to be tested and, if necessary, revised (Grumbine, 1994; Simberloff, 1998).

discussed above, in lieu of open communication about normative deliberations and the decisions they inform, ecological forestry draws upon the authority of science to ground and justify decisions, by use of the word "ecological." Although this tactic may in many ways be effective, especially since people are generally more inclined to trust decisions that have been informed by scientific expertise (Shindler & Mallon, 2009), the fact remains that scientific information alone neither constitutes nor justifies a management decision (Nelson & Vucetich, 2012a). Science cannot say what level of retention is right or wrong, what amount of timber harvest is appropriate or inappropriate, or what number of owls on the landscape counts as success or failure. These normative judgments are the logically necessary complement to a scientific understanding of forest ecosystems, without which management decisions cannot be made.

Second, to account for the normative dimensions of decision-making and goal-setting processes, ecological forestry outsources normative questions to external authorities, by deferring critical decisions to "management objectives" or "desired future conditions," both of which, as I noted earlier, are actually normative concepts. In some cases, the importance of the normative decisions underlying management objectives and desired future conditions is explicitly acknowledged, and in other cases, the normative dimensions of ecological forestry are only implied (see Table 4.1). And yet, even where the normative dimensions of ecological forestry are explicitly highlighted, they are not meaningfully addressed or justified, but instead considered extrinsic to, and outside the control of, ecological forestry. In other words, the implication is that management objectives or desired conditions are externally set, i.e. by public opinion polls, current policy mandate, landowner preference, or some other process, and then treated as an input variable to ecological forestry. The problem is that ecological forestry, as it currently stands, takes no ownership or responsibility for the management objectives it might be used to pursue, which in turn allows a broad range of potentially conflicting management actions to be called "ecological forestry." On the surface, it may appear that ecological forestry corrects for this problem by being selective about the actions it will take and the objectives it will pursue. However, upon closer examination it becomes apparent that ecological forestry does not restrict the actions and objectives that it can or will accommodate because it relies on two ambiguous concepts, both of which can be interpreted to connote a problematically wide range of meanings.

The first ambiguous concept is “conditions in the natural range of variability.” As noted above, nature offers an extensive set of possible scenarios for management to emulate, based upon its historic range of variability. Without a normative framework structuring decisions about which model of disturbance should be emulated from within the historic range of variability, ecological forestry essentially leaves a carte blanche for any management action. Consider the observation made by Oliver and Larson (1996): “there are probably few human disturbances for which a counterpart cannot be found in nature” (p. 92). In other words, for any given objective, an analogue can probably be found in nature to justify the management actions best suited to meet it. This observation has profound implications for ecological forestry. The only guidance for how to make specific management decisions about retention is the instruction to base these decisions on management objectives. But management objectives can also be quite diverse, ranging from, for example, maximum efficiency harvest to restoration of historic levels of old-growth. Therefore, because the ranges of management objectives and natural disturbance are both so wide and variegated, the set of management actions that can reasonably be called “ecological forestry” is virtually unrestricted.

The second ambiguous concept is “ecological.” It could be argued that, although “conditions in the natural range of variability” indeed offers a wide range of possible models for management action, ecological forestry cannot in fact be used to pursue any and all management objectives because, as Franklin et al. (2007) note, ecological forestry “always include[s] ecological objectives” (p. 23). It would seem that management objectives in ecological forestry are inherently constrained in some way, since they will always be oriented in an "ecological" direction. However, as discussed above, the word "ecological" is both variable and value-laden, and can point to very different management actions (for example, the "ecological" objective of protecting spotted owl habitat may conflict with the "ecological" objective of creating early seral habitat). In addition, calling the outcome of an action "ecological" does not specify the nature of the impact. Does an "ecological" objective aim to provide active benefit, or simply to do no harm? Different answers to this question could lead to significantly different management actions. The literature offers no definition and sets no guidelines for the meaning of "ecological," nor does it indicate any minimum threshold of "ecological" goals that must be met for a management action to be considered "ecological forestry." As such, using the word "ecological" actually does little to constrain the range of management objectives that can be pursued by ecological forestry. For example, although retention is generally recommended to be no lower than 5-10%, in some areas it is practiced at levels as low as 1% (Gustafsson et al., 2012). Based upon the current literature, as long as such a minimal retention treatment is modeled on a non-anthropogenic disturbance that plausibly could have occurred in a historic range of variability (e.g. a volcanic eruption); and as long as it achieves an objective that can at least in one sense be considered "ecological" (e.g. providing ideal conditions for certain colonizing or pioneer species), a 1% treatment can reasonably be called "ecological forestry."

The problem with ambiguity

Before proceeding further, it will help to first clearly explain the problem to which I have so far only alluded, namely, the issue of ambiguity and resultant variability. Throughout the chapter I argue that the ambiguous normative and ethical dimensions of ecological forestry, stemming from its ambiguous metaphysical underpinnings, are open to a problematically wide range of interpretations, which permit a significant amount of variability in how ecological forestry can be understood and applied. I argue here that ecological forestry is excessively permissive and unconstrained, which is problematic for reasons that are at once conceptual and practical.

The conceptual dimensions of the problem relate to the purported purview of ecological forestry. Ambiguity and variability are only problematic when clarity and consistency are required. If ecological forestry were being proposed merely as a set of tools and methods, metaphysical and normative theory would be unnecessary, and even misplaced. For example, it is unreasonable to expect that a power drill will be accompanied with carefully reasoned guidelines detailing the purposes for which it should or should not be used.[29] At times ecological forestry is presented in such a manner, as no more than a set of tools. Franklin et al. (2007), for example, wrote, "Three principles form the basis of an ecological forestry program… 1. Incorporating biological legacies into harvest prescriptions 2. Incorporating natural stand development processes, including small-scale disturbance, into intermediate treatments 3. Allowing for appropriate recovery periods between regeneration harvests" (p. 24). As a silvicultural toolkit, ecological forestry is fairly clear and consistent: leaving legacy elements, retaining green trees, and managing on extended rotations (Franklin et al., 2007; North & Keeton, 2008; Seymour & Hunter, 1999). By and large, however, ecological forestry is not presented merely as a set of tools. It is, rather, proposed as a more overarching conceptual framework. Franklin (1989b) described new forestry as "a philosophical underpinning for the oft-maligned multiple use concept" (para. 4), and more recently Franklin and Johnson described ecological forestry as a "philosophy of forest management" (*S.1784: The O&C Land Grant Act*, 2014) and a "philosophical basis for management" (Franklin & Johnson, 2013, p. 430). As a philosophy, it would seem that ecological forestry needs to be unified by more than a small suite of silvicultural practices, considering the

[29] Although I will note that even power tools generally come with some minimal guidelines, such as "not for use by small children" or "not to be use while under the influence of intoxicating substances." These injunctions in fact reflect a basic ethical position, namely, that human life is of value and ought not to be compromised.

"broad spectrum of specific prescriptions" to which they can be appropriated (Franklin et al., 2007, p. 24).

Variability in interpretation is of course inherent in any sort of philosophy, including a philosophy of forest management. In fact, in many ways variability could be considered an asset. Ideas and practices that are flexible enough to allow for interpretation are also more widely applicable than those that are narrower in scope, because they can be tailored to specific needs in specific contexts. However, a set of ideas so unconstrained as to justify or permit any action, or that seemingly justifies contradictory actions, also fails to coalesce into a unified philosophy. A philosophy must be practicable, adequate to address the problem at hand, and internally consistent (Callicott, 1993). Ecological forestry is an applied philosophy, so evidently it is practicable, i.e. it can be put into practice. It is proposed as a solution to a particular problem or set of problems, so it aspires to adequacy (its actual adequacy, however, is questionable- a point to which I will return later).

However, it is not clear that, conceptually, ecological forestry is a coherent and internally consistent philosophy, since in practice it can take such a wide array of forms, as justified by such a wide variety of possible objectives. As noted above, the variability inherent in the concepts "natural range of variability" and "ecological" translates into a virtually unrestricted range of management actions, e.g. from retention levels hypothetically ranging from 1% to 99%. Empirical data on biophysical responses to retention is as yet limited (Gustafsson et al., 2012), although there is tentative evidence that retention levels at or below 15% do little to alleviate at least some of the environmental damages that are associated with traditional forestry (Aubry et al., 2004; Rosenvald & Löhmus, 2008). In addition, as evidenced by public ranking of visual effects of forestry treatments, a 15% variable retention harvest has roughly the same visual appeal as a clearcut (Ribe, 1999). And yet a 15% retention harvest could be called "ecological forestry" as reasonably as could a 70% retention harvest. In ecological forestry, specific management decisions are made on the basis of management objectives and desired future conditions, but there is no theoretical framework to discriminate between objectives for which ecological forestry should or should not be used. Since there are no normative constraints limiting the ends to which ecological forestry can be applied, there are in effect no constraints on the management actions that can be pursued. Thus, conceptual ambiguity in ecological forestry translates into practical variability.

"Ecological forestry" can be used to describe a wide range of actions that may not always be ideologically (i.e. metaphysically or ethically) commensurate with one another, undermining the usefulness of the phrase "ecological forestry" to describe a specific, discrete set of management practices. One problematic implication is that ecological forestry can quite readily be misrepresented, either intentionally or non-intentionally, or misunderstood, potentially perpetuating the climate of antagonistic politics and litigation that has characterized forestry for the past several decades, at least in the Pacific Northwest (Davis, 2001; Hays, 2007). For example, an environmentalist might support ecological forestry based on the promise that it will uphold ecological integrity, only to be shocked and outraged when a dramatically different, more industry-friendly idea of "upholding ecological integrity" is realized in practice. Although this scenario is far from inconceivable, based on current thinking about ecological forestry, it is also far from unavoidable. A "betrayal" of the sort described above would not occur if proponents of ecological forestry directed more attention toward formulating and communicating its normative principles. This would require clear parameters on the meaning of "ecological," including explicit articulation of the normative, and ultimately ethical, values and beliefs it reflects. Such an effort would ensure that prescriptions are not misrepresented to stakeholders, and also build a normative framework into ecological forestry itself. This framework could serve as at once a lens, to focus and define the philosophy, and a filter, to distinguish practices that can be considered "ecological forestry" from those that cannot (Figure 2.1). I will comment on what a normative framework might entail at the end of the chapter (see "Recommendations").

I would also point out that, perhaps even more problematic than the potential socio-political tolls of miscommunication, there is the danger that forests could continue to sustain irremediable damage, if they were managed under certain extreme but very plausible interpretations of "ecological forestry." The stakes in ecological forestry are high, with profound and possibly irreversible consequences. Beyond the social and political arena in which forest management most immediately plays out, the decisions that are made about whether and how to harvest, thin, restore, or preserve a forest reverberate extensively and into the future, not only affecting the availability of goods and services that humans want and need from forests, but also which of, or perhaps whether, the ensemble of non-human species who also depend on forests will flourish, dwindle, or go extinct. Mistakes in forest management are potentially costly, in more than monetary terms.

Prudence would seem to dictate that ecological forestry should be defined within constraints that limit its scope to a smaller set of actions and objectives that will not, to the best available knowledge, perpetuate or exacerbate the detrimental effects associated with traditional forestry practices. Without these constraints, the outcomes of practices carried out under the banner of "ecological forestry" are as likely to represent a positive step forward as they are to maintain the status quo, or even take a step backward. To illustrate, consider what might happen if ecological forestry, with the range of management actions that it currently permits, were widely accepted and broadly implemented. If an environmentally-conscientious but ultimately financially-motivated private forest manager adopted "ecological forestry," with the belief that it could be suited to his existing timber production objectives, he might continue to harvest at minimal (perhaps 5%) retention levels, with the notion that he is in fact preserving "ecological values" that will mitigate damage to the land. He might carry out a spatially extensive harvest at this low (and possibly or probably ineffective) retention level, believing that his actions have limited adverse effects on biodiversity, soil quality, water cycling, or any other ecological property of the forest.[30] The scientific literature suggests that this belief might be incorrect (Gustafsson et al., 2012). If, on the other hand, the manager had not used ecological forestry, he might have contained harvest activities to a smaller area, at only slightly higher levels of intensity. It has been suggested that containing harvest to smaller units of more intensive management may in certain ways be less impactful than spreading less intensive management over wider areas (Sedjo & Botkin, 1997). The controversial conversation about the relative costs and benefits of the two approaches is, yet again, beyond the scope of this paper, but the salient point to make here is that a low-level retention harvest driven by the objective of maximizing production objectives would not be sanctioned by, and could not be defended as, "ecological forestry," if ecological forestry had normative constraints limiting its range of acceptable management objectives.

Without a theoretical framework in place to guide values, the management objectives they inform, and the management actions that are consequently pursued, a wide range of different and potentially incompatible versions of ecological forestry become possible. The lack of normative structure at the theoretical level shifts the normative burden from theory to application, necessitating that values be thoroughly deliberated, clearly communicated, and effectively defended by managers and decision-makers. As I will demonstrate in the following example, and in additional examples throughout the chapter, this may not always be a realistic expectation of current forest management planning processes.

The case of western Oregon. As an applied example of ecological forestry, the Johnson and Franklin plan for western Oregon should be formulated to meet a specific set of management objectives. These objectives, in turn, should have been decided upon by careful normative deliberation about how the land should be managed. Johnson and Franklin (2012) themselves indicate a very clear role for these normative deliberations:

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[30] Franklin and Johnson (2012) do suggest that if ecological forestry is widely adopted, it will probably need to be done on larger expanses of land to account for the loss of timber, relative to the amount that would be removed under a traditional management regime.

> Determining the ‘appropriate’ land base for timber production can be informed but not defined by scientific considerations. Policy makers are responsible for identifying important resource values, determining acceptable trade-offs among resource outputs and risks to species and ecosystems, and deciding where the burden of proof lies when uncertainty exists. Within a decision framework provided by expression of those preferences, science and scientists can help develop and evaluate choices for resource management. (p. 3)

And yet, even though they highlight the importance of values in determining management actions, Johnson and Franklin do not openly discuss the process behind or outcomes of normative decisions in their plan. In their 2012 report Johnson and Franklin outline the collaborative process of designing the pilot projects, in which they explained to various stakeholder groups how stands were selected for treatment, and also elicited commentary. They also explain that they “worked with professionals…and with the public in a variety of settings. These included office meetings to develop criteria for stand selection, public workshops, and a series of field trips to selected stands, where we discussed our approach and showed sample marks” (Johnson & Franklin, 2012, p. 16). In addition, the BLM website provides comments received during a public scoping period in 2011, when public opinions regarding the measures proposed specifically for the Roseburg Pilot were recorded (USDI Bureau of Land Management, n.d.b). And yet, neither Johnson and Franklin, nor the information provided by the BLM, explain how the interests and values of various parties were synthesized and eventually represented, or not represented, in the proposed plan.

From their reports, it is apparent that Franklin and Johnson engaged various interested parties to explain the plan. It also seems that ecological forestry objectives were at least communicated with, and perhaps to some extent influenced by, stakeholders. Beyond these basic pieces of information, however, Johnson and Franklin do not offer further commentary, leaving questions unanswered about in what capacity, whether empirical or normative or both, goals and objectives were discussed and determined in these forums. For example, did “development of stand selection criteria" include open consideration of all values at stake, tradeoffs being made, potential benefits derived, and losses possibly to be sustained (Johnson & Franklin, 2012, p. 41), and to what extent were public suggestions incorporated? Were managers and stakeholders consulted after ecological forestry treatments had already been designed by Franklin and Johnson, or did managers and stakeholders actually contribute to the treatments' design? Public participation is widely recognized as critical to social acceptability, and an essential component of natural resource management (McCool & Guthrie, 2001; Raedeke, Rikoon, & Nilon, 2000; Shindler & Neburka, 1997; Tuler & Webler, 2010). However, on the basis of Johnson and Franklin's (2012, 2013) reports, the extent and quality of the participatory process behind the plan remains unclear. A good participatory process is generally acknowledged to be one in which participants are not merely invited to learn about decisions that have already been made, but also actively engaged and empowered to influence those decisions (Tuler & Webler, 2010; Rowe Frewer, 2000). If stakeholders were in fact deeply involved in setting prescriptions, Johnson and Franklin stand only to gain support by providing more thorough information about their engagement with stakeholders. If, on the other hand, stakeholder participation was relatively limited, and Franklin and Johnson were themselves primarily responsible for designing the plan, questions still remain about the values and thresholds of acceptability they utilized to generate ideas before they were presented to stakeholders for commentary and approval.

Without a clear articulation of the values underlying the Johnson and Franklin plan, and the objectives it would be used to pursue, it is difficult for an individual to assess whether he or she should trust, and ultimately support, the western Oregon ecological forestry plan. Shindler and Mallon (2009) reported a hig degree of uncertainty in public attitudes toward natural disturbance-based management (which could reasonably be called "ecological forestry"). Although there was tentative support for management proposals, people expressed considerable hesitations about how the treatments would be used (e.g. to harvest old forests or to build more roads). Particularly relevant to this discussion is Shindler and Mallon's further finding that people who reported higher trust in managing agencies also more strongly supported disturbance-based management (Shindler & Mallon, 2009). Johnson and Franklin themselves highlight the importance of building trust and social acceptability (Franklin & Johnson, 2014; Johnson & Franklin, 2012), and yet, the literature seems to suggest that, if they indeed want to build trust and acceptance of ecological forestry, they need to be more forthcoming in communicating about the values underlying their plan (Vaske et al., 2007; Visschers & Siegrist, 2008).

It certainly may be the case that the normative deliberations underlying the "decision framework" cited above actually occurred in the formulation of Johnson and Franklin's ecological forestry plan. However, Franklin and Johnson do not document enough information to be certain about whether, and if so how, that process worked. This critical omission of information about the normative dimensions of the plan not only undermines trust-building and public acceptance, but also leaves many normative questions unanswered (see Table 5.1).[31] With different answers to any of these questions, a single ecological forestry prescription may point to two or more dramatically different, even conflicting, management actions (Figure 3.1). I will note that, particularly in the earlier phases of management planning, it might be extremely difficult, perhaps even impossible, to describe management actions to the extent that there would be precise answers to specific questions about prescriptions. However, this difficulty heightens the necessity for clear communication of normative values and the objectives they motivate. If people feel that managers are more or less aligned with their own values, they might be more inclined to trust them to set actual prescriptions, even if

[31] These comments on trust and public support are speculative since, with the exception of one survey by Pew Charitable Trusts (2013), no published empirical work has been done to gauge social acceptability of the Johnson and Franklin plan so far. In addition, it is questionable whether the survey in fact elicited people's opinions about ecological forestry, or more generally about whether they support forest management for financial or conservation purposes.

they do not know very specific details in advance.[32] Failure to specify the normative underpinnings of resource management plans, on the other hand, seems far more likely to result in confusion and concern about what the plan entails and what it aims to achieve.[33]

Multiple interpretations of management for multiple values

In large part the challenge of building a normative framework in ecological forestry stems from its commitment to managing for a plurality of values. Since ecological forestry is not oriented toward any single or primary value (or set of values), but is instead identified as an inherently multiple-use philosophy, the observation that it takes many forms to suit many objectives is not at all surprising. This variability, though perhaps valued for its wide applicability, unfortunately becomes problematic when it allows ecological forestry to be used to pursue inconsistent and potentially incommensurable management actions. To manage for multiple values without losing conceptual and practical consistency, ecological forestry needs an established normative framework to guide deliberations and decisions about, and tradeoffs between, multiple objectives.[34]

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[32] This is an empirical claim, which, to my knowledge, has not been tested.

[33] I cannot say for sure that uncertainties surround the conversations about ecological forestry, since the accounts of public interactions and social scientific empirical work are so limited. However, there are other reported cases where normative ambiguities leave unresolved questions about what management practices will actually be pursued. The report on public comments for the BLM's upcoming Resource Management Plan, for example, documents public questions and concerns (DS Consulting, 2014). Notes from public workshops indicate that people wanted, "numbers of how/what BLM is protecting" and "more detail in alternative plans to understand options" (DS Consulting, 2014, pp. 12-13). Another comment was " [it would] be helpful to have real numbers to determine what the tradeoffs are" (DS Consulting, 2014, p. 13). Although people were often asking for quantified figures, I would contend that they were more fundamentally asking for information that would help them assess whether their values and objectives were being met in the proposed plans. Answering to these requests would ideally include a clear articulation of the goals of the plan, as well as the values underlying those goals.

[34] I use the words "value" and "objective" somewhat interchangeably in this section. They are distinct from one another (as I will discuss later), but for the sake of simplicity in discussion, here I will assume that a value (e.g. spotted owls or timber resources) directly translates into an objective to manage for the good of that value (e.g. spotted owl conservation or sustained yield).

However, in comparison to the extensive commentary on relevant ecological and silvicultural principles, the normative commentary in ecological forestry is largely absent, and relatively unsophisticated even when it is present. Although nearly every theoretical work claims that ecological forestry manages for multiple values (see Table 3.1), the meaning, logistics, and implications of this claim are neither clearly nor consistently explained. The literature employs enough language in common that ecological forestry appears philosophically unified, but meaningful differences are revealed upon closer inspection. Ideas advanced in the ecological forestry literature about how multiple values can (or should) be managed can be categorized into four primary types, each of which I will describe below.

Compatibility. Sometimes authors suggest that if ecological forestry is implemented, ecological and economic values can be managed together simultaneously, without tradeoffs or prioritizations. This idea implies that multiple values are somehow compatible with one another. Compatibility can imply one of two ideas: 1) multiple objectives (e.g. ecological and economic) are not antithetical to one another, and so can be managed together as effectively as they could be managed individually; or 2) multiple objectives are not distinct, but in fact represent a single value (Figure 4.1a). The first interpretation suggests harmony, where multiple values peacefully coexist in separate dimensions, not impinging upon one another. The second interpretation suggests synchronization, where ecological and economic objectives may be conceptualized and communicated separately, but are in fact one and the same. In both interpretations, the implication is that what is "good" for one value or set of values can be achieved while also promoting what is "good" for other values.

One fairly extreme version of compatibility can be described as optimization. Gustafsson et al. (2012), for example, note that there is a need to "develop approaches that can optimize these [economic, social, and ecological] benefits" (p. 643). Franklin and Johnson (2012) also suggest that variable retention harvest produces "optimal conditions" for meeting both early seral goals and timber production goals (p. 434). The idea that mutual benefits can be achieved for multiple values is controversial (see, for example, Kareiva & Marvier, 2012; Nelson et al., 2009; Polasky et al., 2008). The scenario of maximizing for multiple values, so-called "win-win" scenarios, may be observed in some cases where objectives are in fact compatible with one another, but it cannot be counted on as a rule (McShane et al., 2011). Generally, in situations where benefits to one objective cannot be enhanced without costs to other objectives, it is unrealistic to expect that each individual objective can be optimized (Vrugt, van Belle, & Bouten, 2007). The "best" strategy in these scenarios is represented not by a single optimal solution that is ideal for every objective, but by a set of Pareto solutions, which envision different optimal conditions for the collective set of all objectives being managed together (Zitzler & Thiele, 1999). Although specific tradeoffs may be different in each scenario, it is impossible to avoid tradeoffs altogether when management objectives conflict with one another, as they often do in ecological forestry (North & Keeton, 2008). I will note that Franklin and Johnson (2013) very explicitly state that ecological forestry "do[es] not attempt to optimize for singular outcomes" (p. 430), and truthfully the idea of optimization is generally not prevalent in the ecological forestry literature. I bring it up only because the idea does appear sporadically in the literature (see also Franklin, 1998; Mori & Kitagawa, 2014), and may generate the false impression that optimization of conflicting objectives is a realistic model of management for multiple values.

Another more moderate and far more widely embraced version of compatibility is "integration," (Franklin, 1998; Franklin et al., 1997; Franklin & Johnson, 2013; Johnson & Franklin, 2013; Lindenmayer et al., 2012; Orians & Franklin, 1990). The Merriam-Webster dictionary defines the word "integrate" as, "to combine (two or more things) to form or create something; to make (something) a part of another larger thing." Although the feasibility of managing to optimize for multiple values is tenuous at best, it does at least suggest a normative target, namely, to actively create ideal conditions for multiple ecological and economic or social values. With “integration,” on the other hand, there are unanswered questions about the nature of the dynamic: is one set of values absorbed into the other, like salt dissolved in water, or are all values somehow combined without forfeiting their individuality, like a suspension o oil and water (Figure 4.1b)?

The question may seem trivial, but its answer can amount to the difference between one prescription and another. For example, if economic values and ecological values are integrated by subsuming the former into the latter, the overall health of the landscape may be seen as supporting timber and economic development, in which case landscape health would become the primary focus of management actions. This might result in a certain number of regeneration harvests, producing a small amount of early seral on the landscape, in the range predicted by estimates of historic conditions. If, on the other hand, “integration” were an attempt to directly provide both economic and ecological benefits, management might be pushed toward higher levels of regeneration harvests, probably at a cost to at least one ecological value, such as red tree vole habitat. This example not only demonstrates that “integration” is conceptually elusive, but it also reveals that true integration, like optimization, is actually not very realistic. In the example above, one value, whether economic or ecological, has to accommodate the other. Thus, even the seemingly neutral and harmonious language of “integration” in fact implies tradeoffs and prioritizations, which, as I now discuss, are at times implied somewhat more directly, but are never made truly explicit in the ecological forestry literature.

Even tradeoffs. Some authors suggest that ecological forestry can manage for multiple values in relative equilibrium with one another. This is a far more conservative aspiration than compatibility, either in its extreme version (optimization) or its more moderate version (integration). A major premise, not only of ecological forestry but also of multiple-use forestry in general, is that forests contain limited resources that must serve a multitude of values (Swanson & Franklin, 1992; Vincent & Binkley, 1993). In other words, as noted above, values cannot be optimized indefinitely. Rather than attempting to maximize benefits, therefore, one approach to managing multiple values may be to minimize harm, by creating the best possible scenario for each value within the limitations imposed by the context of all values (a Pareto optimal solution). This approach will inevitably require tradeoffs, which entail alternating losses and gains for different values.

The language commonly employed in the ecological forestry literature to discuss tradeoffs that evenly serve multiple values is "balance" (Gustafsson et al., 2012; Lindenmayer et al., 2012; Palik et al, 2002; Seymour & Hunter, 1999; Stoneman, 2007; Swanson & Franklin, 1992;). "Balance" is defined by Merriam-Webster as, "a state in which different things occur in equal or proper amounts or have an equal or proper amount of importance." Again, at least two different meanings of "balance" are possible and, depending on which interpretation is made, different management actions may result (Figure 4.1c). On the one hand, balance can be interpreted as egalitarian, i.e. different values should be equally represented. For example, the value of spotted owl conservation may be balanced equally against the value of a fire-resilient landscape. The calculation of balance would be fairly straightforward in the equality interpretation of balance, requiring only a division of the landscape into two types, with half managed for spotted owls and half for fire resilience. The benefit of this approach is that it remains simple even with the addition of many more values, a mere matter of calculation and division. Unfortunately, such an arbitrary egalitarian approach would also be somewhat absurd, and is very clearly not the method proposed in ecological forestry, which is quite explicitly advanced as an alternative to segregated multiple-objective forestry approaches (Franklin et al., 1997; Franklin et al., 2007; Lindenmayer et al., 2012).

Thus, we can say with confidence that ecological forestry adopts the second interpretation of balance, namely, what is "proper." This interpretation of balance is not characterized by equal representation of multiple values, but by an *appropriate* representation of multiple values. The critical point is that a decision about an appropriate balance is clearly a normative judgment, and different people may have radically different ideas about what constitutes an "appropriate" balance of objectives. Therefore, when in the literature a statement such as, "ecological forestry balances multiple objectives" is made without clarification, it actually offers little information about what "balance" entails, or how it can be achieved. Reaching a balance requires open consideration of all values at stake, and decisions about how and why to appropriately weigh and prioritize them. There is no simple or widely accepted system for comparing and arbitrating among values,[35] and ecological forestry itself, as I have argued, has no established normative framework. As such, the interpretation of "balance," and the range of actions that may result from trying to achieve it, is unrestricted.

So far in this section I have shown that, although concepts such as "integration" and "balance" appear to be straightforward, on closer inspection they quickly become problematically ambiguous. Such words may serve as effective rhetorical devices, but they do not convey a clear and applicable conceptualization about how forests would be managed for multiple objectives under an ecological forestry approach. The next category is somewhat different from the previous two. Statements in this category about how ecological forestry manages for multiple values at least suggest a basic orientation toward one set of objectives, which might be used to structure prioritizations and tradeoffs. However, I will again argue that, because the concepts remain so generalized and the language so imprecise, these descriptions still do little to explain how ecological forestry would manage for multiple competing values, both in theory and in practice.

Uneven tradeoffs. Unlike the conceptualization of even tradeoffs, with uneven tradeoffs certain values are suggested to be primary, with the implication that other, subordinate values will be adjusted accordingly. Two ideas are useful for understanding this category. First is "priority," referring to a value or set of values clearly identified for prioritization in management decisions. Prioritization does not

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[35] Various methods have been devised to quantify the value of non-monetary ecosystem services (Farley, 2012), a discussion that is beyond the scope of this paper. It will suffice to say that such methods are themselves widely acknowledged to be both variable and controversial (de Groot, Alkemade, Braat, Hein, & Willemen, 2010; Wallace, 2007).

indicate that de-prioritized values are relinquished or abandoned, but rather that management actions are oriented in a clear direction to serve a primary purpose, based on decisions about which value or values are most important. The other useful idea is "enough," referring to either the point below which there is no longer *enough* to adequately satisfy a value, or, conversely, the point at which there is *enough* to adequately satisfy a value. The former can be thought of as a threshold, which reflects the amount of sacrifice that is considered tolerable. The latter can be thought of as a goal, which reflects the conditions deemed necessary or desirable. Goals and thresholds are defined based on normative criteria of acceptability. For example, consider a scenario in which a sustained yield of harvest is identified as the primary objective for a piece of land, with the subsidiary objective of spotted owl conservation. Is the goal to sustain the amount of timber currently generated from thinning on federal lands, to increase harvest by a certain margin annually, or something else entirely? Are outcomes acceptable only if the spotted owl populations on the landscape do not further decline, or is some specific amount of population depletion acceptable (and if so, what is that threshold of acceptability)? Without criteria of "enough" or "not enough," management will pursue prioritized objectives aimlessly and without constraint, possibly to the detriment of other subsidiary objectives. Thus, priorities need to be defined and parameters of "enough" (i.e. goals and thresholds) need to be established whenever tradeoffs are being made, in order to guide informed management decisions and the actions used to pursue them.

Not often in the ecological forestry literature are values explicitly identified as priorities, but there are exceptions. Seymour and Hunter (1999), for example, state, "What distinguishes ecological forestry, as we define it here, is the emphasis placed on natural patterns and processes: understanding them, working in harmony with them, and maintaining their integrity, even when it becomes financially difficult or inconvenient to do so" (Seymour and Hunter, 1999, p. 29). The degree of specificity here is unmatched in the remainder of the literature, but there are some others who are at least clear about the need for tradeoffs, even though they may be less clear about what such tradeoffs entail. Long (2009), for example, notes that, "the overarching goal is restoration, to the extent practical, of composition, structure, and function" (p. 1871). That seemingly slight phrase, "to the extent practical" immediately imposes limitations upon restoration goals by suggesting that they will always be enacted within the limitation of some higher objective, "the practical," the nature of which Long does not specify.[36] North and Keeton (2008) also clearly state that, "[m]anagers' best efforts to mimic natural disturbance regimes will inevitably involve tradeoffs between economic, social, and ecological objectives" (p. 345), although they do not further define these tradeoffs or explain how they should be made.

In some cases prioritizations are strongly implied, but not to the extent that they are beyond doubt. For example, describing new forestry, Franklin (1989b) wrote, "Judgments regarding timber production, recreation, and the enhancement of wildlife and wilderness will be made with our eyes clearly focused on what will best maintain resilient, diverse, and sustainable forest ecosystems" (para. 41). On the one hand, the sentiment certainly seems to be that timber, recreation, wildlife, and wilderness objectives will be traded in favor of resilience, diversity, and sustainability. On the other hand, the choice of language is subtle enough as to remain unclear. "Focus" implies observation and attentiveness, leading to more knowledge and clearer understanding of the object of focus. Empirical work shows that knowledge does not necessarily translate into concern or value (Bord, O'Connor, & Fisher, 2000; Hunter & Rinner, 2004), suggesting that an object of focus is not necessarily an object of value. For a simple example, consider that a child may steal a bar of candy with his eyes "clearly focused on" the clerk behind the counter. And yet, even if being "clearly focused on" resilience, diversity, and sustainability is

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[36] This is one reading. A different reading might be that Long suggests restoration is in fact the primary goal, and that "the extent practical" represents the threshold past which there is not "enough" to meet other objectives. The point is that both interpretations, although quite different from one another, are tenable.

inferred to mean that resilience, diversity, and sustainability are values, empirical work also indicates that value does not directly translate into behavior (Corraliza & Berenguer, 2000; Dietz et al., 2005; Stern, 2000). In other words, stating a value still says nothing about how that value will be made manifest or acted upon, particularly when stacked and weighted against other potentially conflicting values.[37] Thus, the initial reading in which Franklin seems to clearly prioritize "ecological values" quickly becomes far less certain under consideration. If I seem to equivocate, consider how an unscrupulous manager, with an objective of maximally profitable timber production, might be able to construe Franklin's statement to his benefit. He might undertake intensive harvest practices on the land, claiming alignment with Franklin's position and retorting to any criticism raised against him, "my eyes were clearly focused on what would best maintain resilient, diverse, and sustainable ecosystems, while my hands were busy running the chainsaw."

Another version of uneven tradeoffs identifies what could be interpreted as a main purpose for a management action, with what could be interpreted as a subsidiary purpose indicated subsequently. Franklin et al. (2000), for example, wrote of using biological legacies to "conserve biological diversity and ecological function while allowing for economic use" (p. 7). More vague still, Johnson and Franklin (2013) noted that, "ecological forestry starts with an ecological foundation and then factors in economic and cultural considerations" (p. 4). Such statements can clearly be interpreted differently and lead to different management actions. As with "integration" and "balance," the phrasing might have been chosen more for rhetorical purposes than to clearly communicate an idea. If the phrasing was purposive, however, these statements might be read to suggest that ecological forestry should prioritize ecological values, and then accommodate social values to the extent possible. And yet, even with a statement of broad priorities, there are still unanswered questions about which ecological values (biodiversity? water?

[37] This is an important point of divergence between values and objectives.

landscape diversity?) and which social values (jobs? profit? fire security?) are being referenced.

My commentary on the second concept critical to informing decisions about tradeoffs, i.e. the idea of "enough," will be brief, because it is never addressed in the ecological forestry literature itself. Perhaps we are supposed to rely on experts in other disciplines, e.g. population ecologists, forest economists, and soil scientists, to fill in the details about which criteria they would advise as desirable goals or reasonable thresholds. And yet, even with such established criteria, without a clear and consistent normative framework describing how objectives for endangered species, timber revenue, and soil quality can and should be prioritized when they are not mutually compatible, ecological forestry provides no meaningful or, more importantly, applicable system for making tradeoffs between objectives. Thus, although I have detailed small differences in the rhetoric used to describe how ecological forestry manages for multiple objectives, this examination has hopefully revealed that most ecological forestry discussions about managing values are too vague to be practically useful. Although I have pointed out distinctions between them, all of the conceptualizations of "managing for multiple values" in the ecological forestry literature can truly be placed in the fourth, overarching category, described next.

Ambiguous. Essentially a default category, I label any case in which ecological forestry is clearly identified as managing for multiple values, without any indication of what "managing for multiple values" entails, as "ambiguous." Statements in this category are analogous to a recipe with an ingredient list but no instructions: even though the parts are listed, they could be combined in any number of different ways, and there is no guarantee that the final product will be an intended or desired result.[38]

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[38] I should also add that the "recipe" for ecological forestry does not even provide a list of specific ingredients. Ecological forestry refers broadly to "ecological" and "economic" values. An analogous recipe might refer simply to "dry ingredients" and "wet ingredients." Such sparse details offer little

Ambiguous conceptualizations, not surprisingly, take a variety of forms. For example, Palik et al. (2002) wrote that, “the ultimate objective is to facilitate implementation of natural disturbance-based silviculture without ignoring the economic goals of commercial timber management or the interests of stakeholders concerned about biodiversity” (p. 353). They seem to imply that it is not any particular set of values, but the practice of silviculture based on natural disturbance itself, that is the highest good and the ultimate objective, within which both economic and ecological values should be upheld to the extent possible.[39] Often ambiguous statements can be interpreted to fall within any of the other three categories discussed above. For example, a simple description such as, “forest restoration activities that achieve ecological goals while simultaneously providing social and economic benefits” (Johnson & Franklin, 2009, p. 2) could be read as a form of integration, based on the invocation of simultaneity. However, a distinction could also be drawn between “achiev[ing] ecological goals” and “providing social and economic benefits.” This statement could be read to imply that “ecological goals” might be characterized by neutral impact or no harm, in contrast to the pursuit of actual social “benefits.”

Ecological forestry proponents generally agree that forests should be managed for multiple values that may at times conflict with one another. And yet, the ecological forestry literature is generally devoid of clear and consistent ideas about how to manage for multiple conflicting values, instead employing ambiguous language that does little to specify how various objectives should be managed alongside or against one another. To summarize this discussion, Table 6.1 shows examples of each of the four subtle yet distinct conceptualizations of what it means to manage for multiple values, all of them appearing in a single frequently cited

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instruction, and two bakers working with the same “recipe” are almost guaranteed to produce quite different products.

[39] This statement very clearly misses the point, made above, that it is actually impossible to implement disturbance-based silviculture without reference to these values. Values are not upheld to the extent possible within a preconceived management regime based on natural disturbance; rather, management based on a selected model of natural disturbance is designed based on an existing set of values and objectives for the forest.

work on ecological forestry (Franklin et al., 2007). To reiterate, I have classified these statements according to my own interpretations, but others are certainly plausible, an admission that only serves to emphasize the point that the language about managing values in the ecological forestry literature is vague enough to allow for different interpretations.

The current lack of normative framework structuring how multiple values are managed is a critical and potentially problematic weakness in ecological forestry because it permits a wide range of management actions that may be neither practically nor ideologically consistent with one another. Without a clear and consistent normative framework in place at the theoretical level, value prioritizations and tradeoffs between objectives must be defined and communicated in application. I will now return to the Johnson and Franklin plan to demonstrate that, once again, normative decisions about how to manage for multiple values are not necessarily made clear at the applied level, leaving unanswered questions about the objectives and potential outcomes of ecological forestry in western Oregon.

The case of western Oregon. The Johnson and Franklin plan for western Oregon demonstrates how ambiguous value commitments challenge the consistency, and so undermine the application, of ecological forestry. Although the core strategy of the plan has remained stable over the years (see "The Johnson and Franklin Plan for Western Oregon," above), the explanations Franklin and Johnson have made to justify it have varied considerably. They never openly discuss value commitments or priorities, beyond the generic dictum that ecological forestry will manage for multiple (economic and ecological) values. As such, readers are left either to try to infer the plan's values indirectly, by way of the objectives Franklin and Johnson highlight, or to speculate about what Franklin and Johnson mean when they employ vague and variable language of the sort highlighted in the previous section. Neither approach leads to any clear or satisfactory conclusions about the values underlying the plan.

The 2009 report frames ecological forestry as “Restoration of Federal Forests in the Pacific Northwest.” “Key goals” for restoration are identified as, “making Pacific Northwest forests more resistant and resilient to wildfire and insects in the face of climate change; conserving old growth forests and trees; and creating an immediate, predictable, and a sustainable timber flow to support locally-based restoration economies” (p. 11). However, the extent to which these various goals will be met on the land base, and in what capacity, is not clear. The paper covers an array of topics, including the silvicultural activities proposed, the potential land base for harvest, and implications for carbon (an issue that is not addressed in subsequent papers), with the earlier part of the report seeming to emphasize ecological objectives (pp. 28-42), and then shifting to emphasize economic objectives (pp. 42-63). In the final section about post-disturbance (salvage) logging, Johnson and Franklin note, “Conflicts often exist between economic and ecological objectives as timber salvage is generally about recovering economic values rather than enhancing ecological recovery” (p. 66). Therefore, as general guidelines for post-disturbance logging, they suggest,

> 1) Do no significant additional ecological damage…
> 2) Consider the merit of potential activities in the context of the primary management objectives for the site (e.g., maintenance of biological diversity, watershed protection, or wood production)…
> 3) Give full consideration to the ecological roles played by biological legacies… (Johnson & Franklin, 2009, p. 67)

The language is nondescript (“no significant additional damage;” “give full consideration”), and the suggestion to base decisions on “primary management objectives for the site” is similarly ambiguous. In theory ecological forestry manages for both ecological and economic objectives, but here we have a case where the two are clearly in conflict with one another, i.e. the ecological value of a burned site as a natural complex early seral ecosystem versus the economic value of the recoverable timber volume. Without telling us how, specifically, ecological and economic objectives should be balanced or prioritized in this situation, the guidelines above essentially give no guidance, and provide no indication that the plan is based on any clear or practically relevant conceptualization of its underlying values.[40]

The 2012 paper by Franklin and Johnson emphasizes ecological restoration, defined as,

> the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. Ecological restoration focuses on reestablishing the composition, structure, patterns, and ecological processes necessary to facilitate terrestrial and aquatic ecosystem sustainability, resilience, and health under current and future conditions. (p. 430)

Franklin and Johnson very briefly touch upon other economic objectives, identifying the need for revenue as a source of funding for restoration efforts (p. 429), and also labeling the Moist Forest restoration strategy as, "a pathway to long-term sustained timber yield" (p. 437). Timber objectives are addressed far less extensively, mostly in the final three pages of the article, than objectives targeting ecological restoration, and there is no explicit statement that increased timber yield is an active goal of the plan.[41] In fact, timber is treated almost apologetically, addressed more for the potential controversy that it will generate than it is advanced and defended as a desired outcome. On the basis of this paper, it would seem that the priority is ecological objectives, with additional economic benefits flowing where they will, but not actively pursued.

In contrast to the relatively consistent 2012 article by Franklin and Johnson, the 2012 report by Johnson and Franklin seems to waver considerably between value commitments. Immediately, the "problem definition" frames ecological forestry as a strategy to fulfill the policy mandate for sustained yield, in the case of Moist Forests, and to restore fire resilience, in the case of Dry Forests (p. 1). Later, however, both Moist and Dry Forest strategies, including regeneration harvests, are

[40] Johnson and Franklin later note, "forests within Moist Forest LSRs and stands reserved in the Moist Forest Matrix would not be salvaged. Salvage, though, would be considered for stands in the Matrix that have timber production as one of the primary objectives" (p. 69). Note that they say salvage would only be "considered." It remains unclear how an actual decision about management actions (i.e. whether to do salvage logging and, if so, to what extent) should be made.

[41] They do come close: "our restoration strategy could increase timber harvest from the federal forests of the PNW over the next 15 years" (p. 435; note: *could*, not *should*).

again described as “restoration strategies” to achieve various goals related to resilience and conservation (pp. 31, 61). Criteria for success are explicitly defined as, “achievement of diverse early successional ecosystems with their constituent biota,” highlighting that, “retention of old-growth forest stands and of older trees in younger stands will be seen as high priority” (Johnson & Franklin, 2012, p. 27).[42] And yet, Johnson and Franklin discuss projected outcomes in terms of volumes of sustained yield, not in terms of the potential amounts of early seral or old-growth conditions on the landscape.

By the following year, Johnson and Franklin (2013) were emphasizing the objective of sustained yield quite explicitly: “In this discussion, we highlight use of Ecological Forestry on these lands to provide a permanent timber supply through sustained yield management” (p. 1). The majority of the document does, in fact, emphasize the ability of ecological forestry to contribute to a sustained yield of timber. In a different article from the same year, however, Franklin and Johnson (2013) once more took a strong stance for ecological values, stating, “Our proposals are motivated by ecological goals and the desire to see that all management of federal lands is ultimately based on ecological principles” (p. 432). At the hearing before the Committee on Energy and Natural Resources in 2013, they asserted that ecological forestry would “provide both ecological and economic benefits now and into the future” (*Challenges and Opportunities*, 2013b, p. 20), but they explicitly emphasized ecological forestry as a way to achieve higher timber yields on O&C lands: “We wish today to describe Ecological Forestry concepts and how they can assist in providing a sustained yield of timber harvest from the BLM O&C lands,” (*Challenges and Opportunities*, 2013b, p. 20). The testimony of the following year “address[ed] how utilizing ecological forestry principles in managing these lands could provide ecological benefits and a sustained yield of timber harvest and

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[42] Explanations offered to justify Dry Forest strategy are far more consistent, with the emphasis on ecosystem resilience and only marginal contributions to sustained timber yield. Success is defined as, “improvements in the resistance and resilience of the majority of forest ecosystems within the Dry Forest landscapes, while still retaining largely continuous forest cover (i.e. no clearcuts)” (Johnson & Franklin, 2012, p. 27).

revenue" (*S.1784: The O&C Land Grant Act*, 2014, p. 42). In contrast to 2013 testimony, the 2014 testimony highlighted the ecological (i.e. early seral) benefits of harvest and discussed sustained yield goals and outcomes only briefly (see *S.1784: The O&C Land Grant Act*, 2014, p. 45), seeming to imply that a sustained timber supply is an additional benefit, rather than a primary objective, of ecological forestry.

Thus, there are persistent vacillations in message, with Johnson and Franklin alternatively describing goals in ecological terms (restoration) and economic terms (sustained yield). It is evident that Johnson and Franklin aim to achieve both ecological and economic goals, but they give no specific explanation of what these goals are, and how they would be practically realized by using ecological forestry. Instead, they rely on the same generalized language described above to explain and justify ecological forestry's ability to manage for multiple values: "economic and ecological benefits" (Johnson & Franklin, 2012, p. 1); "increasing the compatibility of long-term timber production and species and ecosystem conservation" (Johnson & Franklin, 2012, p. 31); "integrate ecological and economic goals" (Johnson & Franklin, 2013, p. 2); "achieve the multiple goals for BLM's Western Oregon Forests" (Johnson & Franklin, 2013, p. 1). Such ambiguous phrasing leaves critical questions unanswered. For example, what is meant by "economic" and "ecological" values? To meet an objective, does ecological forestry actually have to produce benefits, or must it simply cause no harm? What are the specific goals, i.e. at what point is an objective achieved? Different answers to these questions could lead to very different implementations of ecological forestry.

Without a coherent normative narrative about how the land should be managed under the plan, it is not clear that there is an overarching sense of purpose for the O&C land base. According to legal mandate, the purpose of the O&C lands is to supply a sustained yield of timber (H.R. 7618, 1937). Even so, the Johnson and Franklin plan could readily be interpreted to allow for a very limited, and certainly sustainable, timber harvest, with an abundance of "ecological" benefits, such as habitat for spotted owls and increased landscape heterogeneity. Alternatively, the plan could be interpreted to manage the land base much more intensively than has occurred under the Northwest Forest Plan, but still maintain what could be considered "ecological values," such as clean water and early successional habitat. The point is, without actually defining goals and the values they reflect, identifying priorities, and describing how and why tradeoffs are made, it is not clear which objectives will be achieved, and to what extent, under the Johnson and Franklin plan.

It could be argued that Franklin and Johnson are simply tailoring the information they provide to suit different audience groups. This tactic of differential messaging, known as "audience design" or "audience tuning," is in fact an important element of effective communication (Echterhoff, Higgins, & Groll, 2005). However, particularly when a proposed measure is of high moral importance, as issues surrounding forest management in the Pacific Northwest are, empirical work suggests that, for building social acceptability, trust based on the perception of shared values is more important than information (Earle & Siegrist, 2008). The current literature by Johnson and Franklin, characterized by vague and apparently wavering value commitments, may be doing little to dissipate distrust and hesitation about ecological forestry (Shindler & Mallon, 2009), if people are unable to gauge whether the Johnson and Franklin plan in fact adequately recognizes and represents their own values.[43] Thus, to meet the unique challenge of building trust, it seems that a more effective communication strategy would convey clear, consistent information about the values underlying ecological forestry, and how they are reflected in management objectives (Cvetkovich & Winter, 2003; Visschers & Siegrist, 2008).

Arguably there are cases where a single management action can in fact serve multiple objectives. If ecological and economic goals are actually compatible, as Johnson and Franklin (2012) suggest (p. 30), there is no problem with describing ecological forestry interchangeably as a strategy for restoration and sustained yield.

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[43] I must reiterate that this comment is largely speculative, due to an overall dearth of empirical work examining social perceptions of and attitudes toward the Johnson and Franklin plan for ecological forestry.

For example, regeneration harvest may both produce sustained timber yields and restore early seral habitat to the landscape. However, it is not clear that management for restoration is equivalent to management for sustained yield. If there is an appreciable difference between the management actions that would be taken if restoration were the sole objective, and actions that would be taken if sustained yield were the sole objective, there will be tradeoffs in trying to manage for both. For example, Johnson and Franklin (2012) note that their strategy will still leave early seral at "relatively low levels" (p. 73), begging the question of why the Moist Forest plan does not implement a more extensive program of early successional harvest. It seems that the agenda of restoring early seral ecosystems, achieved in concert with producing a sustained yield of timber, has been de-prioritized in relation to the competing and, apparently, stronger objective of restoring old-growth and habitat for the spotted owl. Once again, however, the accuracy of this speculation is left to the imagination, because Johnson and Franklin do not make their reasoning process transparent. They are clearly trying to meet several objectives at once. What is not clear, based on the current literature, is in what capacity and relative proportions the various objectives would be met if their plan for western Oregon were implemented.

Ethical Ambiguities

Although it is primarily discussed as a strategy for forest management, ecological forestry is also a conservation strategy (Gustafsson et al., 2012; Henson et al., 2013; Lindenmayer et al., 2012; Long, 2009). It is therefore not altogether surprising that ecological forestry echoes ideas that have become increasingly prevalent in the general field of conservation. Historically, conservation efforts have often been concentrated in specific areas set aside as biodiversity reserves (Miller, Minteer, & Malan, 2011). Across the globe there are also relatively small intensive management areas, where forests have been appropriated primarily or exclusively to economic use (Seymour & Hunter, 1999). However, most of the world's ecosystems are not in preserves or intensive management zones (Gustafsson et al., 2012), which is why certain members of the conservation community, including ecological forestry advocates, have recently suggested that conservationists' efforts need to extend past reserves, to also achieve conservation goals in these multiple-use areas (Franklin & Lindenmayer, 2009; Gustafsson et al., 2012; Kareiva & Marvier, 2012; Lindenmayer & Franklin, 2002; North & Keeton, 2008). The difficult question then becomes, how can conservation goals be met in these areas that are also used to pursue multiple social and economic objectives? Ecological forestry attempts to offer an answer to this question.

Conservation certainly has important scientific foundations in biology and ecology, but it is also an ethic, premised on an understanding of how humans ought to interact with the natural world (Callicott, 1990; Vucetich & Nelson, 2013). One of the most basic tenets of ecological forestry, and yet one that is rarely if ever stated explicitly, is the ethical position that functional forest ecosystems should be conserved. The understanding of "functional forest ecosystem" and "conserve" may vary, but it is unlikely that any purported advocate of ecological forestry would disagree with this statement. The question to ask is, *why* should functional forest ecosystems be conserved? This question is related to, but somewhat distinct from, the questions I have entertained so far in this chapter, which have been concerned primarily with defining the "what" of ecological forestry: what are the principles behind it? What prescriptions will be made in application? What does it aim to achieve? Both empirical knowledge and normative judgments contribute to answering these "what" questions, but, as I have argued, only the former are clearly expressed in the ecological forestry literature. As a result, I have showed that ecological forestry can be highly variable, because how it is interpreted and applied is contingent upon normative judgments that are neither conceptualized nor communicated clearly. To push the point further, I will now argue that these normative judgments, which so critically determine the course of ecological forestry, are themselves made on the basis of answers to fundamentally ethical questions

(Figure 5.1).[44] In other words, it is not possible to fully understand *what* ecological forestry will do without also understanding *why* it is being proposed.

Ecological forestry is premised on the understanding that humans should manage forests "ecologically." Regardless of the particular meaning that is attached to the word "ecological," this is a claim about how humans should interact with forests, and, as such, it is inherently an ethical claim (Nelson & Vucetich, 2012a). And yet, as with other normative dimensions of ecological forestry, the reasoning behind the claim is never clearly stated. Instead, there is an overall lack of overt ethical discourse in the literature, in spite of the implicitly ethical nature of the matter at hand. Echoing the same points that I have made throughout this chapter, in this section I will show that ecological forestry has no clear ethical orientation, a deficiency that undermines its consistency as a philosophy of management and conservation, and allows for a range of different and potentially incommensurable actions to be pursued under the label "ecological forestry."

What is the problem?

Certain methods and ideas borrowed from postmodern thought are useful for analyzing changes that have been occurring in forest management since the late 20th century. Postmodernism is not so much a unified philosophy or theory as it is a mode of critical thinking. It probes systems of thought, action, and belief, in order to reveal and challenge the validity of their underlying assumptions. As such, whether under the label of "postmodernism" or not, systematic deconstruction of beliefs and

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[44] To understand the distinction I am making between "normative" and "ethical," consider a decision about whether to buy a bag of apples or a gallon of ice cream. The buyer will deliberate, perhaps, over whether she should stick to her diet or have a more enjoyable Friday night, but the question she asks herself will probably be quite a generic normative question: "what should I do?" Contrast this scenario to a situation where the buyer is deciding between a pack of genetically-modified chicken breasts and a pack of locally-produced organic tofu. This might very well be an ethical decision, in which the buyer asks herself the ethical question, "what is the *right* thing to do?" (Nelson & Vucetich, 2012a). The distinction is not sharp, and my intention in making it is merely to illustrate that the normative judgments underlying decisions about forest management, including ecological forestry, are tied to deeply moral questions with profoundly ethical implications.

assumptions can be used to examine the ideologies underlying any sort of social institution, including forestry. McQuillan (1993), for example, argued that new forestry was part of a larger process of cultural disillusionment in the late 20th century, in which fundamental assumptions about control, productivity, and the human separation from nature, all associated with traditional forest management, were examined, deconstructed, and ultimately rejected. Accounting for one of the main drivers of the turn away from traditional forestry, Lee (2009) suggested that the cultural fascination with old-growth is rooted in its complexity, which resonates more with the postmodern notions of reality than the simplified, well-regulated forest stand of the modern era. Purdon (2003) drew upon postmodern deconstruction to reveal and critique the metaphysical assumptions about the human-nature dualism embedded in ecosystem management. He suggested that instead of using "natural" reference conditions, a culturally constructed concept that has become antithetical to achieving sustainable forest management, management should seek to restore the "historic" conditions that are best suited to the current socio-political context (Purdon, 2003).

Another conceptual tool that can be borrowed from postmodernism to deconstruct and analyze ideas is problematization. The 20th century French postmodernist Michel Foucault defined problematization as the process of formulating "the elements that will constitute what the different solutions attempt to respond to" (Foucault, 1984/1997, p. 118). In less abstract terms, this concept is actually central to adaptive management of natural resources. According to the USDI Technical Guide to Adaptive Management, "of particular importance in adaptive management is that stakeholders assess the resource problem and reach agreement about its scope, objectives, and potential management actions" (Williams et al., p. 22). Ecological forestry is a response to the perceived problem of traditional forestry (Franklin & Johnson, 2013; Lindenmayer et al., 2012; Seymour & Hunter, 1999), and yet, the ecological forestry literature never explicitly identifies what the problem with traditional forestry is. Instead, the problem that ecological forestry aims to address is generally implied in two major ways that I will describe below.

Empirical pseudo-problems. In ecological forestry, problems are most frequently couched in purely empirical terms. Strictly speaking, empirical observations cannot in themselves indicate a problem. An idea is formulated as a problem when it is conceptually discordant, generating confusion, tension, or discomfort that needs to be either remediated or reconciled to the greater schematic of "things as they ought to be." Without some subjective sense of how things *should* or *should not* be, a problem cannot be said to exist. Statements of what "should" or "ought" to be fall within the prescriptive (i.e. normative), rather than the descriptive (i.e. empirical) realm (Nelson & Vucetich, 2012a). Problems therefore presuppose normative judgments, and although there is nothing inherently wrong with problems whose premises are primarily empirical, they are incomplete without a normative element. A set of purely empirical statements does not, in itself, constitute a "problem," although it can be used to imply a problem. These cases, in which empirical statements are used to imply a problem without the requisite normative elements, I am referring to as "empirical pseudo-problems."

In the ecological forestry literature, statements of empirical pseudo-problems take two forms. One form, which I will describe as "ecological pseudo-problems," are empirical observations about changes in or simplifications to ecosystem structure, composition, or function resulting from traditional forestry practices (Franklin et al., 2000; Franklin & Johnson, 2011; Gustafsson et al., 2012; Long, 2009; Swanson & Franklin, 1992). For example: "Biological legacies typically left after traditional regeneration harvest practices and those created by natural disturbances can be distinctly different" (Franklin et al., 2007, p. 11). Another version of ecological pseudo-problem that is sometimes seen in the literature makes the observation that forests resulting from traditional forestry operations differ from the unmanaged forest ecosystems studied by ecologists: "Studies of natural, including old-growth, forests have clearly shown that their composition, functional capabilities, and structure are very different from those of plantations and other young stands that are intensively managed for wood production" (Franklin, 1998, p. 134; see also Franklin et al., 2000; Franklin et al., 2007; Franklin & MacMahon, 2000; Swanson & Franklin, 1992). In both of the examples above, an observation is made about a forest ecosystem and rhetorically implied to be problematic, and it indeed seems safe to infer that the observed conditions are considered bad, wrong, or in some way different from "things as they ought to be." Still, the actual problem, i.e in what respect, or why, these observed conditions are considered wrong, is not specified. As I will discuss below, different ethical perspectives would identify the problem of traditional forestry, and its effects on forest ecosystems, quite differently, possibly leading to different and ethically incompatible management actions in response.

The other form of empirical pseudo-problem I will describe as "social pseudo-problems." Social pseudo-problems entail the empirical observation that people value forests in many different ways: "Society needs commodities from forest land. Society also wants and needs amenities and ecological values maintained. Many people also want long-term rather than short-term perspectives in resource stewardship emphasized and more options in the face of future uncertainties" (Franklin, 1989a, p. 549; see also Aber et al., 2000; Franklin, 1989b; Franklin & Johnson, 2012; Gustafsson et al., 2012; Lindenmayer et al., 2012; Swanson & Franklin 1992). Although values are explicitly mentioned, the claim being made is social scientific, not normative, and so does not properly constitute a problem. It may be tempting to infer, based upon the statement of a social pseudo-problem, that an author or group of authors is suggesting that forests should be managed to serve the full range of social values, reflecting a profoundly ethical belief about the purpose of forests (i.e. that they should provide the goods and services that humans want and need). This belief would shape the normative decisions about how forests should be managed, which would, in turn, translate into certain practical management actions that might differ dramatically from the decisions and actions that would follow from a different ethical belief about the role or purpose of forests. Because of its potential influence on how ecological forestry is interpreted and applied, the problem with social values and traditional management would best be carefully reflected upon, first and foremost, and then stated explicitly, rather than implied and inferred.

Semi-ethical problems. At times ecological forestry is advanced as a form of sustainable forest management (e.g., Attiwill, 1994; Gustafsson et al., 2012; Lindenmayer et al., 2012; North & Keeton, 2008). Sustainability is another normative concept. Conditions are deemed "sustainable" based on ethical beliefs about what matters and who counts to the extent that they should be sustained (Alroe & Kristensen, 2003; Becker, 1997; Johnston, Everard, Santillo, & Robert, 2007; Nelson & Vucetich, 2012; Shearman, 1990). For example, a timber manager concerned only for the immediate welfare of human beings might see a plantation of Eucalyptus on a 40-year rotation as "sustainable." A conservation advocate concerned for the welfare of all species might not. Because its meaning can vary according to different ethical views and beliefs about moral consideration, "sustainability" must be qualified by normative judgments about what and who should be sustained, for how long, in what quantity, and of what quality (Costanza, Mageau, Norton, & Patten, 1998).

In the ecological forestry literature, there is broad agreement that forest management should be sustainable (or should not be unsustainable). Unfortunately, as with other normative concepts employed by ecological forestry, "sustainability" is rarely defined. I classify statements invoking the concept of sustainability (and the problem of non-sustainability) to justify ecological forestry as "semi-ethical problems." They indirectly identify an ethical problem by drawing upon the inherently normative ideas of "sustainability" and "non-sustainability." However, without elucidation of their ethical underpinnings, the concepts of sustainability and non-sustainability remain vacuous, and do not point to the specific problem or problems being addressed by ecological forestry.

For example, sometimes sustainability is stated simply as a management goal: “Any set of management practices should therefore be sustainable for the indefinite future” (Aber et al., 2000, p. 3). In such cases, the problem addressed by ecological forestry is implied to be unsustainable forest management.[45] However, without describing what is meant by “sustainable,” both the problem being addressed and the solution being proposed remain unclear. Simply stating that forest management ought to be “sustainable,” without further normative clarification (i.e. what should be sustained, to what degree, and for whom) does not actually explain what is wrong with traditional forestry, beyond the somewhat tautological suggestion that it is, somehow, “unsustainable,” or not as sustainable as we want it to be.

Sometimes the problems associated with unsustainable forest practices are more clearly implied: “Timber harvesting or any other extraction of biomass should not reduce the possibilities for the future long-term provision of biodiversity and other ecosystem services” (Gustafsson et al., 2012, p. 643). At a certain level this statement does represent the problem, i.e. unsustainable forestry practices reduce long-term provision of biodiversity and ecosystem services, which is wrong. But there is still another layer to the problem, which is not addressed: *why* is it wrong to reduce long-term provision of biodiversity and ecosystem services? Is it wrong for humans to compromise these values because it is fundamentally wrong to so dramatically alter the planet and its ecological systems? Is it wrong for humans to compromise biodiversity and ecosystem services because our species depends upon them for survival and wellbeing? Or is it an entirely different problem?

There are rare cases when a problem is clearly implied. Lindenmayer et al. (2012), for example, assert that sustainable management is, “critical to the future of humankind” (p. 421) This statement suggests that unsustainable forest

[45] Since it is explicitly stated that management ought to be sustainable, unsustainable management (i.e. management that is not sustainable) would logically be contrary to “things as they ought to be,” i.e. sustainable. Therefore, statements that claim, “forest management should be sustainable” essentially convey that non-sustainable forest management is a problem. The terms still need to be normatively defined, however.

management is problematic because it fundamentally threatens the survival and welfare of the human species. Lindenmayer et al. make a more explicit normative statement about the problem of non-sustainability than most of the literature related to ecological forestry.[46] It bears noting here that the problem Lindenmayer et al. identify is one that falls cleanly within the traditional forestry paradigm, which contends, on the basis of an anthropocentric ethic, that forests and natural resources should be managed for the human good. As such, Lindenmayer et al. seem to be problematizing not the ethic of traditional forest management, but rather the inability of traditional forest management to serve the full range of use values upheld in its own ethic. I will return to this point later (see "Paradigm Shift in Forest Management?").

Although problematization may seem like an arcane exercise, there is practical value in trying to identify the specific problem being addressed by ecological forestry. The purpose of conceptualizing and stating a problem is to allow for the formulation of proper solutions (Foucault, 1984/1997). As discussed by Foucault (1984/1997),

> [problematization] develops the conditions in which possible responses can be given…This development of a given into a question, this transformation of a group of obstacles and difficulties into problems to which the diverse solutions will attempt to produce a response, this is what constitutes the point of problematization." (p. 118)

In what I am calling empirical pseudo-problems, ecological forestry states the "given" of the problem: either some sort of ecological simplification, or the diverse assortment of social values associated with forests. However, pseudo-problems stop short of translating the given into an actual problem by failing to answer the critical

[46] The question could be asked, "why is it wrong to threaten the future of humankind?" Lindenmayer et al. do not answer this question, and neither will I. Although it is a legitimate critique to suggest that I have stopped probing for the core problem of ecological forestry somewhat arbitrarily, since it is always possible to ask "why" yet again, I will simply note that once a practice (such as ecological forestry) is justified as a way to secure the future of humanity, it seems likely that few would disagree or ask for further explanation. It also bears pointing out, however, that the same general assent might not be found in response to a statement such as, "it is wrong to threaten the future of Pacific giant salamanders."

question of *why* these things are not as they should be, and therefore problematic. Semi-ethical problems, on the other hand, come closer to stating a problem by introducing the implicitly normative element of sustainability. And yet, without actually specifying the ethical dimensions of the concept "sustainability," in most cases semi-ethical problems do little more than empirical pseudo-problems to define the scope of the problem requiring a solution.

With only partial awareness or acknowledgment of a problem, only partial solutions will be formulated in response (Foucault, 1984/1997). Consider the following hypothetical example: a child is beaten up by a group of bullies at school. When he goes home, he tells his mom that his shirt is ripped, but explains no more. Without understanding the rest of the problem, the only response his mother will make is to mend his shirt. If she were aware of the full situation, she would probably still mend the shirt, but she would also pursue further actions to remedy the deeper problem, namely, that her child is being bullied. The case is similar for ecological forestry: if only the empirical aspects of the problem, such as changes in soil quality and loss of biodiversity, are acknowledged, an empirical response will probably seem suitable. Over time, such a response is also likely to be a source of ongoing frustration for managers and scientists, faced with the persistent ineffectiveness of a partially-conceived solution that is inadequate to fully address the crux of the problem. If, on the other hand, the problem were recognized to have an ethical dimension, along with its empirical aspects, the proffered solution would also include an ethical dimension, and so would be adequate to address the full scope of the problem at hand. I have noted periodically throughout this chapter that the empirical principles of ecological forestry (i.e. biological legacies, green tree retention, and long rotations), generally well developed and extensively discussed in the literature, are not matched by parallel normative or ethical principles or discussions. This empirical bent makes sense, if ecological forestry has indeed been conceptualized in response to a problem that has been formulated in empirical, or at best nominally ethical, terms.

And yet, the ethical dimensions of the problem addressed by ecological forestry are of critical importance, because with different ethical understandings of why traditional forestry is problematic or unsustainable, ecological forestry could be used in different and quite possibly contradictory ways. For example, consider the empirical observation that harvest leaves fewer legacy elements than historic, non-anthropogenic disturbance regimes. Why is this a problem? The answer to this question will determine the nature of the solution that is pursued. If it is a problem because people dislike the appearance of clearcuts, then enough trees will be left to meet social thresholds of visual acceptability. If it is a problem because trees are living beings, venerable and worthy of respect, perhaps the number of trees retained or even the process of harvesting those trees will be different. It is important to note that the difference is not in the details of the biophysical impacts left by clearcuts, but in the ethical lens through which those impacts are interpreted. The former might reflect an anthropocentric understanding of the value of forests, whereas the latter might reflect an ecocentric ethic. I will more fully explain this distinction below, as it applies to ecological forestry. For now, a final important point to make is that the question, "why are traditional management activities problematic?" cannot be answered through scientific or empirical inquiry alone. It is a fundamentally ethical question, which requires a fundamentally ethical answer. Without recognizing that the question of how forests ought to be managed is actually an ethical question, and that the problem of traditional forest management might actually be an ethical problem, ecological forestry represents an imperfect, impermanent, and ultimately insufficient solution to a problem of far greater scope than it is currently equipped to address.

Why ecological forestry?

Claims about appropriate forest management represent ethical claims about what constitutes a proper relationship between humans and forests (Nelson & Vucetich, 2012a). The relationship between humans and forests may be characterized in many ways, but a main distinction depends on how forests are attributed value. Two possibilities present themselves:

1) Forests do not possess intrinsic value. “Ecological values,” in this case, would be one set of human values, perhaps greater or lesser than, for example, the value for recreation or aesthetic appeal, but the difference between them would be only of degree, not of kind. Value would be defined by its benefit for humans. If a property or process in a forest were not valuable to humans, it would not receive moral consideration.[47]

2) Forests do possess intrinsic value. The forest ecosystem, with its associated functions, processes, and assemblages of species, would be valuable in itself, regardless of its use to humans. Forests may certainly still hold instrumental value for humans, but even without this degree of utility, forest ecosystems would still bear moral consideration in their own right.

A basic distinction made in environmental ethics is that ecosystems and biodiversity may be maintained for a variety of benefits they provide to humans, an anthropocentric ethic aligned with the first view described above, or they may be protected because they carry value in themselves, a non-anthropocentric or, more specifically, ecocentric ethic aligned with the second view (Curry, 2011; Nelson & Vucetich, 2012a; Robinson, 2011). This ethical framework is useful to the present conversation about ecological forestry, because ideas that diverge on the basis of these two different ethical beliefs may lead to very different management approaches. Ecological forestry at times seems to value forests anthropocentrically, and at times ecocentrically, but on the whole it does not overtly gravitate toward

[47] To be clear, I use words such as “function,” “use” and “benefit” to refer to both utility values, such as timber and non-wood products, as well as non-utility values, such as spiritual fulfillment and aesthetic appreciation derived from forests and their associated biodiversity. Often instrumental values at stake for humans could in fact be described as “ecological,” e.g. clear running water, carbon sequestration, and tall forests teeming with a diversity of interesting and engaging life forms. The point to keep in mind is that, hypothetically, if ecological forestry does in fact attribute only instrumental value to forests, then if these current instrumental ecological values were to fall out of social favor, they would no longer be taken into account in management decisions. Thus, if spotted owls were to go extinct, for example, the plan for western Oregon, so focalized around spotted owl conservation, might look dramatically different.

one position or the other. For example, ecological forestry is often proposed as a way to conserve biodiversity by providing continuous cover, forage, and habitat, and also improving landscape connectivity to facilitate dispersal (Franklin et al., 1997; Franklin & Johnson, 2013; Hanson et al., 1995; Henson et al., 2013; Lindenmayer et al., 2006; Lindenmayer & Franklin, 2002; Long, 2009). Discussion of biodiversity, classically associated with a conservation approach advancing the idea of intrinsic value (Soule, 1985), may lend the impression that ecological forestry adopts such a perspective. However, biodiversity is also commonly associated with ecosystem services (examples in Aber et al., 2000; Franklin & Johnson, 2011; Gustafsson et al., 2012; Long, 2009), which is an inherently and unapologetically anthropocentric concept (Redford & Adams, 2009), and one that is used as a common justification for ecological forestry measures. Neither an anthropocentric nor an ecocentric ethic is endorsed explicitly or consistently across the theoretical literature, and in many cases the discussion is too vague and generalized for any definitive interpretation, as shown in Table 7.1.[48]

An anthropocentric, instrumental value approach would only be focused on values for humans, while an intrinsic value approach would still be concerned with more instrumental, narrowly human social or economic values, but in addition to the values inherent in the forests themselves. In other words, while anthropocentrism attributes intrinsic value only to humans, more expansive ethics still attribute intrinsic value to humans, but *in addition to* broader sets of entities who are also perceived to hold intrinsic value that makes them worthy and deserving of moral consideration (Nelson & Vucetich, 2012a). A customary schematic in environmental ethics demonstrates this moral expansion as a series of accretions (Figure 6.1), from humans (anthropocentrism) outward to non-human animals (zoocentrism), living beings (biocentrism), and the collective biotic and

[48] One notable exception is in Franklin's (1989b) work introducing the idea of new forestry. At the very end of the article he poetically entreats, "Let us adopt a forest ethic. Let us approach forest ecosystems with the respect that their complexity and beauty deserve. And, considering our current level of knowledge, let us approach the forest with appropriate humility" (Franklin, 1989b, para. 42). This notion of a "forest ethic" is entirely absent from later works.

abiotic systems that comprise and support existence on Earth (ecocentrism; Callicott, 1993; Nelson & Vucetich, 2012a). To be clear though, extending moral consideration to broader sets of beings does not nullify, preclude, or replace the moral standing of the beings in the inner circles. Moral expansion has a distinctly additive effect.

The overlap between the various ethical stances depicted in Figure 6.1 has some important implications for ecological forestry. One implication relates to the earlier discussion of value tradeoffs. An anthropocentric ethic would categorically prioritize “human” values (economic or social objectives, or ecosystem services). An ecocentric ethic, on the other hand, would not categorically prioritize any value set over any other.[49] It would simply consider, i.e. recognize, weigh, and arbitrate amongst, both purely anthropocentric and other non-anthropocentric values. Therefore, it bears noting that ecocentrism could serve as an overarching ethical framework within which to weigh various “human” and “non-human” values, but anthropocentrism could not.

A second important point to be made in light of the overlap between ethical frameworks is that a decision prioritizing “human” over “non-human,” or “ecological,” values can still be made from within an ecocentric ethical framework. For example, consider the question of whether to suppress a wildfire that threatens human development, even though fire is characteristic of the region and critical to maintaining landscape heterogeneity (Noss et al., 2006). A decision motivated by an anthropocentric ethic would certainly favor fire suppression, and it is very likely that a decision motivated by an ecocentric ethic would do the same. Even though the two decisions lead to the same management action (fire suppression), there is still an important difference to note between the two decisions. The decision, when made from an anthropocentric framework, would be based solely on what is in the best human interest. From an ecocentric framework, on the other hand, interests

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[49] Ecocentrism is sometimes mistakenly equated with misanthropy, leading to the belief that an ecocentric ethic will categorically prioritize “ecological” values over “human” values. This is not true.

other than human interests would be duly considered in the process of setting priorities and making the decision. This example stands to illustrate that, although different ethical frameworks do not necessarily lead to different outcomes, they do involve very different decision-making processes, with different normative deliberations, and decisions motivated by different intentions. Ethics makes a distinction between deontological reasoning, which evaluates morality by criteria other than measurable results (e.g. duties or intentions), and consequentialist reasoning, which evaluates morality by outcomes (Curry, 2011; Nelson & Vucetich, 2012). Natural resource management is a field largely defined by consequentialism (Callicott, 1990), and ecological forestry i   no exception.[50] However, ecological forestry also provides powerful insight into the need for a deontological perspective in evaluating natural resource management, and for two reasons.

First, intentions are key to building public trust and acceptability, both of which are essential in the era of modern forestry that so integrally involves stakeholders in natural resource management (Hays, 2007; Johnson & Franklin, 2009; Johnson & Franklin 2012; Winkel, 2014). Recent work in social science suggests that people accept or reject management actions based in large part on whether they trust the agent behind the action (Cvetkovich & Winter, 2003; Shindler & Mallon, 2009; Vaske et al., 2007). Trust, in turn, depends on the perception of shared values (Cvetkovich & Winter, 2003; Siegrist et al., 2000). As such, if the public values forests intrinsically, they are likely not to be well disposed toward decision makers who manage forests only for their use value. Second, and quite simply, prescriptions are set according to “management objectives” and “desired conditions,” but objectives and desires reflect intentions that are driven, at least in part, by ethical values and beliefs (Ives & Kendal, 2014; Keeney, 1996; Stern & Dietz, 1994).

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[50] This is largely because natural resources have historically been managed as, of course, resources, which placed inherent emphasis on the use value of natural spaces. However, even ecological forestry theory is consequence-oriented. For example, in mimicking natural disturbances, the emphasis is invariably upon the outcome or effects, not the process of disturbance itself (Long, 2009). Disturbance is valued for what it does, not for what it is.

The language of “values” sometimes suffers from a degree of ambiguity in the scholarly literature (Ives & Kendal, 2014). According to cognitive hierarchy theory, widely adopted in social science work, values lie at the base of a triangle comprised of value orientations (or beliefs), specific attitudes, behavioral intentions, and finally behaviors (Vaske & Donnelly, 1999). According to this framework, what is commonly called an ecological “value” is probably more accurately labeled an “attitude” toward a specific management objective, for example, the support for preservation of trees over 150 years old (Dietz et al., 2005). Values, on the other hand, are stable and enduring beliefs, operating as interpretive frameworks that impact the formation of opinions and behaviors higher up in the cognitive hierarchy (Rokeach, 1973). A favorable attitude toward preservation of old trees may be driven by a value that says, “all living beings should exist with integrity in their own right, along with the non-living systems with which they are interconnected.” Alternately, the same attitude may be rooted in a value such as, “I depend on ecosystem functions and processes performed by forests, and old trees contribute critically to that functionality.” People embracing both values may support the objective of preserving old trees. Objectives, therefore, cannot be assumed to reliably reflect values (Ives & Kendal, 2014). And yet ecological forestry seems to count on general statements of objectives, e.g. old-growth conservation, as adequate substitutes for communicating values. An objective is informative about intentions to some extent, but it does little to explain the value judgments motivating it. The underlying values may, however, come to light in a case where two people supporting the same objective, but for different reasons, turn out to have two very different ideas of what that objective specifically entails.

Intentions and the values they reflect are in fact essential to consequences, because different ethical values and intentions will motivate different actions and outcomes. This statement may be read as a contradiction of my earlier assertion that different ethical frameworks do not necessarily lead to different outcomes. To answer this criticism, I will borrow a useful idea from ecology, the ubiquitous concept of scale (Wiens, 1989). At the very small scale of individual decisions, anthropocentric and ecocentric motivations may indeed resemble or even perfectly match one another. However, at a broader scale involving multiple decisions over larger spatial and temporal extents, a management strategy (such as ecological forestry) that is motivated entirely by anthropocentric concerns is likely to differ significantly from an ecocentric strategy motivated to protect both the instrumental *and* the intrinsic values of the forest. The anthropocentric strategy might aim to achieve a minimized vision of ecological integrity, maintaining ecosystems intact enough that they can continue to supply all desired benefits, but leaving no element, process, or property in excess. Since forests would be valued as resources for humans, the goal would be to use them as efficiently as possible, in order to produce as much as possible of everything that people want from them (Callicott, 1993). The ecocentric strategy, by contrast, might aim to achieve a full and rich vision of "ecological integrity," perhaps striving for more than basic species viability or minimum acceptable soil quality. Instead of asking, "how much can we feasibly take from the forest?" management decisions might instead be made by asking, "how much can we possibly leave?"

The phrase "ecological forestry" can be used to refer to a wide range of management actions, in pursuit of a wide range of management objectives, challenging ecological forestry's stance as a clear, consistent philosophy of forest management. It has now hopefully become clear that the ambiguity about what ecological forestry is, or what it will do, is rooted in unanswered ethical questions about why it should be applied. Why should ecosystem functions and processes be maintained? Why should old-growth be preserved? Why should diverse resources and habitats be protected? The answers to these questions are critical, not as a matter of esoteric intellectual interest, but because they define the ethical framework that will fundamentally influence decisions about applied management actions. Without providing clear answers to these questions, ecological forestry is conceptually and practically unrestricted in the range of different and ethically incommensurable applications it may be used to pursue. This range of potential variability not only undermines ecological forestry as a consistent philosophy of forest management, but also stands to perpetuate both the environmental degradation and the social tensions that ecological forestry purports to alleviate.

The case of western Oregon. As with the theoretical ecological forestry literature, Johnson and Franklin make no overt ethical claims in their applied plan for western Oregon, either by relying on empirical claims to imply an ethical position, or, when ethical questions cannot be avoided, by addressing them in non-ethical language.

For example, in their most recent writings about the plan, Johnson and Franklin (2013) emphasize the objective of providing a sustained yield of timber. Much like "sustainability," "sustained yield" is a broad and generic phrase that requires clarification to take on specific and applicable meaning (Nelson & Vucetich, 2012b). A very small timber yield, such as one single tree in a stand per century, can be harvested indefinitely, but so can much larger yields of timber, across wider landscapes and on shorter rotations. Therefore, simply stating that "sustained yield" is an objective of ecological forestry says little about the extent of harvest proposed, and so does little to describe a discrete set of management actions that may be used to attain a "sustained yield" of timber. Excluding a worldview that equates ecological integrity with human non-intervention, a single-tree harvest each year would probably not generally be thought to degrade ecosystem integrity. At higher timber yields, however, the understanding o what extent of harvest can be "sustained" without compromising ecosystem integrity will depend on how "ecosystem integrity" is defined. Without normative judgments about what amount of timber is necessary or desirable- a complex conversation in the ethics of consumption (Buchholz, 1998; Shaw & Newholm, 2002)- and what degree of change is permissible before an ecosystem is considered degraded, "sustained yield" is not meaningfully defined. However, Johnson and Franklin avoid the need to normatively define a desirable quantity of timber for sustained yield, by advancing sustained yield as a goal mandated by policy, based on the Northwest Forest Plan, the O & C Bill, and the revised NFMA planning rule (Franklin & Johnson, 2012; Johnson & Franklin, 2012). The case is similar with other normative (and specifically ethical) concepts, notably "resilience" and "restoration," both identified as key elements of the ecological forestry plan (Johnson & Franklin, 2012, p. 31). Both of these words can be used variably (Brand & Jax, 2007; Higgs, 1997; Jackson & Hobbs, 2009; Standish et al., 2014), and so can be used to justify a range of management actions that may look very different in application if they are based on different metaphysical and ethical ideas about how humans relate and ought to relate with forests.

"Sustained yield," "resilience," and "restoration" all require that ethical and normative questions be answered before they can be applied (see Table 8.1). In employing these concepts, Johnson and Franklin merely tip their hats to ethics, relying on the rhetorical force of the metaphors to carry them forward without meaningfully addressing any of the difficult ethical questions that they raise. For example, statements such as, "the Franklin/Johnson restoration strategy focuses on reestablishing ecosystem functions by modifying or managing the composition, structure, spatial arrangement, and processes necessary to make ecosystems sustainable and resilient under current and future conditions" (Johnson & Franklin, 2012, p. 32) are so replete with unanswered ethical questions as to be essentially meaningless. For example, why does the goal of sustainable, resilient ecosystems justify modifying their composition, structure, spatial arrangement, and processes? What degree of modification is permissible? Is the role of management only to ensure that basic ecosystem functions that are socially necessary and desirable are perpetuated? Or should some "extra" be left beyond what is strictly needed for forests to adequately supply benefits and services to humans? Should management be geared toward current or future conditions if the two are appreciably different? Do the needs of the future outweigh the needs of the present, or vice versa? While it is certainly possible, even probable, that Johnson and Franklin have grappled with such difficult ethical questions, they do not communicate either the process or the results of these deliberations in writing.[51]

Although the Johnson and Franklin plan does not explicitly endorse any particular ethical position, several of the actions proposed strongly suggest that ecological forestry in western Oregon rests upon an anthropocentric, utilitarian ethic. One source of evidence is Johnson and Franklin's description of values strictly as social values. For example, their plan remains fiercely committed to spotted owl conservation and old-growth, but they justify these objectives as policy mandates, i.e. of the NWFP, the O&C Act, or the NSO Recovery Plan (Johnson & Franklin, 2012), or by their alignment with societal values. For example, Johnson and Franklin (2009) suggest using age limits to delineate which trees can and cannot be cut, because "[s]ociety is interested in conserving older forests and trees" (p. 4). Spotted owl recovery is discussed as a "standpoint" from which certain actions, such as harvest in older forests, cannot be justified (Johnson & Franklin, 2013, p. 20). Nowhere is the intrinsic value of old-growth forests or spotted owls stated (or denied) as an explicit ethical commitment of the plan itself. By aiming to satisfy a mixture of stakeholder and policy objectives, Johnson and Franklin are able to avoid the complex ethical questions of recognizing and managing (i.e. deliberating, weighing, and prioritizing) values associated with forests, both instrumental and intrinsic. In other words, rather than confronting the question of how forests *should* be managed, they are essentially checking off a shopping list of objectives dictated by policy and social demands. Although this strategy ensures that decisions are democratic, and perhaps even participatory, it does not necessarily mean that the outcomes are good, right, or appropriate. Public values and attitudes are important empirical factors that may contribute to a decision, but they do not necessarily reflect how forests ought to be managed (Bengston et al., 2004).

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[51] To be both fair and clear, I openly acknowledge that my comments on the Johnson and Franklin plan, both here and throughout this thesis, are based on ideas and opinions that Franklin and Johnson have expressed in publically available writings. I do not pretend to know the true nature of their personal beliefs or ethical commitments.

A hypothetical example will illustrate the point. The Johnson and Franklin plan does not acknowledge the issue of barred owls, who are considered a primary threat to the spotted owl population (US Fish and Wildlife Service, 2011b). If, hypothetically, reducing the barred owl population allowed spotted owls to be de-listed as a threatened species, for reasons entirely unrelated to increased habitat availability, how would ecological forestry prescriptions, currently operating under guidelines from critical habitat and NWFP allocations, be made? If the owl were de-listed, what would happen to the areas of critical habitat, restricted from harvest only for the sake of the spotted owl? In the current plan, is old-growth preserved simply because it is essential to a species of interest, which itself represents a current societal value that may change over the years? Or if the public interest shifted to value early seral habitats, would early seral be prioritized over old-growth on the landscape? These are extreme and in many cases unlikely examples, but they do illustrate the point that, if ecological forestry is in fact a utilitarian philosophy that manages to satisfy the prevailing social values, its usage will fluctuate over time and across space, according to the desires and objectives of relevant stakeholders.[52]

Some of the tradeoffs Johnson and Franklin (2012, 2013) propose to increase the sustained-yield land base also suggest that the plan for western Oregon is motivated by an instrumentalist, anthropocentric value orientation. I will discuss three proposed measures in particular: revisions of riparian reserves; eradication of survey and manage; and reallocation of younger stands in late-successional reserves to the matrix.

Riparian reserves. Johnson and Franklin (2013) suggest that, according to the report by Reeves et al. (2013), riparian buffers implemented under the NWFP

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[52] I should note that this synchrony with public opinion may actually be considered a virtue in a management philosophy. However, once again, if normative decisions are guided purely by democratic principles, this mode of decision-making should be decided deliberately rather than by default. In other words, the public should not be the gauge of right or appropriate action for lack of other options. An alternative approach would be to engage in ethical discourse to systematically consider the appropriateness of various management actions, in a process that could certainly incorporate, but would not simply defer to, public opinion (see Chambers, 2003; Minteer & Collins, 2005; Nelson & Vucetich, 2012a).

should be redesigned to allow for a higher level of timber harvest without compromising forest streams. They would prioritize "ecological" values in 30 to 50% of current riparian reserves, but in certain portions of the remaining riparian reserves the plan would allow a higher amount of harvest, relative to current NWFP protocol, in order to "achieve ecological goals and sustained yield goals" (Johnson & Franklin 2013, p. 24). Certainly, this strategy is bound to be less disruptive to riparian ecosystems than traditional forestry practices before the NWFP was implemented. It may also serve the purpose of ensuring the basic continuity of some amount of ecosystem functionality. However, the underlying ethical premise behind the suggestion is that management should work at the limits of feasibility, leaving only what is deemed "enough," but without specifying "enough for what." Johnson and Franklin (2012) say, "Re-evaluation of the riparian buffers could focus on actually determining the areas that are actually critical to functioning of aquatic ecosystems," (p. 74), implying that their intention is to secure only those "critical" elements of aquatic ecosystems, trimming any excess that is currently (and unnecessarily) appropriated to riparian ecosystem health, in order to appropriate it more usefully to other desired objectives, in this case, the economic agenda of timber production.

As Shaffer (1981) pointed out, concepts of viability are fraught with ambiguities. For example, is this revised buffer strategy "enough" to ensure that threatened fish populations will increase, or be sustained at current levels? That they will persist for the next 50 years, 100, or 1000? That they will survive assuming relatively stable conditions, or will population numbers fluctuate drastically with stochastic events or other unforeseen circumstances (Shaffer, 1981)? None of these questions are answered. The justification provided is that the original buffers were temporary and, at the NWFP's inception, intended to be modified with time and better information (Johnson & Franklin, 2012, p. 74). The deferral to policy is an inadequate answer to the ethical questions at hand, and does not weigh the plenitude of interests, human and non-human, at stake in reducing the extent of riparian buffers. In short, the management actions proposed for riparian zones seem to make certain ethical assumptions about the use value of streamside ecosystems (although, to reiterate, they do not actually state them explicitly). If, with open ethical discourse, these assumptions were undermined or deemed inappropriate, the ecological forestry strategy for managing riparian reserves might change significantly.

Survey and manage. Johnson and Franklin (2012) advocate renunciation of the survey and manage clause of the Northwest Forest Plan.[53] Survey and manage, according to Johnson and Franklin, places unnecessary constraints on the areas available for sustained-yield harvest (Johnson & Franklin, 2013). As such, they suggest a reworking of the clause:

> Species generally were not put under Survey and Manage because they were thought to be endangered. Rather, they were put into that category because we did not know how the NWFP might influence their habitats or knew little about their life history. Thus the burden of proof was placed on the land manager to show that they were not harming them…An alternative approach would be to require evidence that population levels and trends for the species indicated concerns. Where that was established, special protocols would apply. (Johnson & Franklin, 2012, pp. 74-75)

Justified as a way to allow for lower levels of retention and eliminate unnecessary survey costs (Johnson & Franklin, 2013, p. 26), changing the survey and manage requirements essentially prioritizes potential economic benefit, of unspecified amount, for higher risk of species loss, also of unspecified amount. Even with all of the empirical information supplied, a decision about whether or not to revise the survey and manage clause cannot be made without invoking ethical ideas. However, Johnson and Franklin defer matters of ethics to the realm of policy: “Ultimately the level of risk that is chosen is a policy call and should be viewed as such, even while society and decision makers consider inputs from the scientific community” (Johnson & Franklin, 2012, p. 75). By trying to relegate the decision to policy,

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[53] The O&C Land Grant Act of 2015 does in fact adopt this recommendation, stipulating that survey and manage procedures will not apply in Forestry Emphasis Areas of either Dry or Moist Forests (S.132, 2015, p. 13).

Johnson and Franklin again avoid the critical ethical conversation that could amount to the difference between one management approach and another. I will also point out that Franklin and Johnson are effectively setting the proposed policy, particularly in the case of the recent O&C legislation, in which the ecological forestry plan is entirely based on their recommendations (S.132, 2015). Thus, it seems fair to note that the responsibility for (ethical) decisions about risk lies at least partially with Franklin and Johnson, and yet, if they have indeed considered the ethical dimensions of revising survey and manage, they do not describe that process or the ethical reasoning they employed. The suggestion to remove survey and manage procedures seems to prioritize utilitarian economic values over the value of non-human species (either intrinsic or instrumental), but overall it is not clear that the ethical motivations behind and implications of this suggestion have been duly considered.

Re-allocation of LSR lands. Johnson and Franklin (2013) suggest moving some young areas of spotted owl non-critical habitat in LSRs to matrix for harvest. They point out that some stands in LSRs, which, had they been allocated as matrix under the NWFP, would have been available to harvest, were instead allocated to LSRs to be accelerated toward suitable spotted owl habitat by strategic thinning (Johnson & Franklin, 2012, p. 74). The explanation of the reasoning behind the proposed transfer is as follows:

> Assuming that the majority of the currently unharvested forests in the matrix end up being reserved for the NSO, re-evaluating the importance of previously harvested stands in LSRs to provision of NSO habitat and its potential contribution to other management goals, such as provision of early successional ecosystems and timber, seems appropriate. (Johnson & Franklin, 2012, p. 74)

In other words, certain areas in the matrix have been restricted from harvest because of spotted owl activity. Johnson and Franklin are suggesting that because there is, in effect, "reserved" land in the matrix, certain stands in LSRs (which are of less current value to spotted owls), should be re-allocated to the matrix, and appropriated to other uses (i.e. timber production). In 2013 they elaborated: "While there were other justifications for LSRs, especially within the range of the Marbled Murrelet, conservation of the NSO was the major justification for the size and placement of the LSRs" (Johnson & Franklin, 2013, p. 23). Now, they argue, critical habitat is "out of sync" with the Northwest Forest Plan allocations, with areas of higher-priority owl habitat in the matrix and lower-priority or non-habitat in reserves (Johnson & Franklin, 2013, p. 23). Thus, they suggest that young, non-critical habitat in reserves should be transferred to the matrix, to compensate for the critical habitat in the matrix where attempts to harvest would be blocked by litigation on the basis of the Endangered Species Act.

As with the previous two suggestions about how to adjust the sustained yield land base, the suggestion to transfer lands from LSRs to matrix also seems to be motivated more by economic, anthropocentric concerns than by ecocentric concerns for the intrinsic value of forests o species. Transferring young reserved stands outside of critical habitat to the matrix for harvest may or may not do harm to spotted owl population viability, but it certainly does not help them either. Johnson and Franklin (2013) do provide an estimate for how much timber will be produced from the transfer, both short term and long term, (p. 23), but the (ethical) question remains of whether these values are ample justification for the potential risk to spotted owl populations. Johnson and Franklin also justify harvest on the grounds that early seral habitat is required on the landscape, but it is not clear whether this is a genuine goal, or simply another way to push for higher levels of harvest, nor is it clear how the value placed on early seral ecosystems compares to the value placed on sustained yield. The fact of the matter is that Johnson and Franklin do not clearly explain the values behind their plan. I have made the point several times, so I will not dwell on it here: the decisions being made require transparent deliberation and communication of the ethical questions about values at stake. Because Johnson and Franklin do not openly explain how their plan values early seral, in comparison to sustained yield, spotted owl conservation, and any other number of possible objectives, it is not clear how or why they formulated this strategy, or whether it is appropriate.

These examples seem to suggest that the ethical orientation of the western Oregon ecological forestry plan is anthropocentric and utilitarian. However, I once again fully admit that my observations are inferential and, to some extent, speculative. At the theoretical level ecological forestry assumes no ethical position, and Franklin and Johnson offer no clear and explicit statement of the ethical beliefs underlying their plan for western Oregon. Although the emphasis in the examples above is on maximizing the amount of timber that can be extracted, that emphasis may be a function of the fact that the focus of these examples is the controversial matter of increasing the level of timber that can be produced on BLM western Oregon lands. If Johnson and Franklin had written a report where they were specifically discussing a different issue, e.g. carbon storage, they might have focused on maximizing the amount of forest that could be used to store carbon, by pointing out tradeoffs and sacrifices in other objectives. The point is that, although Johnson and Franklin may place emphasis on different objectives at different times, their plan needs an overarching ethical framework to unify, both philosophically and practically, how and why various objectives are pursued. Without a coherent ethical narrative to tie all of these various goals and objectives into one overarching strategy, the Johnson and Franklin plan does not provide enough information about how, and to what ends, ecological forestry will be applied across the western Oregon landscape for stakeholders and decision makers to make careful and informed decisions about whether it should be implemented. Managing for uncertainty is unavoidable in forest management (Dietz, 2003; Christensen et al., 1996; Franklin, 1995). However, while uncertainty about outcomes may be unavoidable, uncertainty about the objectives, values, and intentions that underlie management decisions is not. Dissipating this uncertainty requires open ethical discourse and clear communication of values, a process that is decidedly challenging, but far from impossible (Nelson & Vucetich, 2012a).

Paradigm Shift in Forest Management?

Ecological forestry is supposed to be qualitatively different from, and an improvement upon, traditional multiple-use forestry (Seymour & Hunter, 1999). Much would seem to hinge upon the meaning of the word "ecological," which has been selected to represent the unique character of "ecological" forestry, distinguishing it from traditional and alternative forestry practices. Unfortunately, as I have argued throughout this chapter, the word is acrobatic in the range of interpretations it can accommodate, and the measures it can be used to justify. "Ecological" can refer to past conditions or future adaptations; it can be understood as including or excluding humans; it can refer to composition or function; and it can refer to a nearly inexhaustible number of properties of ecosystems, including water, soil, carbon, biodiversity, nutrient cycling, or productivity, and at any scale. As such, the word "ecological" can quite readily justify a wide spectrum of actions, some of which may not in fact be significantly different from practices enacted under traditional (i.e. utilitarian and anthropocentric) forest management.

Ecological forestry does not actively guide values, nor does it represent a distinct ethical view about how forests ought to be managed. Instead, it works within value frameworks established by decision-makers and stakeholders, managing forests in alignment with historic, non-anthropogenic processes to a degree that is deemed appropriate, as defined in the context of the full set of objectives for the forest. With this understanding of ecological forestry, one point becomes clear: the word "ecological" does not inherently mean that proponents and practitioners of ecological forestry attribute intrinsic value to forests, or that they value ecological goals (whatever they may be) over economic goals. Ecological forestry does not necessarily consider which management actions would be "best" (another normative concept) for the forest itself, because the forest does not necessarily possess a good of its own. "Ecological" in "ecological forestry" is a normative concept, couched in scientific authority, but it is not developed as an ethical stance in the ecological forestry literature.

Traditional forestry practices are implied to be problematic because, when management practices alter conditions that have historically characterized the ecosystem, forests are unable to sustain the full range of values for humans. If this is the case, the problem with traditional forestry is essentially identified as one of execution, which can be fixed by adjusting management practices so that forests can provide for the full range of goods and services that humans want and need. However, as I have argued, management for multiple values is not a simple matter, requiring deliberation and debate about inevitable tradeoffs and sacrifices. It is not even clear that forests can be managed to satisfy all that is needed and demanded of them (García-Fernández, Ruiz-Pérez, & Wunder, 2008), and it is certainly not clear that forests should be managed in such a way. Therefore, a more productive solution, in response to a fundamentally different problem, may be not to practice forestry differently, per se, but rather to revise the ethic underlying it (Franklin, 1989b). In other words, if the fundamental problem with traditional forestry is actually its utilitarian, anthropocentric ethical foundation, then ecological forestry only represents a solution if it makes a significant shift away from the traditional forestry paradigm by offering a different and more appropriate ethic. Has ecological forestry made such a shift?

Philosopher Thomas Kuhn (1962/1970) defined a paradigm as an overarching worldview, in which, "[m]en whose research is based on shared paradigms are committed to the same rules and standards for scientific practice" (p. 11). According to Kuhn, problems and solutions are framed within the dominant paradigm: "paradigms gain their status because they are more successful than their competitors in solving new problems that the group of practitioners has come to recognize as acute" (p. 23). He elaborated that, "one of the things a scientific community acquires with a paradigm is a criterion for choosing problems that, while the paradigm is taken for granted, can be assumed to have solutions" (p. 37).

This is an interesting gauge of change, and suggests that ecological forestry may in fact represent a transitional phase. Enough of a new paradigm has developed to allow recognition of a problem, but because it remains tethered to the language and ideology of the waning traditional forestry paradigm, ecological forestry perhaps cannot yet articulate problems in ethical terms. Kuhn also noted that a new paradigm replaces "previously standard beliefs or procedures" (p. 66). With ecological forestry, a shift in procedure certainly seems to be taking place, but what about beliefs? If, under the ecological forestry philosophy, forest ecosystems are still ultimately considered resources to be exploited, and only the tools and types of exploitation have changed, then the core beliefs of traditional forestry have not been replaced, and ecological forestry can best be understood as an offshoot of the traditional forestry paradigm. If, on the other hand, ecological forestry views forests not as so many goods and services, but as complex, living systems with value in their own right; and if it proposes new, more appropriate ways for humans to interact with forests, then the very foundations of the traditional forestry paradigm have been overturned. On the basis of the current literature, it is simply not clear whether ecological forestry represents such a veritable ethical shift.

Recommendations

In this chapter I have argued that the phrase "ecological forestry" can be used to describe a wide range of drastically different and ethically incommensurable management actions, because the proposed ecological forestry philosophy lacks an established normative framework. Without any clear and consistent commitment to normative and ethical principles, in either theory or application, the meaning of "ecological forestry" is nebulous, its purpose is unclear, its range of applications is unrestricted, and its potential for success is impossible to assess. I will now offer some brief speculations on how ecological forestry might move forward, to either compensate for or correct its present normative deficiencies.

By way of compensation, ecological forestry could be used without established ethical principles, but several adjustments would need to be made in how it would be conceptualized and described. First, ecological forestry would need to relinquish its claim as a philosophy, instead serving as a set of tools and practices. Second, the role of "management objectives" and "desired future conditions" in setting ecological forestry prescriptions would need to be far more emphatically stated, and the amount of potential variability openly acknowledged. And third, ecological forestry would need to be situated squarely in a broader ecosystem management context, with established participatory processes and decision-making procedures in place to structure how multiple objectives would be considered, weighed, and prioritized.

Although establishing a process to consider and prioritize amongst different values may be a viable strategy, it is not clear that, beyond its technical elements, it represents a marked change from, or improvement over, other forms of forest management in the traditional multiple-use paradigm. It would also do little to constrain the range of actions that could be pursued using ecological forestry. If ecological forestry is to make a significant departure from both traditional and alternative forms of management, it needs to incorporate the leading science, as it already does, but it also needs to meaningfully address the challenge of deciding how forests should be managed, not simply to meet all social values and objectives, but also to consider how they ought to be managed in an ethically appropriate way.

Currently, ecological forestry fails to coalesce into a distinct, unified philosophy of forest management. I suggest, therefore, that to correct this inconsistency, ecological forestry could itself adopt an overarching ethical orientation. This is probably riskier, and bound to be more controversial, than taking the ecosystem management approach outlined above, which would remain ethically neutral. However, it is the more radical and progressive approach to take. As a full-fledged philosophy of forest management and conservation, ecological forestry would be truly novel if it were to establish carefully selected, core ethical principles that departed from the prevailing anthropocentric, utilitarian ethic underlying traditional forest management. Ethical principles could, in some cases, take the form of specific guidelines. For example, as a matter of principle, ecological forestry may assert that restoring the viability of one species will not be prioritized over preventing risk to the viability of many species; or that achieving economic solvency for a local community justifies risks to threatened species viability, but the pursuit of excessive profit does not.[54] In addition, since site-specific nuances and conflicts are inevitable, it seems that ecological forestry would be strengthened if ethical principles were adopted in conjunction with a virtue approach, as suggested by Heller and Hobbs (2014). For example, a general commitment to avoiding measures that threaten species of concern might be bolstered by a parallel commitment to wise adjudication, respect for all interests at stake, generosity in cultivating benefits, and due humility in making sacrifices. With this bold approach to overtly ethical forest management, combined with the substantial and constantly increasing body of knowledge about forest ecosystems, ecological forestry stands to develop into a consistent, enduring, and truly revolutionary philosophy for forest management and conservation.

Conclusion

Spurr and Cline (1942) proposed a method, which they called "ecological forestry," to shift forests toward more complex, heterogeneous conditions, such as would be created by non-anthropogenic processes of disturbance and succession. The missing piece in this portrait, however, is that they made these suggestions as a way to achieve "profitable forest management" (p. 420). Spurr and Cline were very much aligned with the natural resource management and conservation mentality of the day (Hotelling, 1931; Murie, 1954), and it is deeply telling to see "ecological

[54] Of course, these principles would also require discussion and decisions about embedded normative concepts, such as what constitutes "viability," "solvency," or "excess."

forestry" advanced to promote pure production values with which, in modern times, it is generally disassociated. This seeming incongruity, however, is entirely consistent with the ambiguities of the term "ecological forestry."

In this chapter I have outlined the history and context in which ecological forestry emerged, and I explained how two core concepts from forest ecology, disturbance and succession, are translated into forest management practices, retention and harvest. I argued that, while the scientific elements of the ecological forestry approach are relatively well established, its metaphysical, normative, and ethical underpinnings do not receive equal or adequate attention. The resulting ambiguities, I argued, allow for a broad spectrum of different and potentially conflicting management actions to take place under the label of "ecological forestry." This wide range of variability is problematic because it undermines social trust and acceptability, both of which are critical to the successful implementation of forest management, but also because it permits forestry practices that may ultimately perpetuate, or even exacerbate, the environmental damages that ecological forestry purports to avert. I used the specific example of the ecological forestry plan for western Oregon to demonstrate how metaphysical, normative, and ethical ambiguities translate into uncertainties about the objectives of the plan, the values and intentions underlying it, and even what the prescriptions themselves would entail.

Early studies indicate that the technical aspects of the ecological forestry toolkit may in fact reduce changes to forest ecosystems in the post-harvest stand (e.g., Mori & Kitagawa, 2014; Seidl et al., 2014). As such, it seems that ecological forestry can lead to outcomes different than those of traditional management practices. However, it remains unclear to what extent the motivations of ecological forestry differ appreciably from those of traditional forestry. If ecological forestry still operates on the assumption that we can and should take as much as possible from a forest landscape, and that forests stand only to meet the needs and desires of human populations, then it is still bound to the traditional forestry paradigm. If, on the other hand, ecological forestry attributes intrinsic worth to forest ecosystems, defining and protecting their integrity as fully as possible, it may be that ecological forestry is in fact a pioneer into a truly novel philosophy of forest management.

Since, as I have argued, ecological forestry has not yet taken an official stance on this matter, it may be beneficial to offer a reflection on one further meaning of the world "ecological." "Ecological" can refer, on one hand, to the relationships constituting the living systems of the earth. Our understanding of these relationships is constantly growing, and will continue to evolve with further scientific studies and discovery. However, it is perhaps time to explore a different meaning of the word "ecological," which literally means, "according to knowledge of home." What does it mean for humans to be at home in the world? As a species, what niche do we occupy and what role do we play? In this sense, "ecological forestry" might represent a vision of how that role could be wisely, prudently, and appropriately- in other words, ethically- enacted through forestry.

CHAPTER ONE FIGURES

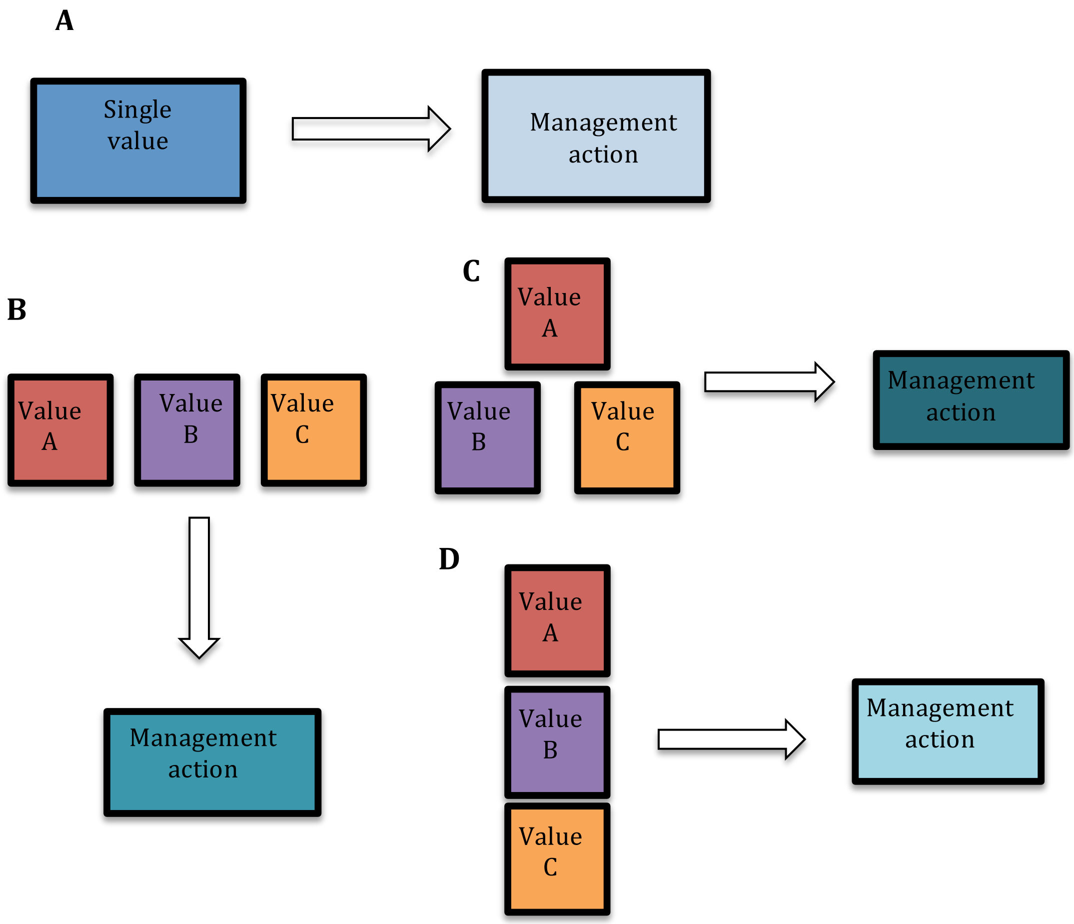

FIGURE 1.1 Illustration of the difference between managing for a single value and managing for multiple values. (A) When a forest is managed for just one single value, a decision about the proper course of action is relatively straightforward. When there are multiple values, however, there are multiple ways that those values might be managed. (B) All values might be considered equally important, or (C) and (D) some values may be considered more important than others, and therefore prioritized over the others. Each of these scenarios might lead to a different set of management actions.

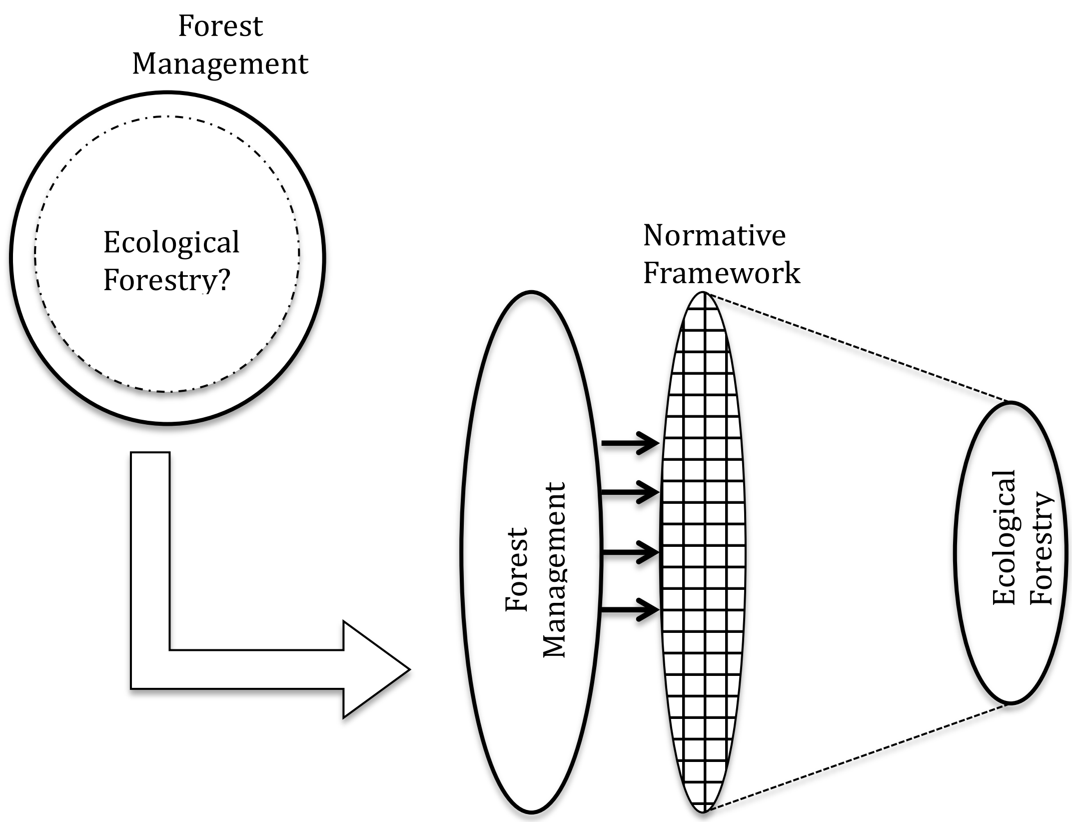

FIGURE 2.1 The role of a normative framework in ecological forestry. Without normative principles, ecological forestry is not clearly differentiated from other management strategies. An established normative framework could at once serve as a lens, bringing ecological forestry into clear focus as a management philosophy, and a filter, restricting the management strategies that can be called “ecological forestry” to only those that are aligned with its normative principles.

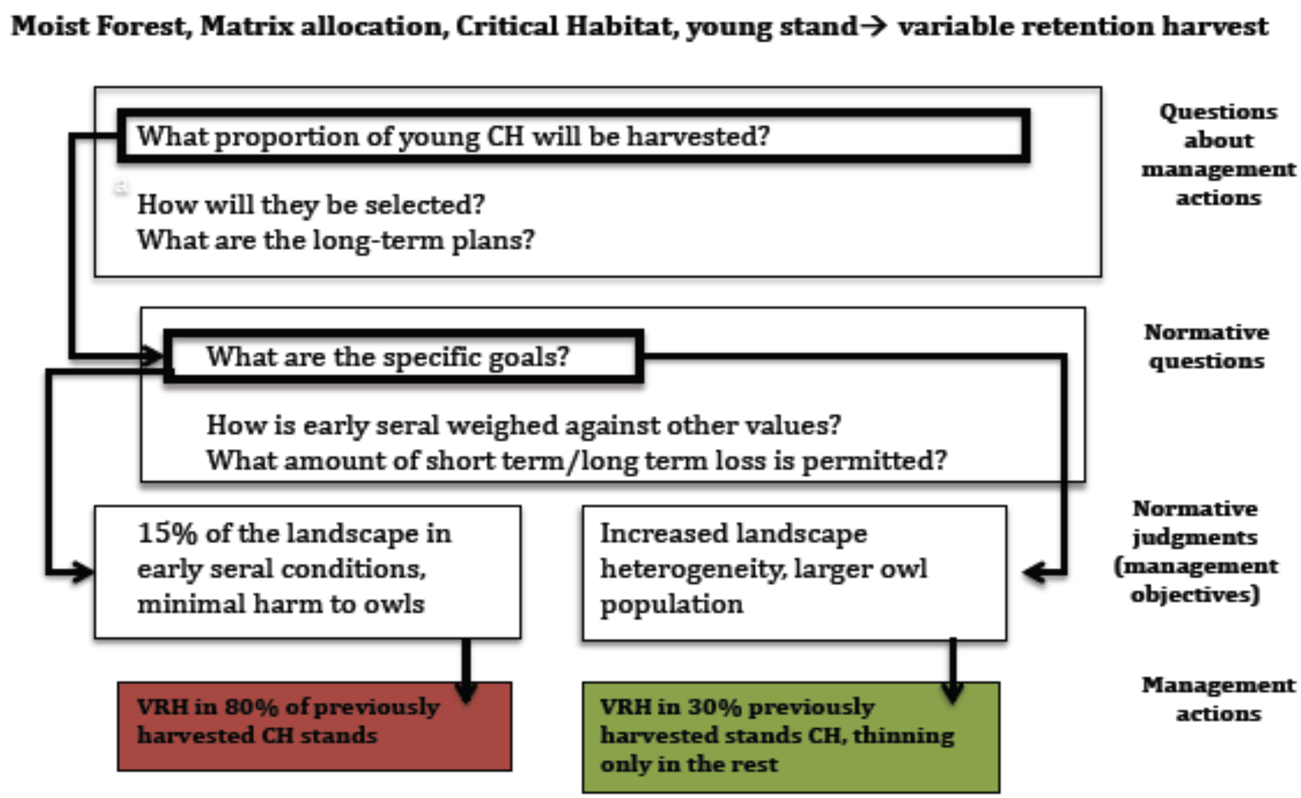

FIGURE 3.1 Diagram of normative questions and judgments embedded in management decisions. Different normative judgments made in answer to normative questions may produce different management actions. Consider the case of young Moist Forests on matrix land in critical habitat (CH) of the spotted owl. Johnson and Franklin (2012, 2013) suggest that land meeting these criteria is a candidate for variable retention harvest (VRH). Without understanding the normative underpinnings of the plan, however, several uncertainties remain. The first tier of this schematic identifies some specific uncertainties about the prescription itself (from Table 5.1). Information about normative judgments made at the third tier in response to normative questions at the second tier (also from Table 5.1) would clarify these uncertainties. Depending on normative judgments, specific objectives are set and management actions are designed accordingly. Thus, for the young Moist Forest on matrix land in critical habitat, variable retention harvest (VRH) may be realized in two very different ways, based on different normative ideas about how the land should be managed. Please note: numbers in this schematic are arbitrary, and for illustrative purposes only.

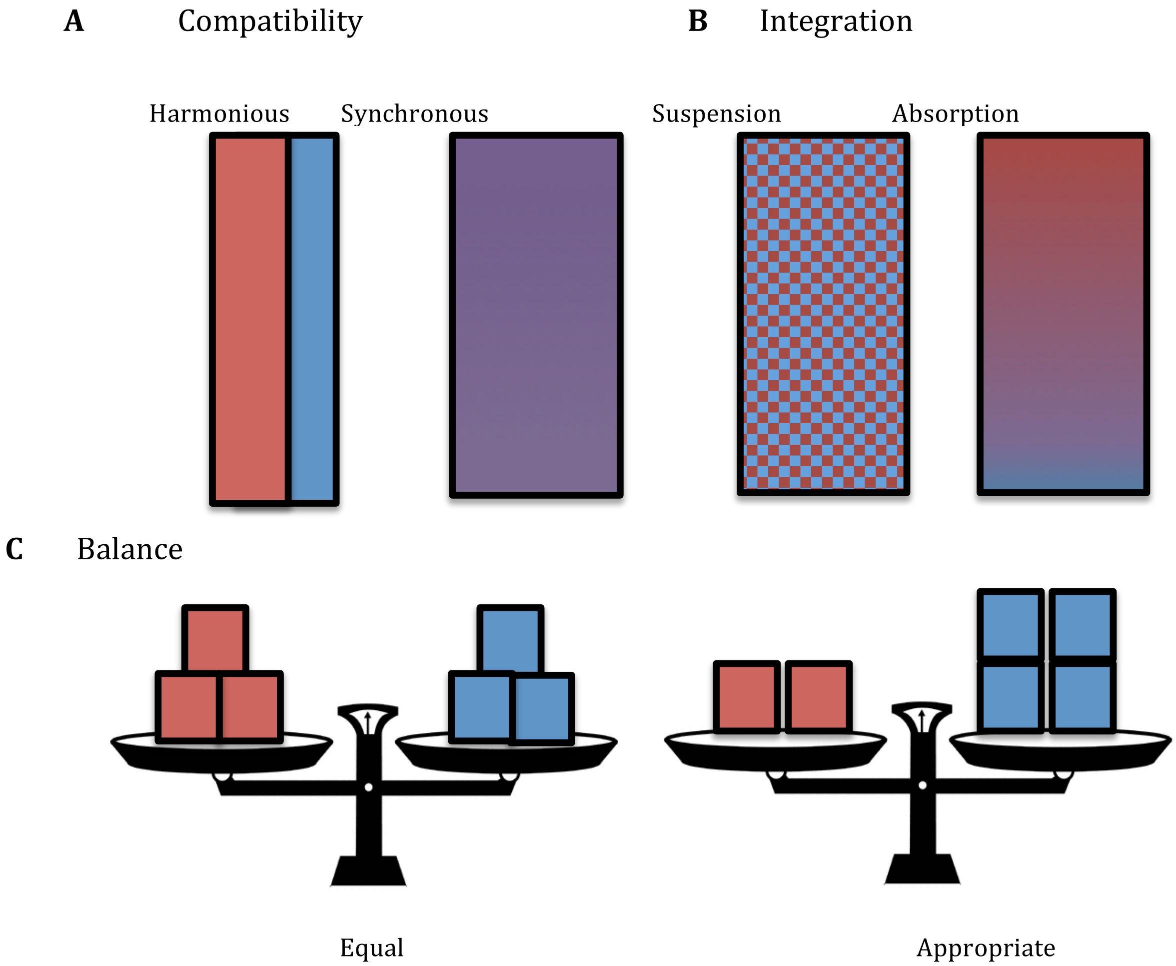

FIGURE 4.1 Illustration of ambiguous language about multiple values. Ambiguous language about managing for multiple values suggests different ideas. (A) Compatible values can be understood in two ways: 1) compatible values are separate and harmonious, so that both values inform objectives that can be achieved without impeding one another, or 2) compatible values are synchronous, so that achieving objectives informed by one value also achieves objectives informed by the other value (i.e. managing for one value is in effect the same as managing for the other). (B) Integration can also be understood in two ways: 1) integration in which two values are combined but still remain distinct, like a suspension of particles in a solution, or 2) integration in which two values are combined by absorbing one value into the other. (C) Balance has two interpretations as well: 1) equal balance, in which values are weighted in an egalitarian manner, or 2) appropriate balance, in which values are weighted according to some (normative) understanding of relative importance.

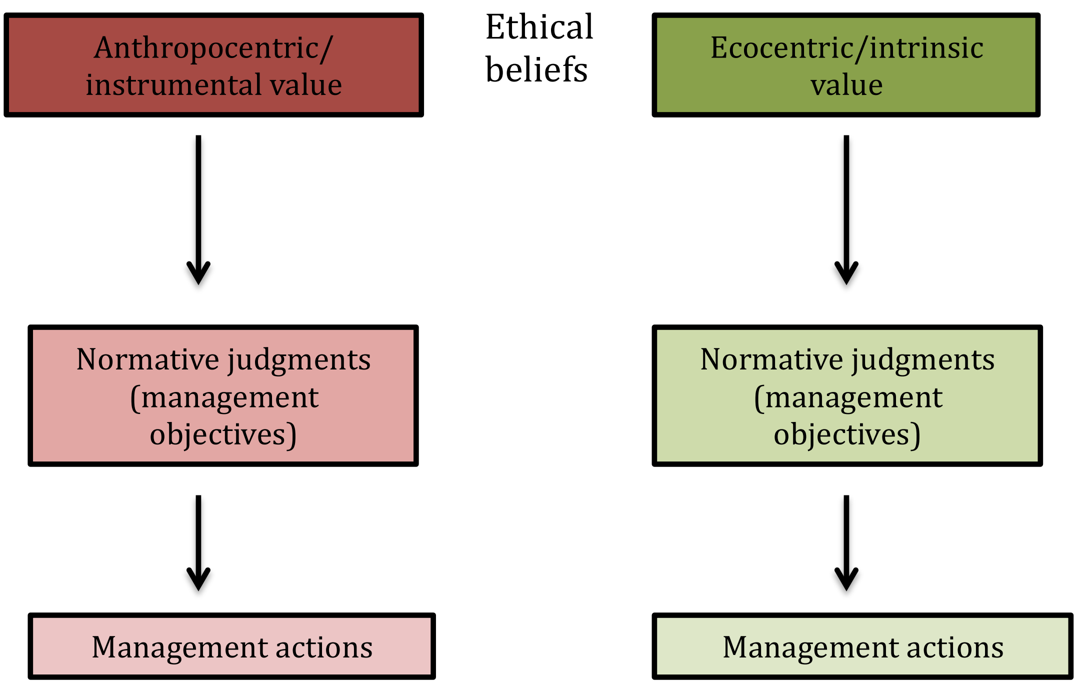

FIGURE 5.1 Diagram of the relationship between ethical beliefs, normative judgments, and management actions. Figure 3.1 showed that even what appears to be a particular prescription for a given site (i.e. variable retention harvest for a young Moist Forest on matrix land in critical habitat for the spotted owl) can vary in detail depending on normative judgments and the objectives they inform. Here I show that answers to normative questions, i.e. normative judgments, are themselves informed by ethical beliefs. Different value orientations will inform different normative judgments about how forests ought to be managed, and therefore which objectives ought to be pursued, and to what extent. Based on these different objectives, different management actions will be prescribed.

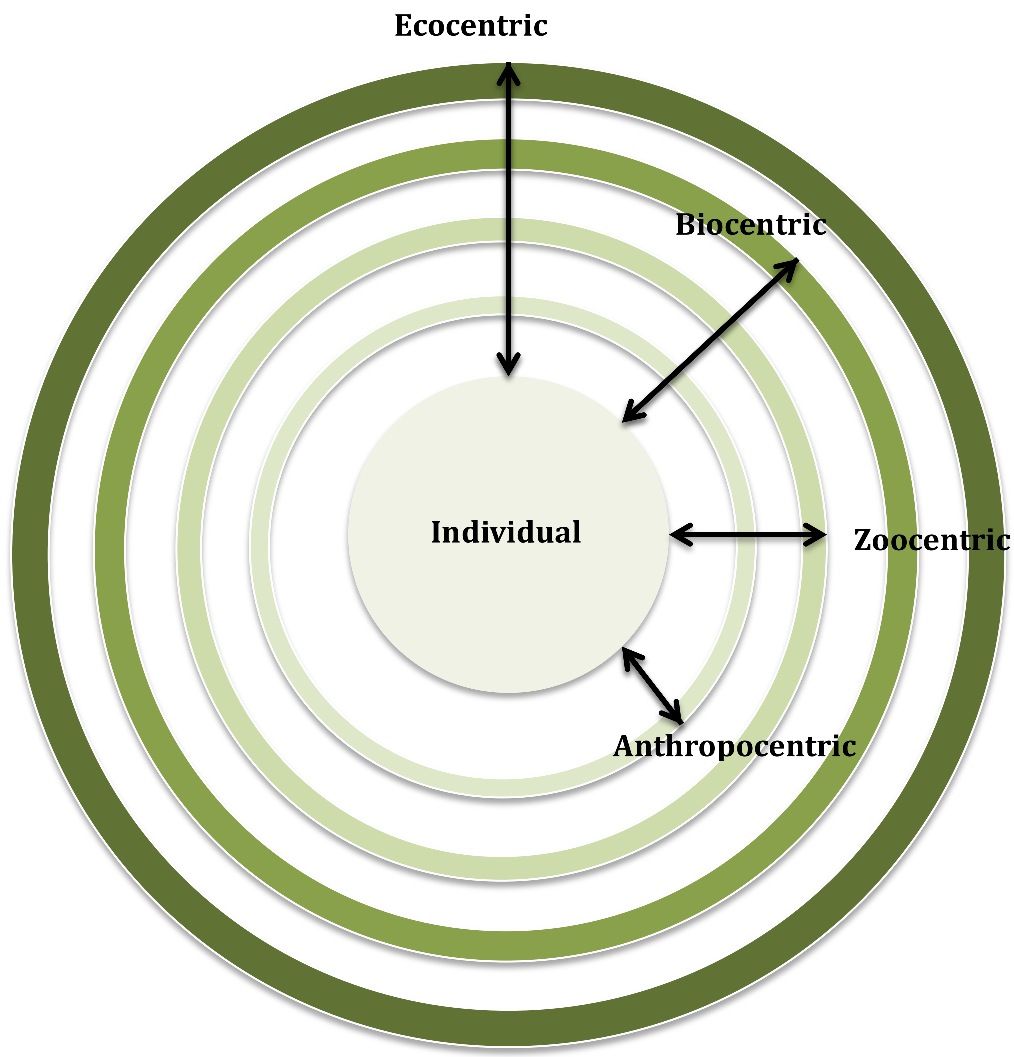

FIGURE 6.1 Moral accretions in an increasingly expansive environmental ethic (based on Callicott, 1993; Nelson & Vucetich, 2012a). In the narrowest circle, an individual attributes only him- or herself with intrinsic value. An anthropocentric ethic attributes all humans with intrinsic value, and a zoocentric ethic extends intrinsic value to all animals. A biocentric ethic attributes all living beings with intrinsic value, and finally an ecocentric ethic attributes biotic and abiotic collectives (e.g. ecosystems, species, communities) with intrinsic value. Each of the accretions expands the moral universe without excluding the inner rings. In other words, a zoocentric, biocentric, or ecocentric ethic still attributes all humans with intrinsic value.

CHAPTER ONE TABLES

TABLE 1.1 Different labels referring to ecological forestry ideas.

Label	Example citations
New Forestry	Franklin, 1989 Gillis, 1990 Swanson & Franklin, 1992 McQuillan, 1993
Retention forestry	Franklin, Berg, Thornburgh, & Tappeiner, 1997; Lindenmayer & Franklin, 2002 “variable retention harvest system” Vanha-Majamaa & Jalonen, 2001 “green tree retention” Mitchell & Beese, 2002 “retention system” Gustafsson et al., 2012 “retention forestry” Lindenmayer et al., 2012 “retention harvesting”
Disturbance-based forestry	Palik, Mitchell, & Hiers, 2002 “modeling silvicultural disturbances after natural disturbances” Drever, Peterson, Messier, Bergeron, & Flannigan, 2006 “natural-disturbance-based management” (NDBM) North & Keeton, 2008 “disturbance-based forest management” Long, 2009 “emulating natural disturbance regimes”
Ecological forestry	Seymour & Hunter, 1999 Franklin, Mitchell, & Palik, 2007 Johnson & Franklin, 2009, 2012, 2013 Franklin & Johnson, 2012, 2013

TABLE 2.1 Proposals for use of ecological forestry on O&C Lands. Prescriptions in Moist Forests are made by NWFP land allocation, status within or outside of spotted owl critical habitat (CH), and age (adapted from Johnson & Franklin, 2013, p. 19).

Critical Habitat Status	**NWFP Allocation**					
	Matrix over 120	Matrix 80-120	Matrix under 80	Reserve over 120	Reserve 80-120	Reserve under 80
In CH	No	No	Possible regeneration harvest	No	No	Thin only
Outside CH	No	Maybe	Regeneration harvest	No	No	Thin only (or transfer to matrix)

TABLE 3.1 Citations from the literature identifying ecological forestry (and associates) as a strategy for multiple-use forest management.

Example citations	Multiple values/objectives statements
Franklin, 1989a	"we have finally begun developing a sound ecological basis for the concept of multiple use forestry" (p. 549)
Swanson & Franklin, 1992	"The intent of these programs [*New Perspectives, New Forestry*] is to better match management practices with the broad array of human values and philosophies concerning natural resources" (p. 263)
Franklin, Berg, Thornburgh, & Tappeiner, 1997	"the creation and maintenance of structurally complex managed stands is being developed as the primary approach to managing forests for multiple, complex objectives, including production of wood products" (p. 112)
Lindenmayer & Franklin, 2002	"Ecologically sustainable forest management [*retention forestry*] perpetuates ecosystem integrity while continuing to provide wood and non-wood values" (p. 6)
Palik, Mitchell, & Hiers, 2002	"In all cases, the ultimate objective is to facilitate implementation of natural disturbance-based silviculture without ignoring the economic goals of commercial timber management or the interests of stakeholders concerned about biodiversity" (p. 353)
Franklin, Mitchell, & Palik, 2007	"some fundamental principles for ecological forestry transcend systems, conditions, objectives, and context, and can be applied in varying degrees in virtually all settings where melding of ecological and economic goals is an objective" (p. 1)
North & Keeton, 2008	"Forest landscape sustainability, once measured as a constant supply of timber, has become a more complex concept where social, ecological, and biodiversity needs must be met in addition to economic revenues (Hunter, 1999)… Consequently, sustainable management of "matrix forests" is increasingly viewed as an essential complement to other conservation approaches (p. 342)
Franklin & Johnson, 2012	"We view our restoration strategy as a credible alternative to the extreme choices with which stakeholders are currently being presented of either managing federal lands for intensive wood production, on the one hand, or effectively preserving all of it for owls, on the other" (p. 437)
Gustafsson et al., 2012	"retention forestry…is highly adapted to the sustainable management of forests for environmental, economic, and cultural objectives" (p. 643)
Lindenmayer et al., 2012	"Global adoption of the retention approach in implementing sustainable forest management is critical to balancing the ecological, social, and economic values of forests" (pp. 428-429)

TABLE 4.1 Examples from the ecological forestry literature in which normative decisions are deferred. In some cases the need for normative decisions is explicitly highlighted, but then given no further treatment or consideration. In other cases, the need for normative decisions is only implied.

Normative decisions clearly identified	
Swanson & Franklin, 1992	"A major challenge to ecosystem scientists and managers is merging the design of forest stands, landscape patchworks, and stream/riparian networks to produce the most desirable future landscape conditions and levels of productivity. The difficult social aspect of this challenge is to determine those desirable future conditions" (p. 271)
Franklin et al., 1997	"Answering the question of how much to retain is conceptually very simple- it depends upon the management objectives for the harvest unit, which of course includes landscape-level considerations" (pp. 119-120)
Franklin et al., 2000	"The question of how much is conceptually easy but practically difficult to answer. Obviously, legacies should be retained at levels sufficient to achieve the desired management goals!" (p. 6)
Lindenmayer & Franklin, 2002	"Identifying and prioritizing management objectives, which defines the tradeoffs between economic and conservation goals, must precede the development of a silvicultural prescription (Gibbons and Lindenmayer, 1996; Franklin et al., 1997). Once management objectives are defined and the relevant information assembled, silvicultural prescriptions that provide for structural retention can be developed" (p. 167)
Mitchell & Beese, 2002	"As with other silvicultural systems, successful implementation of the retention system requires clear identification of a desired future condition of the stand and landscape" (p. 402)
Franklin et al., 2007	"The implementation and expression of ecological forestry concepts will vary in practice based upon specific goals for management, characteristics of tree species and ecosystems, variation in starting conditions of stands and sites, and landscape context" (p. 1)
Normative decisions more subtly implied	
Long, 2009	"ENDR is one of several similar conceptualizations…with the goal of approximating a desired reference condition" (p. 1868)
Franklin & Johnson, 2012	"restoration should center on restoring resilience and functionality in the context of desired future conditions, even while learning from the past" (p. 430)
Gustafsson et al., 2012	"The necessary area or volume to retain within stands will vary with and should be adapted to local conditions, but we suggest 5%-10% as a strict minimum, and considerably more is often likely to be needed to achieve the desired ecological objectives" (p. 635)

TABLE 4.1 (continued)

Normative decisions more subtly implied (continued)	
Lindenmayer et al., 2012	"Details of retention harvesting prescriptions will vary among forest ecosystems…other important variables include specific management objectives and integration of retention with other ecologically oriented management approaches, such as riparian protection" (p. 426)

TABLE 5.1 Normative questions about ecological forestry prescriptions that lead to questions about the prescriptions themselves. Here is both a general template for the sorts of uncertainties that might remain when information about normative judgments is not provided, as well as a specific example from western Oregon.

Prescription	Examples of questions about specific management actions	Examples of normative questions
General form		
Moist or Dry? NWFP Land Allocation? NSO Status? Age?→ Management action	What proportion of the land base will be appropriated to this particular strategy? How will a stand within the land base be selected for one prescription as opposed to another? Which legacy elements will be selected for retention within a stand? What are the future plans for the stand/land base?	What are the goals? What values do they represent? How were they prioritized over other potential goals? How much is needed and how much is desired? Are they the same? What counts as "enough?" How much loss is permitted, and how much benefit is expected?
Applied example		
Moist Matrix Critical Habitat Young→	What proportion of young CH matrix will be harvested for regeneration each year, and over what amount of time?	What specific goals (amount of early seral, number of spotted owls, timber revenue for O&C counties) are to be met?
Variable retention regeneration harvest	How will young matrix CH stands be selected for regeneration, as opposed to CH stands that will not be harvested?	How are the need(s) or desire(s) of/for early seral being weighed against the need(s) or desire(s) of/for the NSO? Against rural community welfare?
	Will these lands be put on long rotations? Sustained in a diverse early seral condition? Thinned for accelerated old-growth conditions?	What amount of habitat loss for NSO is permissible, if it is short term versus long term? How much early seral is needed on the landscape, and according to what definition of "need?" How much timber revenue is needed to support rural counties?

TABLE 6.1 Ambiguous language describing how ecological forestry manages for multiple values or objectives.

Multiple value management concept	Examples from Franklin et al., 2007
Compatibility	"some fundamental principles for ecological forestry transcend systems, conditions, objectives, and context, and can be applied in varying degrees in virtually all settings where melding of ecological and economic goals is an objective" (p. 1)
Tradeoffs (even)	"The challenge then is to develop approaches that lead to maintenance (or restoration) of ecological complexity, along with opportunities to meet certain timber management goals. The balance may shift toward one goal or the other at different times and different locations, depending upon priorities among management objectives" (p. 33)
Tradeoffs (uneven)	"In many cases, the ultimate objective is to facilitate implementation of silviculture based upon natural disturbance and stand development models without completely ignoring economic objectives" (p. 34)
Ambiguous	"the desire [is] to achieve multiple objectives, i.e. to maintain ecological values and produce some wood for extraction" (p. 33)

TABLE 7.1 Examples suggesting that ecological forestry is motivated by an intrinsic value approach, an instrumental value/ecosystem services approach, or leaving ethical underpinnings unclear.

Citation	Ethical approach
	Intrinsic value implied
Franklin, 1989b	"Let us adopt a forest ethic" (para. 42)
Kirkman & Mitchell, 2006	"The Stoddard-Neel Approach [*similar to ecological forestry*] recognizes forest values not only for the wood or wildlife that can be harvested, but they are valued as complex ecosystems that support unique habitats for a diverse group of plants and animals" (p. 73)
	Instrumental value/ecosystem services implied
Franklin, 1989b	"Only in this way can we maintain our options in the face of the great uncertainties created by air pollution and global climate change" (para. 41)
Franklin et al., 1997	"A common perspective is that lifeboating of biological diversity is primarily intended to sustain species of esoteric or peripheral interest in managed stands, such as officially listed rare or endangered species. In fact, much of the diversity that is sustained by structural retention, such as fungal species capable of forming mycorrizhae, play important functional roles" (p. 116)
Aber et al., 2000	"current management policies and practices should not devalue the resource for future generations" (p. 3)
Palik et al., 2002	"An equally compelling challenge is the growing recognition that biodiversity goals must be incorporated into commercial forest management to sustain productivity and meet the interests of concerned constituencies" (p. 353)
Frankln et al., 2007	"the primary goal for retaining large trees is sustaining ecological services, rather than regeneration potential" (p. 28)
North & Keeton, 2008	"Disturbance-based forest management is increasingly used in forest types across North America to enhance the range of ecosystem goods and services provided by managed forests" (p. 36)
Lindenmayer et al., 2012	"These forests are immensely important as a primary source of ecological goods and services essential to humankind and are worth trillions of dollars annually. Unfortunately, many key values are threatened in these forests including forest biodiversity and forest carbon stocks" (p. 422)
	Unclear
Franklin, 1989a	"Stands with structural diversity are essential to the maintenance of many ecological values, including many wildlife species" (p. 549)
Orians & Franklin, 1990	"The proof will be in the diversity- the richness of these stands, in their continued functioning in terms of watershed regulation, and in terms of productivity" (p. 453)

TABLE 7.1 (continued)

	Unclear (continued)
Swanson & Franklin, 1992	"This perspective does not constitute a 'naturalistic ideology' in the sense of managing ecosystems for the sake of naturalness. Rather the strategy is to use knowledge of natural ecosystems to develop practices of sustainable ecosystem management" (p. 291)
Franklin et al., 1997	"Variable retention harvest prescriptions are appropriate where management objectives include maintenance or rapid restoration of environmental values associated with structurally complex forests" (p. 115)
Aber et al., 2000	"The National Forest System should be viewed as a multifaceted resource of continuing value" (p. 3)
Lindenmayer & Franklin, 2002	"Conserving biodiversity for its own sake is only one of many possible goals of matrix management. Another is the production of commodities, such as wood, and services, such as well-regulated flows of high-quality water" (p. 7)
Long, 2009	"it is anticipated that ENDR will be an effective tool in the conservation of biodiversity which will, in turn, provide buffering with respect to ecosystem processes" (p. 1869)
Mitchell et al., 2009	"Ecological forestry has been often used when conservation of biodiversity is a major goal, but it is also relevant to maintaining or enhancing ecological services" (p. 395)
Franklin & Johnson, 2012	"restoration should center on restoring resilience and functionality in the context of desired future conditions, even while learning from the past" (p. 430)
Gustafsson et al., 2012	"Forests…harbor most of the biodiversity terrestrial biodiversity; and provide critical ecosystem services" (p. 633)

TABLE 8.1 Normative and ethical questions underlying concepts of sustained yield, resilience, and restoration, as advanced in the Johnson and Franklin plan for western Oregon.

Concept	Definition	Example normative questions	Example ethical questions
Sustained yield	"organization of a property for continuous timber production, under the silvicultural prescriptions, rotation ages, and cutting cycles reflective of the goals for the forest" (Johnson & Franklin, 2013, p. 1)	How much timber counts as "sustained," and for what amount of time? Is this a minimum allowable value, and if so, how was it determined? Is the goal to maximize this value, and if so, within what constraints? Or is there an upper limit deemed to be enough?	Does economic stability justify risking species extinction? (Do other species count as moral agents?) Is it just that some human communities should have to reduce income/revenue expectations to keep more forestland intact? Is it right to risk the economic good/livelihood of people for the survival of non-human species?
Resilience	"The capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks" (USDA 2011, p. 8524, as cited in Johnson & Franklin, 2012, p. 31)	What properties of the ecosystem are being considered? At what spatial scale, and over what time period? What degree of change is acceptable, and how is acceptability defined/determined?	Are current species assemblages more important than assemblages that may be adapted to future conditions? Is overall ecosystem resilience more important than single-species conservation? Is overall ecosystem resilience more important than economic stability for rural communities?

TABLE 8.1 (continued)

Concept	Definition	Example normative questions	Example ethical questions
Restoration	"Assisting ecosystem in the recovery of resilience and the capacity to adapt to change if the environment where the system exists has been degraded, damaged, or destroyed. Ecological restoration focuses on reestablishing ecosystem functions by modifying or managing the composition, structure, spatial arrangement, and processes necessary to make terrestrial and aquatic ecosystems sustainable, and resilient under current and future conditions" (USDA 2011, p. 8524, as cited in Johnson & Franklin, 2012, p. 31)	What type and degree of degradation must occur before a landscape needs restoration? How is degradation defined and identified? What criteria must be met to consider a landscape restored?	Should ecosystems be kept in conditions that best suit human needs and desires? Is it right to restore ecosystems to conditions that are not assured to be viable in the future? What responsibility do we have to leave the world in a certain condition for future generations (human and/or non-human)? Is there intrinsic worth in ecosystems as they have existed in the past, or should their integrity as dynamic and changing systems be respected?

CHAPTER TWO: ARGUMENT ANALYSIS

Introduction

How can we make good decisions about forest management? Sound science is without question a pillar of environmental decision-making (Steel, List, Lach, & Shindler, 2004), but science alone does not constitute a decision, let alone a good one. Decisions in forest management also require judgments about a right or proper course of action. These types of judgments are normative, conveying ideas about how the world ought to be, or how forests ought to be managed. Often these normative judgments are so integrally embedded into the structure of decisions as to go unacknowledged, and therefore escape critical examination. However, just as the science informing a decision can be assessed for accuracy, so too can normative judgments be assessed for appropriateness.

Although many decisions are simple and involve little risk (e.g. should I wear my black t-shirt or my white t-shirt today), decision-making processes in natural resource management are often controversial, with important values at stake and multiple perspectives from diverse stakeholder groups conflicting with one another (McCool & Guthrie, 2001). In such cases, different decision alternatives will be advanced through arguments. For example, current federal legislation proposing the use of ecological forestry, as proposed by Drs. Jerry Franklin and Norm Johnson, on the O&C lands in western Oregon (S.132, 2015) has generated extensive conversation among scientists, policymakers, and various interest groups in the Pacific Northwest, with a variety of arguments being made about why ecological forestry should or should not be implemented. By formulating, examining, and evaluating the premises, both scientific and normative, that underlie these arguments, gaps and ambiguities can be identified and specific points of conflict or dissent made clear. This process can in turn facilitate dialogue and communication, encouraging a more transparent and informed decision-making process (Dietz, 2003; Lynn, 2011; Nelson & Vucetich, 2012a).

The purpose of this second chapter of my thesis is to perform a formal analysis of arguments for and against ecological forestry. I will begin by describing the process of argument analysis, and explain how I have applied it in the current project. I will then present a series of arguments about ecological forestry, beginning with a set of broad theoretical arguments, and then turning to a set of arguments specifically pertaining to the case of ecological forestry in western Oregon. Each argument will be followed by commentary and critique, in which I will analyze the argument by discussing the extent to which its individual premises are truthful and controversial. I will conclude with an overall assessment of the present discourse around ecological forestry, highlighting the contribution that argument analysis might make to it.

Methods

Nelson and Vucetich (2012a) suggest using argument analysis to systematically examine and evaluate arguments about natural resource management, where decisions are often complex and highly controversial. Because the idea of using ecological forestry to manage forests, particularly in the Pacific Northwest, has inspired strong and conflicting opinions, argument analysis presents itself as a useful tool that can reveal some of the ambiguities and uncertainties that may be clouding decisions, and also ease communications among generally contentious stakeholder groups. Formulating arguments requires a commitment to accurate representation of various positions, and actively guarding against personal opinions that may influence the structure or critique of arguments. This analysis is informed by an extensive review of literature about ecological forestry and related topics (see Chapter One), and I have, to the extent possible, withheld any personal beliefs, biases, and presuppositions that might have affected how I formulated or assessed the arguments. Nonetheless, because the selection, formulation, and evaluation of an argument is, at least to some extent, an inherently subjective process, I used a four-step methodology to ground, affirm, and when necessary re-direct my choices along the way. The four steps include Argument Selection, Argument Formulation, Argument Review, and Argument Evaluation. I will describe each step in detail below.

Argument Selection

Based on a reading of the scholarly literature (peer-reviewed journal articles and technical reports), federal testimony and legislation, and the popular media (newspaper and magazine articles, interest group blogs, and other website content), I initially identified a set of what I believed to be the main reasons- i.e. the reasons most central to the current discourse- why people are arguing that ecological forestry should or should not be implemented.[55] I have divided these reasons and the arguments they underlie into two broad classes: theoretical and applied. The theoretical arguments contend that ecological forestry should be implemented for reasons that proponents of ecological forestry would advance generally and on principle, regardless of site-specific details or contexts. I identified four of these broad theoretical reasons for using ecological forestry (see Table 1.2). The second class of arguments applies to the particular case of ecological forestry in western Oregon (see Chapter One for background and context). In the literature I identified seven main reasons why people are saying we should use ecological forestry in western Oregon, and eight main reasons why people are saying we should not (see Table 2.2).

One of the greatest values of argument analysis is its ability to reveal weaknesses in arguments. If an argument is found to be critically flawed and generally unsound, it probably should not be influential in swaying the direction of a management decision. Because argument analysis is a labor-intensive and time-consuming process, I knew I would not be able to address every single argument

[55] Throughout this chapter, when I refer to "the literature" or "the ecological forestry literature" I refer to my full review of both scholarly and popular sources, unless otherwise specified.

being made about ecological forestry. Instead, I wanted to focus my analysis on the arguments that are currently most influential, where the potential to make a constructive contribution to the discourse is greatest. To assist me in this task, I identified ten experts in forest ecology, silviculture, and forest management to act as consultants as I first selected and later refined arguments for analysis. All of these individuals are highly knowledgeable in their fields, and also have a demonstrated interest in ecological forestry. After obtaining approval from the Oregon State University Institutional Review Board (study ID 6560), I emailed each expert to request his or her assistance with the project. Once an expert had consented to participate, I sent him or her a Qualtrics questionnaire, designed to elicit feedback about which reasons I should formulate as arguments and subsequently analyze. This Argument Selection questionnaire (Appendix A) presented the experts with two tables of reasons, one for the theoretical reasons (Table 1.2) and the other for the applied reasons (Table 2.2). Experts were asked to indicate which reasons they believe are more or less central to the current discourse surrounding ecological forestry, by rating each reason on a scale from 0 ("completely irrelevant") to 10 ("absolutely crucial"). They were also asked to suggest more accurate wording for the reasons they rated, or alternative arguments for analysis as they deemed fit. Using the feedback I received, I selected a final set of reasons to formulate into arguments, a process I will describe in more detail below.

Argument Formulation

According to the rules of logic, an argument is composed of a set of propositions, called premises, which together support a claim, called a conclusion (Copi & Cohen, 2009). Any argument can be formally constructed as a series of premises leading to a conclusion. For example, when I work at home I usually choose a sweatshirt to keep nearby, since I know I will inevitably get cold. Usually my dog falls asleep on top of this sweatshirt before I have a chance to put it on, and then I have to decide whether or not I should disturb him to retrieve it. More often than not I decide not to disturb him. Were I to wonder what line of reasoning supports this decision, I might formulate the argument formally, as follows:

P1: My dog fell asleep on the sweatshirt I had planned to wear, and now I am cold.
P2: A sleeping dog should not be woken, unless there is a very good reason to do so.
P3: Retrieving a sweatshirt to increase one's internal body temperature is not a very good reason to wake a sleeping dog, especially when other sweatshirts are readily available.
C: Therefore, I should not wake my dog to retrieve my sweatshirt.

By formulating the argument as such, I can more easily examine my logic and assess whether I have made a sound argument that justifies a good decision. For an argument to be sound, its conclusion must necessarily follow from its premises, and its premises must all be true (Copi & Cohen, 2009). If the conclusion of an argument does not necessarily follow from its premises, the argument is not valid. If the conclusion follows from its premises, but any of the premises is (or are) not true, the argument is valid but not sound (Copi & Cohen, 2009). In the argument above, P1 (a simple empirical observation) is obviously true and non-controversial. Although P2 and P3 may field some amount of controversy in a general sense, for the parties with an immediate interest in this argument (i.e. me and my dog), they can be considered true beyond dispute. Therefore, since its conclusion follows from its premises and all of its premises are true, this argument can be considered sound.

I employed the same basic process just described to formulate and assess arguments about ecological forestry. To guide me as I began formulating arguments, I chose the example or set of examples in the literature that I believed most fully and accurately represented the logic of the arguments being made. Some arguments could be traced to an explicit source. In these cases, although the full line of reasoning may not have been explicitly stated, the scope and content of the argument was at least defined in a single, relatively discrete location. However, many of the arguments about ecological forestry, particularly those in the theoretical class, were more subtly embedded in and interspersed throughout longer documents. The task of assembling an argument became significantly more challenging when it was scattered piecemeal throughout, and even expressed slightly differently across, multiple sources. I will explain how I used the literature to formulate these arguments on a case-by-case basis in Analysis and Discussion, below.

With reference to the examples from the literature, along with some of the expert commentary from the Argument Selection survey, I formulated an initial version of each argument. My major advisor and I then worked together to hone the arguments, discussing each one extensively and exchanging multiple rounds of edits and revisions. Argument formulation is a delicate balancing act between accurately representing an argument as it is made, on the one hand, and constructing a valid argument, on the other. In many cases the arguments actually being made in the ecological forestry literature are missing premises. In other cases the premises that are stated or implied do not actually lead to the conclusion to which they are intended to lead. We tried to stay as true as possible to both the premises and conclusions stated in the literature, but in many cases we had to make revisions or addendums in order to create logically valid arguments.[56] Most of the arguments changed significantly over the course of several weeks. Once we felt we had accurately represented them, we returned the arguments to the experts for review.

Argument Review

To check for accuracy and to counter any biases I may have inadvertently introduced into the arguments, I designed a second Qualtrics questionnaire (Appendix B) to ask experts to assess the arguments I had formulated. Each expert received an individualized Argument Review survey with three arguments I had

[56] In the Analysis and Discussion section I will detail this process of creating and fixing arguments in some limited cases, but in most cases I will show arguments only in their final versions.

specifically chosen based upon his or her particular area of expertise.[57] Experts were first asked, "Do you believe that I have accurately represented this argument?" If they answered "yes," they were directed to a series of questions in which they could provide suggestions about better wording for premises and conclusions. After offering suggestions, they were then asked to assess whether each premise was 1) true and 2) controversial, responding in open comment boxes where they could qualify their responses as fully as needed. If, on the other hand, they answered "no" to the first question ("do you believe that I have accurately represented this argument?"), they were asked to provide general commentary and invited to offer any suggestions for improving the argument.

Only the applied arguments about ecological forestry in western Oregon were sent out for expert review. Because of the challenge with sourcing arguments in the literature, discussed above, the theoretical arguments are largely composed of missing or highly ambiguous premises that I constructed based on my overall survey of the ecological forestry literature. Even though they are so fundamental to ecological forestry, these arguments are expressed only skeletally in writing, often with just one critical premise provided and the rest of the premises, and sometimes even the conclusion, left to inference. In fact, none of the theoretical arguments are presented in the literature as arguments per se. Instead, premises are generally stated as propositions, e.g. "[e]cological [f]orestry incorporates principles of natural forest development, including the role of natural disturbances in the initiation, development, and maintenance of stands and landscapes" (Johnson & Franklin, 2013, p. 1), with the implied conclusion, "therefore we should do ecological forestry."

I formulated each of the theoretical arguments in what I believed to be the most accurate way possible. However, as I will discuss below, all of the theoretical arguments (and many of the applied ones as well) are based on premises whose ideas are conveyed in language that is vague and open to a range of different and

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[57] I sent only three arguments to each expert so as to limit my demands on their time and energy to what I hope was a reasonable minimum. Most of the arguments were reviewed by three experts, but three arguments were reviewed by only two experts.

potentially conflicting interpretations. As I formulated the theoretical arguments, I decided to outline their structure but leave their content relatively generic, i.e. without attaching a single meaning to words that can be interpreted in various ways, in order to demonstrate and discuss the implications of the ambiguous use of language in the literature. Having made this decision, I anticipated that experts would point out that the theoretical arguments are too generalized to be meaningful, commentary I had received about the language of the theoretical reasons presented in the Argument Selection survey. The criticism is most certainly relevant, but it is also one of which I was already aware, and had deliberately decided to use for illustrative purposes. Therefore, rather than splitting the experts' attentions and potentially causing confusion with the generalized and ambiguous theoretical arguments, I decided to instead focus their attention on the more concrete applied arguments, where their feedback had the potential to be more directed, constructive, and illuminating.

After receiving the experts' feedback, I tabulated all of their responses in an Excel spreadsheet so that I could more easily compare comments against one another, and also against the arguments I had sent out (full results of Argument Review survey available upon request). Once again my major advisor and I worked together to revise arguments by incorporating expert feedback, exchanging several more rounds of revisions until each argument reached the final form presented in the analysis below.

Argument Evaluation

This final step entailed systematic assessment of each argument. Relying heavily on expert opinion and supporting literature, I evaluated individual premises for both truth and controversy, and also considered the extent to which all the premises together support their conclusions. These assessments are detailed in the Analysis and Discussion section. Because argument analysis is a practical tool intended to ease communication and facilitate understanding in groups, assessments of premises and conclusions are often displayed in an argument table (Figure 1.2). This format is easier to absorb, and also allows for quick comparison between arguments. For the sake of space I have chosen not to use tables in this chapter, so my analysis will be entirely textual commentary.

Results

Although I utilized a survey format to elicit expert commentary, my intention was never to analyze the experts' responses as data. Not only was my sample size extremely (and purposefully) small, precluding statistical inferences to broader populations, but I also planned only to use expert opinion in an advisory or consultative capacity, to ground truth, so to speak, my reading of the literature. As such, I did not perform any formal qualitative or quantitative analyses to look for patterns in survey responses. However, there are some interesting trends in the responses I received, which became important in shaping how I proceeded with the rest of the argument analysis. Therefore, in this section I will comment briefly on the results of the two surveys, Argument Selection and Argument Review. The results of Argument Formulation and Argument Evaluation will comprise the remainder of the chapter (Analysis and Discussion, below).

Argument Selection

Of the ten experts I contacted for assistance, nine participated in the Argument Selection survey. The ratings assigned to reasons by each expert are listed in Table 3.2, along with summary statistics. All of the applied reasons were rated roughly in the middle of the range from 0 (argument completely irrelevant to the discourse) to 10 (argument absolutely crucial to the discourse), with average ratings of 5.1 for pro-ecological forestry reasons and 4.5 for anti-ecological forestry reasons. The theoretical reasons were on average rated slightly higher (6.2). For all of the reasons, theoretical and applied, the variance between different experts was quite high.

Even without formal analysis, the results of the Argument Selection survey suggest that a majority of the experts did not interpret the purpose of the survey as I had planned. Instead of objectively assessing each reason and indicating how central (i.e. relevant or crucial) it is to the position for or against ecological forestry, many of the experts appeared to instead offer their subjective opinions by indicating either personal agreement or disagreement with each reason. As seen in Table 3.2, several experts either rated pro-ecological forestry reasons consistently higher than anti-ecological forestry reasons, or vice versa (compare, for example, Expert D with Expert E in Table 3.2), suggesting that they were biased to one side of the debate or the other. This interpretation is further validated by textual feedback.[58] For example, one applied pro-ecological forestry reason I offered in the survey was, "[ecological forestry will achieve] restoration of landscape heterogeneity by creating more complex early seral." One expert suggested that more accurate wording would be, "[ecological forestry] is not a substitute for landscape heterogeneity or complex early seral created by natural disturbance processes." Clearly the suggestion does not refine the phrasing of a reason in favor of ecological forestry, since it actually transforms the statement into a reason *against* ecological forestry. Although little feedback was as extreme as in this example, much of the commentary I received did show similar trends, with experts questioning if not openly disputing the soundness of certain reasons, rather than commenting on the extent to which each reason is being prominently advanced in the current ecological forestry discourse. Of course I cannot know definitively how experts assigned numerical scores of centrality, but if my suspicions are correct, for many experts a low score for a reason (e.g.

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[58] There is, of course, the possibility that the numbers reflect a genuine belief that I more accurately captured the central arguments from one side of the discourse or the other. However, it is hard to accept as coincidence that certain experts who are openly supportive of ecological forestry consistently rated pro-ecological forestry arguments (theoretical and applied) higher than anti-ecological forestry arguments, and certain experts who are openly opposed to ecological forestry consistently rated anti-ecological forestry arguments higher than pro-ecological forestry arguments.

"[ecological forestry] does not effectively create complex early seral") conveys that he or she does not believe the statement to be true, *not* that he or she believes the reason is not central to the ecological forestry discourse in the Pacific Northwest; and a high score, conversely, conveys that an expert believes the statement to be true, *not* that he or she believes it is central to the discourse.

This unanticipated circumstance somewhat shifted my approach to selecting arguments. Rather than relying heavily on experts' ratings of reasons, as I had planned, I relied primarily on my own judgment to decide which feedback to incorporate, focusing on expert advice that was also supported in the literature. Although this strategy was far from ideal, we (my major advisor and I) decided that it was not a critical failing in the process, especially since we had never planned to choose arguments merely by calculating mean ratings and pursuing the arguments with the highest scores. Expert opinion was always meant to be advisory, not deterministic, and although without doubt many other arguments could have been analyzed, I am confident that the arguments we ultimately selected for analysis represent at least some of the most influential arguments currently being advanced in the discourse surrounding ecological forestry in western Oregon.

Out of the original table of reasons, the final set of reasons I selected for analysis is shown in Table 4.2. I had already decided to retain all of the theoretical reasons, and in addition I selected four reasons in favor of and five opposed to ecological forestry in western Oregon.[59] In formulating arguments, sometimes what may initially appear to be one argument splits into two or several separate arguments. This was the case with one of the applied pro-ecological forestry reasons I selected for analysis (see Table 4.2). Therefore, although I originally selected nine applied reasons, I formulated ten applied arguments. I will more fully explain why I selected particular arguments in the Analysis and Discussion section, below.

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[59] Although imbalanced, I sensed that the two early seral reasons opposed to ecological forestry were closely linked, so I decided to follow through with analysis of both of them in order to better understand how they are different and how they relate to one another.

Argument Review

The same nine experts who took the Argument Selection survey also took the Argument Review survey. In the extensive feedback I received for all ten applied arguments, two general trends became apparent. First is the range of variety in opinion. Experts were in consensus that I had overall “accurately represented” five of the ten arguments. For the other five arguments the experts were not in consensus, with some believing the argument I had formulated was generally accurate, and others believing it was generally inaccurate. I also received different opinions about the truth and level of controversy of many of the premises. For example, a single premise in one argument was described by a first expert as “true,” by another as “generally true,” and by a third as “not true.” This range of opinions is testament, in part, to the complexity and inherent subjectivity of argument analysis. However, it also suggests that the arguments being made about ecological forestry are elusive to the extent that there is disagreement, even among experts, about what is being argued and whether arguments are supported by sound evidence.

The second trend to point out is that many of the experts’ feedback about arguments wavered between assessment of representativeness and critique. My hope in consulting experts was more to ensure that I had represented the arguments being made in the discourse around ecological forestry, rather than to ask whether they believe the arguments are generally good or bad. However, many of the experts ended up focusing on the accuracy of the arguments’ contents, rather than commenting on whether I had captured them correctly. Although their feedback still proved very helpful in informing my critique, and was often fascinating in itself, it was unfortunately somewhat less helpful for determining whether the arguments I had formulated accurately represented the arguments actually being advanced.

Therefore, as with Argument Selection, I was again confronted with the task of selectively incorporating feedback from the Argument Review survey. In most cases I followed up with individual experts via email to clarify their comments, testrun potential changes, and discuss points of confusion, before working through several more rounds of revision with my major advisor to bring the arguments to their final forms.

Analysis and Discussion

Theoretical Arguments

The four theoretical arguments about ecological forestry make the case that forest management should follow some basic principles: management should be somehow science-based; it should be based on natural processes in a historic range of variability; it should be sustainable; and it should attend to multiple objectives. Any proponent of ecological forestry would agree on the importance of these four principles, and also contend that ecological forestry is or does them all. Unlike the applied arguments, I will not examine any theoretical arguments against ecological forestry in this analysis. Such arguments are not explicitly made in the ecological forestry literature, and although they can certainly be extrapolated from a larger literature base, e.g. from authors questioning the theoretical merit of disturbance-based management (e.g. Kuuluvainen & Grenfell, 2012) or proposing "land-sparing" over "land-sharing" management approaches (e.g. Phalan et al., 2011), including this range of arguments would have broadened my analysis significantly. My purpose with this set of arguments is to examine the theoretical case for ecological forestry, rather than to engage in larger debates about the relationship between science and management, the use of the historic range of variability, sustainability, or multiple-use forest management. All of these debates are deeply intertwined with the conversation about whether ecological forestry should be implemented, as my analysis will hopefully make clear. However, other than highlighting specific points of intersection with the ecological forestry discourse, it is beyond the scope of the current project to make a meaningful contribution to those broader discussions.

Another general point I will make by way of preamble concerns the strength of the arguments (both theoretical and applied) in this chapter. Arguments supporting the use of ecological forestry can be weak or strong, in a formal sense. A weak argument will establish that ecological forestry is a feasible or acceptable option for forest management. In these arguments, although the premises establish that ecological forestry could be implemented, the conclusion that it should be implemented does not *necessarily* follow from the premises (Copi & Cohen, 2009). A stronger argument, in contrast, would actually assert that ecological forestry is the best or only option, in which case the conclusion that it should be implemented would be far more compelling. Consider the follow generic argument:

P1: Forest management ought to do X.
P2: Ecological forestry does X.
C1: Therefore, ecological forestry is an acceptable form of forest management.
P3: Management types B and C also do X.
P4: Ecological forestry does X better than management types B and C.
P5: We ought to use whichever type of forest management best does what it ought to do.
C2: Therefore, we ought to use ecological forestry.

While the first half of the argument establishes ecological forestry as a possible option (a weaker argument), the second half of the argument establishes ecological forestry as the clearly preferable option, eliminating the viability of substitutions or alternatives (a stronger argument). Notice that, once we accept P3, we cannot arrive at C2 without P4. The question, therefore, is whether P3 is true. Arguably it is, since there are plausible management alternatives that might be able to achieve the same objectives as ecological forestry. For example, ecological forestry is proposed theoretically as a way to achieve multiple management objectives on the same piece of land, but a multiple-use approach in which a forest is managed for different objectives (e.g. biodiversity and timber production) in separate zones might also be used (Sedjo & Botkin, 1997; Vincent & Binkley, 1993).

As a similar applied example, ecological forestry is proposed as a way to create complex early seral conditions in the Pacific Northwest, an objective that could also be met by refraining from logging and reforestation after natural disturbance (DellaSala et al., 2013).

As noted above, given P3 and without P4, C2 is not supported and the argument is not valid. And yet, P4 is never stated or even clearly implied in the ecological forestry literature. However, even if P4 were included, it would need to be verified before the argument could be considered sound. Verifying P4 would require comparing ecological forestry's ability to do X against every other management practice that might also do X. Though extensive and undeniably challenging, this task is far from impossible, especially with modeling studies that can estimate the outcomes of different management strategies across time and space even when large-scale empirical experiments are logistically impractical to implement. Unfortunately, the situation becomes infinitely more complex when we consider that ecological forestry is not being proposed to achieve just one objective, but a plurality of objectives. As such, even if we can compare ecological forestry's ability to meet its various objectives against all plausible alternative management strategies, it may turn out that ecological forestry is superior in achieving certain objectives, but not others; or it may best achieve an objective at the stand scale, but not at the landscape scale. When there is only one objective of concern (X), the decision about which management strategy is "best" is relatively simple: whichever management strategy produces the greatest benefit to X (according to an established notion of "benefit") is superior to all others. With multiple (potentially conflicting or competing) objectives, on the other hand, understanding what constitutes the "best" management solution is far less simple, since it must be predicated on ideas about how those multiple objectives should be met relative to one another. In other words, deciding how multiple objectives are "best" met requires a normative judgment. This normative judgment would need to be articulated and the criteria for "best" solution clearly established, in order to test and subsequently assess the truth of P4 (for further discussion, see "Arguments about multiple values and objectives," below).

Because I am generally not working from explicitly stated premises and conclusions, I cannot say definitively whether the arguments made in the ecological forestry literature are more accurately represented by C1 or C2 above. For the sake of clarity and consistency, throughout this chapter I will outline the premises of each argument (theoretical and applied) along the lines of the generic structure shown in P1 and P2 above, which more accurately reflect the sorts of premises articulated in the literature than P3, P4, and P5. However, I will conclude arguments with some version of C2, "we ought to use ecological forestry." Rhetorically it carries more force than "ecological forestry is an acceptable management practice," and I also believe that implicit in all of these arguments is the underlying if unverified premise that ecological forestry is in fact the superior management practice for achieving what it purports to achieve (otherwise, it seems reasonable to assume that proponents of ecological forestry would be arguing for whichever management practices they believe more suited to the tasks at hand). I will also note the possibility that, although no single argument may make the case that ecological forestry is the best or only management practice to meet any one objective, the whole body of arguments might be taken in sum to suggest that ecological forestry is the best or only management practice that can meet all of its objectives at once (although this claim would also require verification for the argument to be sound).

I now turn to the theoretical arguments in earnest, beginning with the argument that forest management should be science-based.

The "best ecological understanding" argument

My original conception of a "best available science" argument reflected a rather loosely-conceived sentiment commonly conveyed in the ecological forestry literature, which suggests that forestry should somehow be modeled or based on a body of current scientific knowledge (e.g., Aber et al., 2000; Franklin, 1995; Franklin

& Agee, 2003; Franklin & Johnson, 2013, 2014). However, expert feedback suggested that "best available science" was too generic of a categorization. I therefore focused on a specific reference in Franklin and Johnson's (2014) hearing before the Committee on Energy and Natural Resources, in which they noted that, "[e]cological forestry is based, therefore, on application of our best current ecological understanding of forest ecosystems" (*S.1784: The O&C Land Grant Act*, 2014, p. 42). Adopting this statement as a general theoretical claim about ecological forestry, I constructed the argument around it as follows:

P1: Natural processes of disturbance and succession ("natural processes") have certain known effects in forests.
P2: With ecological forestry, forest management practices are based on the effects of natural processes in forests.
C1: Therefore, ecological forestry is based on application of the best current ecological understanding of forest ecosystems.
P3: When managed, forests should be managed based on the best current ecological understanding of forest ecosystems.
C2: Therefore, actively managed forests should be managed using ecological forestry.

P1 is true and non-controversial. Studies on the effects of natural disturbance have increased dramatically since the 1980s (Attiwill, 1994), and although there is doubtless still much to be learned, ecologists do have a working understanding of the developmental pathways a stand is likely to follow over time (Franklin et al., 2002; Oliver, 1981). P2 is true to the extent that ecological forestry uses silviculture to approximate some of the patterns and effects of natural disturbance and stand development processes, for example by retaining green trees and biological legacies; allowing for extended regeneration periods; and managing on longer rotations than traditional intensive management practices (Franklin & Johnson, 2012; Franklin et al., 2007). I will discuss the extent to which P2 might not be true below. First, though, I will point out the major problem with the argument as written, which is that C1 does not follow from P1 and P2. Both P1 and P2 are statements about disturbance and succession, but C1 broadens to, quite generally, "the best current ecological understanding of forest ecosystems." Arguably, such an understanding would need to also be attentive to hydrology, biogeochemical cycles, population and community dynamics, and any other number of multi-scale, hierarchical processes and functions also operating in complex forest systems (Messier et al., 2013).[60] Ecological forestry, however, seems to be more narrowly based on the best current understanding of *disturbance and succession* in forest ecosystems. Re-written to incorporate this distinction, the argument would be formulated as:

P1: Natural processes of disturbance and succession ("natural processes") have certain known effects in forests.
P2: With ecological forestry, forest management practices are based on the effects of natural processes in forests.
C1: Therefore, ecological forestry is based on application of the best current ecological understanding of *natural processes in* forest ecosystems.
P3: When managed, forests should be managed based on application of the best current ecological understanding of *natural processes in* forest ecosystems.
C2: Therefore, actively managed forests should be managed using ecological forestry.

P1 and P2 remain the same as above, but the change in C1 has implications for the rest of the argument.

I will first point out that the soundness of the revised version of C1 largely hinges on the meaning of the phrase "based on." Although ecological forestry is ostensibly "based on" natural disturbance and succession, the meaning of "based on" is left decidedly and perhaps even deliberately unclear, especially considering statements such as the following from Franklin et al. (2007): "managers should

[60] The matter becomes even more complicated when we consider that the best current ecological understanding of forest ecosystems is also likely an understanding of forests as socio-ecological systems (e.g. Currie, 2010). As discussed in Chapter One, ecological forestry does not account for human values, and is not even predicated on accurate science about human attitudes and opinions, as I will discuss later in this chapter. With this realization, C1 in the original argument becomes even more disputable.

determine how similar to the reference condition a stand needs to be to achieve ecological forestry goals. The answer is driven by objectives" (p. 34). In other words, in ecological forestry managers are given license to implement even a very loose interpretation of management "based on" natural processes, which might in some cases be desirable for meeting particular objectives. For example, stand-replacing wildfires characteristically leave behind a large amount of dead wood, including snags (Lindenmayer et al., 2004). Adapting this model to his own needs, a manager might design a harvest retaining 5% of the initial green tree density and a small handful of snags to meet the primary objective of regenerating shade-intolerant tree species. The question to ask is whether this retention harvest, which could rightly be considered an ecological forestry treatment, is "based on" natural disturbance. To answer this question, we need a clear understanding of what it means for management to be "based on" natural processes. According to one expert in forest ecology, "the best we can do through management is roughly approximate some of the structures and processes of natural disturbances. It's an imitation that has some but not all attributes of the natural system." If "based on" means "roughly approximate," as suggested by this expert, it seems fair to agree that P2 is true, especially relative to more intensive forestry practices associated with clearcutting. However, when compared against more stringent interpretations of management "based on" natural disturbance, ecological forestry may not measure up. In short, "based on" is a normative concept that needs to be clearly defined before we can assess P2 and C1. At what spatial and temporal scales are reference conditions set, and how much deviation from these reference conditions is permitted before management is no longer "based on" natural processes? These are the sorts of normative questions that need to be answered in order to determine whether P2 is supported and C1 justified.

To assess whether P3 is true, we should consider a subsidiary argument supporting it:

P1*: Management that is based on the best current ecological understanding of natural processes in forest ecosystems will maintain biodiversity and desirable ecosystem functions in forests.
P2*: Biodiversity and desirable ecosystem functions should be maintained.
C* (P3 above): Therefore, when managed, forests should be managed based on application of the best current ecological understanding of natural processes in forest ecosystems.

The repercussions of changing C1 in the main argument become apparent in P1* here. There have been extensive studies of various practices that may be used as part of a management regime based on natural processes, including single-tree and group selection (e.g., Annand & Thompson, 1997; Harpole & Haas, 1999; Jalonen & Vanha-Majamaa, 2001; King, Degraaf, & Griffin, 2001; Moorman & Guynn, 2001; Robledo-Arnuncio, Smouse, Gil, & Alía, 2004) different rotation lengths (e.g., Kaipainen, Liski, Pussinen, & Karjalainen, 2004; Lassauce, Larrieu, Paillet, Lieutier, & Bouget, 2013; Liski, Pussinen, Pingoud, Mäkipää, & Karjalainen, 2001), different thinning regimes (e.g., Bailey & Tappeiner, 1998; Garman, Cissel, & Mayo, 2003), and variable retention harvesting (e.g., Aubry et al., 2009; Heithecker & Halpern, 2006; Linden & Roloff, 2013). However, side-by-side empirical studies comparing the effects of a selected natural disturbance against the effects of an anthropogenic approximation of those processes (with the exception of clearcuts compared against stand-replacing natural disturbance events) are relatively limited (Kuuluvainen & Grenfell, 2012). The work that has been done suggests that, for different response variables (e.g. bird community composition, soil carbon, snag basal area), patterns observed after disturbance-based harvest converge to differing degrees with patterns observed in the wake of natural disturbance (e.g., Hocking, Babbitt, & Yamasaki, 2013; Huggard, Grover, Dzus, Smith, & Schieck, 2015; Schieck & Song, 2006; Spaulding & Rothstein, 2009; Spence & MacLean, 2011; Strojny & Hunter, 2010; Thiffault, Bélanger, Paré, & Munson, 2007; Van Wilgenburg & Hobson, 2008). Even while scholarly opinion seems to often endorse the theoretical merit of management based on natural processes (Kuuluvainen & Grenfell, 2012), empirical evidence has not clearly indicated that harvest imitating the structure of post-natural disturbance conditions also maintains the same species assemblages, processes, and functions as natural disturbance. The idea that it does remains a hypothesis, at present neither true nor untrue, and certainly controversial (Bergeron, Drapeau, Gauthier, & Lecomte, 2007; Kuuluvainen & Grenfell, 2012).[61] I will also point out that simply basing management on natural processes (by any definition of "based on") does not ensure that conditions remain desirable. To maintain desirable conditions, management must be based specifically on natural processes that are known to maintain desirable conditions (Drever et al., 2006). Thus, P1* would more accurately (and tautologically) be written, "management based on the best current ecological understanding of natural processes that maintain desirable conditions in forest ecosystems will maintain biodiversity and desirable ecosystem functions." The point might seem arcane, but there are instances of highly resilient ecosystems in non-desirable states that are maintained organically by natural processes (Standish et al., 2014). In these cases, P1* as stated above would actually be false.

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[61] In emulating natural disturbances to maintain biodiversity and ecosystem function, I do not find it altogether clear whether the intention is to produce effects as close as possible to those that would follow from a natural disturbance, or to minimize the effects of anthropogenic disturbance. In other words, the question is whether humans are trying to act as surrogates of natural disturbance, e.g. creating complex early seral conditions, or to enact disturbance without significant adverse impact, e.g. maintaining pre-harvest species in the post-harvest stand, as would seem to be the case with "lifeboating" (Franklin et al., 1997). The difference between these two agendas is important for two reasons. First, in the former case management would need to approximate not only the effects, but also the frequency and spatial distribution of natural processes, whereas in the latter, the goal is seemingly to be able to exceed characteristic (natural) levels of disturbance without negatively impacting the ecosystem. Second, to verify empirical premises supporting an argument for the former type of disturbance-based management, we would need to look at comparisons of the management regime against the natural disturbance regime it is designed to emulate, to see if their effects on response variables of interest are the same. To verify empirical premises supporting an argument for the latter type of disturbance-based management, we would need to look at comparisons of the management regime against both intensively managed and unharvested stands, to see if post-harvest response variables of interest are less impactful than the former and roughly equivalent to the latter. Although the confusion over these two iterations of disturbance-based management may be my own, I will note that Klenk et al. (2008) found a high degree of variation in how the idea of management emulating natural disturbance is conceptualized among forest scientists, suggesting that there may be genuine confusion over the topic.

P2* in the subsidiary argument, though perhaps once contested, seems to be broadly accepted in theory, as evidenced by national (USDA Forest Service, 2012) and global (Millennium Ecosystem Assessment, 2005) environmental policy statements. Unfortunately, we may not be in such strong consensus about the meaning of "desirable ecosystem functions" and how they are "maintained" (ambiguities that are also pertinent to the interpretation of P1*). For example, two people may agree that productivity is an important and desirable function of forests, but one perhaps may value it for efficient timber production and the other for carbon sequestration. In this case, the first person might interpret "maintain" as, "maintain throughout and across rotations," whereas the second might interpret "maintain" to mean, "maintain indefinitely." At present the ecological forestry literature does not clearly or consistently suggest any particular interpretation for these key normative concepts (see Chapter One), so although P2* is generally true, in practical forums it is likely to generate controversy if it is interpreted differently by people with conflicting ideas about which forest characteristics are "desirable" and how those characteristics should be "maintained." Therefore, C* is supported by one premise that cannot be considered true, for lack of sufficient empirical evidence; and another premise that, though generally true, is controversial on account of the ambiguity of its normative concepts. As such, C*, the critical normative premise P3 in the original argument, cannot be considered sound with the currently available information about the outcomes of ecological forestry and the current lack of information about the values underlying it.

Overall, the "best ecological understanding" argument rests largely on ambiguous normative concepts and plausible if not yet verified empirical premises. Support does seem to be building for the idea that management approaches like ecological forestry, which more closely resemble natural processes than traditional intensive management practices, can more effectively maintain forest ecosystem processes and functions (e.g. Fedrowitz et al., 2014; Kuuluvainen & Grenfell, 2012). To test whether ecological forestry is effective, however, the normative question, "effective for what purpose?" first needs to be answered, necessitating that the specific goals of ecological forestry (and the values they represent) be more clearly defined.

The "emulation of natural processes in the natural range of variability" argument

As discussed above, the idea that management should be based on natural disturbance appears frequently in the ecological forestry literature (Franklin et al., 2007; Franklin & Johnson 2012; Long, 2009; North & Keeton, 2008). A number of experts indicated that the wording of this argument needed to be carefully treated, since disturbance-based management can take various forms (Klenk et al., 2008). I therefore turned to the literature for more specific references. Johnson and Franklin (2009) specify that ecological forestry is "based on…principles of natural stand development, including the role of natural disturbances in the initiation, development, and maintenance of forest ecosystems" (p. 22). Principles of stand development and the role of natural disturbances, in turn, are established with reference to historic conditions (Franklin & Johnson, 2012). With these ideas in mind, I constructed the argument as follows:

P1: In un-managed forests, natural processes of disturbance and succession have historically occurred within a natural range of variability ("natural processes").
P2: These natural processes maintain forest ecosystems in desirable conditions.
P3: Desirable conditions will be maintained in forest ecosystems as long as human disturbances are based on natural processes.
P4: Desirable conditions should be maintained in forest ecosystems.
C1: Therefore, active management in forests should be based on natural processes.
P5: Management using ecological forestry is based on natural processes.
C2: Therefore, actively managed forests should be managed using ecological forestry.

It is first important to note how closely this argument resembles the revised version of the "best ecological understanding" argument. In fact, the "emulation of natural processes in the natural range of variability" argument can be seen as a more fully developed iteration of the subsidiary argument discussed above. When I had originally conceived of the "best ecological understanding" argument broadly as a "best available science" argument, it appeared to be distinct from the argument that management should emulate natural disturbance in the natural range of variability. However, once "best available science" was narrowed to "best ecological understanding of natural processes," the two arguments became nearly identical.[62] The one novel element that has been added in this argument is the idea of the natural range of variability (P1).

The natural (also "normal" or "historic") range of variability concept has received considerable critical evaluation (e.g., Klenk et al., 2009; Kuuluvainen & Grenfell, 2012; Landres et al., 1999; Veblen, 2003). Landres et al. (1999) define the natural range of variability as "the ecological conditions, and the spatial and temporal variation in these conditions, that are relatively unaffected by people, within a period of time and geographical area appropriate to an expressed goal" (p. 1180). As evidenced by the definition, the main challenge of using the natural range of variability to guide management is that a reference condition for "natural" must be selected, based upon normative criteria (Callicott et al., 1999; Landres et al., 1999).[63] Although it is invariably to the past that ecological forestry practitioners make reference (e.g., Corace et al., 2009; Franklin & Johnson, 2012; Johnson & Franklin, 2009; Stoneman, 2007), it is not clear how an appropriate reference frame or baseline of natural conditions is supposed to be selected in ecological forestry, which leaves room for different and potentially conflicting interpretations. Franklin

[62] I had also originally conceived of this argument as pertaining specifically to disturbance, not disturbance and succession. However, a closer examination of the literature suggested that the two are not considered altogether distinct. Disturbance is viewed as an infrequent stand-replacing event as well as a recurring small-scale event. Both are seen as part of natural stand development (i.e. succession), and both are appropriated to silvicultural designs in ecological forestry treatments (Franklin et al., 2007).

[63] Another main criticism is that, given the uncertainties of a changing global climate, past conditions may not be a suitable guide for managing forests in the future (Hobbs et al., 2009; Landres et al. 1999; Long, 2009).

and Johnson (2012) specify that ecological forestry does not seek to restore historical conditions as a goal, but rather to use historical processes as a guide:

> restoration should center on restoring resilience and functionality in the context of desired future conditions, even while learning from the past. Attempting to return landscapes to a given historical state is unlikely to create either resilience under current and future conditions or socially desirable outcomes (Hobbs et al. 2011). (Franklin & Johnson, 2012, p. 430)[64]

Unfortunately, this statement still offers little by way of practical information about how (and why) to select and use particular reference conditions from the extensive record of the past. As such, it is not clearly true that processes in the natural range of variability (P1) maintain desirable conditions (P2), or that management based on those processes will maintain those conditions (P3). By way of illustration, consider only the level of controversy that would surround attempts to harvest the western Oregon landscape by mimicking the extensive, catastrophic wildfires that characteristically occurred in centuries past (Agee, 1993). It seems doubtful that many people would find the conditions following regeneration harvest of multiple thousands of hectares desirable. To assess the truth of these premises, therefore, we need a clear, scale-explicit definition of "natural range of variability," as well as "desirable conditions" and how they should be properly "maintained." Additionally, as we assess P2 and P3, we might ask if they are predicated upon a natural law ethical orientation, which attests that what is "natural" is good and right, and therefore ought to be (Nelson & Vucetich, 2012a). As a principle of logic, what *should be* cannot be justified solely on the basis of what *is* (Moore, 1903). The conditions we now consider to be desirable in forest ecosystems may in fact align with certain conditions that occurred historically, conditions that we consider "natural." For example, in the case of western Oregon, characteristic fire regimes for

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[64] This assertion seems to offer some further insight into what it might mean for management to be "based on" natural processes. Whether this insight is helpful is a question I leave to individual readers.

Moist and Dry Forests are determined with reference to the forest landscape prior to European settlement, which seems to be widely accepted (although not explicitly identified) as a reference for both natural and desirable conditions (e.g. Johnson & Franklin, 2012).[65] However, to contribute to a sound argument, both P2 and P3 need to be justified by an explanation of why those particular historic conditions are good and desirable, other than that they are "natural" and therefore good.

The remainder of the argument is much like the subsidiary argument of the "best ecological understanding" argument above, so I will not repeat my commentary here. In short, along with the lack of a clear explanation of the "natural range of variability" concept, the same critiques made in the "best ecological understanding" argument apply, namely, the ambiguity of normative concepts such as "based on" and "desirable conditions," and how they are "maintained," as well as unverified empirical statements about the effects of management that purportedly emulates natural processes. The argument is logically valid, but its premises require both additional empirical information and normative clarification before they can be considered true and the argument sound.

The "sustainable forest management" argument

Ecological forestry is actually not often proposed as a form of sustainable forest management. In a prominent paper cited frequently in the ecological forestry literature, Lindenmayer et al. (2012) identify variable retention harvest (effectively, ecological forestry) as a strategy of sustainable forestry. In the rest of the literature, although certain ideas related to sustainability, such as maintaining long-term ecosystem productivity and function (e.g. Franklin et al. 1997) and meeting social needs without destroying natural resources (e.g. Johnson & Franklin, 2012) are recurring themes, "sustainability" per se is not explicitly invoked as a justification for ecological forestry. As such, although I identified sustainability as an idea somehow related to ecological forestry, I was not sure if it was a central or

[65] For more extensive discussion, see "Metaphysical Ambiguities" in Chapter One.

somewhat more peripheral argument in the discourse. In the Argument Selection survey the reason representing the sustainability argument was ranked as a 10 by four experts and a 0 by two others, with the rest falling somewhere in the middle range. Even though the ratings were so variable, the sustainability argument did receive the highest score possible from almost half of the experts, so I decided I should pursue it for analysis.

My efforts to formulate the sustainability argument quickly revealed, not surprisingly, that it is indelibly tethered to the concept of sustainability. A generic form of the argument would be constructed as follows:

P1: Forest management should be sustainable.
P2: Ecological forestry is a type of sustainable forest management.
C: Therefore, we should do ecological forestry.

At first glance P1 may appear to be true, but with further consideration it becomes apparent that this premise is stated too generally.[66] Consider the following argument:

P1: Teenagers should have fun.
P2: Underage drinking is a type of fun for teenagers.
C: Therefore, teenagers should drink underage.

Although the argument is valid, since the conclusion is supported by the premises, it cannot be considered sound when premised upon a blanket statement such as "teenagers should have fun," which is clearly not true in all cases. P1 therefore needs

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[66] This argument also provides a particularly good example of the issue I addressed in the preamble, regarding the difference between arguments that ecological forestry *can* be used and that ecological forestry *should* be used. Here, we see very clearly that ecological forestry is proposed as a type of sustainable forest management, but not the sole or best type. A stronger premise might read, "ecological forestry is the best type of sustainable forest management," but obviously the truth of the premise thus stated would be highly questionable. As written, however, the burden of proof remains on ecological forestry to demonstrate its superiority above other types of forest management that might also be called "sustainable."

to be qualified, perhaps by asserting, "teenagers should have fun in legal ways," or "teenagers should have fun in ways that do not compromise their safety and wellbeing," either of which might more accurately represent the sentiment behind the argument.

Just as there are many ways for teenagers to have fun, each with different consequences and connotations, there are many ways for forest management to be "sustainable." Some people might define "sustainable forest management" as management of forests that ensures continuing economic growth and development (Willers, 1994). Other people might define "sustainable forest management" as management that seeks to minimize harm to ecosystem integrity, and does not critically threaten forest health (Callicott & Mumford, 1997). Indeed, an empirical study by Swedeen (2006) showed that people in the Pacific Northwest tend to disagree over the specific meaning of "sustainable forest management," even though they generally agree that it is a good thing. As such, although it seems strange to think that P1 in general would be met with dissent- after all, "[h]ow on earth could anyone be opposed to sustainability?" (Noss, 1991, p. 120)- it is very likely that some people would contest the statement that certain types of "sustainable forest management" should be pursued (Newton & Freyfogle, 2005; Noss, 1991; Willers, 1994).

For the same reasons just discussed, P2 is also questionable. Ecological forestry may not meet certain criteria for "sustainable forest management," in which case P2 might also be considered false. In addition, opinions about the truth of P2 are likely to diverge on the basis of misunderstanding about "ecological forestry." As I discussed extensively in Chapter One, a 5% retention regeneration harvest can be called "ecological forestry" just as easily as a 40% retention regeneration harvest can be called "ecological forestry," even though each prescription may have vastly different outcomes, both economic and ecological. Conceivably, then, even with an established definition of "sustainable forest management," it would still be impossible to say whether ecological forestry meets this definition without also specifying a particular meaning for "ecological forestry."

In short, the "sustainable forest management" argument for ecological forestry has inherited all the ambiguities of sustainability (e.g. Johnston et al., 2007; Kidd, 1992; Lélé & Norgaard, 1996; Newton & Freyfogle, 2005). It unfortunately does little to appropriate the concept of sustainability to the defense of (or attack against) ecological forestry unless the term "sustainable" is clearly defined, which is not the case in the current literature. I will point out that this is not by any means an irremediable omission, and may in fact represent a valuable opportunity to move the present discourse forward. Although there may be disagreement about the meaning of "sustainability," there does seem to be wide agreement that it is good and desirable (Callicott & Mumford, 1997; Swedeen, 2006). Sustainability therefore offers a potentially valuable inroad into much-needed conversations about what vision of forest management ecological forestry strives to achieve. Defining "sustainability" operationally requires the clear and transparent acknowledgment of values before concrete goals and criteria for assessment can be set (Lélé & Norgaard, 1996). In Chapter One I showed that these same normative dimensions of ecological forestry are largely unaddressed in the current literature, a weakness that undermines ecological forestry both in theory and in application. However, it is very possible that by working toward a clear, value-explicit definition of sustainability, we might also come to a clearer understanding of ecological forestry itself.

Arguments about multiple values and objectives

As discussed in Chapter One, one of the key ideas underlying ecological forestry is that forests can and should be managed for multiple values and objectives. Described as a strategy for "land-sharing" (Lindenmayer et al., 2012), in which multiple objectives are managed on the same piece of land rather than segregated into different zones ("land-sparing"), ecological forestry is proposed to "balance" (e.g. Gustafsson et al., 2012, p. 633), "integrate" (e.g. Franklin & Johnson, 2012, p. 430), or “achieve” (e.g. Johnson & Franklin, 2009, p. 2) multiple objectives (see Chapter One). To reiterate, I did not set out to evaluate the argument for a land-sharing as opposed to a land-sparing approach, a discussion beyond the scope of this current chapter. However, I did want to consider multiple-use arguments more closely, in order to systematically examine various nuances that I suspected might allow for different and potentially incommensurable ideas about what ecological forestry is and what it aims to accomplish.

The reason I presented to experts in the Argument Selection survey was, “ecological forestry achieves multiple (social, economic, ecological) objectives.” The experts largely picked up on the point I intended to make, namely, that “achieves” is too general of a word. They suggested alternatives, including ecological forestry “blends,” “balances,” or “responds to” multiple objectives. I therefore decided to look at several different versions of the multiple-use argument by comparing arguments that employ different phrasing or emphasize different ideas in the literature.[67]

The integration argument. Arguments for integrated management in the ecological forestry literature are made quite frequently (e.g., Franklin, 1998; Franklin et al. 1997; Franklin & Johnson 2013, Johnson & Franklin, 2013; Orians & Franklin, 1990; *S.1784: The O&C Land Grant Act*, 2014). As I discussed in Chapter One, the meaning of “integrated objectives” can vary depending on how “integration” is defined. This may seem like a purely semantic issue at first, but forest management cannot practically achieve integration of objectives without a clear conceptualization of what it means for multiple, often conflicting objectives to be integrated. Although the idea of integration may seem to imply compatibility and mutual benefits, tradeoffs between objectives will most likely be necessary to achieve it. This becomes clearer by formulating an argument:

[67] To be clear, the arguments as I have formulated them in this section are not made so explicitly in writing. I have tried to represent various lines of reasoning supporting the idea that ecological forestry should be used because it somehow manages a plurality of ecological and economic objectives. Although I have no doubt that these arguments could be represented differently, I will contend that I have written them to represent at least one way that they could be interpreted, based on what is in print. If shown to be in error and given clearer material as a reference, I will gladly make revisions.

P1: Mutually compatible objectives can be integrated, i.e. managed simultaneously on the same piece of land, in multiple-use forests.
P2: Objectives that conflict can be adjusted so that they no longer conflict, i.e. so that they are mutually compatible, and can be integrated.
P3: An objective that has been adjusted for integration with other objectives cannot be optimized, i.e. met to the extent that it would be met if it were the single objective for the land.
P4: It is better to meet each objective to an extent at which it can be integrated with all other objectives, rather than to meet only select objectives optimally.
C1: Therefore, conflicting objectives should be integrated in multiple-use forests.
P5: Multiple-use forests have both economic and ecological objectives, which sometimes conflict with one another.
C2: Therefore, economic and ecological objectives should be integrated in multiple-use forests
P6: Ecological forestry manages multiple-use forests for integrated economic and ecological objectives.
C2: Therefore, multiple-use forests should be managed using ecological forestry.

P1 is generally true and probably not terribly controversial. The idea is akin to killing the proverbial two birds with one stone: if two tasks are mutually compatible, they can at least theoretically be achieved simultaneously. The objective of old-growth conservation, for example, is arguably compatible with objectives such as carbon storage in forests and clean water (Heiken, 2014). This simultaneity- the idea that multiple objectives can be managed in concert with one another at the same time on the same piece of land- is the meaning I have assigned to the word "integration."[68] There is certainly a possibility that I have mischaracterized the meaning of "integration," but because it is never explicitly defined in the ecological

[68] In the Methods section I noted that I would not assign specific meanings to ambiguous words in the theoretical arguments. "Integration" is one exception where I chose to define a word, in order to demonstrate how a concept that may at first glance suggest compatibility actually implies tradeoffs and prioritizations between conflicting objectives. This definition is also slightly different from the dictionary definition offered in Chapter One. The difference is that the definition employed here is practical, rather than purely conceptual. In other words, I have defined "integration" as I believe it is used to suggest integration would look in application, in the context of forest management.

forestry literature, I have constructed this argument based on what, to the best of my understanding, it is meant to convey.

Jumping now to P5, the other true and probably non-controversial premise, the general statement that forest management has both economic and ecological objectives is fairly straightforward, at least in the arena of active management. With the gravitation toward ecosystem management in recent decades, it seems to have become widely accepted that forests at the very least cannot be managed with complete disregard for ecological consequences (Johnson et al., 1999), so forest management will most likely have at least one objective that can be considered "ecological."[69] It also seems fair to broadly assert that multiple-use forests have economic objectives, including revenue, employment in various sectors of the timber industry, and raw material for an assortment of wood products (Lebedys & Yi, 2014). Finally, the occurrence of conflict is also a basic and self-evident observation, e.g. in recent conflicts in the Pacific Northwest between the objective of timber production and preservation of habitat for the Northern Spotted Owl. Economic and ecological objectives may not always conflict, but they do certainly conflict at times.

P2 and P3 are arguably true, although they might be jarring to see written out explicitly and difficult to understand in the abstract. By way of example, therefore, consider the case of a woman who wants to eat ice cream, lose weight, and save money. Ideally she might like to consume a pint of Chunky Monkey, drop a pound overnight, and spend less than three dollars on the whole enterprise. It seems unlikely that all of these objectives can be met optimally in conjunction with one another. Therefore, she might decide to buy a more expensive package of low-calorie ice cream bars, rather than the discounted container of Ben and Jerry's. She probably will not gain weight, although she certainly will not lose any either. She gets some relief for her craving, but not quite the satisfaction of a full-fat pint. And although the short-term cost is more than she cared to spend in the moment, she is

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[69] However, see Chapter One for a discussion about the problematic usage of the word "ecological."

aware that she is potentially saving money on long-term healthcare expenses associated with obesity. Her objectives remain categorically the same: ice cream, weight loss, and frugality. The difference is in her adjusted expectations. In one case the objective was adjusted in content (pint versus diet bars); in one case, in impact (do no harm versus actually lose weight); and in one case, in scale (short-term versus long-term). Her adjusted objectives also come with adjusted criteria for success or failure: the woman is able to successfully meet all of her objectives to these adjusted degrees, but not to each of the originally conceived optimal degrees.

This relatively simple example serves to illustrate how readily objectives can be fine-tuned to accommodate one another. Returning to forests, consider now the common case where there are conflicting ecological and economic objectives. In the current ecological forestry literature, objectives are not clearly defined or quantified, e.g. as some amount of habitat to support some target population for a certain species at a given scale, or a certain quota of timber production in a particular region over a given time period. Instead, the literature employs only the broad categories “ecological” and “economic” objectives. Where there is already flexibility in tailoring fairly specific goals, such as in the case of the woman above, there is even more flexibility given such generalized objectives. For example, a forest manager charged by a landowner only to meet “economic and ecological objectives” might choose to do occasional fuel treatments but no commercial thinning or regeneration harvests, noting that the carbon stored in unharvested trees will offset future costs related to global warming. The land is still being managed for both ecological and economic objectives, but the specific meaning of “economic objectives” has been vastly adjusted, compared to what might have been the landowner’s actual original objective of producing enough timber to supply a steady flow of logs to fully-staffed mills in three western Oregon counties for the next fifty years. The important point to note is that with higher degrees of specificity about objectives, it becomes increasingly difficult to claim that the objective has been met when it is adjusted and integrated with other objectives. For example, had the woman’s objective been not just to save money, but specifically to spend less than three dollars on her shopping trip, she would not have succeeded in meeting her monetary objective with her final decision. Similarly, had her objective been not to eat ice cream, but more generally to get a sugar fix, her range of options would have expanded significantly. Clarity and transparency, in other words, constrain the range of ways in which objectives can be interpreted, which in turn constrains the range of actions that can be pursued to achieve them.

Any controversy over the idea of adjusting objectives in P2 and P3 would probably be of a philosophical nature, contending that a modified objective is fundamentally altered rather than merely adjusted. In such an interpretation, the woman discussed above, far from meeting all of her objectives with her final decision, would in fact be meeting none of them. What it means to meet or achieve an objective is a question worthy of exploration, as it bears heavily on the process by which objectives for forest management are set, along with actions to achieve them. Does ecological forestry achieve ecological objectives if it creates early seral habitat but compromises late-successional habitat? Does it meet economic objectives if it increases timber production relative to current levels, but still does not significantly improve the quality of living in rural communities? These are questions that would need to be explored in evaluating P2 and P3, along with any ramifications for the remainder of the argument.

P4 is not obviously true or false, and likely to be controversial on account of the word "better." Better in what sense, and for whom? Various interpretations might be "more prudent on principle," "more cost effective for the agencies," or "less contentious among public stakeholder groups." However, the interpretation of "better" that seems likely in this premise is "more fair." If this is the case, the premise makes an appeal to a particular type of distributive justice (Lamont & Favor, 2014; Sadurski, 1984), claiming that it is fairer for all to receive some than for some to receive all. And yet, although the idea that all needs and desires should be met to at least some extent is a democratic notion (Hourdequin, Landres, Hanson, & Craig, 2012), and one deeply ingrained in multiple-use natural resource management since the late 20th century (Kessler, Salwasser, Cartwright, & Caplan, 1992; P.L.86-517, 1960), it is not at all clear that a democratic commitment to meeting all objectives is appropriate in natural resource management.

Steel and Weber (2001) suggest that there is a tension between technocracy and democracy in the management of public lands, since questions asked and decisions made are of an increasingly complex and technical nature that often exceeds lay understanding. However, there seems to be general consensus that scientists should not themselves be responsible for making management decisions (Steel et al., 2004). Who, then, should be charged with governance of federal forests? I would suggest that, although technocracy is not the right solution, neither should democracy be the default. Instead, perhaps what we need is a model for both informed and well-reasoned decision making, which is attentive to the values of the public without being deterministically bound to them. One potentially useful model for management might be deliberative democracy, a process-oriented form of public engagement with an emphasis on sharing values and building mutual understanding (Chambers, 2003). Rather than seeking an outcome that is somehow representative, whether of all or only the prevailing interests in society, the goal and source of legitimacy in deliberative democracy is accountability, i.e. the ability to justify a decision to all parties, even if the decision does not reflect their particular views and values (Chambers, 2003). This notion transforms an understanding of democracy that is driven by the public into an understanding of democracy that is accountable to the public. Although empirical work on the strengths and weaknesses of deliberative democracy is at present lacking, it has been extended to natural resource management (Lane, 2003; Parkins & Mitchell, 2005) and represents a promising field for exploration. In any event, the postmodern turn in the 20th century, though enlightening on many fronts, has also affected ethics to the extent that anything but an at least conditionally relativistic stance risks being frowned upon as cultural hegemony (Hatch, 1997; Schweder, 1990; Taylor, 1954). However, it is perhaps time to seriously re-consider the idea that some objectives, and some values, are more appropriate guides than others in managing the earth's forests.[70] I am not saying this is necessarily the case; I am simply suggesting that it is an option, which can and should be carefully and openly explored.

For the sake of argument, however, assume that we do live in a pluralistic universe of relative values, none of which can *a priori* be considered more or less important or worthwhile than others. In this case, it would indeed seem fair and proper to represent all values, as suggested in P4.[71] Unfortunately, this idea comes with its own set of questions about how objectives should be practically integrated, as asserted in C1. In other words, in what capacity and to what extent should values be represented relative to one another? Objectives occupy multi-dimensional space (e.g. content, impact, and scale, from above), and so can be adjusted in an assortment of ways, with incredibly different end configurations. Therefore, even if we have agreed that P4 is true, and that it is indeed most fair to represent all values by integrating objectives, integration might be achieved in any number of ways. For example, one objective might be met almost ideally while two others are fulfilled only nominally. One might be prioritized in the short term with a projected tradeoff to favor other objectives in the long term. These scenarios are vastly simplified, but they serve to illustrate the point that a given set of objectives can be arranged in a nearly infinite range of combinations. Assuming that we want to achieve the best (i.e. fairest, in keeping with the definition of "better" as "most fair" from above)

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[70] This is not to undermine the absolute criticality of public acceptance (Shindler et al., 2004). However, public acceptance does not necessarily have to be won by doling out enough to all contingencies so that everyone is satisfied only to the extent that no one is fully satisfied. I would hypothesize that the public would be accepting of a decision at once well informed, carefully reasoned, transparently communicated, and effectively implemented. This is an empirical claim that remains to be tested.

[71] I will note that representing each and every value is probably not the goal in ecological forestry. As such, P4 might more accurately be written, "it is better to meet each *significant* objective to an extent at which it can be integrated with all other *significant* objectives, rather than to meet only select objectives optimally," to suggest that there is some process by which particular objectives for the forest have been set. However, I will also point out that the literature provides no information whatsoever about the objectives that ecological forestry should be used to pursue, or how those objectives might be chosen. I left the language broad to reflect this ambiguity.

representation of values in integrating objectives, we again need to have a clear understanding of what "fairness" means before we can practically achieve it. Increasingly sophisticated technology is employed to find best-fit solutions after considering various alternatives for meeting multiple objectives (e.g. Diez-Balteiro & Romero, 2008), but a judgment about what constitutes the fairest decision cannot be output from any type of software. Fairness is a normative, prescriptive concept, a definition of which cannot be deduced solely from empirical, descriptive information (Nelson & Vucetich, 2012a). Unfortunately, as I have pointed out several times, normative concepts are not clearly defined or even explicitly addressed in the ecological forestry literature, so I can only offer possible or plausible definitions. Speculatively, then, perhaps "fairness" means that values are somehow *balanced*. With this definition, it suddenly seems that the idea of integration may itself be premised on ideas about balance, which I will discuss next.

The balance arguments. "Balance" is an idea invoked frequently in the literature (Gustafsson et al., 2012; Lindenmayer et al., 2012; Mori & Kitagawa, 2014; Palik et al., 2002; Seymour & Hunter, 1999; Stoneman, 2007). However, the idea of balance can take on at least two meanings: equal balance or appropriate balance. An argument employing the first meaning can be constructed as follows:

P1: Forests have both economic and ecological values.
P2: The economic and the ecological values of forests are equally important.
P3: Management objectives should reflect equally important values in equal measure.
C1: Therefore, forest management should balance economic and ecological objectives.
P4: Ecological forestry balances economic and ecological objectives.
C2: Therefore, actively managed forests should be managed using ecological forestry.

As I discussed in Chapter One, this argument adopts a somewhat crudely egalitarian understanding of "balance" resting on P2, the questionability of which seriously undermines the entire argument.[72] The timber industry is estimated to contribute approximately $583 billion to the global GDP (Lebedys & Yi, 2014), a figure that is dwarfed by the multiple trillions of dollars estimated to be the monetary worth of ecosystem services provided by forests (Costanza et al., 1997; Costanza et al., 2014). Therefore, if importance is measured in monetary value, P2 is blatantly false. If, on the other hand, importance is measured non-monetarily, the truth of the statement would depend upon one's perspective and the measure of importance being employed. If importance is defined relative to mill closures in rural Oregon, perhaps an economic objective such as timber production might appear more important than an ecological objective such as bird habitat. If importance is defined relative to biodiversity, the reverse might seem true. If importance is defined relative to non-human welfare, ecological objectives probably take precedence, but if importance is defined relative to human welfare, the relative weight of economic and ecological objectives remains unclear. Therefore, once again, we find that not only must the language of "economic" and "ecological" values and objectives be clarified, but the meaning of "importance" must also be specified before this argument can be evaluated. I hypothesize, however, that it would be rare to find situations in which economic and ecological values, once defined and measured by some standardized unit of importance, would be found to perfectly equal one another.

Alternatively, there is at least in theory a more nuanced way to *appropriately* balance objectives, relying not on egalitarian calculations, but rather on a considered decision about which values more closely align with what we know of the world today, and what we believe about how the world ought to be. In this case the balance argument would go as follows:

P1: Forests have economic and ecological values.

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[72] I will also reiterate from Chapter One that the notion of equal balance does not appear to be the connotation of "balance" advanced in the ecological forestry literature.

P2: Different economic and ecological values may be more or less important, relative to one another.
P3: Management objectives should reflect the relative importance of different values.
C1: Therefore, forest management should appropriately balance economic and ecological objectives.
P4: Ecological forestry appropriately balances economic and ecological objectives.
C2: Therefore, actively managed forests should be managed using ecological forestry.

Here, P2 seems far more likely to be true than in the "equal balance" argument above. Unfortunately, we still have not eliminated the need to define "economic values/objectives," "ecological values/objectives," and "importance," and we have actually acquired yet another source of profound ambiguity: what constitutes an appropriate balance? This is a complex and multilayered question. At the operational level, the question is again about how to compare fundamentally different values in a way that allows us to systematically adjudicate among them, an area of ongoing research in economics (de Groot et al., 2010; Raymond, Kenter, Plieninger, Turner, & Alexander, 2014; Smith, Dick, & Scott, 2011). However, at the ethical level, determining what constitutes an appropriate balance requires a clear conception about what the relationship between the human species, in all of its idiosyncrasies (including the economy), and the rest of the planet ought to be. This is a challenging question, and one that I have neither the space nor the qualifications to address at this time. The salient point for the discussion at hand is that this theoretical argument, which I have written as clearly as I can while remaining faithful to the language used in the ecological forestry literature, demands further clarification before it can be evaluated. On a superficial level it certainly seems hard to contend that management should not appropriately balance the relative importance of different values. Indeed, in such an abstracted form the argument is valid, sound, and perhaps even indisputable. However, the pervasive ambiguity of the language in its major premises renders the overall argument vacuous so that, somewhat paradoxically, the very mechanisms that make the argument immune to dissent also deprive it of substance or practical worth.

To conclude this suite of arguments, I will at last address the final premises immediately preceding each of the three conclusions in the arguments above (P6, P4, and P4, respectively). Relying on the extremely limited and highly ambiguous material that has been written about managing for multiple values and objectives in ecological forestry, these premises are tenuous at best. Without a clear understanding of what constitutes an integration or appropriate balance of objectives, it is also impossible to assess whether ecological forestry actually achieves it. Although it is constantly reiterated in the literature that ecological forestry does these things (see Chapter One), the critical question remaining is, how? As I have tried to emphasize in this section, the "how" is a complex, profoundly difficult, and absolutely crucial part of managing for a plurality of values in one stretch of forest. It is not enough for people to agree that ecological forestry should be implemented because it integrates or appropriately balances multiple objectives. We must also have a common definition of what "integration" means, or how an "appropriate balance" is achieved. As such, although all the arguments outlined in this section may technically be valid, they cannot be considered sound without further and explicit clarification of their critical normative concepts. [73]

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[73] Of course, at the theoretical level it is unreasonable to expect explicit definitions for "ecological" or "economic" objectives, or principles to arbitrate amongst them, since there is so much variability among contexts. For example, at the theoretical level it would be fruitless to define "ecological objectives" as the habitat needs of the Northern Spotted Owl, or "economic objectives" as the financial needs of rural Oregon communities, since these issues are relevant specifically and exclusively to the Pacific Northwest. Still, as I argued at length in Chapter One, ecological forestry is rendered obscure and inconsistent by its pervasive use of ambiguous normative and ethical concepts, a situation that needs to be remedied before we can even understand what ecological forestry is, let alone decide whether we should be using it. Normative and ethical clarity does not necessarily entail ascribing precise meanings to the words "economic" and "ecological," or defining some exact condition as an "appropriate balance" between them. Instead, it might be achieved by establishing overarching principles to guide decisions (e.g. ecosystem resilience should first be secured before managing for the interests of any single species); or it might be achieved by simply articulating a commitment to pragmatic, context-specific deliberations amongst values and objectives (Minteer, Corley, & Manning, 2004). However, as a hybrid between a strictly pragmatic, contextual approach and a more rigid framework in which overarching ethical principles are firmly established (Minteer et al., 2004), I suggest that ethics might govern management and conservation of forests as they govern relations between people, based upon an understanding of humans as a moral community with certain rights, duties, and ethical norms guiding our interactions (Leopold, 1949/1966). In other words, ecological forestry might offer a clear vision of how humans ought to relate with forests and

The "subtle emphasis" arguments. As discussed in Chapter One, sometimes in the literature it is implied that ecological forestry prioritizes some set of values or objectives over others. These arguments, like the ones above, are also conceptually ambiguous and, depending on how certain terms are used or defined, could serve to justify very different courses of action, even though they may appear to lead to the same conclusion. Consider, for example, the following argument:

P1: Humans require a sustained yield of some amount of timber.
P2: Forests must be actively managed if they are going to provide a sustained yield of timber.
P3: Humans value certain functions and processes historically performed by forest ecosystems ("desirable ecosystem functions and processes").
P4: Desirable ecosystem functions and processes should be conserved in actively managed forests.
P5: Management objectives should be appropriately prioritized (i.e. forests should be managed for the maximum sustained yield of timber that does not compromise conservation of desirable ecosystem functions and processes).
P6: Ecological forestry appropriately prioritizes objectives (i.e. produces as high of a sustained yield of timber as possible, while conserving critical ecosystem functions and processes).
C: Therefore, actively managed forests should be managed using ecological forestry.

Now compare the argument above with the argument below:

P1: Humans need a sustained yield of some amount of timber.
P2: Forests must be actively managed if they are going to provide a sustained yield of timber.
P3: Forests are complex living systems with a broad spectrum of biodiversity and various interacting functions and processes ("forest ecosystem complexity").

their biodiversity- not necessarily by endorsing particular behaviors and practices, but by advancing a unified ethical perspective about how forests are perceived, along with the values, beliefs, and virtues that should govern how humans interact with them. I entertain some additional ideas at the end of Chapter One, but truthfully, it is beyond the scope of the current project to make a meaningful contribution to the conversation about how ethics should be incorporated more actively into forest management (Lynn, 2011; Minteer & Collins, 2005; Nelson & Vucetich, 2012a; O'Hara, 1996). However, this is a topic I hope to continue exploring in the future.

P4: Forest ecosystem complexity should be conserved in managed forests.
P5: Management objectives should be appropriately prioritized (i.e. the primary objective is supporting forest ecosystem complexity, and whatever amount of timber is produced in conserving forest ecosystem complexity is acceptable).
P6: Ecological forestry appropriately prioritizes objectives (i.e. supports forest ecosystem complexity, while still providing some amount of timber).
C: Therefore, actively managed forests should be managed using ecological forestry.

The conclusions of these two arguments are identical, as are the chains of reasoning leading to them. In fact, the arguments differ only in the characterization of forests in P3 and the conceptualization of appropriate prioritization in P5 and P6. In other words, the arguments are distinguished by their normative concepts. However, once again because of normative ambiguities in the literature, it remains unclear which of these two arguments more accurately represents the arguments being made about ecological forestry. Sometimes in the literature the language seems to emphasize the instrumental value of forests, while in other cases the language either suggests that forests carry intrinsic value, or is ambiguous enough to defy categorization as one view or the other (see Table 7.1 from Chapter One). These different views are rooted in different ethical beliefs about moral consideration: the former might be linked to an anthropocentric value orientation, and the latter (when clear) to a bio- or ecocentric value orientation (Nelson & Vucetich, 2012a). Depending on how a forest is perceived, whether exclusively for its use value or also as holding value in itself, different understandings of appropriate interactions will follow. In other words, when P3 changes, P5 changes accordingly. For example, in the first argument above, forests are identified as mere resources. They may supply a range of values of different types, from timber to health benefits to aesthetic appeal, but ultimately they are valuable only to the extent that they are useful to people. On this view, timber might be seen as a value uniquely associated with forests, which should therefore be prioritized as long as other subsidiary use values are maintained in functional (or acceptable) conditions. In the second argument, on the other hand, forests seem to be identified as moral entities. They may supply necessary and desirable goods and services to humans, but their instrumental value cannot be seen in isolation from their intrinsic value. On this view, timber might be considered a convenient byproduct that may, but does not always, result from management actions, and should not necessarily be a primary motivating factor in how humans interact with forests.

There are of course numerous intermediate positions between the two views outlined above, and I will again point out that my different conceptualizations of "appropriate prioritization" are largely speculative, since the literature offers no clear guidance on what is considered "appropriate" or "inappropriate" in ecological forestry. My purpose here is mainly to demonstrate that it is the normative premises that critically characterize these arguments. Depending on how P3 and P5 are interpreted, two people who think they agree to the same premise ("ecological forestry appropriately prioritizes objectives") and the same conclusion ("therefore, actively managed forest should be managed using ecological forestry") may have extremely different ideas about what they are agreeing to, to the extent that they do not actually agree with one another. If made explicit, P3 and P5 could clarify the normative and ethical underpinnings of ecological forestry, which, as I have repeated several times in this chapter and discussed at length in Chapter One, are currently unaddressed in the literature. The choice is between a blandly agreeable but ambiguous argument or a potentially contentious but clear argument. The fact of the matter is that the normative premises have to be present for the argument to work, and the argument is rendered practically useless by their obscurity. It therefore seems sensible to err on the side of transparency, so that there is at least a platform for discussion and debate. Clarity may indeed carry the risk of generating controversy and opening the argument to critique, but this is the discursive process that argument analysis serves to support, and which can arguably lead to more thoughtful and carefully-reasoned management decisions (Nelson & Vucetich, 2012a; O'Hara, 1996).

A consumption argument

In juxtaposing so-called "ecological" with "economic" objectives, the arguments discussed above raise important questions about value, morality, and consumption. These were not issues I had originally considered for analysis, but in the Argument Selection survey one expert suggested that there may be a more fundamental argument underlying all the theoretical arguments about managing for a plurality of economic and ecological values, and I agreed that it was an important line of reasoning to pursue. Because there truly is no reference for this argument in the ecological forestry literature, I worked with the expert who made the suggestion to construct a theoretical argument establishing the need to manage for multiple economic and ecological values, as follows:

P1: As a society, we value environmental wellbeing.
P2: Management of public lands ought to reflect public values.
C1: Therefore, management of public lands ought to reflect our value for environmental wellbeing.
P3: As a society, we have very consumptive lifestyles.
P4: Our consumptive lifestyles have certain consequences that are harmful to the environment.
P5: Nonetheless, we choose not to change our consumptive lifestyles.
P6: We ought to accept the consequences of our choices.
C2: Therefore, we ought to accept the consequences of our consumptive lifestyles.
P7: By managing public multiple-use forests using ecological forestry, we accept that we will continue doing some harm to the environment, as a consequence of our consumptive lifestyles, while also reflecting as best as possible our value for environmental wellbeing.
C3: Therefore, we ought to manage public multiple-use forests using ecological forestry.

P1 seems to be true. Modern industrial societies generally rate concern for the environment quite highly (Franzen, 2003). The New Ecological Paradigm scale has been used to measure an increase in reported proenvironmental attitudes (Dunlap, Van Liere, Mertig, & Jones, 2000), although use of the scale in various studies has been questioned (Hawcroft & Milfont, 2010), along with the validity of the scale itself (Vucetich, Bruskotter, & Nelson, 2015). Nonetheless, even though it is not clear what is meant by "environmental wellbeing," a potential source of controversy, with the premise stated so generically, it seems fair to say with relative confidence that most people do, to some extent or in some capacity, value the environment and have an interest in its wellbeing, whether for its own sake or not (Vucetich et al., 2015).

P2 is a premise that will occur several times throughout this analysis in the applied arguments that follow, either exactly as written here or in a related form (e.g. management of public lands should reflect "the public good" or "the public interest," rather than "public values"). Generally experts ranked the premise as true and fairly non-controversial, an opinion that I will subsequently accept in assessing arguments. However, I will point out, as discussed above, that it is not apparent that people have any overarching or unified sense of what it means to manage for public values (or the public interest or the public good). Although it may be generally true that management of public lands should reflect public values, the question of *how* to do this is open for debate. Answering this question necessitates very deliberate decisions about 1) who counts to the extent that their values should be considered; 2) which of their values should be represented; and 3) how these values should be balanced or prioritized relative to one another, particularly when they conflict. These questions also coincide with more theoretical questions about democratic and participatory processes. For example, does "reflecting public values," mean that management should reflect the will of the majority? Maybe "reflecting public values" implies an egalitarian approach, in which all values are equally represented, or represented in proportion to their relative importance (an idea that comes with its own problems- see the balance arguments, above). Or perhaps it means that management elicits, considers, and somehow answers to public values, but does not necessarily take public opinion as a blueprint for management decisions (Chambers, 2003; Knopp & Caldbeck, 1990). While P2 (and others like it) may be true when stated so generically, it needs to be clarified with a practical and applicable understanding about how public values can and should be represented in management objectives on public lands. Without this understanding established, it is impossible to assess whether strategies advanced as a reflection of public values- including ecological forestry- seek to realize an appropriate or even deliberate interpretation of "managing public lands to reflect public values."

Limiting the scope of the discussion to American society, P3 certainly seems true. US consumption alone represented $1.4 x 10^{10} in 2013 (World Bank, 2015), and arguably consumption itself is ingrained into social and psychological identity in modern capitalist culture (Pepper, Jackson, & Uzzell, 2009).[74] P4 also seems generally to be true (Aber et al., 2000), if we agree that effects such as terrestrial, aquatic, and atmospheric pollution and rapid acceleration in species extinctions can be described as "harmful."

P5, however, is not obviously true, and likely to be controversial. Assessing it would require, first and foremost, empirical investigations from a variety of disciplines, probably including evolutionary biology, cognitive and social psychology, and sociology. To briefly comment here I will note that, although arguably consumption patterns have not changed appreciably, even in spite of increasing information about global climate change and its likely impacts in the not too distant future (Dilley, 2014; Page & Page, 2014; Thøgersen, 2014), there is also evidence suggesting that people can and do change consumption patterns and the lifestyles they support (Frederiks, Stenner, & Hobman, 2015; Hanss & Böhm, 2013; Pepper et al., 2009; Tobler, Visschers, & Siegrist, 2012).[75] Therefore, P5 is at least questionable,

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[74] This is not to say that consumption is excessive, an assertion that would need to be backed by evidence that, according to at least some calculations, is currently lacking (Arrow et al., 2004; Ehrlich & Goulder, 2007).

[75] I will also note that P5 dramatically simplifies the issue of choice, since it is not clear that reducing consumption is a choice that can be made at the level of the individual (Koletsou & Mansy, 2011). Powerful groups in society have vested interests in perpetuating certain lifestyles and patterns of consumption (Staats, 2004). As such, decisions about consumption are not made entirely on the basis of radical free will or perfect autonomy (Bandura, 2000); they are at least partially conditioned by social and psychological power structures operating in society.

and would more accurately (but also more weakly) be stated, “nonetheless, *some* people choose not to change their consumptive lifestyles.” However, even with the revision, the concept of “change” would need to be clearly defined (e.g. change to what extent, and for what purpose) before the premise could be verified or falsified.

P6 makes a claim about responsibility, i.e. a person who makes a choice ought to accept responsibility for the consequences of that choice. Although this seems to be an appropriate proposition, it should certainly not be confused with the proposition that we should simply accept the choices we make without reflecting upon them. The assertion that we ought to accept the consequences of our consumptive lifestyles is significantly different from the assertion that we ought to accept our consumptive lifestyles. A case in point, the argument leaps from accepting the consequences of our choices in C2, to seemingly accepting the choices themselves in P7. This premise presumes a rather static vision of human values, both individual and collective, and one that is immune or otherwise resistant to change from either endogenous or exogenous forces. Even if it is the case that our society on the whole chooses not to relinquish environmentally damaging, consumptive lifestyles, this does not suggest that our choices cannot (and should not) be otherwise. We marvel to behold the ingenuity of human technological innovation, and even the plasticity of the human brain itself, so surely human values can be dynamic as well. The 20th century alone witnessed monumental leaps in human rights awareness; is it truly such a leap of the imagination to think that further moral growth is possible?

Ecological forestry as proposed in P7 seems quite well suited to a world in which we accept responsibility for the environmentally damaging consequences of our consumption to the extent that we try to minimize them, but tacitly accept our choice not to change our consumptive lifestyles. For those who are not inclined to assume P5 as an immutable fact of human nature or society, however, the suggestion that it is appropriate for ecological forestry to provide a structured outlet for consumptive behaviors, as long as it somehow mitigates their negative consequences, may not be acceptable.[76] From this perspective, it might be proposed that instead of serving as an apologetic for current patterns of behavior, as conveyed in P7, ecological forestry could instead advance a novel vision for how we might change our consumptive lifestyles, and interact with forests in a radically different way than we have in the past. The ecological forestry literature never explicitly defines any specific goals or aspirations to indicate what amount of revenue and jobs, and ultimately what amount of consumption, it proposes to support. Exploring this current gap in the literature might provide a convenient way to initiate discussions about goals for natural resources, and the sorts of lifestyles we expect (and should expect) them to support.

The topic of consumption is a relevant and urgently needed area of ethical exploration, particularly as we confront the complex challenges of conservation and land use facing us in the 21st century (McAlpine et al., 2015). Questions pertinent to ecological forestry include: have we in fact reached a position where we believe we are bound to current levels of consumption, and that the morally appropriate course of action is to accept the consequences, rather than to challenge highly consumptive behaviors? How are instrumental (i.e. consumption) values appropriately compared with intrinsic values, if we do subscribe to the idea that forests have intrinsic value? How are non-subsistence consumption values appropriately compared with subsistence values, if we acknowledge that humanity relies on and will continue to rely on the earth's natural resources for its continuing survival? Although undeniably difficult, it is absolutely pressing that we begin making a meaningful

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[76] I could also question the mutability of the human value for environmental wellbeing since, like P5, P1 is also an empirical claim. This is a valid criticism, and one I would answer to by first pointing out that, as stated, the first part of the argument (P1-C1) represents an anthropocentric perspective that attributes value according to human wants and needs. From this perspective, human value for the environment might indeed be fickle and transient, in which case P1 is an empirical proposition that, like P5, needs verification. The argument could, however, be framed differently, e.g. (P1) forests have intrinsic value, which (P2) humans have a duty to respect, and therefore (C1) management ought to reflect the intrinsic value of forests. With this line of reasoning, P1 and P2 are not empirical but ethical premises, which, if accepted as true, would suggest that the value of environmental wellbeing is far less transient than in my original formulation of the argument. However, thus written P1 and P2 might (not necessarily will) also become more controversial (Vucetich et al., 2015).

response to these questions before we can conceptualize, and then practically realize, an appropriate balance of a plurality of forest management objectives and the values underlying them.

Applied Arguments: Pro-Ecological Forestry in Western Oregon

Sustained yield arguments

Ecological forestry is currently being proposed for implementation in western Oregon for a number of reasons, one of the most prominent of which is to increase harvest levels on federal lands. Timber production has historically been a primary economic base for many rural communities in Oregon (Gale et al., 2012), particularly for the 18 O&C counties on BLM lands in western Oregon (Tuchmann & Davis, 2013). The Northwest Forest Plan (NWFP) brought about dramatic changes in 1994, when allowable harvest on public lands was limited to a fraction of its historic levels (Gale et al., 2012). Over the course of only five years following the implementation of the NWFP, timber production on federal lands dropped to less than 10% of what had occurred in the 1980s (Gale et al., 2012). Although the NWFP allows for regeneration harvest on the approximately 25% of all BLM lands in western Oregon designated as matrix (USDI Bureau of Land Management, n.d.a), regeneration harvests have largely been prevented by environmentalist litigation, on the grounds of the Endangered Species Act (Thomas et al., 2006). Ecological forestry is therefore proposed as a way to increase harvest levels on federal lands, to bring them closer to the timber volumes predicted under the NWFP (Johnson & Franklin, 2013).

I selected this argument for analysis because timber is a recurring theme in Johnson and Franklin's (2009, 2012, 2013) reports for the BLM and their testimony before Congress (*Challenges and Opportunities*, 2013b). Five of the experts with whom I consulted rated the reason "increases timber yields (financial stability/jobs)" as 7 or above in the Argument Selection survey, one of only two reasons rated so highly by over half of the experts. I took this as confirmation that the argument about timber was important to pursue for analysis. However, as I began formulating the argument, it became clear that there are at least two different arguments made about a sustained yield of timber, one legal and one moral. I will begin with the legal form.

The "sustained yield" argument- legal form. For reference I used Johnson and Franklin's (2013) report, in which they point out the legal mandate of the 1937 O&C Act that O&C lands be managed "for permanent forest production, and the timber thereon shall be sold, cut, and removed in conformity with the principal of sustained yield for the purpose of providing a permanent source of timber supply" (H.R.7618, 1937, para. 1). Johnson and Franklin further write,

> Perhaps the most elusive and frustrating part of managing BLM's Western Oregon Forests has been the failure to establish a land base for sustained yield management as mandated in the 1937 O&C Act…Thus, this section of this report highlights likely sources of a land base for sustained yield management…in the context of a broader discussion of the potential contribution of Ecological Forestry. (p. 15)

The argument I formulated using these comments is as follows:

P1: The O&C Act of 1937 mandates that O&C lands be managed for sustained yield to provide a permanent source of timber.
P2: Forest management should follow all applicable laws.
C1: Therefore, O&C lands should be managed for sustained yield to provide a permanent source of timber.
P3: Federal legislation mandates that threatened and endangered species be protected.
C2: Therefore, management of O&C lands should not compromise the protection of threatened and endangered species.
P4: Ecological forestry can be used to manage O&C lands for sustained yield to provide a permanent source of timber without compromising protection of threatened and endangered species.
C3: Therefore, O&C lands should be managed using ecological forestry.

I will first point out that Johnson and Franklin, whose writings I use as references for all of the applied pro-ecological forestry arguments, rarely argue that ecological forestry should be used to manage the O&C lands. Instead, as seen in the examples above, they describe a context in order to establish the need for ecological forestry, and then explain how the land base might be managed under an ecological forestry approach. I believe I am justified in extrapolating arguments from Franklin and Johnson's writings, since ultimately their work is used to support implementation of ecological forestry in western Oregon (S.132, 2015; S.1784, 2013). Nonetheless, I also feel obliged to be clear in stating that Johnson and Franklin generally do not explicitly *argue for* ecological forestry in their writings.[77]

Returning to the argument at hand, P1 is an empirical statement, easily verified as true with reference to the text of the O&C Act (H.R.7618, 1937). Although the premise is not likely to be controversial in general, i.e. to the extent that the act does in fact mandate that O&C lands be managed for sustained yield, there is likely to be disagreement over what qualifies as a "sustained yield to provide a permanent supply of timber," since no amount is defined in the bill itself. This will become important once the O&C Act has to be weighed against other environmental legislation, as I will discuss below.

P2 is probably true and not terribly controversial. However, it does raise an important question about natural resource management, namely, to what extent should laws be followed if they are no longer suited to their social and historical contexts? For example, the O&C Act was written in 1937 in the spirit of the times, when forests were viewed as mere resources to be extracted for human use (Callicott, 1990). In the 1990s, federal agencies increasingly shifted toward ideas of ecosystem management (Bengston et al., 2001), viewing forests not only as resources to be extracted, but also as complex living systems with multiple use and

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[77] There are occasional exceptions. For example, Johnson and Franklin (2012) wrote, "We believe that it is time to begin moving O&C management toward an integrated approach" (p. 77). Even more specifically, Johnson (2013) testified before Congress, "we suggest an "Ecological Forestry" approach to management of the BLM O&C lands" (*Challenges and Opportunities*, 2013b, p. 20).

non-use values (Grumbine, 1994). Given what we know and believe about forests today, is it still appropriate that management adhere to laws based upon narrowly utilitarian resource values? Although it is difficult to assert that P2 is false, in the sense that management should not follow all applicable laws, we might still ask what the structure and purpose of the applicable laws *should be*. The current legal system has arguably become rigid, hindering managers' flexibility to respond to new scientific findings and changing social contexts (Garmestani, Allen, & Cabezas, 2008). If we have entered an era characterized by so-called "wicked problems" requiring adaptive management approaches, it seems likely that there will also need to be adjustments in how the legal system interacts with forest management (Cosens, Gunderson, Allen, & Benson, 2014; Craig & Ruhl 2014; Garmestani, Allen, & Benson, 2013; van Rijswick & Salet, 2012). The discourse around ecological forestry in western Oregon may not be the most appropriate or the most effective forum for engaging such broad theoretical questions about environmental policy, but I would be remiss if I failed to point out that there is at least some room for dispute in P2, and although it may be true that forest management should follow applicable laws, it also seems to be true that applicable laws should be written in a way that supports good forest management.

P3 refers to the Endangered Species Act (ESA). Although true as stated, the premise does nothing to describe how the ESA should be met alongside other legislation, particularly the O&C Act discussed above. The conflict between the ESA and the O&C Act is a persistent problem facing the BLM, and one that has not yet been satisfactorily resolved (see, for example, DS Consulting & Oregon Consensus, 2014). Where some contend that the ESA takes precedence over the O&C Act, others argue in the other direction, contending that the first and primary purpose of O&C lands is to produce a sustained yield of timber. As such, while C1 and C2 on their own are supported, they stand in tension with one another when combined into a single argument, and there is a good chance that people with different perspectives about which law takes precedence will disagree about what it should mean to manage O&C lands for a sustained yield of timber (e.g. how much timber, and over what amount of time), and what it should mean for management of O&C lands not to compromise threatened and endangered species (e.g. at what scale of impact, and by what definition of "compromise").

Ecological forestry is, of course, proposed as a solution by which both laws and their associated objectives can be met, as stated in P4. This is a claim supported by only limited evidence. Empirical work on variable retention harvest has reported mixed if tentatively optimistic results suggesting that many species are less negatively impacted by ecological forestry than by traditional harvest (e.g. Lindenmayer et al., 2012; Mori & Kitagawa, 2014; Rosenvald & Löhmus, 2008). However, impacts of the measures proposed specifically in western Oregon have not been tested, even though pilot projects have been enacted on three sites (Johnson & Franklin, 2012). Effects on particular species, such as spotted owls, red tree voles, and marbled murrelets, would be highly relevant in assessing whether threatened and endangered species are compromised by ecological forestry, but at present there are no projections about what these species' responses to ecological forestry treatments on O&C lands might be (Johnson & Franklin, 2012). Therefore, empirical verification of ecological forestry's ability to protect threatened and endangered species in the Pacific Northwest is as yet lacking.

P4 also makes an unverified empirical claim about the social acceptability of ecological forestry. The ESA is often enacted through citizen or interest group lawsuits, rather than active agency monitoring or regulation (Earthjustice, 2003). As such, only if ecological forestry effects conservation of threatened and endangered species to an extent that is socially acceptable will it escape environmentalist litigation, and actually be able to produce a sustained yield of timber. Clearly, as a strategy of active management, ecological forestry can be used to harvest timber. However, if ecological forestry is seen as compromising protection of threatened and endangered species, it likely will not be considered acceptable by environmentalist groups, in which case there is no reason to believe ecological forestry would be able to achieve any timber production beyond what has occurred under the current NWFP management framework.

In order to assess whether ecological forestry is acceptable amongst environmentalist groups, two critical questions must be answered: 1) what amount of timber does ecological forestry aim to produce; and 2) is the type and extent of harvest required to produce this amount of timber under an ecological forestry approach socially acceptable to the extent that it will not be seen and litigated as a violation of the ESA? The only information we have in answer to the first question is that ecological forestry aims to produce a sustained yield of timber (e.g. Johnson & Franklin, 2013). The next logical question to ask, of course, is, "what is a sustained yield of timber?" Unfortunately, nowhere in the literature is a particular goal for "sustained yield" specified (see Chapter One).[78] "Sustained yield" is a normative concept, since individuals and interest groups with different personal and social norms will have different ideas about what level of timber is necessary and desirable, and define "sustained yield" accordingly. Therefore, a definition needs to be established through a careful and transparent deliberative process, in which decision-makers engage with relevant stakeholders to set a reasonable and appropriate expectation for timber production on O&C lands. Until we have such an established definition of "sustained yield," we do not know how much timber ecological forestry aims to produce, which means we also cannot know what extent of harvest would take place under an ecological forestry approach; estimate its

[78] It could be argued that, even without a defined goal for "sustained yield," it is enough to know that 30-40% of the standing volume will be retained in an ecological forestry regeneration harvest, as proposed by Johnson and Franklin (2012, 2013). In answer, I would point out that even with these guidelines in place, we still do not know how extensively these retention harvests will be carried out across the landscape, without some specified target volume per year. Knowing the extent of regeneration harvest would be important for assessing both biophysical impacts, particularly on threatened and endangered species, as well as social acceptability. However, I will also note that the latest O&C legislation actually specifies that approximately 1% of the Moist Forestry Emphasis Areas will be harvested for regeneration each year (S.132, 2015). Therefore, even if we do not know where this figure came from, we are currently equipped with enough information to assess both the biophysical impacts and the social acceptability of ecological forestry, as long as we have the stipulations written into the bill. Working with Franklin and Johnson's writings alone, however, we do not have enough information to make these assessments.

likely effects on threatened and endangered species; or determine whether these effects are considered socially acceptable. In other words, without an answer to the first question, we cannot answer the second question, and without answers to either of these questions, it is not at all clear that P4 is true.[79]

Altogether, to assess the legal version of the sustained yield argument, we need to first determine what is an appropriate relationship between the ESA and the O&C Act. Are we obligated to uphold both and, if so, to what extent? In addition, we need an established goal for "sustained yield" in order to assess whether ecological forestry can in fact reconcile the two laws. Until some of these key gaps are filled, the argument is valid but cannot be considered sound.

The "sustained yield" argument- moral form. As mentioned above, the argument for timber production does not rest only on a legal claim. There is also a deeper moral claim being made, which would perhaps explain why we are (or should be) concerned with upholding the legal mandate of the 1937 O&C Act. This argument is somewhat more challenging to locate explicitly in writing, although it is a recurring theme in the literature. My primary source of inspiration (not so much a reference) was the preamble about the O&C Act on Senator Wyden's webpage: "The bill will increase harvests and provide a steady supply of trees from federal O&C lands that will mean more jobs and new certainty for the mills and timber companies that rely on federal forests" (Office of Senator Ron Wyden, 2015, para. 1). I also referred to Johnson and Franklin's (2012) statement:

> Expectations regarding timber harvests have not been met…creat[ing] uncertainty regarding the land base available for sustained timber production. In addition, the potential end of Congressionally-appropriated county payments- historically derived from federal timber stumpage- and high unemployment in southwest Oregon counties have refocused attention on timber harvest from these lands. (p. 1)

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[79] We also cannot determine whether ecological forestry in fact produces a sustained yield of timber, as asserted in P4, without a definition of "sustained yield."

Working from these sources, I originally constructed the argument as follows:

P1: Prior to the NWFP, timber production on O&C lands provided economic stability for rural Oregon communities.
P2: It is unjust to deprive communities of economic stability.
C1: Therefore, depriving rural Oregon communities of economic stability by limiting timber production on O&C lands was unjust.
P3: We ought to right past injustices whenever we can.
C2: Therefore, we ought to restore economic stability to rural Oregon communities.

This line of reasoning supports the conclusion that we ought to restore economic stability to rural communities in Oregon. It concludes neither that we ought to restore a timber-based economy, nor that we ought to use ecological forestry to do so. I therefore re-wrote the argument with the premises necessary to lead to the conclusion that ecological forestry should be used to support rural communities on O&C lands:

P1: Prior to the NWFP, timber production on O&C lands provided economic stability for rural Oregon communities.
P2: It is unjust to deprive rural communities of economic stability.
C1: Therefore, depriving rural Oregon communities of economic stability by limiting timber production on O&C lands was unjust.
P3: The injustice of depriving rural Oregon communities of economic stability by limiting timber production on O&C lands can only be made right by restoring timber production on O&C lands.
P4: We ought to right past injustices if we can.
C2: Therefore, we ought to restore timber production on O&C lands in order to restore economic stability to rural Oregon communities.
P5: By managing the O&C lands using ecological forestry, we can increase timber production to a level that will restore economic stability to rural Oregon communities.
C3: Therefore, O&C lands should be managed using ecological forestry.

Although the premises now lead to the conclusion that ecological forestry should be used on O&C lands, several of them make very questionable claims.

P1 is an empirical statement that is generally true and non-controversial. Although “economic stability” is not defined in the O&C Act or the ecological forestry literature, it is probably related to the idea of having a stable economic base, which is, “a term used to describe and analyze the major industries providing jobs within a given market area" (Gale et al., 2012, p. 46). Reducing harvest on federal lands had pronounced effects on employment, with approximately 11,400 jobs, most of them in rural Oregon communities, lost between 1990 and 2000 as a result of the NWFP (Charnley et al., 2006). In addition to jobs, the timber industry had also previously represented a significant source of funding for public services. Historically the O&C counties received 75% of the timber revenues from harvest on federal lands, with one third of that amount used to manage the lands themselves and the remainder spent at the discretion of the counties (Tuchmann & Davis, 2013). Payments to O&C counties, which averaged $150 million prior to the NWFP, had dropped to $40 million as of 2011, a sum paid through the Secure Rural Schools fund established in 2000 when the counties continued to struggle in the aftermath of the NWFP (Tuchmann & Davis, 2013). Without this subsidiary funding, payments from timber revenue on O&C lands would have been only $9 million in 2011 (Tuchmann & Davis, 2013). As such, it seems fair to agree that timber production on federal lands provided economic stability for the 18 O&C counties, and that their economic stability was negatively impacted by the NWFP.

Although, as stated in P2, it may often be wrong to deprive a rural community of economic stability, if economic stability rests on an illegitimate industry or practice, P2 falls apart. For example, imagine a community whose financial stability rests on (illegal) production and trade of crystal meth. Is it unjust to deprive this community of its economic base? Although the answer is not categorically no, it is also not categorically yes. The question is complex because it requires not only a judgment about the morality of the economy in question, but also a judgment about what it means to uphold justice. For example, it may be considered a matter of legal justice to halt an illegal drug enterprise, but it may also be considered a matter of social injustice to remove the economic base from a community that is socio-economically disadvantaged and disempowered to achieve other forms of subsistence (Sadurski, 1984). Husserl (1937) suggested that justice is enacted when we treat others as equals, i.e. as we ourselves would be treated. From this perspective I may consider it a matter of justice to help a drug-dependent community that is otherwise unable or unmotivated to help itself, or a matter of injustice to impose my values and norms on a community where other values and norms prevail. The point is that P2 may or may not be considered true, according to different ideas about justice. Although there is clearly a qualitative difference between a community dependent on crystal meth and a community dependent on timber, there is a valid case to be made that the ways in which timber was extracted throughout the better part of the 20th century were unethical (Callicott, 2013; Moore & Nelson, 2010), and the economic prosperity it fuelled therefore illegitimate. There is also, however, a case to be made that rural, historically timber-dependent communities did suffer an injustice when they were deprived of a traditional way of life, and given only limited assistance to pursue other options for economic stability. As such, P2 merits much further discussion amongst decision-makers and stakeholders alike, and although it seems unlikely that it will ever be assessed simply or unilaterally as “true” or “untrue,” there is certainly potential for productive conversation that will at least help people understand the different values and opinions that might be underlying either support for or opposition to this argument.

Turning now to P3, it seems generally inaccurate to say that the wrong of taking away economic stability by restricting timber production can be made right only by restoring timber production. This premise reflects a very narrow notion of restorative justice (Wenzel, Okimoto, Feather, & Platow, 2008), which accepts remediation for injustice only in the same form in which the injustice was initially enacted. Even if we accept this idea of justice, the wrong identified in P2 is not the loss of timber production per se, but the loss of economic stability. Thus, the assertion that a timber economy must be restored to enact justice is questionable unless a valid case is made that it was the industry itself, rather than or along with the economic stability it supported, which was of value.[80]

Like P2, P4 seems like a relatively safe statement at first glance, but with further consideration it becomes questionable. First, the premise contends that the ability to right a past injustice provides a sufficient reason to right the past injustice. In other words, if we can restore justice, we should. This is a version of the naturalistic fallacy (Moore, 1903), in which a descriptive observation (we are able to right a past injustice) is conflated with a prescriptive norm (we *should* right a past injustice). In less formal terms, the premise perpetuates a myth that, for many of us at least, is dispelled quite early in life by our mothers and kindergarten teachers: just because you can does *not* mean that you should. Although arguably the notion that justice should be upheld is a universal principle (Schweder, 1990), a commitment to justice cannot be justified merely by virtue of the fact that we are able see justice done. In other words, there needs to be an ethical justification for why past injustices should be made right.

In addition to the leap of inference from "can" to "should," P4 like P3 before it is not supported by clear definitions of its critical ethical concepts, in this case "injustice" and how it can be made "right." According to Wenzel et al. (2008), an injustice might be made right either through retributive justice or restorative justice. The former (at least theoretically) achieves justice through punishment of the person or persons responsible for the injustice, while the latter achieves justice by re-establishing the values that were displaced in the enactment of the injustice (Wenzel et al., 2008). In the case of rural Oregon communities, if justice is served

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[80] I have found no clear evidence of this claim in writing, although one expert did suggest that there may be some amount of nostalgia for days gone by in historic timber towns. However, aside from the traces of this sentiment that I have encountered in various interactions throughout the project, the notion is not prominently advanced.

from a retributive standpoint, it might be considered just to cull the spotted owl population to the level it would have reached by now had harvest on federal lands continued unabated. By this act of punishment for both the owls and the environmentalist groups devoted to their protection, who were arguably responsible for bringing about the restrictions on federal harvest that deprived rural communities of economic stability in the first place, justice would be served (Husserl, 1937). Clearly this conceptualization of justice is absurd in this particular case and should not be pursued, even if technically we *can* do it. Interpreting P4 in this way would also fail to lead to C2. Restorative justice, on the other hand, would be served by healing the damage that was done when timber economies crashed, in which case P4 would indeed support C2. Although it is difficult to argue against P4 with the meaning of "right" so conceived, the premise is still likely to be controversial, since people might interpret "injustice" differently from different ethical frameworks. For example, imagine a case in which the government began enforcing stricter rules against inhumane conditions for farm animals, so that industrial farmers were no longer able to raise animals for meat or dairy as efficiently as before and suffered significant financial loss. The farmers might reason from an anthropocentric, utilitarian ethical framework, believing they were wronged when their needs and desires were subverted to liberal interests and values, and demanding justice in the form of restoration of their livelihoods. Animal rights activists, in contrast, might reason from a zoocentric or biocentric ethical framework, believing that justice was in fact served in restoring farm animals' dignity and inherent value, which was previously and wrongfully denied to them by the farmers. Although both sides may agree that past injustice should be made right, they would patently disagree about the nature of the past injustices, and how they should be made right. Therefore, a broad statement such as "we ought to right past injustices whenever we can" in P4 needs to be qualified, after careful consideration and open discussion to decide what it means to enact justice in the case of historically timber-dependent rural communities and federal forests.

There is fairly limited evidence with which to assess P5, but the small amount of information we do have seems to indicate that it is false. For example, Senator Wyden's office predicts 350 to 400 million board feet per year will be produced under the 2015 O&C Act, compared with the current 150 million produced annually (Office of Senator Ron Wyden, 2015). Is this is actually enough? While a more active timber industry would certainly create some number of jobs and generate some amount of revenue for the O&C communities, its ability to restore economic stability would depend, first and foremost conceptually on the definition of "economic stability," but also practically on the type and extent of harvest implemented. Modern timber practices have become highly mechanized, to the extent that a higher level of production than historically occurred would likely be necessary to sustain the same level of employment. By both Franklin and Johnson's (2012) calculations and O&C Bill projections (Office of Senator Ron Wyden, 2015), ecological forestry will generate far less timber than the average 1.2 billion board feet harvested on O&C lands prior to 1990 (Tuchmann & Davis, 2013). Projections for revenue under the previous version of the O&C Act do not even match 2012 payments made through the Secure Rural Schools funds (Headwaters Economics, 2013). In addition, as noted by Gale et al. (2012),

> Many factors influence forest industry employment and labor income. These can be related to the volume, size, and quality of timber; how and where it is harvested and processed; the level of processing; the degree of utilization of wood fiber residue; market conditions; and technological innovations and other factors such as regulations and shifts in forest management regimes/objectives. (p. 44)

As such, although there is ambiguity about what specifically is meant by "economic stability," by any definition it does not seem likely that ecological forestry on O&C lands will be able to achieve it.[81]

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[81] In addition, all of the concerns and caveats about social acceptability, discussed above in the legal version of the "sustained yield" argument, also apply here.

In short, the vast majority of the premises in this argument are questionable on either empirical or normative grounds. However, the argument does suggest two key points. First, to restore economic stability to rural communities, we need, first and foremost, to define “economic stability” operationally by setting specific goals and criteria for success. And second, if after careful consideration we decide that there is in fact a moral imperative to uphold justice by restoring economic stability to the O&C counties, efforts might better be directed toward finding an alternative, non-timber economic base.

The “keep public lands public” argument

Although an argument suggesting that ecological forestry be used to keep public lands from being privatized appears nowhere in the scholarly literature, and is present only as an undercurrent of some of the public discourse, two of my experts (both well-respected forest ecologists) indicated either on the Argument Selection survey or via personal correspondence that it is perhaps the single most important argument underlying proposals for ecological forestry in western Oregon. As such, working largely on insights from conversations with experts, as well as occasional hints in some of the popular media, I constructed the following argument:

P1: Given our current trajectory, the flow of timber from public lands in the Pacific Northwest will be critically reduced in 15-20 years.
P2: With a critically reduced flow of timber, there may be a societal backlash, putting public lands at risk of privatization.
P3: Producing a higher continuous flow of timber than is currently projected to occur on public lands in the future will avert societal backlash, and reduce the risk of privatization.
P4: Management of public forests should reflect the public interest.
P5: It is in the public interest for currently public lands to remain public.
C1: Therefore, public lands in the Pacific Northwest should be managed to produce a higher continuous flow of timber than is currently projected to occur on

public lands in the future, to avert societal backlash and reduce the risk of privatization.

P6: Managing some public lands using ecological forestry will produce a higher continuous flow of timber than is currently projected to occur on public lands in the future, thereby averting societal backlash and reducing the risk of privatization.

C2: Therefore, some public lands in the Pacific Northwest should be managed using ecological forestry.

P1 is true to at least some extent. Since the implementation of the NWFP in 1994, active management on federal lands has been limited predominantly to thinning in young (under 80 years old), previously harvested stands (Thomas et al., 2006). Harvest in forests over 80 years of age has generally been blocked by litigation tied to the ESA and the survey and manage clause of the NWFP (Thomas et al., 2006), and regeneration harvest on all federal lands in the region of the NWFP has been extremely limited (Charnley, 2006; Tuchmann & Davis, 2013). At current levels of activity, the young stands currently being thinned on BLM lands will pass the *de facto* 80-year threshold over the next two decades (Tuchmann & Davis, 2013), at which point harvest levels will drop considerably, with a far less consistent flow of timber coming in spurts only from some of the younger forests harvested in the 1970s, 1980s, and early 1990s, as they are ready for thinning (personal correspondence with Expert H).

P2 is of course accurate as stated, since it would be difficult to prove that there is no chance whatsoever of a societal backlash in the future. However, the critical questions to ask are 1) what is the nature of this alleged backlash; 2) what is the likelihood that it will occur; and 3) if the backlash does occur, what are the chances that it will put public lands at risk of privatization? The notion of societal backlash is occasionally implied in writing, but never clearly articulated. For example, Deal (2012) wrote in Western Forester about the "fiscal crisis for rural counties that historically depended on timber revenues from federal lands. This fiscal crisis may force stakeholders to come to a new agreement, but time is running short for a long-term solution" (p. 6). In public media there is periodic reference made to "gridlock" (Fattig 2012; Office of Senator Ron Wyden, 2014, n.d.). Secretary Salazar similarly pronounced, "It is time to move beyond the endless lawsuits and court battles that have tied Oregon forests in knots for decades" (US Department of the Interior, 2012, para. 2). In what is perhaps the most explicit statement of the sentiment, John Kober of the Pacific Rivers Council is reported to have said, "'You either support it [ecological forestry] or support sticking with the status quo'…adding that the status quo is risky since it could lead to a political backlash in hard-pressed rural communities resulting in real damage to existing environmental protections" (Mapes, 2013, para. 8).

These murmurings suggest some sort of unease about the current situation, which is somehow tied to what will happen when timber production on public lands drops in the future. The exact nature of this unease, however, remains rather mysterious. It seems doubtful that it would be related to the supply of timber and wood products, since the vast majority of timber in Oregon is produced on private lands, with just over 10% coming from federal lands (4.5% from the BLM) in 2008 (Gale et al., 2012). A more plausible reason for backlash might be a loss of employment. Estimates in 2012 suggested that 8.2 jobs are created for every million board feet harvested (Zhou, 2013), so the loss of roughly 400 million board feet per year on federal lands in Oregon would equate to the loss of about 3,280 jobs (Gale et al., 2012).[82] Clearly the loss of over 3,200 jobs would have a significant social impact, but would it lead to demands that public lands be privatized? Although it is impossible to answer this question definitively, there seems to be evidence to the contrary. Ribe and Silvaggio (2002), for example, found strong opposition to the idea of privatizing public lands in a wide sampling of the public from Oregon and Washington. In addition, although the DeFazio bill preceding Wyden's O&C Act suggested transferring some of the public O&C lands into trusts to be managed by

[82] This figure assumes a complete halt of harvest on BLM lands, which is not considered likely (personal correspondence with Experts H and I).

the state for sustainable timber production (Office of Congressman Peter DeFazio, n.d.), the bill never gained enough support to pass through the Senate, suggesting that privatizing public lands is not viewed as a viable option. The risk of privatization therefore seems minimal, if only on the basis of what appears to be a lack of support for the idea, and although we certainly cannot completely rule out the possibility of societal backlash with calls for privatization of public land, neither do we have enough evidence to assert that there is any likelihood it will occur.

P3, like P2 before it, is speculative, and would depend in large part on the nature of the purported backlash. Even assuming that the backlash will occur simply from a decline in the amount of timber harvested on federal lands, a continuous flow of timber that is higher than current projections is not necessarily equivalent to the amount of timber that would be necessary to avert a backlash. For example, 100 extra board feet per year could count as a "higher continuous flow," but would such a small increase be sufficient to prevent a backlash from occurring? Probably not. Would an extra 100 million board feet per year be sufficient? Possibly, but it is still impossible to say without a better understanding of the backlash. Thus, while P3 may be generally true, the amount of timber that counts as a "higher" continuous flow needs to be quantified before we can evaluate whether it will be sufficient to avert the future societal backlash (assuming a backlash will in fact occur if timber flows decline in the future, as currently projected).

Turning now to P4, it seems true that lands supported by public tax dollars should be managed in the public interest, a premise that was confirmed by expert opinion to be true and non-controversial. The point of controversy would of course be over different interpretations of what is in "the public interest." Luckily, in this argument we are given two relevant options: it is in the public interest either that public lands remain public, or that at least some of them be privatized. P5 asserts that the former is preferable, a position that is probably widely accepted, but also debatable in certain circles. For example, resource-dependent communities are sometimes skeptical of federal control, favoring local autonomy over the natural resources they directly manage and rely on (Raedeke et al., 2000; Weeks & Packard, 1997).[83] It seems likely, therefore, that at least some people would disagree that keeping public lands public is in their interest. While this is a discussion beyond the scope of the current chapter, I will note that if there is in fact a high likelihood of societal backlash and calls to privatize public lands, P5 merits much further consideration. This would need to include discussion about whose interests are at stake, and what the potential impacts of privatizing federal forests in the Pacific Northwest might be at local as well as larger regional, national, or even global scales, in both the short and the long term.

Finally, even if all of the previous premises were true and non-controversial, it still remains uncertain whether using ecological forestry would offset future societal backlash, as asserted in P6. First of all, without understanding what the backlash will be about (and therefore what would prevent it from occurring), it is impossible to determine whether ecological forestry in fact represents an effective solution for deterring it. However, again assuming for the sake of argument that we know the backlash will occur unless some particular amount of timber is produced every year into the foreseeable future, it is still not at all obvious that the amount of timber delivered by ecological forestry would meet these production quotas. As discussed above, the levels of timber projected from using ecological forestry in western Oregon are modest by all accounts (Headwaters Economics, 2013; Johnson, 2013), especially given the fact that it is being proposed only on some select portion of public lands. The 2015 O&C Act proposes to harvest 4-6% of the Moist Forestry Emphasis areas every five years (S.132, 2015), a decidedly small proportion of the land base that does not seem likely to produce an amount of timber significant enough to offset whatever harms or discontents are expected to instigate the alleged backlash. I will also reiterate that the amounts of timber and revenue projected to flow from ecological forestry on O&C lands are not even close to historic levels, and

[83] This is particularly true in the western United States, where there has been a long history of conflict between those of a more libertarian bent seeking control over local lands and the federal government, in a series of struggles known as the Sagebrush Rebellions (Davis, 2001).

in fact would require continuing compensation to generate as much income as the counties have received over the past 15 years from the Secure Rural Schools funds (Headwaters Economics, 2013). As such, while perhaps much higher levels of timber would curtail a social backlash, if it were indeed immanent, it seems unlikely that the relatively small increases that would probably occur under an ecological forestry approach would prevent the backlash from occurring.

Another idea to be explored, however, is whether the mere act of restoring or maintaining some continuous timber production on federal lands as a *symbolic* act would be enough to quell any social dissatisfaction, and thereby avert future backlash. This idea was suggested to me by one of the experts with whom I consulted. I will make two points about it. First, the argument that such a symbolic act would be somehow socially cathartic rests upon an assumption about what the public wants. Unfortunately, recent (i.e. in the past ten years) social science about environmental values and attitudes toward natural resource management in the Pacific Northwest is fairly limited (for some examples of older work, see Loomis, González-Cabán, & Gregory, 1996; Proctor, 1998; Steel, List, & Shindler, 1994; Steel, Lovrich, & O'Toole, 1999).[84] As such, we do not currently know whether there is widespread demand for more harvest than is presently occurring on federal lands; that further reducing those levels will generate widespread discontent; or that increasing those levels will generate broad approval. In fact, in a study of community members from the McKenzie watershed in the Oregon Cascades, Shindler and Mallon (2009) found that about half of the respondents indicated a

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[84] Although it may seem unreasonable for me to suggest that some of the older information about values is insufficient, there is some evidence that values and attitudes about management objectives might not be stable. Montgomery and Helvoigt (2006), for example, found that public support for salmon protection, measured by willingness to pay, declined over the course of only eight years. The point is that my emphasis on the need for more current work is not arbitrary, and that there is a genuine need for more thorough and consistent work tracking environmental values and attitudes about natural resource management in the Pacific Northwest. However, there is also a need to determine at what temporal scales shifts in public values should be considered relevant to management. Should managers respond to short-term fluctuations, or only to more stable trends measured over some longer period of time? These are some of the normative questions that need to be answered in deciding what it means for management to reflect public values.

preference for management pursuing environmental over economic objectives. However, they also found some support for a balance between the two (Shindler & Mallon, 2009), a trend also reported by Ribe (2006) and Charnley and Donoghue (2006). Older work by Ribe and Matteson (2002) also showed that people in the Pacific Northwest who were not aligned with either timber or environmentalist groups were generally moderate, with a tendency toward pro-environmental attitudes. Swedeen (2006) reported that forest stakeholders in Washington largely agreed that federal lands should be managed for biodiversity and restoration of old-growth, and a more recent survey by Pew Charitable Trusts (2013) found that 59% of Oregonians identified old-growth, water, and wildlife protection as management priorities. However, in the same survey, 40% of the respondents said that ensuring the future of logging jobs and the timber economy should be a management priority (Pew Charitable Trusts, 2013).

While existing data tentatively suggests that a slight majority of certain publics may generally support environmental protection over economic gain, without more precise research designed to help us understand how people want management objectives in federal forests to be prioritized, it is difficult to know how these generalized values and attitudes translate into support for specific actions. Research in which people are asked explicitly about tradeoffs between objectives is extremely limited. As a rare example, Ribe and Silvaggio (2002) asked people to weigh different management objectives against one another by reporting agreement or disagreement with a series of statements, such as, "National forests should supply all the timber needed by existing mills. Other resources should be provided as much as possible only after that goal is met" (p. 64). A clear majority (80%) of respondents disagreed with this statement, but responses to other scenarios were often more mixed. For example, 52% of respondents generally disagreed with the statement, "National Forests should produce as much timber as possible now without impairing the ability of the forests to produce an adequate amount of timber and other resource values that may be needed in the future," but 30%

generally agreed with it (Ribe & Silvaggio, 2002, p. 69). To my knowledge, the only example of more recent work touching on the idea of tradeoffs was done by the Oregon Values and Beliefs Project (2013), which found that 57% of Oregonians support environmental protection even at the expense of economic growth, while 35% would prioritize economic growth even if the environment is somehow compromised.

If nothing else, existing empirical evidence shows that public values for forests and attitudes about forest management are complicated. As such, I would suggest that we might need a more systematic program of sociological inquiry to determine 1) how and why people in different interest groups, as well as people unaligned with interest groups, value forests; and 2) how and why they want specific objectives to be managed (and prioritized) on public lands. These are important gaps that need to be filled in order to understand the soundness of the "keeping public lands public" argument, along with several of the arguments throughout this chapter that are also premised on sociological claims about what people want from management of federal forests. However, I would speculate, on the basis of the work discussed above, that in many cases public opinion will not point in an obvious direction for federal forest management. In other words, people are likely to be pluralistic (Gore, Nelson, Vucetich, Smith, & Clark, 2011), and in many cases their values, attitudes, preferences, and opinions may not clearly converge around a single point (e.g. Ribe & Silvaggio, 2002). As such, even with the most current and accurate social science possible, managers and decision-makers will still have to grapple with challenging normative questions about how conflicting values and objectives should be appropriately balanced on public lands.

Returning now to the issue of the symbolic act, in order to evaluate whether it is necessary and appropriate, we need to find out for whom, to what extent, and why there is support for timber production (and how much) on federal lands. These are empirical questions. Once we have clear answers to these questions, we would then need to determine whether and why the support that does exist for increasing harvest on federal lands justifies using ecological forestry as a symbolic act. This is a normative question, which brings me to the second point I will make about a symbolic act. Assuming there is public support, at least among some groups, for higher and/or continuing timber harvest on O&C lands, then an argument about using ecological forestry as a symbolic act would rest on a premise stating that making a gesture with little practical benefit, enacted only to mollify certain interests, justifies potential harm to the Pacific Northwest landscape and biodiversity. In other words:

P1: As a symbolic gesture, ecological forestry will suffice to satisfy the public value for timber production on O&C lands.

P2: Public lands should be managed to satisfy public values, as long as there is no good reason not to do so.

P3: The potential risks to the forest landscape and its biodiversity resulting from use of ecological forestry on O&C lands is not a good reason not to satisfy the public value for timber production on O&C lands.

C: Therefore, we should use ecological forestry to make a symbolic gesture to satisfy the public value for timber production on O&C lands.

I will assume that the empirical questions listed above have been answered, and that some certain amount of timber produced by ecological forestry has been established as an acceptable gesture, making P1 true. I will also assume that P2 is true (although it may be questionable for reasons discussed elsewhere in this chapter), so that I can instead focus on P3. To assess this premise we would first need to know the actual likelihood, nature, and extent of harm to the landscape and its biodiversity that may result from the use of ecological forestry on the O&C lands. These are current research gaps that might be addressed by more focused modeling studies examining the likely impacts of proposed ecological forestry management treatments on particular species or environmental variables of interest in the Pacific Northwest. Assessing P3 would also require sociological information of the sort highlighted above, namely, who values timber production on federal lands (and how much), to what extent, and why. However, even with these key information gaps filled, P3 is fundamentally a normative claim about acceptable levels of risk, requiring us to weigh the value of a symbolic gesture for certain groups of people against potential threats to forests and their biodiversity. As such, the premise would likely remain highly controversial. Nonetheless, open discussion and debate over P3 would require all those with interests at stake to clearly state and justify their opinions in a transparent process that at the very least might lead to a more informed and carefully considered decision.

To briefly summarize, the assumptions and ambiguities in the "keep public lands public" argument make it difficult to assess, not least of all because the argument is never actually articulated in writing. Without a clear understanding of the future backlash or what might avert it, we are entirely unequipped to ascertain whether it is likely and, if so, whether ecological forestry can prevent it from occurring. If this argument is in fact the backbone of the case for ecological forestry on O&C lands, far more explanation is needed before it becomes a sound argument justifying a good decision.

The "old-growth conservation" argument

In the original table of reasons on the Argument Selection survey, I presented experts with two potential branches of a pro-ecological forestry conservation argument: 1) conservation of threatened and endangered biodiversity; and 2) conservation of old trees and old-growth forests. Although I identified two separate reasons in the table, I was not certain whether there was actually a difference between conservation of threatened and endangered species and conservation of old-growth, or whether one was more influential than the other. The experts provided useful feedback, overall rating the old-growth conservation reason very highly (second only to the sustained yield argument). Written commentary from the experts also emphasized the importance of the conservation arguments to the discourse. However, because the experts' feedback did not clearly indicate that one conservation argument is more important than the other, I chose to focus on what I assumed to be the more generalized argument about old-growth conservation, since people arguing for the conservation of old-growth are probably also motivated by concern for threatened and endangered late-successional species.

Johnson and Franklin (2009) list "conserving old growth forest and trees" as one of their "key goals" (p. 11), but generally their reports focus much more on silvicultural practices to increase timber harvest or create complex early seral conditions on the landscape. As such, I originally put together the argument for old-growth conservation largely through informed guesswork, as follows:

P1: In the Pacific Northwest, late-successional species are threatened by habitat loss.
P2: It is possible to reverse this habitat loss by restoring late-successional/old-growth habitat to the Pacific Northwest.
P3: People in the Pacific Northwest want federal forests to be managed for conservation of threatened and endangered late-successional species.
P4: Management objectives on public lands should reflect public values.
C1: Therefore, federal forests in the Pacific Northwest should be managed for conservation of threatened and endangered late-successional species, by restoring late-successional/old-growth habitat.
P5: By managing federal forests with ecological forestry, late-successional/old-growth habitat will be restored to the Pacific Northwest.
C2: Therefore, federal forests in the Pacific Northwest should be managed using ecological forestry.

When I sent this argument back to three experts for review, they gave me very mixed responses. One expert suggested minor adjustments in wording, but thought the argument was generally accurate. The other two experts, however, expressed apprehensions over the idea of ecological forestry as a strategy for old-growth conservation. Two of their comments were particularly useful as I developed the final version of the argument shown below. One expert wrote, "The assumption is that [ecological forestry] is the only way to manage for and restore [late-successional-old-growth]. It depends on the characterization and definition of [ecological forestry], which has not been defined in this set of [premises].” The other useful comment was, “if [ecological forestry] contributes to the restoration of old growth it does so only indirectly.” Upon reflection, I realized that the confusion about ecological forestry and old-growth conservation is rooted in different conceptualizations of ecological forestry. On the one hand, as a set of practices (e.g. variable retention harvest, variable density thinning, long rotations), ecological forestry is akin to a silvicultural system (Puettmann et al., 2009). In this sense, it would be difficult to understand how ecological forestry- an active management strategy and ultimately a method of harvest- could achieve old-growth conservation. On the other hand, ecological forestry is presented as a philosophy of forest management (Franklin & Johnson, 2013; *S.1784: The O&C Land Grant Act, 2014*). In this sense, old-growth conservation is part of an overarching ecological forestry approach to management and conservation of the Pacific Northwest landscape. In my original formulation of the old-growth conservation argument, I presented ecological forestry only as a philosophy, which is likely to create confusion if people are also or only thinking about ecological forestry as a set of active management practices. Therefore, the entire argument for old-growth conservation needed to change, to capture the silvicultural angle but also show how ecological forestry is justified as an overarching old-growth conservation strategy. The result is as follows:

P1: People in the Pacific Northwest value old-growth conservation.
P2: Management objectives on federal forests should reflect public values.
C1: Therefore, federal forests in the Pacific Northwest should be managed for old-growth conservation.
P3: Legally, a sustained yield of timber must be produced on BLM O&C lands.
P4: On the current trajectory, the flow of timber from thinning young stands on BLM O&C lands will be critically reduced in 15-20 years.
P5: When the flow of timber becomes critically reduced, old-growth on O&C lands will be at risk of harvest.
P6: The risk of harvesting old-growth on O&C lands should be removed.

P7: Federal forests should be managed in a way that both removes risk to old-growth and follows the law.
P8: Using ecological forestry, BLM O&C lands can be managed to produce a sustained yield of timber from young stands, thereby following the law and removing the risk of harvest in old-growth.
C2: Therefore, BLM O&C lands should be managed using ecological forestry.

Unlike the first version of the argument, this argument represents ecological forestry as a set of tools that can be used to achieve a legally mandated sustained yield of timber, but it also situates these tools in a context in which they are being used to achieve old-growth conservation.

To the extent that we have accurate and current empirical information (discussed above), P1 seems to be correct (Pew Charitable Trusts, 2013; Shindler & Mallon, 2009; see also Ribe & Matteson, 2002; Ribe & Silvaggio, 2002) and is generally accepted as true (Spies & Duncan, 2009), although the premise does not specify how much or in what capacity people value old-growth conservation relative to other values and objectives. P2 also seems to be true and non-controversial, at least in a general sense. If we accept that both P1 and P2 are true, it indeed seems that conservation of old-growth should be (to some unspecified extent) achieved by federal forest management, as stated in C1.

P3 is verifiably true. To reiterate, the 1937 O&C Act mandates that the O&C lands be managed "for permanent forest production, and the timber thereon shall be sold, cut, and removed in conformity with the principal of sustained yield for the purpose of providing a permanent source of timber supply" (H.R.7618, 1937, para. 1). As discussed earlier, it remains to be seen how much precedence that law has over subsequent environmental legislation, most notably the ESA. I will also reiterate that the O&C Act of 1937 fails to specify what quantity of timber must be produced to qualify as a "sustained yield."

P4 also seems true (Tuchmann & Davis, 2013), as discussed above. However, it is not clear that there is any "critical" threshold below which some series of negative consequences will begin to unfold. Even more questionable is the notion that such a series of negative consequences would represent a threat to old-growth, as stated in P5. In fact, it is somewhat self-contradictory for the argument to on the one hand state that because people value old-growth, old-growth should be protected (P1-C1), and on the other hand suggest that old-growth will be put at risk when harvest levels drop in the future (P5). Assuming that the only way old-growth will be at risk is if it is no longer valued by a significant (or at least outspoken) portion of the public- a debatable but probably fair assumption- P5 essentially states that if timber levels decline, social commitment to old-growth conservation will waver. Keeping in mind the assertion in P2 that management of public lands should reflect public values, it would seem that, were the public to decide that old-growth conservation is less important than a continuing supply of timber in the future, harvest of old-growth would be justified as a reflection of public values. If this is the logic underlying the old-growth conservation argument, ecological forestry is essentially being advanced as insurance against fickle and presumably fluctuating human values: rather than putting ourselves in a situation in which we may be tempted to relinquish our commitment to old-growth conservation, ecological forestry proposes to avoid the situation altogether. This line of reasoning puts little faith in people and their values, and I will tentatively if also somewhat optimistically point out that, given what appears to be a staunch public commitment to old-growth conservation (with the caveat, again, that empirical work is relatively limited), it seems reasonable to assume that harvest of old-growth forests in the future will be as difficult to push through litigation as it is under the current policy framework. In other words, there is no reason to believe old-growth in the future will be more at risk than it is at present. The question, therefore, is whether old-growth is currently at a significant level of risk that needs to be reduced. There are certainly some who believe so, and are devoted to taking old-growth definitively “off the table” (personal correspondence, Expert B and Expert F), an agenda that is in fact stated as an aim of the most recent O&C legislation (Office of Senator Ron

Wyden, 2015). Whether this elimination of risk is a reasonable desire, and one that justifies the use of ecological forestry, merits further discussion.

To further contest the truth of P5, I will also point out that harvesting old-growth is not the only conceivable future response to a "critical reduction" in timber. An alternative would be regeneration harvest in younger stands. The USDA Forest Service Planning Rule (2012) specifies that trees are not supposed to be harvested for commercial purposes before they reach the culmination of mean annual increment. Thus, technically, harvesting young forests runs contrary to mandate, while there are no legal constraints against harvesting old-growth on matrix lands under the NWFP. Nonetheless, given what at least appears to be the prevailing social climate, it seems far more likely that, should the need arise, the stipulations of the Planning Rule would be overruled instead of the ESA (which would hypothetically be invoked, as it has for the past 20 years, to prevent harvest in old-growth forests).[85]

At this point it seems reasonable to note that ecological forestry essentially proposes to conduct regeneration harvests proactively in stands that have both generally passed the culmination of mean annual increment and are not yet considered old-growth. The question, therefore, is whether on the current trajectory there will actually be some sort of a critical juncture when timber production on federal lands slows in the future. If so, we basically have a choice between regeneration harvest now in slightly older young stands, or regeneration harvest later in slightly younger young stands. Once again, the relative merits and deficiencies of these two approaches should be openly examined and discussed, without losing sight of the fact that the nature of the alleged critical juncture is nebulous and its occurrence speculative (unless or until more information is provided about it). Therefore, before a decision is made, it might be prudent to at

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[85] The rule about regeneration harvest in young forests does not apply when harvest is conducted for non-economic reasons (USDA Forest Service, 2012). It is therefore relatively easy to imagine that future harvests in young stands could be justified primarily for early seral or meadow restoration, with timber as a byproduct.

least do some work to determine how people feel about timber harvest now and in the future, relative to how they value federal forests generally and old-growth in particular. With this baseline knowledge, it would be far easier to assess the actual degree of risk that there will be a future crisis putting either very young or (less likely) very old forests at risk, and therefore easier to determine whether there is need for current preventative action (i.e. ecological forestry). Without this baseline knowledge, the only evidence we have to assess P5 is anecdotal.

P6 is not obviously true or false. While in general it might be nice to remove all risk to old-growth, the appropriateness of removing all risk would depend on the level of risk actually posed to old-growth, as well as other consequences of preventing that risk, in this case by using ecological forestry on O&C lands. I have already addressed the former point, so I will comment now on the latter. Possible consequences might be biophysical impacts, such as on water quality, carbon storage, or landscape resilience. However, there might also be consequences for future old-growth forests. Conducting regeneration harvest in younger forests will (arguably) delay these stands from developing into mature and old-growth forest (but see the "future old-growth" argument below for further discussion). If this is indeed the case, the question to ask is whether preventing risk to extant old-growth justifies delaying development of future old-growth. This is a complex ethical question, analogous in many ways to the challenging questions about the duty of current generations of people to protect the welfare of future generations (e.g. Johnson, 2003; Norton, 1982; Page, 2006). It is not my place or within my ability to make a meaningful contribution to that conversation here, so I will once again merely note that the issue is an important one, which needs to be acknowledged and discussed thoroughly before decisions about ecological forestry and old-growth are made.

I will also point out that P6 redefines the value of old-growth established earlier in the argument. In effect P6 asserts that, regardless of the will of the public, existing old-growth forest *should not be* at risk of harvest, period. The argument therefore shifts from anthropocentrically identifying the instrumental value of old-growth as one of a plurality of human values (P1), to identifying the intrinsic value of old-growth (P6). It would be difficult to justify P6 any other way. P5 suggests that in the future people will no longer value old-growth as they do today, and so fail to champion its protection. However, P6 asserts that old-growth should still be protected, a line of reasoning that would not be readily justified from an anthropocentric, instrumental value perspective.[86] In other words, if the imperative to protect old-growth were only rooted in public values, P6 would not be commensurable with P5, and the argument would fall apart. Therefore, for the argument as a whole to be internally consistent, P6 needs to be motivated by intrinsic value. Although some may contend that being motivated by intrinsic value makes the premise more controversial, on the assumption that people are generally oriented toward anthropocentric values (Marvier & Wong, 2012), recent work suggests that this may not be the case (Vucetich et al., 2015). To know whether P5 would turn out to be controversial from an ethical perspective, therefore, would require an understanding of how people in the Pacific Northwest value forests, an empirical question that merits exploration.

As noted in the legal argument above, the extent to which old-growth conservation should be maintained if it conflicts with sustained yield laws remains

[86] P6 could still theoretically be motivated by instrumental value if it were based on the assertion that old-growth provides goods and services that are essential to people. However, for this to work, it would have to be the case, once again, that in the future people will be unaware of or unresponsive to their own need for old-growth conservation, since P5 establishes that people in the future will consider harvesting old-growth, theoretically risking their own wellbeing. In this case, P6 would need to be prefaced by two more premises stating that 1) people should not risk their own wellbeing, and 2) old-growth is essential to human wellbeing, and therefore (P6) old-growth forests should not be put at risk. Instead of this complex and circuitous line of reasoning, P6 resting on the intrinsic value of old-growth forests seems to make more sense, at least in my mind. If this is the case, and old-growth conservation is motivated by intrinsic value, P1-C1 actually become unnecessary. However, I will also note that P1 might actually be a statement that people value old-growth forests intrinsically, in which case P5 would still work, since attributing intrinsic value does not necessarily mean intrinsic value will always be prioritized over other instrumental values such as timber production (Vucetich et al., 2015). In other words, people might reasonably consider harvesting in old-growth even while acknowledging its intrinsic value. However, P6 would still pull a trump card, essentially saying that the intrinsic value of old-growth forests *should* in fact be upheld over and against their instrumental (in this case, economic) values, to the extent that they should not even be put at risk of harvest.

to be settled. P7, therefore, is generally agreeable and non-controversial if read as a statement of an ideal, but there are likely to be conflicting ideas about what it means in practice. However, the potential divergence of opinion about P7 becomes less problematic with P8, where ecological forestry is proposed as a practical solution by which both legality and old-growth conservation can be achieved. As I discussed earlier (see the legal form of the "sustained yield" argument), this is a largely untested claim about social acceptability, since in terms of logistics and in the absence of litigious obstruction, ecological forestry would clearly be capable of producing a sustained yield of timber from a given land base. The other uncertainty is whether enough timber would be produced to meet the sustained yield mandate of the O&C Act, a question that can only be answered by establishing a clear definition of "sustained yield." If ecological forestry is not able to produce an amount of timber that meets a settled-upon definition of "sustained yield;" or if in the current social climate ecological forestry is incapable of conducting harvests that will not be blocked by legal action on the grounds of the ESA; then ecological forestry cannot effectively remove the (hypothetical) risk that old-growth on O&C lands will be harvested to supply higher volumes of timber in the future.

Overall, this argument rests upon ambiguous and largely speculative claims about the current and future risks facing old-growth. For the argument to be sound, three conditions would have to be met: 1) there would need to be a credible risk that people will no longer value old-growth in the future, to the extent that they will consider harvesting it when timber volumes drop in 15 to 20 years; 2) we would need to agree that old-growth forests hold intrinsic value that should be protected under all circumstances; and 3) ecological forestry would need to be able to produce a socially acceptable sustained yield of timber. Without knowing whether and to what extent these conditions are met, I cannot at present assess this as a sound argument.

The "restoration of early seral" argument.

I originally identified two versions of a pro-ecological forestry early seral argument, one about creating landscape heterogeneity, and the other about creating habitat for early seral species. Both versions appear in the scholarly literature (Franklin & Johnson, 2012, 2013; Johnson & Franklin, 2012, 2013) and congressional hearings (*Challenges and Opportunities*, 2013b; *S.1784: The O&C Land Grant Act of 2013,* 2014). However, I was surprised to discover that discussion of early seral is at least thus far generally absent from the public discourse, a finding confirmed by conversing with one of my experts. I was therefore unsure whether I should pursue these arguments for analysis, especially after they received relatively low ratings from experts on the Argument Selection survey. Nonetheless, after reflection I decided I would be remiss if I did not address at least some part of the pro-ecological forestry early seral argument, since one of the tenets of ecological forestry is that, "timber harvests will be difficult to implement unless there are evident *ecological* and social benefits" (*Challenges and Opportunities*, 2013b, p. 20; emphasis added), and restoration of complex early seral conditions is arguably the key "ecological contribution" used to justify variable retention regeneration harvest (Johnson & Franklin, 2009, p. 54). Both versions of the early seral argument (heterogeneity and biodiversity) received roughly equal ratings from experts, so I opted to focus on biodiversity, speculating that it is likely to be of greater public interest than landscape heterogeneity and resilience. The argument I formulated about early seral biodiversity is as follows:

P1: Certain types of biodiversity ("early seral species") depend on complex early seral ecosystems for habitat.
P2: On the current management trajectory, the currently inadequate amounts of complex early seral habitat in the Pacific Northwest will not increase, sustaining the threat of habitat loss to early seral species.
P3: If possible, we should protect species from the threat of habitat loss by providing them with adequate amounts of habitat.

P4: By managing federal forestlands using ecological forestry, we can provide adequate amounts of complex early seral habitat for early seral species in the Pacific Northwest.

C: Therefore, we should manage federal forestlands in the Pacific Northwest using ecological forestry.

The weaknesses in this argument are largely related to limitations in empirical knowledge. P1, for example, is unclear because, while it is certainly true that various species associate with complex early seral habitat (Swanson et al., 2011) it is not at all clear that they depend upon it exclusively (Swanson, Studevant, Campbell, & Donato, 2014). I will address this point more thoroughly below.

P2 has multiple steps, so I will go through them individually. First, the "current management trajectory" assumes that the NWFP will continue to be implemented as it has been for the past 20 years, i.e. with harvest on federal lands limited to thinning in young stands only (Thomas et al., 2006). The current trajectory would also include current fire suppression and post-disturbance logging activities, as well as climate change estimates that predict a higher occurrence of wildfire in a hotter, drier future climate (Mori et al., 2013). Without significant social or political change, the proportion of early seral conditions on the landscape and their rate of formation are, as stated in P2, not likely to increase. In fact, Spies et al. (2007) project declines in the amount of diverse (i.e. complex) early seral conditions in the Oregon Coast Range over the next century. However, climate change introduces a degree of uncertainty, since arguably a higher occurrence of fire will also generate a higher abundance of natural complex early seral conditions in the future (Swanson, 2012). Whether they endure on the landscape, however, will again depend on social factors, namely whether and to what extent post-disturbance logging is implemented.

The truth of the proposition in P2 that complex early seral habitat is currently inadequate is still somewhat unclear. If we assume that "adequate" is the amount of complex early seral habitat needed to conserve early seral species- a figure presumably estimated on the basis of the historic range of variability- there is not enough accurate information to assess the truth of this premise, at least as of now. Estimates for historic amounts of early seral are difficult to attain, given a high degree of variation in how long recently disturbed areas take to achieve canopy closure (Swanson, 2012).[87] General estimates for historic early seral conditions in the Pacific Northwest range from 5-20% of the landscape (Swanson, 2012). Takaoka and Swanson (2008) found that open meadow conditions and shrub fields (types of complex early seral habitat) dropped from 5.5% to 2.5% between 1946 and 2000 in the Oregon Cascades, while Kennedy and Spies (2004) found similar declines in shrubs and herbs between 1939 and 1993 in the Oregon Coast Range. Spies et al. (2007) estimated that approximately 2% of the forest landscape in the Oregon Coast Range is currently in complex early seral conditions. However, estimates for the current amount of early seral conditions across the overall NWFP landscape, or on BLM lands in particular, have not been made. Thus, there is tentative but not conclusive evidence that complex early seral conditions in the Pacific Northwest are limited relative to historic levels.

The final leg of P2 asserts that early seral species are threatened by habitat loss. I will first note that information about the resource and habitat needs of many early seral species is quite scarce (Swanson et al., 2014), so questions about the extent to which they rely on early seral habitat are as yet largely unanswered. Swanson et al. (2014) assert that numerous species prefer or are associated with complex early seral conditions, and they estimate that 22 wildlife species of conservation interest (i.e. threatened or endangered) are obligates of early seral forest ecosystems (i.e. they can survive only in early seral conditions). However, Swanson et al. (2014) included both conditions following natural disturbances and conditions following clearcuts in their classification of “early seral forest ecosystems.” To know whether these species are specifically dependent on complex

[87] Disagreements over what counts as “early seral” may also be complicating efforts to quantify its present and historic occurrences.

early seral conditions, and might therefore be threatened if complex early seral conditions are decreasing, we would need to know whether there are differences significant to these species between natural complex early seral conditions and the open conditions following harvest (Swanson et al., 2014). There is considerable evidence suggesting that the observed richness of some taxonomic groups is different in young intensively managed forests, compared with young unmanaged forests (Paillet et al., 2009). There is also evidence that some species are more abundant in certain types of early seral conditions. Betts et al. (2010), for example, observed that some bird species have a higher likelihood of occurrence where early seral broadleaf conditions (a type of complex early seral habitat) are present, a finding that suggests these species might be at risk of habitat loss if broadleaf early seral conditions continue to decline. However, the extent to which species respond to post-anthropogenic harvest conditions differently than they respond to post-natural disturbance conditions tends to vary by species (e.g., Boan, McLaren, & Malcolm, 2011; Chaundy-Smart, Smith, Malcolm, & Bellocq, 2012; Hodson, Fortin, & Bélanger, 2011; Payer & Harrison, 2000; Simon, Stratton, Forbes, & Schwab, 2002; Spear & Storfer, 2010; Strojny & Hunter, 2010; Van Wilgenburg & Hobson, 2008; Zwolak, 2009). Altogether, the studies directly comparing wildlife species' responses to conditions following natural disturbance with conditions following anthropogenic harvest suggest that there is no single answer to the question of whether species rely specifically on natural complex early seral conditions. Therefore, to assess P2, we would need to 1) decide which species are particularly of interest; 2) determine the extent to which those species are dependent on natural complex early seral conditions as opposed to other post-harvest early seral conditions; and 3) ascertain whether there are sufficient amounts of whichever types of early seral can support those species across the landscape.

P3 is a highly precautionary normative premise, essentially asserting that efforts to protect species should be made even if they are not already necessary (in the sense that species are not listed under the ESA). This is a relatively liberal view that seems to conflict with much of the Johnson and Franklin ecological forestry plan, which actually seeks to increase the level of risk tolerated for species protected by the survey and manage clause of the NWFP (see Chapter One). P3 would likely inspire disagreement largely related to the meaning of the phrase "if possible." For example, from a perspective concerned primarily with de-listing the Northern Spotted Owl, it may not seem possible to proactively protect early seral species in the Pacific Northwest, if protecting early seral habitat might conflict with restoration of spotted owl habitat.[88] From a different perspective, perhaps of a deer hunting or butterfly enthusiast, it may seem very possible and indeed desirable to lower risk to early seral species of interest, even if it entails a higher degree of risk for late-successional species. Therefore, while it might be broadly true that species should be protected proactively if possible- a claim that, in its generality, is likely to be disputed by few- the premise is controversial because different people may have different beliefs about when proactive conservation of early seral species would or would not be possible.

Finally, P4 is questionable on empirical grounds, since ecological forestry's ability to actually create complex early seral conditions that support the range of complex early seral-associated species that would be present following natural disturbance has not been verified. While there is at this point a body of work comparing the effects of variable retention harvest on biodiversity against clearcuts or unharvested forests (e.g., Fedrowitz et al., 2014; Lindenmayer et al., 2012; Mori & Kitagawa, 2014; Rosenvald & Löhmus, 2008), I am aware of only very limited work directly comparing the impacts of retention harvest against the post-natural disturbance complex early seral conditions it is designed to emulate (Huggard et al.,

[88] The answer in ecological forestry is, of course, that early seral species can be proactively protected without compromising late-successional species, an empirical claim that remains to be validated.

2015; Robertson & Hutto, 2007; see also Swanson, 2012; Swanson et al., 2014).[89] Thus, P4 is for now both unverified and controversial.

Overall, this argument requires further empirical evidence about 1) current, historic, and likely future amounts of early seral conditions across the landscape, and on BLM O&C lands in particular; 2) early seral species, and the extent to which they rely on complex early seral habitat; and 3) whether variable retention harvest, as employed in the Johnson and Franklin plan, in fact creates complex early seral conditions that would support all or some subset of early seral species. In addition, if any conflict does in fact exist between protection of early seral species and conservation of late-successional species, P3 also requires us to engage with normative questions about how the two ought to be managed in relation to one another. This would likely be a source of ongoing tension, but one that, once openly acknowledged, could be discussed in a way that might make a productive contribution to conversations about how the Pacific Northwest landscape should be managed.

Applied Arguments: Anti-Ecological Forestry in Western Oregon

Early seral arguments

Early seral also appears in arguments against ecological forestry, both in the scholarly literature (DellaSala et al., 2013) as well as in arguments advanced by representatives of environmentalist groups (e.g. Heiken, 2011; Kerr, 2013). Although the debates over early seral are not widely advanced in the public discourse (with the exception of interest groups who are attentive to the issue), I chose to analyze the early seral anti-ecological forestry arguments because, as noted above, creating complex early seral conditions is supposedly one of the most compelling "ecological" reasons for using ecological forestry. If the arguments refuting the "need" for more complex early seral habitat and/or ecological forestry's

[89] I will also note that both of these studies found evidence contesting the hypothesis that variable retention harvest is an adequate substitute for naturally created complex early seral conditions, for at least some species.

ability to provide it are sound, ecological forestry's "ecological" justification for regeneration harvest suffers a significant blow.

I identified two possible iterations of anti-ecological forestry early seral arguments, one contending that there is already enough early seral across the Pacific Northwest landscape, and the other contending that ecological forestry does not actually create complex early seral conditions. As noted in the Methods section, I decided to pursue both arguments to see how they relate with one another, whether they somehow work together, and if there are any contradictions between them.

The "enough early seral" argument. I originally formulated this first early seral argument as follows:

P1: Early seral conditions created by roads and clearcuts on private lands are equivalent to early seral conditions that would be created using variable retention harvest (ecological forestry).
P2: There is neither need nor desire for an increased abundance of the sorts of early seral conditions created by roads, clearcuts, and variable retention harvest (ecological forestry) on federal forests in the Pacific Northwest.
P3: We should not increase the supply of what is not needed or desired in greater abundance than is already present.
C1: Therefore, federal forests should not be managed in a way that increases the abundance of early seral conditions in the Pacific Northwest.
P4: Under an ecological forestry approach, federal forests would be managed to increase the abundance of early seral conditions in the Pacific Northwest.
C2: Therefore, federal forests in the Pacific Northwest should not be managed using ecological forestry.

In this initial formulation, P3 is a broad and relatively vague normative statement. However, on the Argument Review survey one expert suggested how P3 could be more precisely written and developed throughout the argument. I therefore revised the argument as follows:

P1: Early seral species tend to be "habitat generalists," and their habitat is relatively abundant across the Pacific Northwest landscape.

P2: Late-successional species tend to be "habitat specialists," and their habitat is relatively limited across the Pacific Northwest landscape.

P3: On the current trajectory, the currently sufficient amounts of early seral habitat will be maintained, and the currently limited amounts of late-successional habitat will increase across the landscape.

P4: Under an ecological forestry approach, federal forests would be managed for an increased abundance of early seral habitat in the Pacific Northwest, interfering with restoration of late-successional habitat across the landscape.

P5: Federal forest management should not prioritize restoration of relatively abundant habitat for habitat generalists over restoration of relatively rare habitat for habitat specialists.

C2: Therefore, ecological forestry should not be used to restore higher amounts of early seral habitat to federal lands in the Pacific Northwest.

In this version, the focus shifts from early seral conditions in general to early seral species as the gauge for how much early seral habitat is needed and desired. This emphasis on species and their requirements more accurately conveys the arguments actually being made in the discourse. For example, DellaSala et al. (2013) argue,

> creating early seral forests through [variable retention harvest] at the stand level is not necessary, given that it is not in short supply… Additional harvests in remaining older forests to create early seral forests would also result in cumulative impacts to late-successional species and further contribute to the successional debt of older forests. (pp. 425-426)

Echoing these same ideas, Doug Heiken of Oregon Wild wrote, "Validation of the early seral habitat objective requires, among other things, asking if the current and projected amount of early seral habitat might be adequate to meet the needs of the opportunistic and generalist species that tend to occur in those areas" (Heiken, 2011, p. 4), further suggesting that, if there is in fact a need for more complex habitat, other methods might be able to create it "without unnecessarily sacrificing mature forests" (p. 6).

The truth of P1 is somewhat in dispute. Although many species associated with early seral conditions are indeed habitat generalists (Swanson et al., 2011), as asserted in the first half of P1, at least a short list of species have been identified as early-seral obligates (Swanson et al., 2014). What remains unclear is whether these species are specialized to natural complex early seral habitat and resources, or more broadly to any open pre-forest conditions, which would include conditions created by clearcuts and other types of regeneration harvest. Depending on these species' habitat and resource needs, it may or may not be true that early seral habitat is "relatively abundant," which brings me to the second half of P1. To assess this second half of the premise, we would first need to know what "relatively abundant" means. Abundant relative to what baseline? The premise might be asserting that early seral habitat is abundant relative to historic amounts, but it might also be asserting that early seral is abundant relative to other forest age classes and habitat types. Either way, evidence is scarce since, as discussed above, estimates of historic early seral abundance are difficult to obtain (Swanson, 2012) and recent estimates of early seral abundance are limited in scope. Takaoka and Swanson (2008) predicted that about 2.5% of the landscape in the central western Cascades was in open conditions (excluding clearcuts) as of 2000. Ohmann, Gregory, and Spies (2007) estimated 14% in the Oregon Coast Range, most of it created by clearcuts on non-industrial private lands and only 4% of which had live remnant trees, while Spies et al. (2007) estimated that only about 2% of the Oregon Coast Range is currently in complex early seral conditions. In short, to assess the second part of P1, we need more accurate information about the current amount of early seral conditions across the Pacific Northwest, preferably with complex early seral conditions distinguished from open post-clearcut conditions on private lands, as well as better estimates of historic amounts of early seral against which to compare these current figures.

P2 seems to be at least partially true, but with some qualifications. In the proceedings leading up to the development of the NWFP in 1994, the Scientific

Analysis Team was convened to answer a series of questions related to the Northern Spotted Owl and other species associated with old-growth (Thomas et al., 1993). This team shortlisted over 600 late-successional species, indicating that they are "closely associated" with late-successional-old-growth conditions (Thomas et al., 1993). However, Swanson et al. (2014) recently identified only 36 species of conservation interest as mature forest obligates.[90] Thus, although it certainly seems safe to assert that some late-successional species require old-growth habitat and resources, the umbrella statement that they "tend to be" habitat specialists may be too broad and lack empirical backing. As for habitat availability, approximately 33% of the federal forestlands in the NWFP region were estimated to be in late-successional-old-growth conditions as of 2008 (Davis et al., 2011). Wimberly, Spies, Long, and Whitlock (2000) predicted that historically (over the past 500 years) old-growth comprised 25- 75% of the landscape in the Oregon Coast Range, with an average of 46% (Wimberly et al. 2000). Although estimates for current amounts are within this historic range, the figure still falls at the lower end of the spectrum, and so can reasonably (but with room for dispute) be considered "relatively limited."[91]

P3 has two components, but only the second can be considered true. Spies et al. (2007) projected that, assuming current political and social conditions persist into the future, the amount of old forest in the Coast Range will increase over the next 100 years. Davis et al. (2011) similarly reported some loss in old-growth on federal lands over the past 15 years (mainly due to wildfire), but they also noted

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[90] It seems that the concern underlying this argument is to protect species more at risk of becoming threatened, endangered, or extinct. As such, while it may appear unfair to question the first half of P2 on the grounds of the Swanson et al. (2014) findings, which considered only species of conservation interest, focusing on species of conservation interest also seems to be more pertinent to the issue at hand, namely, whether late-successional or early seral species are comparatively more or less at risk from habitat loss. In fact, if there were found to be late-successional obligate species *not* at risk of habitat loss (i.e. not of conservation interest), presumably those species would have an abundance of habitat, which would then call the second half of P2 into question.

[91] The figure generated by Davis et al. (2011) is also only calculated on federal lands, while Wimberly et al. (2000) calculated landscape composition across the entire Oregon Coast landscape. As such, the proportion of old-growth throughout the entire NWFP region is actually lower than 33%, once other ownerships are included. Strittholt, DellaSala, & Jiang (2006), for example, estimated that roughly 28% of the historic amounts of conifer old-growth, or approximately 19% of the total NWFP landscape, are currently in old-growth conditions.

that there is a high proportion of mature and older forests moving toward old-growth conditions, likely continuing the trend of increasingly abundant old-growth across the landscape. Complex early seral conditions in the Oregon Coast Range, on the other hand, are predicted to decrease by almost 50% over the next 100 years (Spies et al., 2007). Evidence therefore tentatively suggests that the first part of P3 is not true, and complex early seral habitat will not be maintained into the future. However, the figure estimated by Spies et al. (2007) did not account for early seral created on private industrial and non-industrial lands, a type of landscape cover that Johnson et al. (2007) predicted would *not* decline over the next 100 years. Hence, once again we face the empirical question of whether open conditions remaining after regeneration harvests on non-federal lands serve the habitat and resource needs of early seral species. If post-clearcut early seral habitat does serve the needs of a particular species, then it is far more likely that 1) current amounts of early seral habitat are sufficient to sustain that species; and 2) current amounts of early seral habitat for that species will be maintained into the future.

P4 is true in the sense that if ecological forestry were used to increase regeneration harvests in the Pacific Northwest, more open pre-forest conditions would be created. The big question is whether these harvests would in fact interfere with restoration of old-growth conditions and late-successional habitat. To answer this question, we first need to establish a clear definition for old-growth and late-successional habitat. The point, which was suggested to me by an expert in forest ecology, might best be understood according to Oliver's (2009) distinction between old-growth as *structure* and old-growth as *process*. If we are considering particular structural elements specifically associated with old-growth- e.g. snags, downed logs, or old trees (e.g. Hansen et al., 1991)- then certainly it makes sense to agree that figuratively "setting back the clock" on the development of such characteristics by harvesting stands that would otherwise begin developing these old-growth attributes within decades in fact represents an impediment to restoration of late-successional habitat. In this sense P4 would appear to be true, although it could very readily be countered by the assertion that under an ecological forestry approach the abundance of early successional habitat will increase *without* destroying (i.e. interfering with restoration of) late-successional habitat. This is an empirical claim that is supported for some species but not others, particularly those more reliant on interior forest conditions (Fedrowitz et al., 2014). Specifically in the Pacific Northwest, there is some evidence that retention might be able to sustain late-successional species (Sillett & Goslin, 1999) but there is also evidence that some late-successional species have mixed responses to different levels of retention (Holloway et al., 2012) and still others are not sustained by retention harvest (e.g. Wilson & Carey, 2000). Thus, the ability of variable retention regeneration harvests to maintain Pacific Northwest late-successional species and their habitat merits much further investigation.

As an alternative to this structural view of old-growth, in the classic conceptual model of succession, the old-growth stage is characterized as a shifting landscape mosaic punctuated by disturbances at various scales, which results in a network of gaps of various shapes and sizes across the forest landscape (Oliver, 1981; Franklin et al., 2002). From this perspective of old-growth as process, early seral patches are actually an integrally embedded if constantly shifting component of a dynamic old-growth landscape. In other words, from a landscape mosaic perspective, early seral is not necessarily an impediment to old-growth, and P4 appears to be less true than it did from the structural perspective described above. However, to accurately assess P4 from this second perspective, we would need to know how much complex early seral would be on the landscape at once under an ecological forestry approach, in order to compare it against the amount estimated to have occurred on the landscape historically, roughly 5-20% to the best of our current knowledge (Swanson, 2012). Finding this figure is challenging not only because, as noted earlier, it is difficult to project how long a stand will remain open before canopy closure (Swanson, 2012), but also because of the mixed ownerships in the Pacific Northwest. For example, if we take the roughly 1% of Moist Forests in

Forestry Emphasis Areas proposed to be harvested annually under the 2015 O&C Act (S.132, 2015), coupled with projections for natural disturbance, in theory it would be possible to estimate how much early seral habitat would be present on BLM lands in western Oregon under an ecological forestry approach. However, if species conservation (and restoration of an old-growth landscape mosaic) needs to be coordinated at a broader regional scale, activity on private, state, and other federal lands would also need to be taken into account to determine whether using ecological forestry according to the Johnson and Franklin plan would create (again, relative to the goal of approximating characteristic age class distributions of forests in historic landscape mosaics) too much, too little, or the right amount of early seral.

P5 actually appears to be generally true, and perhaps not even very controversial. Detached from the Pacific Northwest context and associations with early seral versus late-successional species, it seems sensible to focus conservation efforts on less abundant species whose needs are more specialized, rather than on species that are able to survive in a range of conditions, and therefore have an abundance of habitat options available to them. The controversy and dispute will of course return, once it comes time to specify what counts as "relatively abundant" and "relatively rare" habitat, bringing us back to the normative and empirical questions highlighted throughout my analysis of this argument.

Overall, the "enough early seral" argument requires more empirical evidence about early seral species and current and projected amounts of early seral habitat, as well as normative clarifications about the concept of old-growth, before it can be assessed as a sound argument.

The "ecological forestry does not create complex early seral" argument. This second early seral argument against ecological forestry highlights one of the gaps discussed above in the pro-ecological forestry "restoration of early seral" argument, namely, does the ecological forestry strategy proposed for western Oregon actually create complex early seral conditions, akin to those that would be found after non-anthropogenic disturbance? Dellasala et al. point out this uncertainty (2013):

> An important tenet of ecological forestry is that [variable retention harvests] are needed to produce timber volume while creating early seral habitat for wildlife. [Variable retention harvests] can be an improvement over clearcutting practices, depending on structural retentions, but they remain untested hypotheses regarding benefits to early seral communities. (p. 425)

Somewhat more bluntly, outspoken environmentalist Andy Kerr writes that “naturally created complex early seral forest is far superior to artificially created early seral,” (Kerr, 2013, “Exalt Sloppy Clearcutting,” para. 5), an assertion that at first glance appears to be unsupported by current knowledge. Even according to what DellaSala et al. (2013) wrote, and as I pointed out above, the claim that natural complex early seral conditions are superior to anthropogenic early seral conditions has not been verified, if we take “superior” to mean “superior for the flourishing of early seral species and the persistence of desirable ecosystem processes and functions.” It may very well be the case that ecological forestry can create conditions equivalent to natural complex early seral conditions, but as of now we simply do not have enough evidence to be sure. However, Kerr (2013) might also be using the word “superior” differently, in a way that is closely linked to DellaSala et al.’s (2013) idea of uncertainty. I pursued these threads in constructing the argument as follows:

P1: Natural complex early seral conditions provide important benefits for early seral species.

P2: One objective of ecological forestry is to provide complex early seral conditions for early seral species.

P3: Ecological forestry may not provide all the benefits of natural complex early seral conditions to early seral species.

P4: Management practices that restrict logging after natural disturbance do provide all the benefits of natural complex early seral conditions to early seral species, with a higher degree of certainty than ecological forestry.

P5: A management practice should not be used to pursue an objective if that objective can be achieved with a higher degree of certainty by some other management practice.
C: Therefore, ecological forestry should not be used to pursue the objective of creating complex early seral conditions.

P1 is true and becoming increasingly non-controversial, at least in the scientific community (Donato et al., 2012; Swanson et al., 2011; Swanson et al., 2014). Structurally and compositionally complex early seral conditions provide open, light-filled conditions for a large array of plant species and habitat and forage for a variety of animals, and they contribute significantly to water and nutrient cycling processes (Swanson et al., 2011). P2 as well is verifiably true: the creation of "high-quality early successional habitat" is one of the stated objectives of Johnson and Franklin's ecological forestry plan (*S.1784: The O&C Land Grant Act*, 2014, p. 43). P3 as stated is also true. At present we do not know how closely variable retention harvests enacted under an ecological forestry approach actually resemble natural complex early seral ecosystems- an important empirical research gap that I have already pointed out. Although the meaning of "benefits to early seral species" is not specified, the argument circumvents any problems related to this ambiguity by shifting the emphasis from the benefits themselves to the certainty of their provision. In other words, rather than delimiting a set of specific desired benefits (e.g. pollinator abundance or plant species diversity), and predicating the argument on ecological forestry's inability to provide these benefits (which would require currently nonexistent empirical verification), certainty itself is used as the criterion for comparing the two management strategies. Whichever strategy (ecological forestry or restricting post-disturbance logging) can deliver on its objectives with a higher degree of *certainty* is considered superior, and should therefore be adopted (as stated in P5). I will return to this claim below.

The first part of P4 is clearly true, since in effect restricting post-disturbance logging allows natural disturbance to create complex natural early seral conditions.

The second part of the premise, however, could be disputed. Natural disturbances are stochastic processes, the occurrence of which cannot be predicted with precision or certainty (Turner et al., 1998). Johnson and Franklin (2009) wrote,

> Natural disturbances to preserve mature and older forests can be expected to provide significant amounts of this [early seral] habitat over time, provided that such areas are left unsalvaged and allowed to regenerate naturally. These natural disturbances are highly episodic, however, and are not likely to provide desired amounts of these communities in time and space. (pp. 40-41)

Comparing this statement with the assertion about certainty in P4, it becomes apparent that there are two different meanings of certainty being employed: 1) certainty of early seral occurrence; and 2) certainty of early seral outcomes. Ecological forestry might be able to ensure the occurrence of disturbance (i.e. variable retention harvest) that creates early seral conditions, but as far as we currently know, it cannot ensure that complex early seral conditions will actually result from that disturbance. Conversely, restricting post-disturbance logging will certainly produce natural complex early seral conditions, but their occurrence at predictable spatial extents or time frames cannot be ensured. For the sole objective of creating complex early seral conditions, the second form of certainty is clearly desirable (i.e. it would be nice to know ecological forestry will do what it purports to do), but the desirability of the first form of certainty is much less clear. Heiken (2011) made this point explicitly: “It is unclear why this natural pattern and process is improved upon by more uniform distribution across space and time” (p. 20). In other words, why use ecological forestry to approximate natural disturbance, when we can simply allow natural disturbance to manage the landscape for complex early seral conditions and *all* the benefits they naturally provide to early seral species? If we are interested only in certainty of early seral outcomes, there is no apparent need for ecological forestry.

The crucial point to remember is that creating complex early seral conditions is not the only objective of ecological forestry. Ecological forestry also aims to produce timber. From this multiple-use perspective it is indeed desirable to have a more certain occurrence of early seral conditions, since they would be produced by harvesting a regular supply of timber. Therefore, if the sole objective of management is to create conditions that are as certain as possible to resemble natural complex early seral, it is clearly preferable to rely on natural disturbance, rather than to try to mimic natural disturbance using ecological forestry. This is the meaning of "certainty" that seems to characterize P5 in this argument, in which case P4 appears to be true. However, if the objective is to create complex early seral conditions more predictably and reliably than would occur under natural disturbance regimes (e.g. if there is an additional economic objective to produce timber), P4 appears to be false, and ecological forestry the preferable management strategy. The meaning and value of certainty therefore shifts- and the truth of P4 along with it- depending on whether the argument is made in a single- or a multiple-use context.

In addition, although it may appear agreeable at first glance, P5 cannot be considered true under all conditions, regardless of how "certainty" is defined. For example, if financial objectives can be met more certainly (in terms of both occurrence and outcome) by an assembly line of Third World child sweatshop workers than by a handful of well-compensated middle class Americans, is it right to use the child sweatshop workers? Although the rare radical bottom-liner may answer in the affirmative, it seems likely that most morally sensitive (or non-sociopathic) individuals in the modern age would disagree. The point to note is that by focusing on outcomes alone, we would not be able to discern a difference between the two. Were we to assess management only for its ability to meet set production targets, we would pay no heed to any qualitative differences between Third World child laborers and well-compensated Americans, and certainty would seem to be an appropriate gauge of superiority: whichever produced the desired outcome with a higher degree of certainty would be judged the better practice to implement.

This example illustrates that evaluating a management practice only by its ability to produce outcomes is short-sighted at best, and might lead to morally inappropriate decisions at worst. Exclusively consequentialist approaches, which measure the morality of actions only by their outcomes, constitute one branch of ethics, but there are other approaches as well, which evaluate actions by alternative criteria such as motive, intention, or virtuous character (Curry, 2011; Sommers & Sommers, 2004). Comprised largely if not exclusively of consequentialist arguments like the "ecological forestry does not create complex early seral" argument, whose normative premises are attuned to outcomes alone, the ecological forestry discourse appears to be missing the non-consequentialist ethical issues that are also important to consider in making decisions about how we ought to manage forests, and which also factor into people's ethical reasoning (Gore et al., 2011). For example, all outcomes aside, is there a moral difference between undertaking a management action to pursue "purely ecological" objectives, as opposed to also (perhaps primarily) being motivated by economic objectives? Are some motives (e.g. reducing poverty in rural communities) more honorable than others (e.g. accumulation of corporate wealth)? Can it be right to pursue an action for one reason, but wrong to pursue that same action for a different reason? Although undeniably challenging, these sorts of non-consequentialist questions are absolutely relevant to decisions about whether ecological forestry should be implemented in western Oregon, and merit more attention than I can properly give them here.

To summarize the pair of anti-ecological forestry early seral arguments, the previous "enough seral argument" focuses on appropriate conservation efforts to restore what we need (i.e. old-growth), while the "ecological forestry does not create complex early seral" argument directly above focuses on managing what we already have available on the landscape (i.e. current and future early seral). The two arguments complement one another to make a comprehensive case that using ecological forestry to create early seral habitat is unnecessary because there is already enough early seral habitat to support biodiversity, and the wrong management strategy to use even if there is not. However, the crucial point to remember, as I discussed above, is that both of these arguments remove ecological forestry from its multiple-use context, ignoring the coupled objective of producing a sustained yield of timber.[92] By selectively focusing on only a single objective, it could be argued that these two arguments make only a partial (and inadequate) response to the arguments in favor of ecological forestry. In other words, as counter-arguments they contest the use of ecological forestry to create complex early seral conditions, but they do not contest the use of ecological forestry to create complex early seral conditions *and* produce a sustained yield of timber. However, these two arguments also highlight a legitimate point of ambiguity, namely, is the use of variable retention harvest in ecological forestry being proposed primarily to create complex early seral conditions, or to provide a sustained yield of timber? Although the two objectives may be compatible in some ways, they may not be compatible in all ways (an empirical question that has not yet been answered). If they are not perfectly aligned, how will management decisions be made? Will regeneration harvests still be conducted to produce timber, even if there is no need for additional complex early seral habitat to support early seral species? Will prescriptions be designed with higher retention levels producing less timber, if doing so would leave post-harvest conditions more closely approximating those found in natural complex early seral ecosystems? These are the sorts of normative questions not currently addressed in the ecological forestry literature (see Chapter One), a response to which would represent an important (and necessary) contribution to the current discourse.

The clearcut argument

[92] I did not explicitly highlight this observation in my commentary on the "enough early seral" argument, but the same narrow view of variable retention harvest as a tool for creating early seral habitat, carefully ignoring the additional objective of timber production, is operative in that argument as well (see P4 and P5).

Related to the arguments above are concerns about variable retention harvest, and the extent to which it may resemble clearcutting. Experts generally confirmed my sense that this argument occupies important space in the public discourse, and I was particularly convinced when one expert in forest management who has extensive interactions with forest managers and stakeholders rated this reason a 10 on the Argument Selection survey.

Public disapproval of clearcutting is well-established and pervasive (Bliss, 2000). As such, it is not surprising that any practice believed to be affiliated with clearcutting would arouse public suspicion. Heiken (2014), for example, argues, "[t]he 'variable retention harvest' method advocated by Norm Johnson and Jerry Franklin as implemented and incorporated into this project is more accurately described as 'clearcut with reserves'" (p. 5). Kerr (2013) refers to variable retention harvest as "sloppy clearcutting" ("Exalt Sloppy Clearcutting," para. 4), while the American Fisheries Society and Society for Conservation Biology attests that ecological forestry "require[es] the functional equivalent of clearcuts over vast acreages" (American Fisheries Society, 2014). Johnson and Franklin (2012) themselves anticipated that variable retention regeneration harvest would be equated to clearcutting, an association that they categorically deny (*S.1784: The O&C Land Grant Act, 2014*, p. 43). The argument I have constructed from these references is as follows:

P1: Variable retention harvest is a key practice of ecological forestry.
P2: Some of the effects and the appearance of variable retention harvest are not appreciably different from those of a clearcut.
P3: Clearcutting on federal lands in the Pacific Northwest is environmentally damaging and socially unacceptable.
P4: Management practices on public lands should not be environmentally damaging and socially unacceptable.
C: Therefore, federal forests should not be managed using ecological forestry.

P1 is true and uncontroversial: variable retention harvest is identified as an important practice in all of the reports about ecological forestry in the Pacific Northwest (e.g. Franklin & Johnson, 2012; Johnson & Franklin, 2012). P2, in contrast, is not as easy to assess. Originally I had worded P2 in a way that suggested variable retention harvest and clearcutting are, in effect, the same. However, on the advice of one expert in silviculture, I employed more moderate language, which seems to better capture the argument being made. Even the most outspoken opponents of ecological forestry acknowledge that variable retention harvest and clearcutting are not identical. For example, Heiken (2014) notes that, "[c]learcutting with reserves is not as bad as industrial clearcutting, but it is not what these forests "need" ecologically" (p. 6). While it would be difficult to assert that variable retention harvest and clearcutting are exactly equivalent, it would be equally difficult to negate the statement that they do in some ways (of an unspecified number and extent) resemble one another. Both are types of regeneration harvest, and both entail removal of a significant portion of biomass from a forested area. Whether these resemblances are "appreciably different" or not remains unclear, a point I will discuss at length below.

P3 is also true, if we accept "damaging" to refer to a panoply of changes in soil, water, and nutrient dynamics, as well as homogenization of structure and loss of biodiversity, found to occur after clearcutting (Aber et al., 2000). Additionally, as noted above, clearcutting is known to be socially unacceptable (Bliss, 2000), particularly from an aesthetic perspective (Ribe, 1999).

The statement in P4 that management of public lands should not be socially unacceptable is generally true, in accordance with the idea that public lands ought to be managed for public values. It also seems true that management of federal forests should not be environmentally damaging. Stewardship is a clear mandate of the US Forest Service:

> The final planning rule requires that land management plans provide for ecological sustainability…The rule contains a strong emphasis on protecting

> and enhancing water resources, restoring land and water ecosystems, and providing ecological conditions to support the diversity of plant and animal communities, while providing for ecosystem services and multiple uses. (USDA, 2012, p. 21163)

The mission of the BLM is also “to sustain the health, diversity, and productivity of America’s public lands for the use and enjoyment of present and future generations” (USDI Bureau of Land Management, 2012). Both agencies stress the need to sustain ecosystem functions and biodiversity, strongly implying if not explicitly stating that management should not degrade the environment. I will note, however, that some amount of controversy may be tied to this premise, as well as P3, if different people have different understandings of “environmentally damaging.”[93]

Thus, all of the premises in this argument appear to be generally true. As such, the argument hinges upon the link between P2 and P3. Specifically, are the effects that variable retention harvest and clearcutting have in common, i.e. that are “not appreciably different,” the same effects that characterize clearcutting as “environmentally damaging and socially unacceptable?” Bliss (2000) suggested that five main factors underlie public opposition to clearcutting: 1) aesthetics, and negative associations with 2) deforestation, 3) plantation forestry, 4) environmental degradation, and 5) excess and exploitation. I will use this framework to consider how variable retention harvests in ecological forestry may or may not overlap with the unacceptable aspects of clearcuts.

1) Ribe (2009) found that the visual appeal of variable retention harvest strongly depends on both the amount and the pattern of retention, with lower levels of retention (i.e. closer to 0% retention clearcuts) being ranked as less visually appealing. He also reported that people generally found a 40% dispersed retention harvest as visually appealing as an unharvested forest (Ribe, 2009). Therefore, from an aesthetic perspective, variable retention harvest may not differ appreciably from

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[93] For example, where one person might think nothing of a change in plant community composition as long as the land continues to provide necessary goods and services, another may see environmental damage.

a clearcut at lower levels of retention, but it might be significantly different at higher levels. To know for sure how people would respond to the visual impacts of the Johnson and Franklin ecological forestry plan, we would need empirical work specifically querying a relevant sample of the public about visual perceptions of the ecological forestry treatments being proposed.

2) through 4) No empirical work has been done to gauge whether people associate variable retention harvests with either plantations or deforestation, but some limited work has been done to assess people's responses to its environmental impacts. Ribe (1999) found that people assessed a stand harvested using variable retention practices differently when they received information about variable retention harvest's intended environmental benefits. A more recent study by Ford, Williams, Smith, and Bishop (2014) found that people's beliefs about positive environmental impacts of harvest are strongly (and positively) associated with their acceptability ratings of the harvest. These findings suggest that by sharing information about the positive environmental impacts of variable retention harvest as compared with clearcuts, managers might be able to influence social acceptability. However, in the large body of empirical work comparing the effects of variable retention harvest against the effects of clearcuts, mixed results have been reported for different variables. For example, population reductions observed after clearcuts are not observed after variable retention harvest for many, but not all, species (e.g. Fedrowitz et al., 2014; Rosenvald & Löhmus, 2008). Mori and Kitagawa (2014) also found that in many cases species richness after variable retention harvest is maintained relative to unharvested forests, although again, response is species-specific. In a study not focused on biodiversity, Seidl et al. (2014) found that the effects of variable retention harvest may speed the rate at which forests progress toward late-successional conditions relative to clearcuts, but in the long term feedbacks with higher biomass in stands with retained legacies and green trees may increase the occurrence of fires, and thereby delay development of old-growth conditions, compared with stands harvested without retention. To know how these

findings, along with the rest of the large and disparate body of research about variable retention harvest, influences social acceptability, we need to know which particular factors are important to people. In other words, to determine whether people believe the environmental impacts of variable retention harvest differ appreciably from clearcuts, we need to determine first and foremost by which specific criteria (e.g. effects on vertebrate biodiversity, water quality, soil compaction, or some other ecosystem properties or processes) people assess environmental impacts, and then, after providing them with information about how those specific criteria respond to variable retention harvest, ask whether variable retention harvest is acceptable (Ford, Williams, Bishop, & Webb, 2009). This is a research gap that merits considerable attention as we consider proposals to implement ecological forestry in western Oregon.[94]

5) Bliss' (2000) final category raises an interesting empirical question about ethics and moral reasoning: do people judge acceptability more on account of outcomes or intentions? If people are opposed to clearcutting because it has damaging outcomes, then as long as variable retention harvest mitigates environmental damages associated with traditional harvest practices, ecological forestry will likely be considered acceptable to the extent that its outcomes are seen as appreciably less damaging than the outcomes of clearcuts. On the other hand, if, as Bliss (2000) suggests, people are also opposed to clearcutting because it rests on a worldview in which forests are perceived as no more than resources for human extraction, the social acceptability of variable retention harvest likely depends at least in part on whether people feel ecological forestry perpetuates or relinquishes

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[94] Most of the empirical work on variable retention harvest and social acceptability (e.g. Ford, Williams, Bishop, & Hickey, 2009; Ribe, 1999, 2006; Ribe et al., 2013) does not investigate by which specific criteria, or according to which particular outcomes, people might be assessing environmental impacts (for an exception, see Ford, Williams, Bishop, & Webb, 2009). It may be the case that simply knowing a variable retention harvest has positive or negative environmental consequences is sufficient to influence acceptability. However, because there is so much information about variable retention harvest suggesting positive, neutral, and negative impacts on different variables in the ecosystem, we would need to know which factors in particular are of concern to people, before informing them that variable retention harvest has generally positive or negative impacts on those specific factors.

this ethical view about the purpose of forests.[95] However, to understand which ethical worldview the Johnson and Franklin strategy for ecological forestry advances, we need more information about the values underlying the plan, which, as I argued in Chapter One, at present are not at all clear. This is a critical normative gap that needs to be addressed.

Overall, in order to assess this argument, we need to know to what extent the use of variable retention harvest under the ecological forestry plan for western Oregon overlaps with clearcutting, which requires us to understand not only the biophysical impacts of variable retention harvest, but also how and why people judge forest management practices to be acceptable or unacceptable. Most of the work to be done, I will point out, is empirical work investigating public values and attitudes toward different types of harvest. Until these key information gaps start to be filled, however, this argument, like the others analyzed so far, has critical uncertainties, and so cannot be considered sound.

The future old-growth argument

A prevalent theme of the arguments against ecological forestry is concern for old-growth forest. Unlike early seral, there appears to be fairly widespread affinity for old-growth in the Pacific Northwest (Spies & Duncan, 2009), and an unofficial rule that federal lands should be appropriated to its conservation (Strittholt et al., 2006; Thomas, Ruggiero, Mannan, Schoen, & Lancia, 1988). Technically, under the NWFP federal lands are supposed to be managed for some timber, including from regeneration harvest of the roughly 10% of old-growth forests in the matrix (Thomas, 2009). However, in practice active management on federal lands has been restricted mostly to thinning in younger stands (Thomas, 2009), with the unspoken understanding that once a stand reaches 80 years old, it will be left alone (personal

[95] I will also point out that if this were in fact the basis for deciding whether variable retention harvest differs appreciably from a clearcut, there would be evidence for a veritable paradigm shift in environmental ethics, away from the traditional utilitarian ethic and toward a more expansive ecocentric ethic with a fundamentally different understanding of the proper relationship between humans and forests (Callicott & Mumford, 1997).

correspondence, Expert H). This situation translates into an argument against ecological forestry, which, it is asserted, would not only allow but actually mandate regeneration harvest in some of the young and mature stands that would otherwise (arguably) only be thinned, and on track to develop into old-growth. Heiken (2011), for example, argued that the "BLM should protect mature forests because they are the best candidates to develop into old-growth habitat in the shortest time frame" (p. 12). Dominick DellaSala of the Geos Institute (2013) identified as one of the "ecological shortcomings" of ecological forestry,

> lack of recognition for the importance of mature forests in the 80-150 year old age classes in moist and dry forests that will over time increase the deficit of old-growth forests if these mature forests fail to become future old growth because of logging… (*Challenges and Opportunities*, 2013a, "Ecological Shortcomings of Ecological Forestry," para. 1)

From these ideas I formulated the following argument:

P1: On the current trajectory, old-growth will be preserved and young and mature forests will progress toward old-growth conditions ("old-growth restoration").
P2: Ecological forestry will conduct regeneration harvests for timber production in young and mature forests, thereby impeding old-growth restoration.
P3: Management of public lands should reflect public values.
P4: People in the Pacific Northwest value old-growth restoration over other objectives.
C1: Federal forest management in the PNW should prioritize old-growth restoration, unless there is an adequate reason to do otherwise.
P5: Increasing timber production on federal lands is not an adequate reason to de-prioritize old-growth restoration.
C2: Therefore, federal forests in the PNW should not be managed using ecological forestry.

For the past 20 years, forests over 80 years old have been effectively protected, either by the reserve system established under the NWFP or by environmentalist legislation enacted on the grounds of the ESA or the survey and manage clause of the NWFP (Thomas et al., 2006). Regeneration harvest has been extremely limited on federal lands, even in younger forests (Charnley, 2006; Tuchmann & Davis, 2013). For example, 80% of the active management on BLM lands since 1995 has been some sort of thinning, and no regeneration harvests have been conducted since 2004 (Tuchmann & Davis, 2013). P1 assumes that this situation will continue into the future. However, all of the experts raised objections to this assumption, pointing out that it has no legal backing. Young and mature forests are technically available and actually intended for regeneration harvest (Thomas, 2009; USDA Forest Service & USDI Bureau of Land Management, 1994). Although P1 may reflect the social and political situation at present, and describes what might certainly be a likely scenario for federal forest management in the future, it is not necessarily true (and certainly controversial) to assert that these conditions will persist.

The truth of P2 is similarly ambiguous. As originally worded, the premise stated that “active management” conflicts with the development of future old-growth. However, on the advice of one expert who pointed out that in many cases active management actually enhances development of old-growth conditions (e.g. Garman et al., 2003), I realized that the contentious issue is not active management in general, but regeneration harvest specifically. It is true that ecological forestry will be used to conduct regeneration harvests (Johnson & Franklin, 2012). However, whether they will occur on lands that would otherwise be allowed to mature into old-growth is unclear for the reasons highlighted above, namely, that young and mature forests are not technically (i.e. legally) on track to be permanently reserved as old-growth.

Along with normative ambiguities related to the concept of old-growth (as discussed above in the “enough early seral” argument), which need to be clarified to understand if harvesting young forests will in fact “impede old-growth restoration,” another normative question that becomes important in assessing P2 is what counts as "mature" forest. By general consensus, forests under 80 seem to be considered "young" (e.g., DellaSala et al., 2013; Johnson & Franklin, 2012). The age class of mature forests is considerably less well established. For example, Thomas et al. (2006) consider forests in the 80-200 year range "mature." DellaSala et al. (2013), on the other hand, define "mature" forests as 80-120 years old.[96] Recent litigation against an ecological forestry pilot project suggests that harvest in a roughly 110-year old stand, mature by any definition cited here, is not socially acceptable (*Oregon Wild v. Bureau of Land Management v. Scott Timber Co.,* 2015). Does this mean that mature forests are also unacceptable candidates for regeneration harvest, or should it be taken to signify that forests of 110 years old should officially be considered old-growth? Franklin and Johnson (2012) point out that "the age at which forests are deemed 'older' is a social decision" (p. 432), but it is not clear by what process this decision will be made, codified, and subsequently regulated. In the ecological forestry literature, 80, 120, and 160 years have all be proposed as potential ages at which to set forests aside (Johnson & Franklin, 2009), while in the latest version of the O&C Act, stands that have passed a 90 year age class (trees 85 to 95 years old) will not be managed with regeneration harvest (S.132, 2015). However, neither source specifically labels age classes as "young," "mature" or "old-growth." Nonetheless, while it is certainly true that regeneration harvests under ecological forestry would occur in young forests (under 80 years old), it is far less certain (and actually appears increasingly improbable) that they would occur in mature forests, by any of the currently circulating definitions of "mature."

For the sake of this argument we will accept that P3 is true and generally non-controversial. P4 and P5, in contrast, are not evidently true and both controversial. The general dearth of current social science work on public values and attitudes toward specific management objectives, which I have noted several times, renders assessment of P4 difficult. There does seem to be a consensus that

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[96] This is a slight deviation from the 80-150 year range DellaSala (2013) cited for mature forests in his statement for the Committee on Energy and Natural Resources (*Challenges and Opportunities*, 2013a).

people value old-growth (Spies & Duncan, 2009), and empirical work suggests that people see old-growth conservation as a high management priority (Charnley & Donoghue, 2006; Pew Charitable Trusts, 2013; Ribe & Matteson, 2002; Shindler & Mallon, 2009). However, to my knowledge we do not know whether and how people differentiate between conservation of extant old-growth and restoration of additional old-growth, nor do we understand how people would prioritize either or both of these objectives against other objectives, such as increasing timber production to create jobs. P4 therefore requires verification.

P5 represents a normative judgment that is not obviously true or false, and although some people may be inclined to either agree or disagree with P5 on principle, opinions might change with a better understanding of the particular situation. For example, if under an ecological forestry approach there would be enough timber harvested to support a certain number of people deemed relevant, at a certain standard of living deemed worthwhile, and for an amount of time deemed significant, increasing timber harvest may be considered an adequate reason to de-prioritize conservation of potential future old-growth (i.e. currently young and possibly mature forests), while still emphasizing conservation of extant old-growth. If, on the other hand, ecological forestry would support only moderate increases in the standard of living for a select few people, which would perhaps once again precipitously decline after 50 years of variable retention regeneration harvests on BLM lands, increasing timber harvest may not seem like an adequate reason to upset the status quo. The issue therefore merits much further discussion, supported by a sufficient amount of relevant information. Along with projections for timber, revenue, and jobs, details about the projected future abundance of old-growth forest across the landscape under an ecological forestry approach, including effects on biodiversity and a range of other environmental variables, are also necessary for deciding whether a tradeoff between increasing timber production and restoring additional old-growth is appropriate.

In short, this argument rests on a series of unverified claims about the current and future socio-political context of federal forest management in the Pacific Northwest, as well as unstated (or perhaps unnoticed) assumptions about the likely environmental and economic impacts of implementing ecological forestry. If all the empirical premises were verified, and the normative premise P5 duly considered and justified, the argument would be quite sound, and might even garner broad support. At present, however, it cannot even be considered sound.

The "adverse effects" arguments

The final set of arguments I will cover in this analysis relate to potential environmental harms that may result if ecological forestry is implemented in western Oregon. Numerous studies have looked at the effects of variable retention harvest (e.g. Lindenmayer et al., 2012), but generally they document environmental impacts at relatively small spatial and short temporal scales (e.g., Aubry et al., 2009; Fedrowitz et al., 2014; Mori & Kitagawa, 2014). In addition, many of these studies are focused on biodiversity. As such, concerns about a broader suite of environmental impacts, such as on water quality and carbon sequestration, are being expressed by certain prominent voices in the Pacific Northwest (*Challenges and Opportunities*, 2013a; Heiken, 2011).[97] A letter signed by 26 regional organizations, for example, argues,

> Experimental logging methods such as those from Johnson and Franklin have only been applied on a limited number of pilot projects in western Oregon. They have not been tested over long periods or large scale, and this raises questions of consistency with water quality, wildlife, carbon storage, or social acceptance. (American Bird Conservancy et al., 2014, "Mandates aggressive logging and harms water quality," para. 2)

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[97] For example, a Web of Science search in spring 2015 using the keywords "variable retention harvest" and "water quality" returned no results. A search using "water" instead of "water quality" returned one result, and a search on "ecological forestry" and "water quality" returned one result from a study conducted in Germany.

In a generalized form, these sorts of "adverse effects" arguments against ecological forestry might be formulated as follows:

P1: Ecological forestry produces certain benefits (A, B, C).
P2: Ecological forestry produces certain harms (X, Y, Z).
P3: A management strategy should not be used if its harms outweigh its benefits.
P4: The set of harms (X,Y,Z) produced by ecological forestry outweigh the set of benefits (A,B,C) produced by ecological forestry.
C1: Therefore, we should not use ecological forestry.

This argument essentially outlines the probable outcomes of ecological forestry as a cost-benefit analysis, the clear rationality of which is broadly accepted and difficult to dispute (Bennis, Medin, & Bartels, 2010; Funtowicz et al., 1999). However, while the argument is compelling in generic form, it may prove to be more controversial when general variables are filled in with specific content. Consider, for example, a version of the adverse effects argument focusing on carbon. Heiken (2014) asserts that the "BLM has a duty now to reconsider and rebalance the different uses of the forests and shift emphasis from logging toward carbon storage" (p. 12). In his statement submitted to the Committee on Energy and Natural Resources, DellaSala also pointed out,

> President Obama also recently called on federal land agencies to "manage our public lands and natural systems to store more carbon." BLM forests in western Oregon are considered global champions in storing carbon long-term (Smithwick et al. 2002), if they are not cut down. (*Challenges and Opportunities*, 2013a, "Ecological Importance of BLM O&C and Coos Bay Wagon Road Holdings for Clean Water, Salmon, Old Forests, and Carbon Storage," para. 2)

Using these references I constructed the argument as follows:

P1: Management of public lands should reflect the public interest.

P2: It is in the broadest public interest, present and future, to mitigate global climate change.
C1: Therefore, public lands should be managed in a way that mitigates global climate change, unless there is a compelling reason not to do so.
P3: Forests that are not harvested sequester and store carbon over the long term, thereby contributing to global climate change mitigation.
P4: Increasing net carbon emissions is antithetical to global climate change mitigation.
P5: Using ecological forestry to manage federal forests in the Pacific Northwest will release carbon stored in forests, increasing net carbon emissions in order to increase timber production.
P6: Increasing timber production in the Pacific Northwest is not a compelling reason to manage public lands in a way that is antithetical to global climate change mitigation.
C2: Therefore, federal forests in the Pacific Northwest should not be managed using ecological forestry.

P1, like similar iterations addressed throughout this chapter, is generally true and probably quite non-controversial. The point to make about P2 is the extremely broad scope of relevancy it establishes, with global climate change identified as an issue of worldwide concern. Mitigating climate change might entail inconveniences that do not appear to be in the interest of specific individuals, but at the collective level of all people, “the broadest public interest,” it is hard to deny that P2 is true. Once P1 and P2 have been accepted, it also becomes difficult to quibble with C1, at least in a general sense. However, one possible source of controversy would be over the meaning of the word “mitigate.” For example, an individual might agree that management of public lands should mitigate global climate change to the extent that recycling receptacles are required in all National Forests, but not to the extent that management limits the production of timber on National Forests in order to leave carbon stored as standing biomass. The other possible source of controversy, of course, is over what counts as a compelling reason not to mitigate global climate change. I will address this point below.

P3 and P4 also seem true, although expert opinion indicates that there is likely some controversy surrounding both of them. P3 states the empirical fact that forests act as a sink for carbon (Pan et al., 2011), and removing carbon from the atmosphere mitigates global climate change (Bonan, 2008). Depending on whether and how they are managed, forests may hold more or less carbon, but as a rule forests are productive ecosystems that store carbon drawn from the atmosphere and transformed through photosynthesis into biomass. With this point established, it becomes clear that any practice removing biomass from the forest- whether it be variable retention harvest, clearcutting, or the harvest of a single tree- equates to a loss in carbon storage. Fuel treatments might be considered an exception, although there is evidence that the net carbon emissions produced in density treatments may actually exceed the amount of carbon that would be lost to wildfire (Campbell, Harmon, & Mitchell, 2012). Even trees that are converted into "permanent" wood products generally require carbon emissions for production, and the lifespan of most wood products does not exceed what would have been the lifespan of the tree had it remained in the forest (Law & Harmon, 2011). On the reverse side of P3, which states that storing carbon mitigates climate change, is P4, establishing that releasing stored carbon (through emissions) is antithetical to global climate change mitigation, a fact that, though perhaps unpleasant to accept, can no longer be reasonably denied (Blanco et al., 2014).

P5, unlike most of the empirical statements about ecological forestry that I have addressed in this chapter, is actually supported by existing research. Krankina (2014) ran an analysis with figures drawn from Senator Wyden's legislation, which incorporates the Johnson and Franklin plan for western Oregon, and found that using ecological forestry as proposed under the 2013 version of the O&C Bill would result in a net increase of carbon emissions to the atmosphere, relative to projections under the current socio-political framework governed by the NWFP. The second part of the premise, however ("in order to increase timber production"), is only partially true, since ecological forestry is being proposed not only to increase timber production, but also to meet a number of other objectives, including creating early seral conditions and enhancing the resilience of the landscape.

P6 states that producing timber is not a compelling reason to de-prioritize carbon storage, an assertion that is not clearly true or false.[98] P6 is challenging because it can be argued from a number of different perspectives. It invokes the conflict between the immediate needs of a relatively defined group of people (rural communities), with ostensibly measurable benefits to be derived from using ecological forestry, against the more generalized and long-term needs of all people (and life on earth), with relatively modest and more or less intangible benefits that will likely never be traced specifically to the act of restricting harvest on federal forests in the Pacific Northwest. Thus, embedded in P6 are claims about both inter- and intra-generational justice (Kolstad et al., 2014), as well as questions about the morality of weighing specifically human interests against the interests of all species (e.g. VanDeVeer, 1979). It would doubtless be useful to explore P6 as written, focusing specifically on the importance of timber relative to carbon storage, but the overarching question that this argument raises is, what, if anything, could or should count as a "compelling reason" to de-prioritize mitigation of global climate change on public lands? This is a complex question that merits open and extensive discussion, and I will rest content merely to highlight it for more worthy treatment in other forums.

The carbon argument is interesting in that it clearly identifies a single overarching or at least primary value for managing public lands: carbon storage to mitigate global climate change. Implicit in the carbon argument, however, is the premise that so strongly, even singularly, prioritizing one objective over others is appropriate. Thus, while it is difficult to find fault with this argument if its premises

[98] In setting up a cost-benefit analysis of carbon storage against only timber, the carbon argument could be criticized for failing to account for all the potential benefits of ecological forestry. However, this seemingly unfair calculation is largely a function of how I constructed the argument (i.e. carbon vs. timber), and I believe (although this is speculative, since no claim is in writing) that even if all of the multiple objectives of ecological forestry were included, the argument would still be that all of the benefits of ecological forestry do not outweigh the harm of failing to mitigate global climate change.

are all true and broadly accepted, it has some profound implications for management of federal forests. Essentially the carbon argument disputes the claim that federal lands should be managed for any uses that conflict with the single most important objective of climate change mitigation. As one of the experts pointed out, "The broader argument is correct…if carbon sequestration is the primary and sole objective of management of the west side then management for other values, timber, and young, non-tree habitat should not be done." Therefore, although the conclusion of this argument contests the use of ecological forestry, it is broad enough in its scope to dispute any management practices that would increase net carbon emissions on public lands. While the argument is, in this sense, very strong, it also rests upon a fundamental assumption about management priorities on federal lands that, though perhaps true, is bound to be highly controversial, and should be carefully considered before it informs any management decisions.

Conclusion

Ecological forestry is currently being advanced and contested in academic, political, and popular forums through a series of arguments. In this chapter I have formally constructed and systematically evaluated some of the more prominent arguments from the discourse. I began by analyzing a series of broad theoretical arguments for ecological forestry, revealing not only gaps in empirical understanding, but also ambiguities in an assortment of normative concepts, which deprive the arguments of substance or practical value. I then analyzed ten arguments specifically about ecological forestry in western Oregon, as proposed by Johnson and Franklin (2009, 2012, 2013), revealing that many arguments rest on premises that are either unsupported by empirical evidence or crippled by normative ambiguities, or both.

In most of the cases examined in this chapter, arguments are unsound not because their premises are decidedly false, but because their premises are as yet unverified, and therefore not clearly true. By identifying these areas of uncertainty, it becomes possible not only to evaluate an argument, but also to determine what further work might need to be done. In other words, argument analysis can reveal important gaps for research that will be immediately, practically relevant to forest management and conservation. Throughout this chapter I have highlighted key questions that need to be explored in order to verify many of the biophysical, sociological, and economic claims underlying arguments about ecological forestry. Modeling studies probably represent the most promising method for making more informed predictions at multiple scales about the likely biophysical or economic effects of ecological forestry on variables of specific interest to the Pacific Northwest, such as spotted owl populations or revenue for O&C Counties. At the same time, social scientists might build a more precise understanding of how people in the Pacific Northwest value forests, how they want objectives in federal forests to be managed and prioritized, and how they respond to specific management practices. Once some of these gaps have been filled, arguments can be re-visited and re-assessed by stakeholders, managers, and decision-makers. Of course, decisions must often be made even in the face of uncertainty, and arguably perfect information is a rare luxury of modern decision-making (Funtowicz et al., 1999). However, if we must make decisions on the basis of uncertainty, it seems wise at the very least to understand and be clear about the source of our uncertainties, a task to which argument analysis is particularly well suited.

Many of the arguments in this chapter, particularly in the theoretical class, also invoke potentially controversial normative concepts or ethical claims, which are rarely discussed or even stated in writing. This overwhelming failure of the literature to address the normative dimensions of ecological forestry, which I discussed extensively in Chapter One, is symptomatic of a more general inattention to values in natural resource management and conservation (Dietz, 2003). The analysis in this chapter provides numerous examples of this trend, and also highlights two important points. First, although often cloaked in the language of scientific objectivity, decisions about management and conservation are ultimately ethical decisions. Every argument examined in this analysis required at least one normative premise, advancing some idea about what is right or appropriate, and all of them end with conclusions that are prescriptive in nature (Nelson & Vucetich, 2012a). This is the realm of ethics (Sommers & Sommers, 2004). As such, any management decision made (signifying assent to a particular argument or the position it represents) reflects a decidedly ethical notion about how humans ought to interact with forests, even if that notion is not openly expressed. Second, failure to explicitly acknowledge and carefully consider these ethical dimensions of management can be highly problematic. Throughout this chapter I have pointed out where concepts might be interpreted differently according to different values, ethical worldviews, or beliefs about moral standing. My analysis has hopefully served to illustrate how invoking undefined normative concepts can impede or obscure communication, potentially perpetuating conflict and further complicating the already complex and challenging process of making good management decisions.

Although I have tried to be thorough and transparent throughout the chapter, I must acknowledge several additional limitations and shortcomings of my analysis. First is the process of expert consultation, which, though indubitably helpful, would probably have been better achieved through personal interactions in an interview format, rather than by survey. In this way I would have been able to clarify and re-direct experts when I sensed they were expressing personal beliefs rather than objective opinions. Although I was able to overcome this obstacle to some extent through personal correspondence, particularly after the Argument Review survey, follow-up about each particular reason in the Argument Selection survey would have been too extensive of an undertaking, so ultimately the process of selecting arguments was guided less by the experts than I intended or would have preferred. Second, the applied arguments were heavily biased toward arguments about Moist Forest ecological forestry in western Oregon (see Chapter One). Although this is, I believe, representative of the general discourse around ecological forestry, since

Moist Forest treatments seem to be more controversial, a more thorough and comprehensive analysis might have looked at some of the arguments about density treatments and LSEAs in Dry Forests (Chapter One), particularly with regard to their potential impacts on biodiversity and fire resilience. Third, I must acknowledge my own background as a variable in this analysis, and a potential source of bias. Although I have taken every effort to withhold my personal values and opinions, I fully acknowledge that a different individual may have formulated and interpreted these arguments, and the premises supporting them, somewhat differently.

The purpose of this analysis is not to argue that ecological forestry should or should not be used in western Oregon or anywhere else. Argument analysis cannot definitively "solve" problems in natural resource decision-making (Nelson & Vucetich, 2012a). Even if a particular argument is not sound or valid, the position it represents (i.e. that ecological forestry should or should not be implemented) is still plausible, and a position should not be discounted or dismissed on the basis of a handful of less than stellar arguments. Argument analysis can certainly illuminate flaws and weaknesses in arguments, but it is not intended to categorically dismiss certain views or opinions (Nelson & Vucetich, 2012a). Instead, argument analysis is intended to facilitate productive deliberative and decision-making processes. In seeing laid bare the facts, assumptions, values, and beliefs underlying arguments, people might not only be able to more clearly understand one another, but also to more thoroughly examine, clarify, or even question their own thinking.

Argument analysis is challenging and productive as an academic exercise, but its true merit is as a cornerstone of discourse in stakeholder and decision-making forums. I have tried to represent a variety of perspectives throughout this chapter, but inevitably it would be more useful for people with different perspectives to represent themselves and interact with one another. My contribution has hopefully been to reveal focal points for conversation, and encourage an open and transparent discursive process with the potential to generate consensus or, at the very least, build empathy and understanding among stakeholders. By using such a process, we might have a better chance of coming to informed, engaged, and transparent decisions about natural resource management and conservation.[99]

[99] However, for the sake of transparency, I will once more point out that this is an empirical claim that has not been tested, a final sociological research gap that merits further attention.

CHAPTER 2 FIGURE

Premise	Type	True or appropriate?	Controversial?
P1 Public forests in the Pacific Northwest have trees over 160 years old.	Ecological	True	No
P2 Many people in the Pacific Northwest value trees over 160 years old.	Sociological	Generally true	Not really
P3 Management of public lands should reflect public values.	Normative	Generally true	Not really
CONCLUSION Management of public forests in the Pacific Northwest should protect trees over 160 years old.			

FIGURE 1.2 Example of an argument table. Each premise is displayed separately and labeled by type. This can help determine who might be the relevant people to ask for more information or advice, if the truth of a premise is unclear. The table then shows whether premises are true or appropriate, and also whether they are controversial. While I will be doing these evaluations in text, the table format is particularly useful as a tool of communication, since it is far easier to absorb than a full textual analysis. For example, a quick glance at this table would reveal that all the premises are true or generally true, and not really controversial. The argument is therefore quite sound.

CHAPTER TWO TABLES

TABLE 1.2 Theoretical reasons in support of ecological forestry, as presented to experts in the Argument Selection survey. Superscript letters correspond to the final arguments selected for analysis (Table 4.2).

Ecological forestry is based on the best available science[a]
Ecological forestry is a type of sustainable forest management[b]
Ecological forestry emulates the effects of natural disturbance within the historic range of variability[c]
Ecological forestry achieves multiple (social, economic, ecological) objectives[d]

TABLE 2.2 Applied reasons for and against ecological forestry on O&C lands in western Oregon, as presented to experts in the Argument Selection survey. Superscript letters correspond to the final arguments selected for analysis (Table 4.2).

Pro-EF on O&C lands	**Anti-EF O&C lands**
Restoration of landscape heterogeneity by creating more complex early seral	Does not effectively create complex early seral[i]
Supports biodiversity by creating more complex early seral habitat[e]	There is no need for more early seral[i]
Increases timber yields (financial stability/jobs)[f]	Does not provide an adequate amount of revenue/jobs to rural communities
Threat of privatization if a socially acceptable management strategy can't be found to allow more than thinning on public lands[g]	Variable retention harvests are analogous in effect to clearcuts[j]
Conservation of old trees/old-growth forests[h]	Threatens conservation of old-growth[k]
Conservation of biodiversity (particularly threatened and endangered species)	Threatens conservation of biodiversity
Supports forest health and landscape resilience	Not enough certainty about consequences of ecological forestry treatments
	Negative outcomes (water, soil, carbon, wildlife, social acceptability)[l]

TABLE 3.2 Expert ratings of reasons on Argument Selection survey. Reasons were rated based on how central they are to the ecological forestry discourse, on a scale from 0 ("completely irrelevant") to 10 ("absolutely crucial").

	Expert A	Expert B	Expert C	Expert D	Expert E	Expert F	Expert G	Expert H	Expert I	Mean	SD
Theoretical											
Ecological forestry is based on the best available science	5	8	8	10	2	2	4	8	8	6.1	2.9
Ecological forestry is a type of sustainable forest management	6	7	10	10	0	0	10	10	4	6.3	4.2
Ecological forestry emulates the effects of natural disturbance within the historic range of variability	7	6	6	9	0	0	9	5	8	5.6	3.4
Ecological forestry achieves multiple (social, economic, ecological) objectives	9	7	9	10	1	5	10	6	4	6.8	3.1
Mean theoretical	6.8	7.0	8.3	9.8	0.8	1.8	8.3	7.3	6.0		

TABLE 3.2 (continued)

				Pro- EF on O&C lands							
Restoration of landscape heterogeneity by creating more complex early seral	5	6	9	8	0	1	7	2	6	4.9	3.2
Supports biodiversity by creating more complex early seral habitat	1	6	9	8	0	1	7	2	5	4.3	3.4
Increases timber yields (financial stability/jobs)	4	7	9	8	2	5	5	10	10	6.7	2.8
Threat of privatization if a socially acceptable management strategy can't be found to allow more than thinning on public lands	6	6	6	10	1	1	0	3	6	4.3	3.3
Conservation of old trees/old-growth forests	1	8	5	10	1	3	7	9	4	5.3	3.4
Conservation of biodiversity (particularly threatened and endangered species)	3	7	7	9	0	0	9	7	5	5.2	3.5
Supports forest health and landscape resilience	5	6	6	8	0	0	8	5	5	4.8	2.9

TABLE 3.2 (continued)

Mean pro-EF on O&C lands	3.6	6.6	7.3	8.7	0.6	1.6	6.1	5.4	5.9		
Anti- EF on O&C lands											
Does not effectively create complex early seral	1	2	4	2	10	7	2	3	6	4.1	3.0
There is no need for more early seral	1	3	4	1	1	9	2	5	8	3.8	3.0
Does not provide an adequate amount of revenue/jobs to rural communities	7	2	5	0	1	10	3	10	3	4.6	3.7
Variable retention harvests are analogous in effect to clearcuts	7	1	2	1	8	7	2	10	8	5.1	3.6
Threatens conservation of old-growth	4	2	3	0	9	5	3	5	8	4.3	2.8
Threatens conservation of biodiversity	7	2	3	0	9	4	1	4	8	4.2	3.2
Not enough certainty about consequences of ecological forest treatments	5	2	3	3	10	9	6	4	5	5.2	2.7
Negative outcomes (water, soil, carbon, wildlife, social acceptability)	1	2	3	1	10	9	1	8	8	4.8	3.9
Mean anti-EF on O&C lands	4.1	2.0	3.4	1.0	7.3	7.5	2.5	6.1	6.8		

TABLE 4.2 Arguments selected for analysis. Superscript letters show how arguments correspond to reasons in Tables 1.2 and 2.2.

Theoretical	In favor of EF	Opposed to EF
Best ecological understanding argument[a]	Sustained yield arguments (2)[f]	Early seral arguments (2)[i]
Emulation of natural processes in the natural range of variability argument[c]	Keep public lands public argument[g]	Clearcut argument[j]
Sustainable forest management argument[b]	Old-growth conservation argument[h]	Future old-growth argument[k]
Arguments about multiple values and objectives[d]	Restoration of early seral argument[e]	Adverse effects argument (carbon form)[l]

CONCLUSION

"The misobservations, the misstatements, the misinterpretations, of life may cause less gross suffering than some other evils; but they, being more universal and more subtle, pain. The remedy lies…in correct intellectual habits, in a predominant, ever-present disposition to see things as they are, and to judge them in the full light of an unbiased weighing of evidence applied to all possible constructions, accompanied by a withholding of judgment when the evidence is insufficient to justify conclusions." T.C. Chamberlain, 1890

In this thesis I have examined, critiqued, and hopefully clarified ecological forestry and the discourse surrounding it. In Chapter One I argued that, while the scientific theory and silvicultural practices of ecological forestry are relatively well developed, critical metaphysical, normative, and ethical questions remain unanswered. This leaves ecological forestry unconstrained in the range of actions and objectives it can be used to pursue, and allows for inconsistencies that undermine ecological forestry as a cohesive philosophy of forest management and conservation. In Chapter Two I demonstrated how the discourse around ecological forestry is riddled with uncertainty, rooted in both largely unverified scientific and deeply ambiguous normative premises. By highlighting these premises, the argument analysis pointed out some of the key questions that need to be answered before the arguments being made about ecological forestry can be considered sound justification for management decisions. Although I have touched on many topics in this thesis, two key and recurring themes have been the importance of normative clarity and the problem of normative ambiguity. Certainly, there are gaps in empirical knowledge that need to be filled before we can anticipate or evaluate possible or probable outcomes of ecological forestry. However, I would argue that the more crippling gap in ecological forestry is its current inattention to normative and ethical concepts. Until at least some of these concepts are duly considered and clarified, it is all but impossible to assess what ecological forestry is, let alone whether it is an effective or appropriate strategy for forest management and conservation.

The next question, therefore, is how to approach the challenge of filling in the normative and ethical gaps and begin moving the conversation forward. Developing and subsequently advancing clear notions about how forests should be managed is by no means a simple task. Beset by what might appear to be an endless stream of impossible ethical conundrums- how to weigh the rights of the present against the rights of the future (e.g. Johnson, 2003); how to compare the moral standing of humans against the moral standing of non-humans (e.g. VanDeVeer, 1979); whether to protect the welfare of the individual or the persistence of the collective (e.g. Lynn, 2011)- the choices we face in managing the world's forests might only seem to range from bad to worse, or perhaps all appear equally good (Cornett & Thomas, 1996). In this seemingly impenetrable muddle, it might be argued that there is no right or most appropriate course of action, and so no point in trying to find one. In answer to this disheartening argument, I would point out some of the developments currently taking place in scientific disciplines. For example, efforts to conceptualize, study, and understand forests as coupled socio-ecological systems in a changing climate are gaining traction, even as they acknowledge a degree of complexity that confounds the computational abilities of the most advanced computers, let alone a single human mind (Messier et al., 2013). Scientific endeavor forges onward to confront the unique and bewildering challenges of the world we live in (Funtowicz et al., 1999). Why should the case not be the same for ethics?

And in fact, ethics has recently occupied a prominent position at the forefront of natural resource management and conservation, where in certain circles the conversation has adopted an overtly moralistic tone. Some people, having accepted increasingly common assertions about the ubiquity, and indeed dominance, of the human species (e.g. Lewis & Maslin, 2015; Steffen, Crutzen, & McNeill, 2007; Vitousek, Mooney, Lubchenco, & Melillo, 1997), suggest that natural resources should be managed and conserved "for the people," protecting biodiversity and the ecosystems that support them to the extent possible, but with the ultimate objective of securing human welfare (e.g. Kareiva & Marvier, 2007, 2012). Though advancing their ideas under the enlightened banner of pragmatism, these conservationists actually perpetuate a historically entrenched, anthropocentric vision of humans and human values (Callicott, 1990), which is seemingly resigned to the self-serving habits of a species assumed to be stubbornly committed to pursuing its own interests above all others. Such so-called "New Conservation" strategies that settle for old ethics fail to realize that we can make decisions on the basis of what should be, and not just what seems easiest or most apparently possible. Leaving aside the unsubstantiated empirical claims underlying this argument (Doak, Bakker, Goldstein, & Hale, 2013), the position is also decidedly defeatist in refusing to accept the possibility of further moral development. Had we succumbed to this same resignation in years past, we might still today be living in a world where women, Jews, and African Americans, among many others, would be denied what are now considered basic human rights.

An ethical framework as narrow as anthropocentrism acts as a fine-mesh moral filter, ensuring that we concern ourselves only with those things that are of direct interest, value, or benefit to the human species. Much as managing to meet the needs of single indicator species will inevitably fail to meet the needs of all the species in a community (Landres, Verner, & Thomas, 1988), management and conservation decisions pursued on the basis of an anthropocentric ethic focused on a single species- our own- are bound to be shortsighted, catching only a tiny glimpse of what is surely a more complex, more challenging, and infinitely richer moral universe than one populated by humans alone. This is the danger, and indeed the tragedy, of New Conservation. As an alternative, management and conservation resting on a more expansive ethic might recognize the moral standing of a far fuller range of entities, and try to see what non-human values might be at stake in the decisions we make and the actions we pursue. Of course, we are invariably (and biologically) bound to see the world through an anthropogenic lens. Nonetheless, with creativity, empathy, and above all humility, we might yet be able to achieve an ethical perspective that acknowledges the inherent value of forests, and at the very least try to respect all that they represent to humans and non-humans alike. From this perspective we might view forests- and consider our place as their managers, stewards, beneficiaries, and dependents- quite differently than we would from an anthropocentric perspective.

Where does ecological forestry stand in this broader context of ethics, management, and conservation? This is a question that cannot be answered until proponents of ecological forestry begin to develop and advance some clear (and hopefully well-justified) ethical commitments. Of course, it is likely that people with different ethical views will advance different ideas about what ecological forestry is and what it ought to do, leading not so much to a single established definition, but rather to an open and ongoing dialogue in which the meaning of "ecological forestry" continues to be defined and negotiated. Even if no cohesive philosophy of ecological forestry were to emerge, by bringing values and ethics to the forefront of discussion, at least people would be clear about what they mean when they say they do, support, or oppose "ecological forestry." This would be an improvement over the current state of the discourse. However, if the concept of ecological forestry were to converge, at least in large part, around a clear environmental ethic, committed to acknowledging the inherent dignity and innumerable human and non-human values of forests, it may not only represent but even instigate a broader societal push to re-envision how humans perceive, use, value, and generally engage with forests, advancing a moral paradigm of management and conservation suited to the ethical complexity of the 21st century.

"The bottom line is to do the best we can with the human and material resources available. And to remember to tell the truth- all the truth, all the time- about source of information, and about assumptions involved in decision-making… And, about our passions and the role they have played in our decisions- an open acknowledgement that all decisions, and certainly natural resource management decisions, are ultimately moral choices." Z.J. Cornett & J.W. Thomas, 1996

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APPENDICES

Appendix A: Argument Selection Survey

Please enter your name in the box below. Your participation in this project will be known only to me (Chelsea Batavia) and my advisor (Michael P. Nelson). All responses will be kept confidential according to IRB protocol, and your identity will not be reported in my thesis, at my defense, or in any publications that may come out of this work. I am keeping track of your individual responses only so that I can contact you for clarification purposes.

Ecological forestry represents a position about how forests ought to be managed. My intention is to more closely examine the nature of this position, as well as the arguments made for and against it. In this questionnaire I will present you with two tables. The first is a table of what I have identified as the fundamental claims of ecological forestry, based on my reading of the literature. These are claims that would be made of ecological forestry at any site or in any context. The second is a table of reasons for why people support or oppose ecological forestry. The reasons in this second table pertain specifically to the implementation of ecological forestry on O&C lands in western Oregon. I will ask for your input on both of these tables.

Below are what I believe to be the fundamental claims of ecological forestry.

Ecological forestry is based on the best available science.
Ecological forestry is a type of sustainable forest management.
Ecological forestry emulates the effects of natural disturbance within the historic range of variability.
Ecological forestry achieves multiple (social, economic, ecological) objectives.

Now I would like to ask for your feedback on this table. Please indicate below the extent to which you agree with my assessment that these claims are fundamental to ecological forestry, at any site or in

any context (0 = I wholeheartedly disagree, 10 = I wholeheartedly agree).

	0 — 10
Ecological forestry is based on the best available science.	
Ecological forestry is a type of sustainable forest management.	
Ecological forestry emulates the effects of natural disturbance within the historic range of variability.	
Ecological forestry achieves multiple (social, economic, ecological) objectives.	

Would any of these claims be more accurately represented with different wording? Please make suggestions in the boxes below (if you have no suggestions, simply leave the box blank).

Ecological forestry is based on the best available science.

Ecological forestry is a type of sustainable forest management.

Ecological forestry emulates the effects of natural disturbance within the historic range of variability.

Ecological forestry achieves multiple (social, economic, ecological) objectives.

Are there fundamental claims that you think I have missed? Please make any suggestions in the box below. Again, please bear in mind that this question pertains to ecological forestry as a general strategy, not as a management plan for any specific site or context.

Although there are certain core principles of ecological forestry, more site-specific details emerge when it is applied to a particular context. For my project I am going to examine the applied example of ecological forestry in western Oregon. The O & C Land Grant Act is currently moving through Congress. Under the bill, regeneration harvests would occur in certain areas of the O&C lands, using ecological forestry as defined and described by Drs. Norm Johnson and Jerry Franklin. The bill has sparked lively debate among various social groups in Oregon.

There are numerous arguments made for and against the use of ecological forestry on the O&C lands. In the table below I have listed what I believe to be the main reasons advanced, i.e. those most central to the debate, both in the public discourse and in the scholarly literature. In this section I would like to ask for your feedback on the reasons I have identified.

To be clear, these are reasons given for and against the use of ecological forestry as proposed in the O&C Land Grant Act of 2013, *not* reasons for and against the bill itself. Thus, you will see that certain prominent arguments made for and against the bill, such as streamlining protocols to facilitate timber harvests (pro), or setting a precedent for loosening environmental regulations (con), are not in this table, and not under consideration in my analysis.

Pro EF on O&C lands	Con EF on O&C lands
Restoration of landscape heterogeneity by creating more complex early seral	Does not effectively create complex early seral
Supports biodiversity by creating more complex early seral habitat	There is no need for more early seral
Increases timber yields (financial stability/jobs)	Does not provide an adequate amount of revenue/jobs to rural communities
Threat of privatization if a socially acceptable management strategy can't be found to allow more than thinning on public lands	Variable retention harvests are analogous in effect to clearcuts
Conservation of old trees/old growth forests	Threatens conservation of old growth
Conservation of biodiversity (particularly threatened and endangered species)	Threatens conservation of biodiversity
Supports forest health and landscape resilience	Not enough certainty about consequences of ecological forestry treatments
	Negative outcomes (water, soil, carbon, wildlife, social acceptability)

How central is each reason to the position <u>in favor of</u> ecological forestry on O&C lands? Please assign each reason a number (0 = completely irrelevant, 10 = absolutely crucial). Please note, you are not

ranking these reasons, i.e. you may assign the same degree of centrality to multiple reasons.

	0 — 10
Restoration of landscape heterogeneity by creating more complex early seral	
Supports biodiversity by creating more complex early seral habitat	
Increases timber yields (financial stability/jobs)	
Threat of privatization if a socially acceptable management strategy can't be found to allow more than thinning on public lands	
Conservation of old trees/old growth forests	
Conservation of biodiversity (particularly threatened and endangered species)	
Supports forest health and landscape resilience	

Would any of these reasons be more accurately represented with different wording? Please make suggestions below.

Restoration of landscape heterogeneity by creating more complex early seral	
Supports biodiversity by creating more complex early seral habitat	
Increases timber yields (financial stability/jobs)	
Threat of privatization if a socially acceptable management strategy can't be found to allow more than thinning on public lands	
Conservation of old trees/old growth forests	
Conservation of biodiversity (particularly threatened and endangered species)	
Supports forest health and landscape resilience	

Have I missed any reasons that you believe are central to the position in favor of ecological forestry on O&C lands? Please make suggestions in the box below.

Now please do the same exercise from above with the reasons representing the position <u>opposing</u> ecological forestry on O&C lands (again, 1 = completely irrelevant, 10 = absolutely crucial).

	0 — 10
Does not effectively create complex early seral	
There is no need for more early seral	
Does not provide an adequate amount of revenue/jobs to rural communities	
Variable retention harvests are analogous in effect to clearcuts	
Threatens conservation of old growth	
Threatens conservation of biodiversity	
Not enough certainty about consequences of ecological forestry treatments	
Negative outcomes (water, soil, carbon, wildlife, social acceptability)	

Would any of these reasons be more accurately represented with different wording? Please make suggestions below.

Doesn't effectively create complex early seral

There is no need for more early seral	
Does not provide an adequate amount of revenue/jobs to rural communities	
Variable retention harvests are analogous in effect to clearcuts	
Threatens conservation of old growth	
Threatens conservation of biodiversity	
Not enough certainty about consequences of ecological forestry treatments	
Negative outcomes (water, soil, carbon, wildlife, social acceptability)	

Have I missed any reasons that you believe are central to the position opposing ecological forestry on O&C lands? Please make suggestions in the box below.

Block 2

If you have any additional comments, feedback, critiques, advice, or ideas, please write them in the box below.

Appendix B: Example Argument Review Survey

Below is an example of an Argument Review survey. Each expert received a different set of three arguments. If an expert answered "no" to the first question ("do you believe I have accurately represented this argument"), he or she was then asked to provide general commentary ("please describe how I have mischaracterized this argument"), and then moved on to the next argument. If an expert answered "yes" to the first question, he or she was asked to suggest alternative wording, assess the truth of premises, assess the controversy of premises, and make any other comments before moving on to the next argument.

Please enter your name in the box below. Your participation in this process will be known only to me (Chelsea Batavia) and my advisor (Michael P. Nelson). All responses will be kept confidential according to IRB protocol, and your identity will not be reported in my thesis, at my defense, or in any publications that may come out of this work. I am keeping track of individual responses only so that I can contact you for clarification purposes.

According to the rules of logic, arguments are constructed out of premises (P) and conclusions (C). By laying out the premises and conclusion(s) of an argument, the line of reasoning behind it becomes transparent, facilitating examination and critical evaluation.

Over the past two months I have been formulating arguments for and against the implementation of ecological forestry on the O&C lands in western Oregon. I would now like to ask for your feedback on my work. In this questionnaire I have sent you three arguments for review. Some of them will support the use of ecological forestry on O&C lands, and some will oppose the use of ecological forestry on O&C lands. I will ask you to assess each argument by answering a series of questions. To be clear, my hope in this exercise is to receive your feedback about whether these arguments accurately reflect debates in the public media and scholarly literature. Although you may not agree with some of the premises or conclusions that you read, please try to evaluate each argument objectively, based not on whether you personally agree or disagree, but rather on whether my formulation of the argument lays out the line of reasoning as you have seen or heard it advanced.

Below is my formulation of an argument in favor of using ecological forestry (EF) on O&C lands:

The conservation argument

P1: In the PNW, late successional species are threatened by habitat loss.

P2: It is possible to reverse this habitat loss by restoring late successional/old-growth habitat to the PNW.

P3: People in the PNW want federal forests to be managed for conservation of threatened and endangered late successional species.

P4: Management objectives on public lands should reflect public values.

C1: Therefore, federal forests in the PNW should be managed for conservation of threatened and endangered late successional species, by restoring late successional/old-growth habitat.

P5: By managing federal forests with EF, late-successional/old-growth habitat will be restored to the PNW.

C2: Therefore, federal forests in the PNW should be managed using EF.

Do you believe that I have accurately represented this argument? (If you think there are some adjustments to be made, but the overall line of reasoning is more or less correct, please answer "yes." You will still have the opportunity to make revisions later. If you think that the argument is generally misrepresented, please answer "no.")

- ◯ Yes
- ◯ No

For reference, here again is the argument under consideration:

The conservation argument

P1: In the PNW, late successional species are threatened by habitat loss.

P2: It is possible to reverse this habitat loss by restoring late successional/old-growth habitat to the PNW.

P3: People in the PNW want federal forests to be managed for conservation of threatened and endangered late successional species.

P4: Management objectives on public lands should reflect public values.

C1: Therefore, federal forests in the PNW should be managed for conservation of threatened and endangered late successional species, by restoring late successional/old-growth habitat.

P5: By managing federal forests with EF, late-successional/old-growth habitat will be restored to the PNW.

C2: Therefore, federal forests in the PNW should be managed using EF.

Please describe how I have mischaracterized this argument in the box below. Feel free to make suggestions, or even lay out a basic sketch of how you think the argument should be formulated as a series of premises (P) leading to a conclusion (C).

For reference, here again is the argument under consideration:

The conservation argument

P1: In the PNW, late successional species are threatened by habitat loss.

P2: It is possible to reverse this habitat loss by restoring late successional/old-growth habitat to the PNW.

P3: People in the PNW want federal forests to be managed for conservation of threatened and endangered late successional species.

P4: Management objectives on public lands should reflect public values.

C1: Therefore, federal forests in the PNW should be managed for conservation of threatened and endangered late successional species, by restoring late successional/old-growth habitat.

P5: By managing federal forests with EF, late-successional/old-growth habitat will be restored to the PNW.

C2: Therefore, federal forests in the PNW should be managed using EF.

Would any part(s) of this argument be better represented with different wording? Please make suggestions in the boxes below.

P1

P2

P3

P4

C1

P5

C2

Now I would like you to assess the premises. First, please describe whether and/or to what extent you think each premise is <u>true</u>. Please consider each premise individually, both as I formulated it and as you may have revised it above. (If you did not revise a given premise, simply leave that box blank.)

P1	
P1 (revised)	
P2	
P2 (revised)	
P3	
P3 (revised)	
P4	
P4 (revised)	
P5	
P5 (revised)	

Now please describe whether and/or to what extent you think each premise is <u>controversial</u>.

P1	
P1 (revised)	
P2	
P2 (revised)	
P3	
P3 (revised)	
P4	
P4 (revised)	
P5	
P5 (revised)	

Do you have any additional feedback about this argument? Please use the box below for comments.

Block 1

Below is my formulation of an argument opposed to using ecological forestry (EF) on O&C lands:

The "future old-growth" argument

P1: Under current policy, old-growth (OG) will be preserved and younger forests will be accelerated toward OG conditions.

P2: EF would actively manage young forests for timber production, thereby taking them off the OG track.

P3: Management of federal forests in the PNW should prioritize OG conservation, unless there is an adequate reason to de-prioritize it.

P4: Increasing timber production on federal lands is not an adequate reason to de-prioritize OG conservation.

C: Therefore, federal forests should not be managed using EF.

Do you believe that I have accurately represented this argument? (If you think there are some adjustments to be made, but the argument is more or less correct, please answer "yes." You will still have the opportunity to make revisions later. If you think that the argument is generally misrepresented, please answer "no.")

- ◯ Yes
- ◯ No

For reference, here again is the argument under consideration:

The "future old-growth" argument

P1: Under current policy, old-growth (OG) will be preserved and younger forests will be accelerated

toward OG conditions.

P2: EF would actively manage young forests for timber production, thereby taking them off the OG track.

P3: Management of federal forests in the PNW should prioritize OG conservation, unless there is an adequate reason to de-prioritize it.

P4: Increasing timber production on federal lands is not an adequate reason to de-prioritize OG conservation.

C: Therefore, federal forests should not be managed using EF.

Please describe how I have mischaracterized this argument in the box below. Feel free to make suggestions, or even lay out a basic sketch of how you think the argument should be formulated as a series of premises (P) leading to a conclusion (C).

For reference, here again is the argument under consideration:

The "future old-growth" argument

P1: Under current policy, old-growth (OG) will be preserved and younger forests will be accelerated toward OG conditions.

P2: EF would actively manage young forests for timber production, thereby taking them off the OG track.

P3: Management of federal forests in the PNW should prioritize OG conservation, unless there is an adequate reason to de-prioritize it.

P4: Increasing timber production on federal lands is not an adequate reason to de-prioritize OG conservation.

C: Therefore, federal forests should not be managed using EF.

Would any part(s) of this argument be better represented with different wording? Please make suggestions in the boxes below.

P1

P2

P3

P4

C

Now I would like you to assess the premises. First, please describe whether and/or to what extent you think each premise is true. Please consider each premise individually, both as I formulated it and as you may have revised it above. (If you did not revise a given premise, simply leave that box blank.)

P1

P1 (revised)

P2

P2 (revised)

P3

P3 (revised)

P4

P4 (revised)

Now please describe whether and/or to what extent you think each premise is controversial.

P1

P1 (revised)

P2

P2 (revised)

P3

P3 (revised)

P4

P4 (revised)

P3

P4

C

Now I would like you to assess the premises. First, please describe whether and/or to what extent you think each premise is <u>true</u>. Please consider each premise individually, both as I formulated it and as you may have revised it above. (If you did not revise a given premise, simply leave that box blank.)

P1

P1 (revised)

P2

P2 (revised)

P3

P3 (revised)

P4

P4 (revised)

Now please describe whether and/or to what extent you think each premise is <u>controversial</u>.

P1

P1 (revised)

P2

P2 (revised)

P3

P3 (revised)

P4

P4 (revised)

Do you have any additional feedback about this argument? Please use the box below for comments.

Below is my formulation of another argument opposed to using ecological forestry (EF) on O&C lands:

The carbon argument

P1: Management of public lands should reflect the public interest.

P2: It is in the broadest public interest, present and future, to mitigate global climate change.

C1: Therefore, public lands should be managed in a way that mitigates global climate change, unless there is a compelling reason not to do so.

P3: Forests sequester carbon, thereby mitigating global climate change.

P4: Using EF to manage federal forests in the PNW will release sequestered carbon in order to increase timber production.

P5: Releasing sequestered carbon is antithetical to global climate change mitigation.

P6: Increasing timber production is not a compelling reason to manage public lands in a way that is antithetical to global climate change mitigation.

C2: Therefore, federal forests in the PNW should not be managed using EF.

Do you believe that I have accurately represented this argument? (If you think there are some adjustments to be made, but the argument is more or less correct, please answer "yes." You will still have the opportunity to make revisions later. If you think that the argument is generally misrepresented, please answer "no.")

- Yes
- No

For reference, here again is the argument under consideration:

The carbon argument

P1: Management of public lands should reflect the public interest.

P2: It is in the broadest public interest, present and future, to mitigate global climate change.

C1: Therefore, public lands should be managed in a way that mitigates global climate change, unless there is a compelling reason not to do so.

P3: Forests sequester carbon, thereby mitigating global climate change.

P4: Using EF to manage federal forests in the PNW will release sequestered carbon in order to increase timber production.

P5: Releasing sequestered carbon is antithetical to global climate change mitigation.

P6: Increasing timber production is not a compelling reason to manage public lands in a way that is antithetical to global climate change mitigation.

C2: Therefore, federal forests in the PNW should not be managed using EF.

Please describe how I have mischaracterized this argument in the box below. Feel free to make suggestions, or even lay out a basic sketch of how you think the argument should be formulated as a series of premises (P) leading to a conclusion (C).

For reference, here again is the argument under consideration:

The carbon argument

P1: Management of public lands should reflect the public interest.

P2: It is in the broadest public interest, present and future, to mitigate global climate change.

C1: Therefore, public lands should be managed in a way that mitigates global climate change, unless there is a compelling reason not to do so.

P3: Forests sequester carbon, thereby mitigating global climate change.

P4: Using EF to manage federal forests in the PNW will release sequestered carbon in order to increase timber production.

P5: Releasing sequestered carbon is antithetical to global climate change mitigation.

P6: Increasing timber production is not a compelling reason to manage public lands in a way that is antithetical to global climate change mitigation.

C2: Therefore, federal forests in the PNW should not be managed using EF.

Would any part(s) of this argument be better represented with different wording? Please make suggestions in the boxes below.

P1	
P2	
C1	
P3	
P4	
P5	
P6	
C2	

Now I would like you to assess the premises. First, please describe whether and/or to what extent you think each premise is <u>true</u>. Please consider each premise individually, both as I formulated it and as you may have revised it above. (If you did not revise a given premise, simply leave that box blank.)

P1	
P1 (revised)	
P2	
P2 (revised)	
P3	
P3 (revised)	
P4	
P4 (revised)	
P5	
P5 (revised)	

P6

P6 (revised)

Now please describe whether and/or to what extent you think each premise is controversial.

P1

P1 (revised)

P2

P2(revised)

P3

P3 (revised)

P4

P4 (revised)

P5

P5 (revised)

P6

P6 (revised)

Do you have any additional feedback about this argument? Please use the box below for comments.