

Baseline Wilderness Character Monitoring Assessment for the Ochoco National Forest

by

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ABSTRACT OF THE PROJECT OF

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Wilderness character monitoring (WCM) is an interagency strategy created in 2008 in collaboration between the four federal land management agencies that manage designated wilderness (Forest Service, National Park Service, Fish and Wildlife Service and Bureau of Land Management) and other contributors (Landres et al. 2008). The reports created from this monitoring protocol are meant to reflect how wilderness character changes over time and how wilderness stewardship efforts have impacted those trends in every designated wilderness area (Landres et al. 2008). Wilderness character is a holistic concept comprising not just the physical attributes of a wilderness area, but also the experiential and symbolic ideals that distinguish it from other public lands (Landres et al. 2015). For my MNR capstone project I prepared individual baseline WCM reports for the three wilderness areas in the Ochoco National Forest in central Oregon. Black Canyon, Bridge Creek, and Mill Creek Wildernesses are all breathtaking examples of the Blue Mountains ecoregion and especially excel in their available opportunities for solitude. Ultimately, I found that the Ochoco National Forest should collect more field data and improve existing reporting processes to improve overall data adequacy of the reports. In addition, I also noted that the presence of cattle in all three wilderness areas is presently the biggest detriment to wilderness character in the Ochoco. Through the process of preparing these reports, I enhanced my understanding of public administration functions, improved my collaborative skills, and applied my knowledge of central Oregon ecology.

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Background

In 1921, Forest Supervisor Aldo Leopold of the Gila National Forest in New Mexico wrote a letter to the *Journal of Forestry* that contained a bold new idea (Schneider-Hector 2009). Over the prior decade he had personally observed how an unregulated wolf-hunting policy in the region had upset the balance of the local ecosystem (Schneider-Hector 2009). Although he had previously believed that a landscape without wolves could only bring benefits, he now saw the expansive fields that once hosted grasses and wildflowers grazed to the soil by unthreatened deer and cattle (Schneider-Hector 2009). This experience led Leopold to believe that nature is best managed by letting it be (Schneider-Hector 2009). When local cattle ranchers wanted to construct a road to allow for easier grazing access through a parcel of land that had personal and ecological significance to Leopold, he wrote the letter to the journal and a wilderness proposal to the Forest Service in Washington D.C. urging the agency to recognize the importance of preserving “a continuous stretch of country...in its natural state” (Leopold 1921 cited in Gibbons 2014). His proposal was accepted in 1924, officially protecting over 500,000 acres of wild

landscape around the Gila River headwaters and setting the foundation for future wilderness legislation (Schneider-Hector 2009).

In June 1956, Senator Hubert Humphry introduced the first Wilderness Bill to the Senate floor, which was drafted by Howard Zahniser of the Wilderness Society in collaboration with the Sierra Club, National Parks Association, National Wildlife Federation, and Wildlife Management Institute (McCloskey 1965). The Bill was initially opposed by both the National Park Service and Forest Service, the latter of whom feared that it would jeopardize its multiple-use mission (McCloskey 1965). Nine years would pass before enactment of the Wilderness Act occurred, and in that time 65 variations of the Bill were introduced to the House (20 of which passed), 18 hearings were held (six in Washington D.C. and twelve in the States), and thousands of pages of transcripts and public letters were compiled (McCloskey 1965). Despite the delays, on September 4, 1964, the Wilderness Act was signed into law by President Lyndon B. Johnson with full support from the U.S. Forest Service and other federal land management agencies (McCloskey 1965).

When the Act was passed, 54 wilderness areas in 13 states were immediately established as a part of the newly created National Wilderness Preservation System (NWPS), covering over 9.1 million acres (Wilderness Connect 2023). Since then, new wilderness areas have been established near-annually, with the current number standing at 806 unique wildernesses covering over 111 million acres across 44 states and Puerto Rico, and are co-managed by the Forest Service, National Park Service, Fish and Wildlife Service and Bureau of Land Management (Wilderness Connect 2023). In total, wilderness areas in the NWPS comprise approximately 5% of total land cover in the United States, which is slightly larger than the state of California (Wilderness Connect 2023). While the National Park Service manages the most wilderness acres

(44 million), the Forest Service oversees the most individual wilderness units (448) (Wilderness Connect 2023).

In its mandate, the Wilderness Act requires that “each agency administering...wilderness shall be responsible for preserving the wilderness character of the area” (Wilderness Act 1964). Although the central concept of ‘wilderness character’ was not defined in the original Act, the Interagency Wilderness Character Monitoring Team (IWCMT) agreed upon the following definition:

“Wilderness character is a holistic concept based on the interaction of (1) biophysical environments primarily free from modern human manipulation and impact, (2) personal experiences in natural environments relatively free from the encumbrances and signs of modern society, and (3) symbolic meanings of humility, restraint, and interdependence that inspire human connection with nature” (Landres et al. 2015, p. 7).

From this definition, it is clear that wilderness character is comprised of both tangible and intangible elements, the former substantially easier to measure than the latter. But it is precisely those intangible elements that represent the spirit of Wilderness. Both contemporary and classic literature emphasize how, at its core, an area that embodies wilderness character has the capacity to elicit humility, awaken a sense of interconnectedness with the land, and evoke feelings of restraint and an obligation to nature (Landres et al. 2015).

In order to translate these conceptual ideals to practical measures, five distinct qualities derived from the original Wilderness Act definition of wilderness were identified by the IWCMT: Untrammelled, natural, undeveloped, opportunities for solitude and unconfined

recreation, and other features of value (Landres et al. 2015). Wilderness character monitoring (WCM) is the process of assessing how those qualities are trending over time and how stewardship efforts impact them.

The act of ‘trammeling’ is to intentionally manipulate the land in a way that significantly impacts ecosystem processes (Landres et al. 2018). In other words, a goal of wilderness management is that any action taken has minimal to no impact on the local ecosystem processes. At the time of the 1964 Act’s passing, its creator, Howard Zahniser, stated that the purpose of Wilderness was not just to maintain its natural condition, but to respect and perpetuate natural ecological processes, free of human interference (Kaye 2018). This thinking laid the foundation of the wilderness management ethos, namely that managers ought to oversee their parcels with humility and restraint, leaving the ecosystem to run itself.

Forgotten in this definition are the societies of Indigenous Peoples who inhabited and stewarded these lands for time immemorial before policies like the Wilderness Act. In most cases, these people were forcibly and violently removed from their ancestral homelands, and evidence of their own intentional manipulation of the land gradually faded from these areas as the purpose of the land changed under U.S. government control. It is the goal of WCM report preparers to accurately convey current trammeling actions that occur in wilderness, but also appropriately recognize that the concept itself is inherently problematic to modern standards. That being said, the goal of monitoring trammeling actions is to assess *how* an area is managed in contrast to *what* is there, which is covered by other qualities (Landres et al. 2015).

The natural quality of wilderness is defined as “the indigenous species compositions, structures, and functions of the wilderness” (Landres et al. 2015). This quality monitors the biological and physical elements of wilderness (e.g. plant and animal species/communities, soil,

water and air) and how those components interact with one another (Landres et al. 2015).

Wilderness areas are largely regarded as ecological baselines from which the impacts of human manipulation in other regions can be assessed (Landres et al. 2015). For this reason, wilderness areas are also useful when monitoring the effects of regional or global threats, such as climate change (Landres et al. 2015). Impacts to a wilderness area's natural quality do not need to originate from within its boundaries, as fragmentation from development, pollution, and invasive plant dispersal can all play a role (Cole & Landres 1996).

The idea that wilderness should remain undeveloped and free of permanent structures is a concept that threads nearly every definition of wilderness. Since its first conception in Leopold's 1921 letter, where he expressed the need for "a continuous stretch of country in its natural state," wilderness has been envisioned by western Euro-Americans as a place devoid of human development. Some contemporary interpretations of wilderness character include the perspective that wilderness' purpose is not only to preserve natural landscapes, but also to understand human use and value of the land over time (Cowley et al. 2012). Individuals who share this perspective believe that human history is integral to wilderness, and key cultural resources should be preserved, even if they count as developments (Cowley et al. 2012).

The 'undeveloped' mandate also excludes the use of motorized transport, motorized equipment, or mechanized transport, except when authorized (Landres et al. 2015). Despite this provision of the Act, there is seldom a wilderness in existence today that does not bear the evidence of human modification or occupation (Landres et al. 2015). In addition, many wilderness areas, including the ones described in this report, allow for special provisions to use such equipment in enabling legislation to maintain range infrastructure and suppress wildfires with chainsaws (Landres et al. 2015). Despite allowances, the presence of these modern tools

does have an impact on wilderness character, and the goal is to determine if this quality is stable or improving over time.

The definition of opportunities for solitude and unconfined recreation can be explored in two parts. In the context of wilderness, solitude not only refers to the ability to find privacy and get away from civilization, but to be able to find inspiration, self-paced activities, and a connection with nature (McCool 2004; Engebretson & Hall 2019). Primitive or unconfined recreation experiences are opportunities for physical and mental freedom and challenges in natural spaces that could have real-life consequences in the event of a mistake, and the personal growth that comes from overcoming challenges (McCool 2004; Engebretson & Hall 2019). Some aspects of this quality cannot be controlled by management, as much of this definition is values-based, but local administrators do have some control over this quality. Examples include deciding whether or not to impose special regulations for visitors inside wilderness, choosing whether to develop a trail system for better accessibility, or providing information on recreation opportunities online. Often, managers face the decision of whether to minimize physical impacts from human visitation on the natural landscape at the expense of improving access and thereby decreasing opportunities for solitude and unconfined recreation. Because this quality is highly subjective and complex, the purpose of monitoring this quality is not to understand visitors' experiences, perceptions, or motivations in wilderness, but to monitor whether current management practices allows for opportunities to exist and how the opportunities are changing over time (Landres et al. 2015).

The “other features of value” quality monitors specific, tangible features and how the conditions of these features change over time; it does not monitor the values derived from these features (Landres et al. 2018). These features are meant to derive some “ecological, geological,

or other features of scientific, educational, scenic, or historic value” (Wilderness Act 1964). For inclusion in wilderness character monitoring, the features must be unique and essential to the character of that particular wilderness (e.g. in the case of a Wilderness named after feature). This quality does not monitor the intrinsic values of the feature, but instead monitors its *physical* condition (Landres et al. 2015). It is not required that every wilderness have a feature designated under this category to be monitored, and most do not, including the wilderness areas outlined in this report. Intangible resources such as spiritual values or traditional stories are also important for this quality but are not monitored and are instead covered in the narrative that accompanies the assessment. Together, these five qualities encompass the physical, social, and managerial aspects of a given wilderness area.

It is important to note several things about these qualities: 1) All five qualities are equally important, 2) These qualities apply to every wilderness, 3) These qualities are uniquely expressed in each wilderness, 4) Wilderness character is more than just these qualities, and 5) Management actions may preserve, improve or degrade these qualities (Landres et al. 2015). It is important to monitor these qualities of wilderness character not only to comply with the law and fulfill agency policies, but also to improve wilderness stewardship (Landres et al. 2015). By having a systematic framework in place for monitoring, agency transparency and communication are improved, management decisions are better clarified, and a continued legacy of management actions in wilderness is recorded as future reports are compiled (Landres et al. 2015). Additionally, by having a standardized framework across all four federal land management agencies with wilderness areas under their purview, not only can wilderness character be assessed at the individual unit or forest level, but even at a regional or national scale, which can offer insight into the management and condition of the general Wilderness Preservation System.

For these reasons, the National Wilderness Character Monitoring reports are essential for ensuring the responsible and appropriate management of this country's wilderness areas.

There are many factors that must be considered when creating a national-level socioecological monitoring program to ensure that results are representative and accurate. Due to the spatial scale and number of contributors for this type of monitoring program making the process especially complex, issues that have led to past failures include poorly defined objectives, poor selection of indicators, inadequate survey design or effort, or general organizational problems (Reynolds et al. 2016). While there are a number of ways to address these issues, Reynolds et al. (2016) offer a prescriptive approach that is most suitable for national standardized programs like WCM (See figure 1). They break the monitoring process down into four main steps: 1) frame the problem, 2) design the monitoring, 3) implement the monitoring and learn from the data, and 4) learn to improve the monitoring process and revise objectives (Reynolds et al. 2016). This 'road map' is based on decades of previous efforts to define best monitoring practices. According to them, the most common mistake in the monitoring process is the collecting of data first and defining objectives second, which often results in failing to identify relevant system features needed by decision-makers (Reynolds et al. 2016).

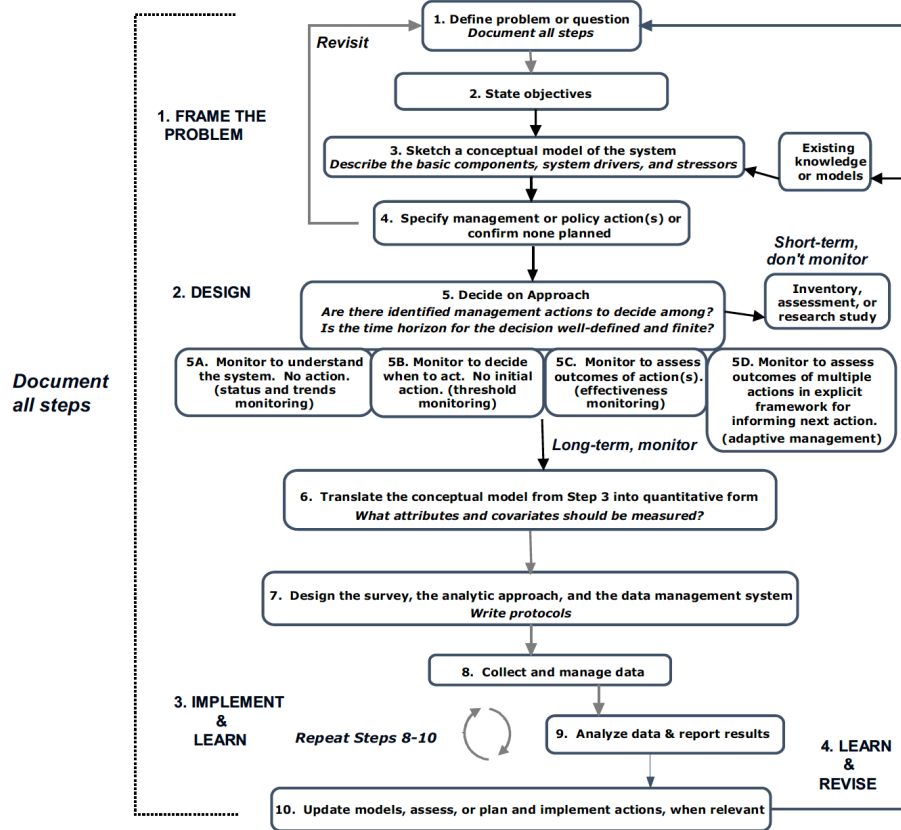


Figure 1: Road map for designing national-level biomonitoring programs by Reynolds et al. (2016).

The final U.S. Forest Service approach to the WCM follows the Reynolds et al. (2016) model closely (see figure 2). However, the first and second steps of ‘framing the problem’ and ‘design’ seen in Reynolds were not explicitly present in the Forest Service’s final approach. This is because that step was addressed during the creation of the monitoring program by the Wilderness Character Monitoring Central Team in 2008, when the problem of needing to monitor wilderness character was identified and the monitoring protocol was developed. The final monitoring approach is a blend of the four options (a-d) outlined in sub-step five of Figure 2. The primary approach more closely follows 5c and 5d, since WCM reports explicitly monitor management outcomes to inform future decisions. That being said, the WCM reports also offer

important insight into general wilderness management structure and processes (5a), as well as inform management where and when certain actions would be most appropriate (5b).

Figure 2: U.S. Forest Service General Approach to Monitoring Trends in Wilderness Character (Landres et al. 2008a.)

- 1. Review the list of indicators and make modifications as appropriate.*
- 2. For each indicator, identify measures that can be used to assess trend in the indicator.*
- 3. Assess trend for each measure.*
- 4. Use these assessments of trend for each measure to decide if each indicator is improving, degrading, or stable.*
- 5. Use these assessments of trend for each indicator to decide if each quality of wilderness character is improving, degrading, or stable.*
- 6. Use these assessments of trend for each quality to decide whether overall wilderness character is improving, degrading, or stable.*

Great effort was taken by agency personnel and other contributors to ensure that adequate measures were conceived that would be representative of trends in wilderness character. During that process, numerous tradeoffs occurred with regards to the quantity of measures selected to characterize each quality. Due to the diversity of the vast NWPS landscape and impracticality of including every representative measure for a certain quality, the minimum number of measures had to be selected that would also not compromise overall data quality (Hall 2023). For example, the given measures for the ‘natural’ quality of the WCM are not nearly exhaustive enough to truly understand the natural processes’ of a certain location. However, the selected measures are feasible to collect and can be applied to every wilderness in the NWPS (Hall 2023).

Careful consideration was made regarding how certain actions in wilderness can impact multiple qualities in contrasting ways. For example, the implementation of treatment for invasive plants encroaching in wilderness may ultimately improve the area’s ‘natural’ quality, but the treatment itself counts as a ‘trammeling’ action, impairing that quality (Lieberman et al. 2018).

The complex assessment landscape has necessitated careful crafting of the technical measures to most accurately reflect changes in wilderness quality. The culmination of these efforts was a nearly 300-page technical guide for personnel to reference when conducting wilderness character monitoring (Landres et al. 2018). The WCM process has been revised several times since its creation, which follows recommendations from Reynolds et al. (2016) to continue learning and revising monitoring plans based on new information.

The format of the three WCM reports for the Ochoco follow the ‘8-point’ template created by the interagency team responsible for WCM reporting, which is the template for a complete baseline report. A baseline assessment is the first WCM conducted for a given wilderness area and is the reference point for all trends recorded in future WCM efforts. Because these reports are based on a template as opposed to being from scratch, I was responsible for obtaining information and data, evaluating its quality, and summarizing the status of each of the selected technical measures. For this reason, there are several sections of the completed baseline WCM reports that are copied straight from the template, including the introduction up to the site-specific narratives, much of the process for selecting measures (other than parts that are specific to the Ochoco WCM reports), the overview of WCM measures, the introduction pages for each quality in the technical section, and some measure descriptions and thresholds for change. Figure 3 shows two example pages from the baseline template (USDA 2020). A completed baseline WCM report for the Bridge Creek Wilderness in the Ochoco is provided as a supplemental document to this capstone report in the Oregon State University Scholars Archive for further reference.

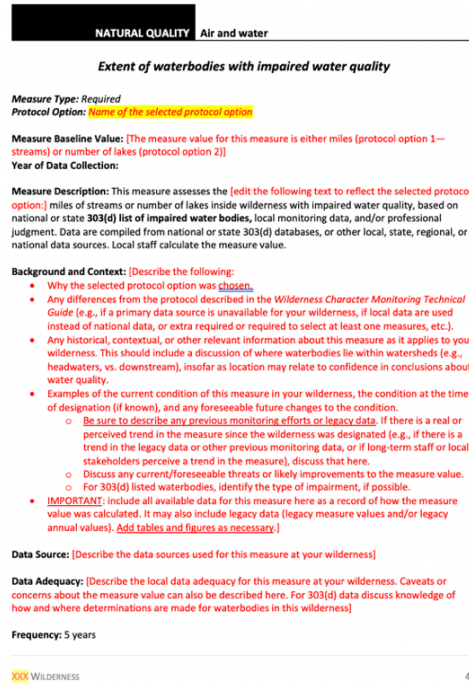
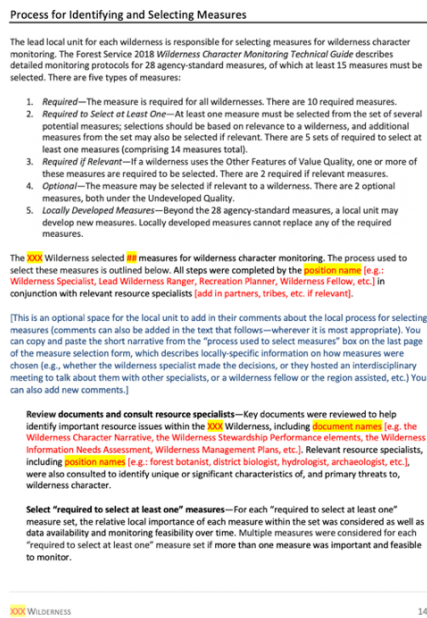


Figure 3: Two example pages from the USFS template for the baseline WCM reports. The left page shows an excerpt from the section on measure selections. The writing in black is left in the final reports, while the text in red is replaced by wilderness-specific narratives. The image on the right shows a typical technical measure page.

Ochoco National Forest WCM Process

In 2018, the USFS committed to assessing all 448 wilderness areas within its jurisdiction over a 5-year period (~20% per year) (USDA 2020). Although the agency was a decade behind the other federal land management agencies in starting the process, it is largely on track to meet its goal by the end of 2023. The Ochoco National Forest in central Oregon (see Figure 4) is an example of one such forest that has not completed a baseline assessment yet. The need to conduct a baseline wilderness character assessment in the Ochoco National Forest’s three wildernesses (Black Canyon, Bridge Creek, and Mill Creek) is especially great given new policies in nearby wildernesses. In May 2021, the Deschutes and Willamette National Forests

implemented a new limited-entry wilderness permit system for five Central Cascades Wildernesses that has impacted visitation to these areas by locals and tourists alike. This region of central Oregon has also seen a massive influx of new residents in recent years. Pre-COVID-19, the nearby town of Bend was the second-fastest growing city in the nation, and many of those new residents moved there particularly for the local outdoor recreation opportunities (Toepfer 2020). In upcoming years, it is expected that visitation in the Ochoco wildernesses will increase and intensify, especially those closest to major towns, as visitors try to find less heavily used and more accessible wilderness. (Beaupre 2021).

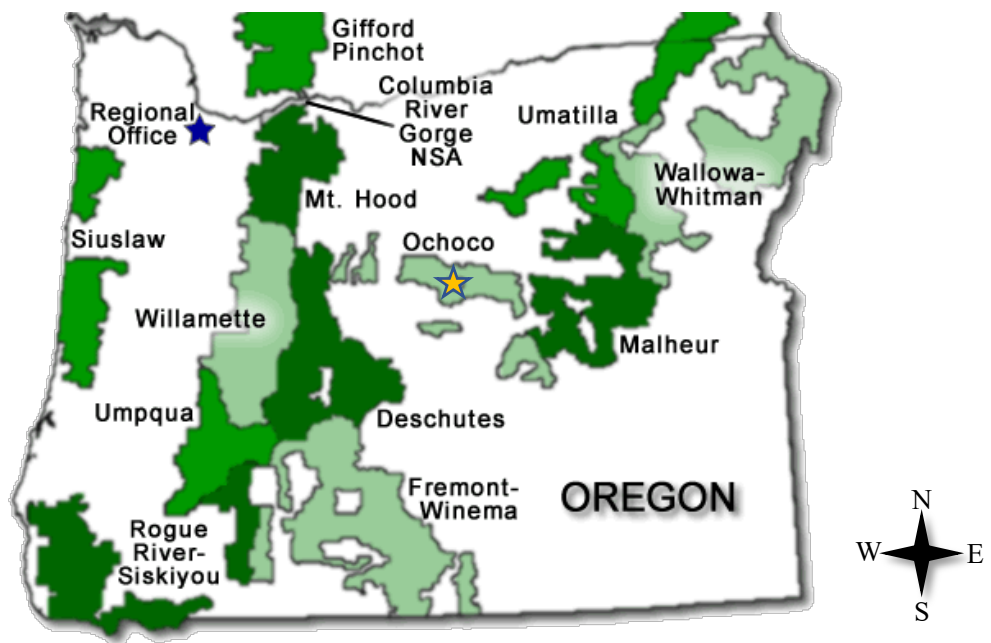


Figure 4: Map showing public lands administered by the Forest Service in the state of Oregon. The location of the Ochoco National Forest is indicated by a yellow star near the geographic center of the state. The Deschutes and Willamette National Forests are directly to the west of the Ochoco. (Provided by U.S. Forest Service Pacific Northwest Region 2023)

Before the Ochoco amends its current forest management plan (last updated in 1989) and experiences the impacts from new visitation, it is important for the management team to have a thorough and accurate baseline wilderness character monitoring (WCM) assessment (Joosen 2021). This assessment can later be referenced by agency personnel at a local, regional, or

national level when analyzing the impacts of increased visitation such as invasive species introduction, dispersed campsite impacts, and loss of opportunities for solitude. These reports are also used at an interagency level to assess the quality of the National Wilderness Preservation System as a whole.

Ochoco National Forest staff have been hampered in implementing WCM due to a lack of resources and knowledge about how to conduct wilderness character monitoring (Joosen 2021). The forest has no dedicated wilderness manager nor any additional personnel who could spend the time needed to create three individualized reports for each wilderness area.

Historically, wilderness management has not been a priority for Ochoco National Forest administrators due to low levels of use in these areas and other management priorities such as wildfire, range, and timber. For this reason, my advisor Dr. Troy Hall and I offered to conduct background data gathering and write the report in coordination with the Ochoco NF recreation planner, Kent Koeller. Dr. Hall was, and continues to be, an essential contributor to the development and application of wilderness character monitoring and is a leading researcher in the field of values and attitudes related to wilderness and natural resource management.

Before my role in these reports' creation could begin, relevant Ochoco program managers and specialists met with the recreation, heritage, lands, and partnerships (RHLP) staff officer over a period of six weeks in 2021 to select which technical measures they thought were most appropriate and feasible to monitor. According to staff from the Ochoco NF, approximately 20-25 people were consulted during this process. From these conversations, 16 measures were selected for all three wildernesses. An optional measure was also selected for both the Bridge Creek and Mill Creek Wildernesses that did not apply to Black Canyon Wilderness. It is also important to note the choice to monitor designated trails in Mill Creek and Black Canyon, but the

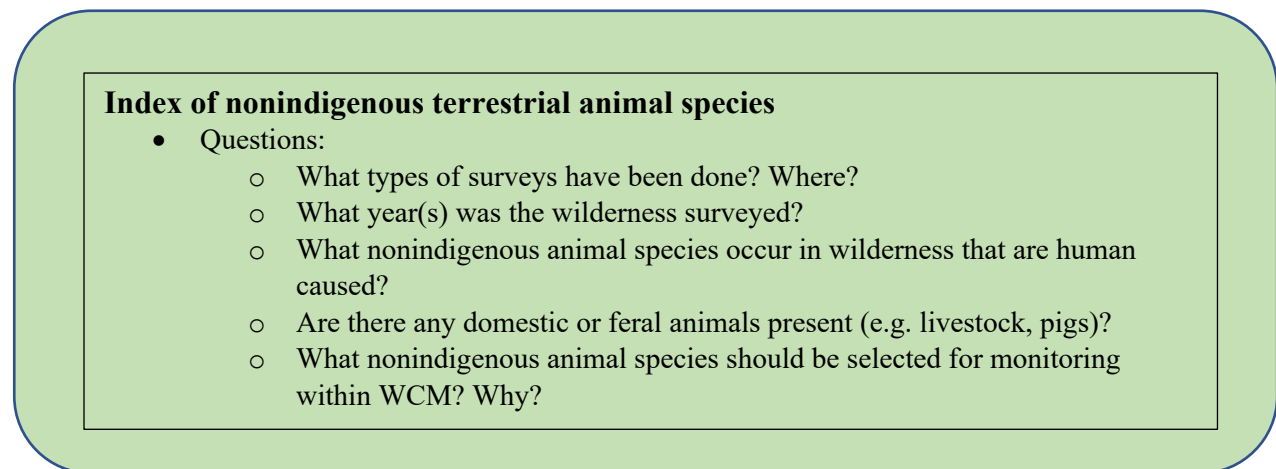
authorized recreation features measure was selected for Bridge Creek. This is because there are no official trails present in the Bridge Creek Wilderness, which is a marked characteristic of the area. The following table shows each of the selected measures for the Ochoco National Forest WCM reports and the quality they support:

Untrammeeled Quality
Number of <i>authorized</i> actions and persistent structures designed to manipulate plants, animals, pathogens, soil, water, or fire. (Required)
Number of <i>unauthorized</i> actions and persistent structures designed to manipulate plants, animals, pathogens, soil, water, or fire. (Required)
Natural Quality
Acres of nonindigenous plant species (Required)
Extent of waterbodies with impaired water quality (Required)
Index of nonindigenous terrestrial animal species (Selection from given options for nonindigenous animal encroachment)
Index of sensitive lichen species (Selection from given options for air quality)
Watershed condition class (Selection from given options for ecological processes)
Number of animal unit months (AUMs) of commercial livestock use (Selection from given options for ecological processes)
Undeveloped Quality
Index of authorized non-recreational physical development (Required)
Acres of inholdings (Required)
Index of <i>administrative</i> authorizations to use motor vehicles, motorized equipment, or mechanical transport (Required)
Index of <i>special provisions</i> authorizations to use motor vehicles, motorized equipment, or mechanical transport (Optional; Only selected for Bridge Creek and Mill Creek Wildernesses)
Opportunities for Solitude/Unconfined Recreation Quality
Index of encounters (Required)
Acres of wilderness away from adjacent travel routes and developments outside the wilderness (Required)
Index of visitor management restrictions (Required)
Acres of wilderness away from access and travel routes and developments inside wilderness (Selection from given options for remoteness from sights and sounds of human activity inside wilderness)
Index of National Forest System (NFS) developed trails (Selected for Black Canyon and Mill Creek Wildernesses)
Number of authorized constructed recreation features (Selected for Bridge Creek Wilderness)

It is important to note that in the original selection document, the Ochoco Forest staff selected a few measures that were ultimately not used in the final reports. Originally, in lieu of ‘acres of wilderness away from access and developments inside wilderness’, an index of recreation sites in primary use areas was selected. This index requires regular field assessment of existing recreation sites in wilderness. Upon discussion with relevant recreation staff, it was decided that completing campsite inventories in the wilderness every five years was not feasible due to staffing limitations, so the alternative option was selected instead. Additionally, the forest also selected the two technical measures meant to support the ‘Other Features of Value Quality’: Condition index for integral cultural features and condition index for other features. However, it was determined by both Dr. Hall and Nancy Taylor (the USFS Regional Wilderness and Wild & Scenic Rivers Program Manager) that the sites the Ochoco wanted to monitor were already covered by other measures and/or did not meet the standard for being designated as an ‘Other Feature of Value’. Aside from the removal or changing of these measures, there were no additional alterations to the original selections made by the Ochoco National Forest.

Once these measures were selected and approved, Dr. Hall and I were able to begin the process of interviewing relevant resource specialists and program managers based on those selections. These choices guided our interview questions, and a supplemental document with technical measures and associated pertinent questions was given to me by Dr. Hall, which was essential for me, especially early in the process. An example of a series of questions for a particular measure from this document is shown in Figure 5. The information and data gathered at this stage comprised most of my additions to the WCM report template. Due to external circumstances, I had to take a step back from this project for an extended period of time during late 2021 and early 2022, so the interview part of the process took place over the course of two

years. Before this break, almost every interview took place virtually due to the COVID-19 pandemic and were done with both Dr. Hall and me present. After the hiatus, the Ochoco offices in Prineville were open again, so I was able to conduct the remaining interviews and ask any follow-up questions in-person. I was given my own workspace close to many of the resource specialists who greatly contributed to these reports, expediting the process.



Index of nonindigenous terrestrial animal species

- Questions:
 - What types of surveys have been done? Where?
 - What year(s) was the wilderness surveyed?
 - What nonindigenous animal species occur in wilderness that are human caused?
 - Are there any domestic or feral animals present (e.g. livestock, pigs)?
 - What nonindigenous animal species should be selected for monitoring within WCM? Why?

Figure 5: A sample of the interview questions from the supplemental document for the measure on nonindigenous terrestrial animal species.

Not every interview was meant to support a specific technical measure. During the process of preparing these reports, I conducted a few interviews with people who could offer insight into the history of these areas. There is little written history about these wilderness areas available, so part of my goal with the narrative sections was to create that written record. I spoke with Steve Lent, the local resident historian at Prineville’s Bowman History Museum who also spent many years working for the local Bureau of Land Management office as a firefighter and was involved in responding to some fires in these wildernesses. He provided valuable insight into how these lands were utilized before their designation as wilderness areas. I also spoke with Barbara “Barb” Smith, who for years served the Ochoco National Forest as a recreation specialist and frequently traveled all of these wildernesses on horseback during her tenure. My

interview with her shed light on some of the more intrinsic and intangible benefits these wilderness areas provide and the locations of historic developments that she was aware of. Finally, I had an opportunity to speak with Don Tryon, a formerly local wilderness lover who was an essential actor in getting the Bridge Creek and Mill Creek Wildernesses designated. He provided me with a history that had previously been unwritten, but essential to understanding why these wilderness areas exist as they do today. These three interviews were unique from the other technical-based interviews in that the information they provided was primarily used for the narrative sections of the reports as opposed to directly supporting the selected measures. However, these details are essential to adequately represent the holistic nature of the ‘wilderness character’ of these places. I also conducted additional research for the narrative sections of the WCM reports from resources found at the local Crook County Public Library.

Perhaps most important to the WCM process, I made personal visits to each of the three wilderness areas prior to beginning any earnest writing for the reports. When staffing and ability allow, encouraging WCM contributors to visit the wilderness areas they monitor can enhance the report writing process. Without these visits, the true character of these places would be lost to me and I would be left with second-hand narratives from those who rarely (if ever) spend time in these wilderness areas themselves. By spending time in these wildernesses, I was able to see the Twin Pillars that draw visitors to Mill Creek yearly, witness the impacts cattle have had in Bridge Creek, and ford Black Canyon Creek fifteen times in attempts to follow some semblance of a trail. While I was only able to observe a small portion of each of these wildernesses during these visits, those experiences were essential to the process of creating these reports.

From the information gathered during the interview process, individual research conducted at the local library, personal visits to the wildernesses and additional data on water

and air quality and selected measures provided by the Forest Service Central Team, I was able to put together the three baseline WCM reports, one for each wilderness in the Ochoco National Forest. After gathering the data for a given measure, I then had to assess the value of those data based on requirements from the USFS Technical Guide (Landres et al. 2018) and determine the overall adequacy of that data based on their quality and quantity. Data adequacy as it pertains to WCMs refers to the reliability of the data to assess trends in wilderness character and is evaluated based on two factors: quantity and quality (Landres et al. 2008a). Data quantity is the level of confidence in the completeness of the information given while data quality is the level of confidence in the data source itself and its ability to represent trends in wilderness character (Landres et al. 2008a).

During the interviews, the answers given by resource specialists can be based on actual data they have on hand (e.g., animal unit months associated with permits for grazing cattle in wilderness) or professional judgment if data are not available. However, relying on professional judgment does reduce the quality of the data recorded. Due to the lack of recent surveys or surveys in general, many of the measures assessed in these reports are partly or wholly based on professional judgment. Where this is the case it is clearly indicated in the report. Issues related to lack of data in the Ochoco WCM reports are covered in the following section on project findings. A table showing each selected measure for the Bridge Creek Wilderness, its data source, and the adequacy of that data is shown below.

Bridge Creek Wilderness		
Measures	Data Source	Data Adequacy
Number of authorized actions and persistent structures designed to manipulate plants, animals, pathogens, soil, water, or fire	Reporting by local resource specialists	Medium
Number of unauthorized actions and persistent structures designed to manipulate plants, animals, pathogens, soil, water, or fire	Reporting by local resource specialists	Medium
Acres of nonindigenous plant species	Reporting by local resource specialists; volunteer data	Medium
Index of nonindigenous terrestrial animal species	Reporting by local resource specialists	Medium
Index of sensitive lichen species	Coordinator for the National Lichen Biomonitoring Program	High
Extent of waterbodies with impaired water quality	National and state 303d datasets; reporting from local resource specialists	Medium
Watershed condition class	USFS WCM Central Team	Medium
Number of animal unit months (AUMs) of commercial livestock use	Agency records; reporting from local resource specialists	Medium
Index of authorized non-recreational physical developments	Agency records; reporting from local resource specialists	High
Presence of inholdings	Agency records	High
Index of administrative authorizations to use motor vehicles, motorized equipment, or mechanized transport	Reporting from local resource specialists	Medium
Index of special provision authorizations to use motor vehicles, motorized equipment, or mechanized transport	Reporting from local resource specialists	Low
Index of encounters	Reporting from local resource specialists	Medium
Acres of wilderness away from access and travel routes and developments inside wilderness	WCM Central Team; verified by local resource specialists	High
Acres of wilderness away from adjacent travel routes and developments outside the wilderness	WCM Central Team; verified by local resource specialists	High
Number of authorized recreation features	Reporting from local resource specialists	High
Index of visitor management restrictions	Agency records	High

Project Findings

General Character of the Wildernesses

The three wildernesses in the Ochoco National Forest (Black Canyon, Bridge Creek, and Mill Creek) are small compared to other wildernesses in the surrounding region that cover anywhere from 50,000 to over 280,000 acres (U.S. Forest Service n.d.). The largest of the three, Mill Creek, stands at 17,400 acres, while the smallest, Bridge Creek, barely meets the required acreage for wilderness areas (5,000 acres), covering 5,400 acres. Despite their small size, each of these wildernesses excels in its ruggedness and offers a unique experience to those who visit.

Black Canyon Wilderness is the farthest east of the three wildernesses in the Ochoco Forest. Covering 13,400 acres, Black Canyon is considered by local personnel to be the most quintessential wilderness the Ochoco has to offer based on the rugged nature of the trail system. Visitors who enter the wilderness from the east must cross Black Canyon Creek at least fifteen times in the first 2.5 miles, and rattlesnakes abound in this part of the forest, but in return hikers receive incredible views of basalt rock formations and ponderosa pine forests.

Bridge Creek Wilderness is the least developed of the wilderness areas in the Ochoco because no official trails exist within its boundaries. The main feature of interest in this wilderness is North Point, where visitors are offered incredible views of the southern Blue Mountains. Most recreators in Bridge Creek are hunters, however, due to the lack of a trail system.

Mill Creek Wilderness is the closest of the three to a major town (Prineville, OR) and so it sees the most visitation. It also has the most maintained trail system and the Twin Pillars, a geographic feature that draws many visitors. However, visitation to Mill Creek is low compared to other wildernesses in the Pacific Northwest. Due to population growth in the central Oregon

region and the new Central Cascade Wilderness Permit System forcing recreators to seek alternative wilderness options, this quality is may change as opportunities for solitude in the Ochoco decrease.

Major Conclusions about Wilderness Character

By the time I completed writing the WCM baseline reports, I had come to two general conclusions/recommendations for future Ochoco management direction: 1) Data adequacy for many measures was low and could be significantly improved by conducting field surveys and improving documentation processes by the next WCM, and 2) The biggest impediment to wilderness character in all three wildernesses is the presence of cattle. If the Ochoco wanted to significantly improve wilderness character, the lessening or complete removal of cattle for commercial use would make the biggest impact, though this is statutorily not allowed.

Throughout the process of creating these WCM baseline reports, it was clear early on to both Dr. Hall and me that there would be limited tangible data for many of the measures and that the professional judgement of resource specialists would be heavily relied upon. The two shortcomings in data fell into two categories: 1) a lack of field survey data, or 2) unreliable or nonexistent reporting processes. The measures that fell into the former category were acres of nonindigenous plant species, extent of waterbodies with impaired water quality, index of nonindigenous terrestrial animal species, and index of encounters. For some of these measures, such as those related to nonindigenous animal and encounters data, the reliability of professional judgement was relatively high due to the general knowledge of animal encroachment and visitation in the wilderness areas. However, professional judgement was weaker for the other measures not only because of the lack of survey data, but many of the relevant resource

specialists had not visited these wilderness areas before, reducing their ability to provide measurable judgement.

The other factor worsening data adequacy for the WCM baseline reports is the general lack of reporting in multiple relevant programs. For example, both the range and fire programs have received approval on multiple occasions in recent years to utilize motorized equipment, motorized transport, or mechanized transport to meet program objectives. In the case of range, this is the permission given to permit holders with commercial cattle grazing allotments in wilderness to use ATVs and chainsaws to maintain existing range infrastructure. Permit holders are supposed to ask the local line officer, usually the district ranger or forest supervisor, for permission each time they want to use their provision, but I was unable to find existing records of those requests that could be used for the WCM reports. Similarly, according to fire personnel, chainsaws are used to suppress fires in the Ochoco wilderness areas 90% of the time. This requires approval from local line officers, which is reportedly granted every time. However, during the process of preparing the WCM reports, a discrepancy appeared between what was reported to Kent Koeller by fire personnel for annual Wilderness Stewardship Performance reports and what fire personnel told me. Kent was under the impression that there had been no chainsaw use in the wilderness areas in the last few years, but upon a brief discussion with relevant fire personnel, it was discovered that several fires had been suppressed using chainsaws during that time. Part of the reason for this gap in communication regarding activities in wilderness is that there is no dedicated wilderness manager for the Ochoco who would normally be responsible for collecting such data.

As visitation in the Ochoco continues to increase, potentially straining the current administrative structure, it may be wise for the forest to seek funding for a GS7-9 Wilderness

Manager position. Recognizing that option may not be realistic, however, I have had discussions with Kent and his supervisor, Jim Beaupre, about improving the reporting process by the next round of WCMs. If surveys can be done (in order of priority: invasive plants, impaired water quality, encounters, and invasive animals) and reporting processes are sharpened, the Ochoco will substantially improve the overall data adequacy for all three WCM reports. This finding is my primary recommendation for future Ochoco wilderness management direction.

The other conclusion I came to at the end of preparing the WCM reports is that the presence of cattle on public allotments is the biggest impediment to wilderness character in all three wilderness areas. There are at least two allotments present in each of the wilderness areas, with varying degrees of coverage. Mill Creek Wilderness and Bridge Creek Wilderness have allotments present within 97.5% and 94% of their boundaries, respectively. Black Canyon Wilderness, in contrast, has allotments present in 14% of its wilderness and they are located only in its southern reaches. However, intrusions from these allotments into Black Canyon proper happen approximately once per grazing season. This wilderness has also experienced some additional cattle intrusions into Black Canyon proper from eastern private properties in the past. The local resource specialist has stated that no intrusions have been reported in the last three years.

The presence of cattle has detrimental impacts to all four of the qualities of wilderness monitored in the Ochoco National Forest. As defined by the USFS Technical Guide, the presence of allotments, regardless of their size, counts as a trammeling action for each one present. Cattle also count as a nonindigenous terrestrial animal species and impact the natural ecosystem through trampling, grazing, defecation, death of native plants and introduction of invasive ones, compaction and destabilization of soils, redistribution of nutrients, changes in geomorphology,

gully formation, and lowering of water tables, reduced water quality and impacts on wildlife populations (Knapp & Matthews 1996; Carter et al. 2020). The presence of livestock results in particularly significant effects on water resources including the disappearance of riparian vegetation, streambank erosion, and a general worsening of water quality (Knapp & Matthews 1996). These impacts are intensified in arid climates like the Ochoco National Forest, where soils are typically more fragile and water resources are less plentiful (Carter et al. 2020).

The infrastructure that supports cattle (e.g., fencing, water improvements) is considered development in otherwise undeveloped wilderness areas. And finally, the presence of cattle is a sign of human activity that reduces available opportunities to be free of human society and find solitude, further diminishing wilderness quality. If the Ochoco National Forest wanted to focus management direction towards improving wilderness character in all three wilderness areas, the lessening or complete removal of cattle would have the quickest and most significant results. However, as per the 1964 Wilderness Act and 1980 Colorado Wilderness Act, grazing cannot be phased out or eliminated in wilderness simply because an area is wilderness. For this reason, there is no administrative obligation to reduce cattle grazing in the Ochoco wildernesses.

General WCM Process Reflections

My experience using the WCM process went smoothly and without complaint. In my opinion, the WCM process does a good job of assessing the four qualities of wilderness. The measures used to represent the qualities are thorough enough to give administrators a good idea of what's happening in the wilderness. Also, because the technical section of the WCM reports is supplemented with an associated narrative, any gaps missed by the technical measures are covered in that part. The process itself was easy to follow, speaking as somebody with minimal

experience in conducting WCM reports. The WCM program developers did a great job compiling the necessary resources to complete this process in a manageable and effective manner (i.e. Landres et al. 2015; Landres et al. 2018).

I also had particular success collaborating with individuals at the Ochoco National Forest in pursuit of this report's completion. However, it was recently brought to my attention that other 3rd-party individuals conducting WCMs for National Forests have not had such a positive experience in that regard. From what I have heard, it sounds like external WCM report developers can be viewed as an 'imposition' by tacking more responsibilities onto already overworked agency personnel. Throughout my time working directly with the Ochoco National Forest, I took special care to conduct myself in an empathetic manner. I understood that I was an outsider 'descending' on their space, asking them to add another task to their plate, so I tried to be as flexible and amenable as possible, such as giving personnel extended grace periods to get data to me. I think it also helped that I had previously worked for the Forest Service in a non-administrative capacity. On one occasion, upon describing my project and work history, a resource specialist visibly relaxed, smiled and said, "Oh! So you're one of us." I have also lived in Prineville, at least part-time, for almost three years, actively work in the community, and my partner has even taught some children of Forest Service personnel. All of these factors strengthened my credibility and trustworthiness at the Ochoco National Forest.

Having third-party individuals conduct WCMs strengthens the monitoring program because it improves agency transparency, can help forests that may not otherwise have the resources to conduct WCM reports, and partners may catch details not disclosed by agency personnel, unwittingly or otherwise. For instance, during the course of my project, I was able to identify reporting discrepancies that may have gone unnoticed if the reports were created

internally (e.g., if a specialist relies on their own impressions rather than consulting colleagues). However, if agency personnel do not trust the individual conducting the WCM reporting process, or just find them annoying and an imposition, hiring a third party could backfire. In response, I recommend that the WCMCT discuss putting together a ‘Code of Conduct’ or some other form of behavioral guidance for WCM reporters, such as discussing conclusions with contributing resource specialists prior to publishing. In a large-scale biomonitoring program, consistency is key, and in my opinion regularly employing third parties to conduct WCMs is necessary to achieve that. This person does not have to be completely external to the agency, just from outside the National Forest, which could help garner trust from resource specialists. Having some standardized ‘Code of Conduct’ created by the WCMCT would be useful guidance for future WCM reporters and hopefully improve the efficiency of the process.

Project Connection to MNR Program Learning Outcomes

This section describes the three primary learning objectives for Oregon State University’s Master of Natural Resources program and how conducting a baseline wilderness character monitoring assessment as my capstone project meets those objectives.

1. “Demonstrate skill in integrative thinking and collaborative learning across several disciplines within the natural resource professions; show familiarity with a wide range of disciplinary knowledge and the capacity to apply knowledge to natural resource problems at multiple scales.”

Throughout my time in the MNR program, I have been fortunate to take classes that have served me well in the preparation of my reports. As mentioned earlier in this paper, the concept of wilderness character is a holistic one, and the measures that monitor it are similar. Throughout

the process I have been tasked with communicating with dozens of individuals in as many different fields both in and outside the agency. Being able to do so in a productive and efficient manner required me to have at least some background knowledge in all of those sectors, which my MNR and Forest Ecosystems and Society (FES) undergrad programs prepared me for. Not only did I collaborate with individuals from different fields, build relationships, and learn more about their professions, but I was able to integrate their combined knowledge into three holistic reports.

2. “Construct a study project about a specific issue using appropriate data/information gathering techniques, cross-disciplinary interactions, and integrated analysis methods.”

My project was quite specific, contained to a single national forest monitoring its wilderness management practices and conditions to draw conclusions about the character of its wilderness areas. The format of these reports and the methodology by which they are completed was based on templates and standards set by the interagency WCM Central Team. While a template was used, my own judgement was essential in assessing how given data connected to wilderness quality. The selected measures were mostly feasible to collect, and it was indicated where data could not be collected, or judgement could not be ascertained. The information for the WCMs was gathered from interviews with relevant resource specialists or data from agency records. A list of all Forest Service personnel who were interviewed for the Ochoco National Forest WCMs and their position titles is provided below. The purpose of this project serves a mission beyond just this graduate project; these baseline WCM reports are part of a much larger collection of reports across the whole country, which as a whole monitor the Wilderness Preservation System’s overall character. I especially look forward to 2028 when the next round

of WCM reports for the Ochoco are due, and trends on wilderness character can start to be ascertained.

Ochoco National Forest Personnel Interviewed for Baseline WCM Reports	
Jim Beaupre----- <i>Recreation Team Lead</i>	Christopher Joosen----- <i>Recreation, Heritage, Lands, & Partnerships Staff Officer</i>
Michael Crumrine----- <i>Invasive Programs Manager</i>	Kent Koeller----- <i>Recreation Planner</i>
Jim David----- <i>Soil Scientist</i>	Yann Lapotre----- <i>Biological Science Tech</i>
Jenifer Ferrial----- <i>Fmr. Forest Botanist</i>	Sam Percy----- <i>Fuels AFMO</i>
Jason Gibbs----- <i>Fire Management Officer</i>	Drew Peterson----- <i>Recreation Crew Foreman</i>
Steven Gibson----- <i>Fmr. Range Program Manager</i>	Robert Piehl----- <i>Wildlife Biologist</i>
Monty Gregg----- <i>Wildlife Program Manager</i>	Brian Reeves----- <i>Fisheries Biologist</i>
Heather Jackson----- <i>Special Permits Officer</i>	Gary Sanders----- <i>Fisheries Biologist</i>
	Jacob Young----- <i>Range Conservationist</i>

3. *“Apply sound methodologies and work ethics to problems in management or sustainability of natural resources.”*

Throughout the process of writing these reports, I made sure to conduct myself in a professional, courteous, and collaborative manner both to reflect positively on Oregon State University and support future cooperation between the university and forest, but to also ensure the best possible quality of these reports. In addition to policy, collaborative management has been a focus in my graduate studies, and I was able to apply some of those strategies during the course of my project. As a general approach, I recognized that I was an outsider ‘descending’ on these specialists and taking up their valuable time, so I tried my best to conduct myself in a way that was not an imposition, which seemed to work. By working in the office directly with resource specialists, I was able to make connections and form relationships with agency personnel that proved beneficial as time went on. It also helped that I had worked for the Forest Service previously and that some agency personnel frequented the local brewery where I work.

By expanding the circle of specialists that I spoke to beyond the original list of relevant personnel given at the beginning of the project, I was able to catch reporting discrepancies and uncover new details that were relevant to the reports that I would not have caught otherwise.

Lessons Learned

This project was the application and the culmination of knowledge and experiences I acquired throughout both my academic and Forest Service tenures. This project further enhanced my knowledge on the workings of public land administration, policy analysis, and collaboration. In my previous positions for the Forest Service, I was either working outdoors or at the work center and rarely did I ever go to the administrative offices. This project gave me an opportunity to observe how different programs in a mixed-use forest interact with one another on a day-to-day basis to meet agency goals. I also witnessed the realities of a forest where priority for wilderness is lower than for other programs and how that can affect the process of creating an accurate baseline WCM. The process of writing the report allowed me to practice my skills at policy analysis as I connected technical measures to the mandates of policy in an objective fashion. Finally, this project gave me the opportunity to collaborate with individuals from many disciplines and merge their specialties into holistic reports that reflected how their fields work together to support wilderness character. The actions of making new connections, broaching difficult professional conversations, and embracing the complexity of the project all made me a better collaborator and overall professional.

MNR Program Recommendations

My overall experience in the College of Forestry MNR program has been positive, challenging, and instructive. Every professor I have been fortunate to learn under has been a master in their study and have excelled at teaching it to others, as well as being supportive of their students' needs. The classes that I have taken have forced me to rethink prior beliefs, learn skills far outside my wheelhouse, and write more papers than I ever thought I would be capable of. But those challenges are why I leave this program feeling confident in my skills in policy analysis and collaborative management, and my knowledge about ecological processes, resource management, and public lands policy.

My only recommendation for the program comes from an experience I had during the transition between undergrad/grad to fully enrolled graduate student. This problem is specific to students in an accelerated master's program. Because I was not considered a graduate student until my undergraduate program was officially completed, I was unable to register for my first term of graduate courses on time. By the time I could register during winter break, all of my courses had already filled up. I was able to get permission from a professor to overenroll his course, but I had to alter my program of study due to this issue. In the long run, this ultimately was a bump in the road, and I was able to take all the courses I wanted to during this program. I also understand why the registrar does not allow current undergraduate students to enroll for graduate courses before the end of their program. My recommendation for the MNR program is to warn students that this will happen before the transition begins so they are prepared for the outcome that they may not get into their desired courses their first term and to set backup options.

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