Licentiate Thesis

Farmers as Managers of Traditional Rural Biotopes: management motivations and policy implications

Traci Birge

Faculty of Agriculture and Forestry

University of Helsinki

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Table of Contents

Abstract ii
Terms and concepts iii
Publications and author contributions iv
Preface v

1 Introduction 1
1.1 Valued or not? Paradox of traditional rural biotopes 1
1.2 Research rationale: supporting farmer management 3
1.3 Multidisciplinary research in agroecology 4
1.4 Research approach and contributions 5
2 Background and concepts 8
2.1 Traditional rural biotopes 8
2.1.1 Definitions and classifications 8
2.1.2 History of management in Finland 9
2.1.3 Current status and conservation in Finland 13
2.1.4 Traditional rural biotopes and EU Agriculture Policy 14
2.2 Holistic approaches relevant to traditional rural biotope management 15
2.2.1 The need for holistic approaches 15
2.2.2 Frameworks and tools for holistic conservation research 17
2.3 Social aspects of management 19
2.4 Ecological aspects of management 20
3 Materials and methods 23
3.1. Study region 23
3.1.1 Raasepori Municipality 23
3.1.2 Historical context: regional traditional agriculture 24
3.1.3 Traditional rural biotope inventory 25
3.2. Research methods 25
3.2.1 Data generation 25
3.2.2 Analysis 28
4 Results & discussion 31
4.1 Identifying traditional rural biotopes and their managers 31
4.1.1 Managers and their farms 31
4.1.2 Traditional rural biotope management history and practices 32
4.2 Traditional rural biotope managers and farming styles 36
4.2.1 Diversity and classification 36
4.2.2 TRB entrepreneurs 37
4.3 Values, motivations and ecosystem services 38
4.4 Management requirements and frameworks 40
4.4.1 The problem of best practices for management 40
4.4.2 Common Agriculture Policy and traditional rural biotopes 41
4.4.3 Merits and pitfalls of the social-ecological systems approach 43
5 Conclusions and policy/management/conservation implications 46
6 Acknowledgements 48
7 References 49
8 Article I
9 Article II

ABSTRACT

Traditional rural biotopes are high nature value (HNV) farmlands that include grazed forests, woodlands, and semi-natural meadows formed through traditional agricultural practices. Agricultural intensification and associated changes in demographics and land use have resulted in a decline in traditional rural biotopes throughout Europe. Despite the downward trend, some farmers still do manage traditional rural biotopes. Literature in farmer behavior variously suggests that agency and structural factors determine farmer decision-making and conservation behavior, and that farmers engage in 'farming styles' according to their own values. The objectives of this research are to 1) understand what motivates farmers and landowners to manage traditional rural biotopes, 2) test whether managers differ in motivation, knowledge or structural factors according to whether the traditional rural biotopes are used in the farming system or managed separately from it as conservation sites or landscape elements, and 3) explore conservation tools and frameworks that might be used to improve policy and agri-extension services for conservation and management of traditional rural biotopes. The purpose of this thesis is to provide support to traditional rural biotope conservation in agriculture by furthering knowledge about manager behavior and motivations and to add to the literature on farmer conservation behavior more broadly with management of traditional rural biotopes as a focus for understanding farmer conservation related decision-making.

The thesis is based on a two-part study in which research was carried out via postal questionnaires and interviews with farmers in Raasepori Municipality, on the southern coast of Finland. In the first part of the study, I sent postal questionnaires to all farms in Raasepori to identify farms with managed traditional rural biotopes. I asked farmers about activities on their farms to determine whether farmers managing traditional rural biotopes differed from other farmers according to nature-based activities or entrepreneurship and to determine whether non-agricultural activities take place on traditional rural biotopes. I considered the results in the context of existing extension services and agri-environmental schemes and explored how holistic conservation tools and approaches, including adaptive management, and social-ecological systems could be used to improve services for farmers engaged in TRB management.

In the second part of the study, I conducted in-depth semi-structured interviews with TRB managers to determine whether sites were managed as part of the farming system or apart from it, motivations for managing traditional rural biotopes, interest and knowledge of conservation of traditional rural biotopes and experiences with extension and inspection services. I tested whether managers who used traditional rural biotopes in their farming system differed from those who did not and examined farmer engagement in traditional rural biotope management according to two sociological theories used in studying farmer behavior: theory of planned behavior and farming styles. I also compare summary findings of management activities to an inventory carried out by Pykälä and Bonn (2000) and present evidence of non-agricultural direct-use benefits (direct use ecosystem services) provided by traditional rural biotopes.

Results indicate that farmers mainly manage traditional rural biotopes for intrinsic values, especially of open landscape, and are less motivated by extrinsic values such as fodder production or collecting special agri-environmental subsidies. Farmers with managed traditional rural biotopes are more likely to engage in entrepreneurship activities that bring the public to their farms or result in branding of their products. Findings support the theory of planned behavior insofar as agency and personal values are important to decision-making. Managers of traditional rural biotopes do not form a distinct farming style, but a group of farmers was identified whose farming system is based on managing traditional rural biotopes and direct sale of the traditional rural biotope products, was identified as a distinct farming style. We called it "TRB entrepreneurship". Implications of the findings for extension services and policy development are that farmers and landowners engaged in management should be viewed as partners in conservation and that adaptive management and understanding of manager heterogeneity should be used to develop and target extension services and conservation strategies.

Keywords Traditional rural biotopes, cultural landscapes, agri-environmental schemes, high nature value, semi-natural grasslands, Finland, farming styles, farmland conservation

TERMS AND CONCEPTS

Adaptive management: An iterative learning and evidence framework for environment and conservation management.

Common Agriculture Policy (CAP): Unified agricultural policy for European Union member states. Subsidies and other programs are an integral part of the CAP.

Ecosystem services: Defined by the Millennium Ecosystem Assessment as the benefits people receive from nature.

European Union (EU): Currently has 28 member states. Finland's agriculture policy changed dramatically after Finland joined the EU in 1995.

Evidence-based conservation management: Application of scientific process and use of systematic reviews and other data collection methods to determine best practices and guide policy.

Farming styles: A theory which refers to distinctive ways of farming practiced by groups of farmers. Farming styles have characteristics that distinguish one style from another.

High nature value farmland (HNV farmland): Farmland that has high biodiversity value through its habitat provision properties. Traditional rural biotopes are considered high nature value farmland.

Social-ecological system: A conceptual framework in which the bio-physical environment and humans are inextricably linked in a complex relationship.

Special agri-environmental schemes: In Finland these refer to agri-environmental scheme sub-measures providing additional payments to farmers for pre-defined biodiversity-supportive management practices.

Information Centre of the Finnish Ministry of Agriculture and Forestry: Collects statistics on Finnish agriculture and forestry (Finnish: **TIKE** Maa- ja metsätalousministeriön tietopalvelukeskus). As of January 2015, their services are now provided by Natural Resources Institute Finland (Finnish: **Luonnonvarakeskus, LUKE**).

Theory of Planned Behavior: States that behavior is shaped by several factors, including subjective norms, personal values and beliefs, and perceived limitations.

Traditional rural biotopes: In the Finnish, Baltic and Nordic region refers to grazed forest and woodlands and semi-natural and natural meadows historically managed for grazing and fodder collection. In text, abbreviation "TRB" is used in figures and tables and to refer to different types of traditional rural biotope managers ("TRB farmer", "non-use TRB owner", "TRB entrepreneur").

PUBLICATIONS AND AUTHOR CONTRIBUTIONS

The thesis is based on the following articles, which are referred to in the text by their Roman numerals. Traci Birge is the corresponding author for all articles.

Original articles

I. Birge, T. & Fred, M. 2011. New ideas for old landscapes: Using a social-ecological approach for conservation of traditional rural biotopes- a case study from Finland. European Countryside 2:133-152. (Reproduced with permission of Walter de Gruyter GmbH).

II. Birge, T. & Herzon, I. 2014. Motivations and experiences in managing rare semi-natural biotopes: A case from Finland. Journal of Land Use Policy 41:128-137. (Reproduced with permission of Elsevier).

Author contributions The table below shows the respective contributions of the authors for each article.

	I.	II.
Original idea	**TB**, MF	**TB**
Design	**TB**	**TB**
Data Collection	**TB**	**TB**
Analysis	**TB**, MF	**TB**
Manuscript preparation	**TB**	**TB**, IH

TB Traci Birge, MF Marianne Fred, IH Irina Herzon

Thesis supervisor: Irina Herzon, Dept. of Agricultural Sciences, University of Helsinki

Examining Professor: Juha Helenius, Dept. of Agricultural Sciences, University of Helsinki

External Examiner: Reija Hietala, Dept. of Geography and Geology, University of Turku

External Examiner: Minna Kaljonen, Finnish Environment Institute

PREFACE

Our collective human history is often depressing from an environmental standpoint. Even now we are in the midst of human-induced climate change and massive loss of biological diversity. Our agriculture is largely unsustainable and contributes to loss of biodiversity, environmental pollution and climate change. A frequent companion in the shift from agriculture to agri-business is the all-powerful master, 'efficiency'. In the name of efficiency, the welfare of our animals, health and environment becomes secondary to production targets. A particularly cruel irony is that our economic system creates conditions that favor importing or growing with petrochemicals fodder for animals while biodiversity-rich meadows literally on the same farm are abandoned to become overgrown. This scenario is played out on farms throughout Finland and elsewhere, where we lose not only readily available fodder, but the habitat that supports rare and endangered species, a landscape element that people find enjoyable, and the human and cultural values (animal welfare, enjoyment of work, cultural continuity) that come from agricultural practices of keeping animals outside on semi-natural meadows and grazed woodlands and forests.

The impact of the dominant agricultural practices on farmland biodiversity, landscape structure, soil fertility, etc. is largely understood. There is handwringing over landscape simplification and loss of traditional farming landscapes. Amidst its larger agricultural policy that actually drives landscape simplification and intensification, the European Union and individual member countries devise programs and incentives for supporting traditional breeds, species and farming practices in an effort to offset intended and unintended policy outcomes.

Traditional rural biotopes are significant in that they provide a different example of human interaction with the environment; a response to the Anthropocene that our influence on the planet can be positive and our production modes sustainable. Thus, traditional rural biotopes are important both for what they are and what they represent. In this thesis, I examine farmers as managers of traditional rural biotopes and also explore how different environmental management and extension frameworks could better support farmers in managing these rare and endangered habitats.

My interest in management of traditional rural biotopes stems from my own farming experience, which includes managing meadows and grazed woodlands. For me, traditional rural biotopes are a manifestation of a key element for sustainable agriculture: a production mode that complements and enhances the local environment and culture.

I. INTRODUCTION

1.1 Valued or not? Paradox of traditional rural biotopes

European traditional rural biotopes are under threat mainly due to changes in agricultural production and demographics. The importance of traditional rural biotopes to European farmland biodiversity is well established (e.g. Vainio *et al.* 2001; Schulman *et al.* 2008; Beaufoy and Cooper 2009; Berglund *et. al*. 2014) and traditional rural biotopes are classified by the European Union's Environmental Commission as high nature value farmlands[1] (Beaufoy and Cooper 2009). Traditional rural biotopes and other high nature value farmlands are part of multifunctional agriculture systems and are biodiversity hotspots in the agricultural landscape. Keenleyside *et al.* (2014) note that semi-natural high nature value farmlands (HNV farmland) exist throughout the European Union both as part of low-intensity agricultural production and as relicts on high intensity farms. They state that, "On fully intensive farms, surviving remnants of HNV land, often with no functional role in the farm business, can be valuable for biodiversity. Although the biodiversity of these remnant HNV patches may be constrained by their small size and isolation, they are important within the wider agricultural landscape as stepping-stones, helping to maintain connectivity amongst other patches of habitat".

In Finland, traditional rural biotopes are designated under the EU Habitats Directive as Special Areas of Conservation and, as such, are included in Finland's Areas of National Responsibility (92/43/EEC; Schulman *et al.* 2008). Their management is supported through special agri-environmental schemes and European Union conservation programs such as Natura 2000. Research on traditional rural biotopes in Finland includes study of their role as habitat for rare and endangered species (e.g. Pykälä 2001; Vainio *et al*. 2001; Pöyry 2007), as culturally valuable archeological sites (e.g. Moisanen and Taskinen 1997; Seppälä 2006), in landscape studies (e.g. Hietala-Koivu *et al*. 1999; Heikkilä 2007 a and b; Raatikainen and Raatikainen 2014) and as part of agri-environmental policy assessments (e.g. MYTVAS

[1] High nature value farmland is defined as, "areas in Europe where agriculture is a major (usually the dominant) land use and where that agriculture supports, or is associated with, either a high species and habitat diversity or the presence of species of European conservation concern, or both" (Anderson *et al.* 2003).

impact assessments[2]). The need for improved measures for conservation of traditional rural biotopes is evident in their continued decline, which is ongoing despite these conservation measures.

Finnish farms, as elsewhere in economically developed countries, operate within a modern context shaped by mechanization and shifting agricultural policy priorities. The large-scale shift from agri-culture to agri-business and its impacts on biological diversity and landscape heterogeneity is well documented (e.g. Altieri 1999; Benton *et al*. 2003). Kaljonen (2011) has noted that there exists institutional ambiguity in agri-environmental policy and governance. Such ambiguities, ambivalence and contradictions affect management and conservation of traditional rural biotopes. On the one hand, there are mechanisms for supporting traditional rural biotope management and growing recognition and organization of alternative production frameworks, including local foods and organic farming, are likely to have positive effects on traditional rural biotope management. But, the larger agricultural structural policies of simplification, expansion and efficiency work against traditional agriculture generally and the extensive agriculture of which traditional rural biotopes are a part (e.g. Finnish Ministry of Agriculture and Forestry 2007; Keenleyside *et al.* 2014).

Despite the context and methods for farming that have resulted in increases in farm sizes, yields, monoculture, and external inputs (and a concomitant decrease in people employed on farms), there exists diversity in how farmers choose to organize their farms and the production methods they employ (e.g. Long and Van der Ploeg 1994; Busck 1999; Schmitzberger *et al.* 2005).

Finland has lost over 99% of its traditional rural biotopes in the past 100 years (Pitkänen and Tiainen 2001), yet a small minority of farmers continue to manage, and in some cases to base their farming systems around, traditional rural biotopes. Farmer management of the semi-natural meadows and grazed forests that make up traditional rural biotopes is one aspect of whole farm organization and production in a heterogeneous agricultural landscape. Schultz *et al.* (2007) assert that successful ecosystem management requires thorough knowledge of not only ecosystem processes, but also the social actors and structures that make these processes viable. Thus, understanding of motivations, attitudes and experiences of farmers who manage

[2] MYTVAS is Finland's impact assessment of the agri-environment schemes. http://www.mmm.fi/fi/index/etusivu/maaseudun_kehittaminen/tutkimus/mytvas.html (Finnish only).

traditional rural biotopes and exploration of extension/advisory options are important aspects of supporting and improving traditional rural biotope management and conservation. As an agroecologist, my interest is in the sustainability of agriculture, and it is clear that farmers, especially those engaged in what can be perceived as conservation activities, are key actors. Ahnström (2009) uses the phrase "in the hands and minds of farmers" to convey the importance of farmers' actions and attitudes to the issue of farmland biodiversity conservation. The sentiment holds true for the management and conservation of traditional rural biotopes.

1.2 Research rationale: supporting farmer management

The dire status of traditional rural biotopes in Finland and the fact that some farmers still manage their meadows and grazed forests brought me to the key question, "How can traditional rural biotopes and the farmers who manage them be supported in management for conservation goals and continuity in the agricultural landscape?" It is this question that I attempt to break down and operationalize through a two part study: 1) a review of holistic environmental management, assessment and extension frameworks and tools that could be applied to traditional rural biotope management and 2) an interview-based municipal-level case study examining farmers as managers of traditional rural biotopes. Together, the two studies add to the literature for improving advice, extension and policy approaches to traditional rural biotope management through better understanding of farmer-as-manager concerns, needs and interests; understanding of the typologies (if such exist) of farmers managing traditional rural biotopes; and through consideration of holistic management strategies and frameworks that could be applied for conservation management of traditional rural biotopes. Thus, results have implications for agricultural policy and agri-landscape conservation and also for understanding farmer decision-making, especially as it relates to agri-farmland conservation and farmer agency.

Essential to my choice to combine review of holistic environmental management methods with a case study of farmers as managers is the assertion that traditional rural biotopes must be integrated into real farming systems in order for long-term management to be sustainable. For this reason, I focus on farmers and landowners and exclude other managers of traditional rural biotopes, for example conservation groups. A second premise is the understanding that there is expressed social will (as articulated in policy positions) for continuing the

management of traditional rural biotopes for reasons associated with environmental goals, cultural and landscape value and the European Union's concept of multifunctional agriculture (e.g. European Commission 2013; Finnish Ministry for Agriculture and Forestry 2007; Finnish Ministry of Agriculture 2014; Keenleyside *et al.* 2014).

In the thesis I use the words "management" and "conservation" within the contexts described above. By management I mean the plans and activities that take place on the traditional rural biotopes for a desired outcome. Conservation mainly refers to the underlying goals (the second premise) that guide policy, plans and actions. Thus, "conservation management" refers to action plans and activities meant to meet articulated conservation goals.

1.3 Agroecology and multidisciplinary research

Natural resource management, ecological economics, agroecology and landscape studies are examples of areas in which research that transcends disciplinary boundaries is required because of the complexity of the problems being addressed (e.g. Jenssen and Goldworthy 1996; Tress and Tress 2001; Wezel and Soldat 2009; Hadorn *et al*. 2006; Zscheischler and Rogga 2015). Jenssen and Goldworthy (1996) note that, "since problems are not disciplinary abstractions but real-life phenomena with many dimensions to them, many problems cannot be addressed adequately through a monodisciplinary approach" and that, "for most problems a multidisciplinary approach is the only effective way to conduct the research". Zscheischler and Rogga (2015) state that a key argument for transdisciplinary research is providing "socially robust" and implementable knowledge together with the capacity to rationalize conflicts and integrate perspectives and sources of knowledge. They note that land use science has been associated with transdisciplinarity since the 1970s (*ibid*). Costanza *et al*. (1991) state that by transdisciplinarity they mean integration and synthesis of many different disciplines. They assert that the intellectual tools and disciplines are secondary to the goal of solving critical problems (Costanza *et al.* 1991 cited in Hadorn *et al.* 2006). Learning, knowledge and different ways of knowing, especially as regards non-scientific actors, is also explicit in trans/multi-disciplinary approach (e.g. Hadorn *et al.* 2006; Zscheischler *et al.* 2014). Emphasis on holistic responses to complex problems are also increasingly found in policy. The Convention on Biological Diversity Aichi Targets is an example of cross-sectoral cooperation made an explicit aim for developing policy for achieving environmental management and biodiversity conservation goals.

The definitions of the various "prefix-disciplinary" ("inter-", "intra-", "multi-", "pan-", "trans-") approaches are still debated (e.g. Jenssen and Goldworthy 1996; Zscheischler and Rogga 2015) and I do not make a significant distinction between their definitions in this paper. More important for this study is the understanding of agroecology as a "quasi-discipline" (Jenssen and Goldworthy 1996) that is characterized by addressing problems (and solutions) which transcend disciplinary boundaries. Originally focused on agronomic practices, agroecology has expanded beyond Altieri's (1989) definition of "the science of applying ecological concepts and principles to the design and management of sustainable food systems" to include social factors such as economics and policy (e.g. Dalgaard *et al.* 2003; Francis *et al*. 2003; Gliessman 2007; Wezel and Soldat 2009). Currently, agroecology is variously interpreted and understood as "a science, a movement and a practice" and has emerged since the 1980s as a distinct conceptual framework (Wezel *et al.* 2009). Wezel and Soldat (2009) assert that there are now two main branches of agroecology: the agroecosystem approach (focusing on field or landscape level agricultural interactions with the environment) and the food systems approach (concerned with social-ecological questions within the food system). The multidisciplinary quality of agroecology is explicit in the four main properties identified by Conway (1987 in Wezel *et al.* 2009) belonging to agroecosystems: productivity, stability, sustainability and equity. Agroecology shares challenges of development of its theoretical framework and methods with other sustainability sciences, such as resilience studies and urban ecology (to name but two), focused on the human-environment nexus (Wezel and Soldat 2009). Agroecology's expanding definition and mandate increases the disciplines involved in agroecology, and framework and operational tools for the broadening scope of agroecology require ongoing development (*ibid*).

1.4 Research approach and contributions

My underlying research motivation, supporting traditional rural biotope management as a conservation and farming activity undertaken by farmers, is in line with agroecology's aim of supporting sustainability in agriculture and also with the problem-oriented perspective of multidisciplinary research (Jenssen and Goldworthy 1996). The main components of this thesis are: 1) case-based study of farmer motivations and experiences in managing traditional rural biotopes, 2) contribution to the literature on farmer conservation behavior, agency and farming types based on the case of farmers as managers of traditional rural biotopes and 3)

exploration of frameworks and tools for improving traditional rural biotope management and conservation. The research questions of each paper are summarized in Table 1. The study falls well within the scope of agroecology's food systems approach described by Wezel and Soldat (2009). The aim and thought process for developing and exploring the research topic draws on knowledge from multiple disciplines. The study is most closely aligned with sociology, which even within the food systems approach, is a relatively new focal area for agroecology (Wezel and Soldat 2009).

As an agroecologist grounded in the natural sciences, I borrow heavily from the social sciences for methods and some theoretical grounding, in particular for using a behavioral approach (Morris and Potter 1995; Kings and Ilbery 2010). Design and analysis of interviews was influenced, however, by the natural sciences. Kings and Ilbery (2010) note that behavorial approach studies using questionnaires and interviews to "understand" farmer decision-making increased in popularity due to their relative ease and replicability but that there is criticism of the inflexibility of response in studies designed to collect only quantitative data, and Burton (2004) criticizes the behavioral approach as it is commonly used for failing to adequately account for significant factors affecting intention and behavior. Mixed methods research is defined as research in which both qualitative and quantitative methods are used (e.g. Tashakkori and Creswell 2007; Bryman 2008). I used quantitative analysis and limited qualititative analysis for the interviews partly in order be more acceptable to the natural sciences tradition and to avoid criticism of the study lacking scientific rigor or being "anecdotal" (challenges of interdisciplinarity: e.g. Fox *et al.* 2006; Tress *et al*. 2007; Broto *et al.* 2009). My aim for the interview process was to produce quantitative data that could be informed and supported by qualitative data from comments and discussions that may taking place during the interviews. Structured interviews are considered quantitative and semi-structured and unstructured interviews qualitative (Bryman 2008). In my interviews, the interview rubric was followed closely but space was always available (and frequently utilized) for further discussion. Emphasis on quantitative data for semi-structured interviews may invite criticism of using an excessively positivist approach, but Bryman (2008) asserts that there is a tendency to polarize or exaggerate the respective capacities of qualitative and quantitative approaches. I return to the possible benefits or shortcomings of the analysis approach in Chapter IV Results and Discussion.

Traditional rural biotopes are elements within the landscape, and study of their conservation and management relates to both landscape and systems research. Although the study is case-

based, results are framed within the context of the literature on farmer decision-making and conservation behavior with the aim of lifting the study up to provide a "bigger picture" perspective often missing from case studies (Zscheischler and Rogga 2015).

Table 1 Research questions addressed in each article.

	Article I	Article II
Research questions	1) Traditional rural biotope manager profile: Do land owners and farmers with managed traditional rural biotopes differ from their peers according to structural factors (area), farming strategy (participation in special agri-environmental schemes, use of direct from farm sales, services), common rural activities (hunting)?	1) What are the management motivations of farmers and landowners managing traditional rural biotopes?
	2) Do traditional rural biotopes provide non-agricultural use benefits?	2) Do traditional rural biotope managers who use their traditional rural biotopes in their farming system differ in farm structural factors or in knowledge, motivation and relevant experiences related to traditional rural biotopes compared to those who manage traditional rural biotopes separate from their farming system?
	3) Are there "hidden" traditional rural biotopes not in the special agri-environmental schemes?	3) Does Theory of Planned Behavior explain traditional rural biotope manager decision-making?

Together, these articles address 1) identification of traditional rural biotopes both inside and outside of special agri-environmental scheme structures; 2) identify non-agricultural use of traditional rural biotopes 3) explore traditional rural biotope manager motivations and experiences in managing traditional rural biotopes 4) contribute to theory on farmers' conservation behavior and farming styles.

The conservation and management issue addressed in the study is relevant to other areas in Finland, the Nordic and Baltic countries, and even elsewhere within the European Union. However, local and regional histories differ, as do policy interpretation and implementation (Beaufoy *et al.* 2011). Hietala-Koivu (2002) asserts that, "landscape level changes cannot be explained without a knowledge of the local rural history or the national or EU agricultural policy programs that have been implemented", and Habel *et al*. *(*2013b) note that

biogeographic history has a strong influence on floristic composition of plant communities. In the next chapter I present a summary of Finnish agricultural history as it affects traditional rural biotopes. In Chapter 3 I delve in further detail into the land use history of Raasepori Municipality, where the case study was conducted. In-depth review of all the national and European Union policy and institutions potentially affecting farming and traditional rural biotopes is beyond the scope of this study, but I do endeavor to explain and relate the findings to the most important policy and institutional mechanisms in the Finnish context: special agri-environmental schemes for traditional rural biotopes and advisory/extension services.

Discussion of selected holistic management frameworks and tools are explored for their relevance to improving traditional rural biotope management and conservation. I looked for existing approaches and concepts that would provide useful frameworks or tools that would promote learning-feedback in management/policy development and would bring the traditional rural biotope manager perspective and experiences into the conversation on traditional rural biotope conservation and management. The key concepts I that guided development of the research and which I explore further in light of my results are described in sections 2.2.

II. BACKGROUND AND CONCEPTS

2.1 Traditional rural biotopes

2.1.1 Definitions and classifications

"Traditional rural biotope" references a livelihood and place between forest and field, along shorelines and encompassing lands too wet or stony or steep to be put to the plow. The term includes a broad range of distinct, managed biotopes that were formed and are maintained by traditional agricultural management activities: grazing, mowing, clearing, burning, and tree management (e.g. Lammi 2000; Schulman *et al.* 2008). In the Nordic and Baltic countries, traditional rural biotopes include grazed forests, wooded meadows, various types of mesic and dry semi-natural meadows, seashore and other natural meadows and areas associated with traditional slash-and-burn agriculture (e.g. Lammi 2000; Vainio *et al.* 2001; Kontula and Raunio 2005; Schulman *et al.* 2008; Berglund *et al.* 2014). Grazing and fodder collection for sheep, cattle and horses were traditionally the main drivers of management for most traditional rural biotope types. In the central and northern European context, these drivers are

thought to have had a mainly positive impact on biological diversity at least up until the end of the 1800s (Pykälä 2001; Berglund *et al.* 2014). Classification of traditional rural biotopes is generally based on flora, percentage of tree cover, and land use history (Pykälä *et al.* 1994; Pitkäinen and Tiainen 2001; Kontula and Raunio 2005). In Finland, sub-category classification varies in resolution according to level of research that has been undertaken for particular biotope types (Kontula and Raunio 2005). For example, seashore and flood meadow sub-categories are more developed than those for wooded biotopes (*ibid*).

The term traditional rural biotope is not widely used outside of Finland. More commonly, the terms "cultural/heritage/traditional landscapes", "semi-natural meadows", and "grasslands" or individual habitat types (e.g. "seashore meadow", "wooded meadow") are used. The Finnish Environment Institute[3] and the Heritage Landscapes Working Group (Vainio *et al.* 2001) maintain that the cultural landscape is composed of traditional rural biotopes (Finnish: perinnebiotoopit, Swedish: vårdbiotoper) and the built cultural landscape. The World Heritage Convention (UNESCO WHC 13/01) defines three main categories of cultural landscape**:** clearly defined landscape designed and created intentionally by man; organically evolved landscape; and the associative cultural landscape. Traditional rural biotope aligns with the organically evolved landscape category.

Traditional rural biotopes of Northern Europe share some characteristics with traditional agricultural landscapes around the world. Like the satoyama traditional landscape of Japan (Katoh *et al.* 2009; Berglund *et al.* 2014), the parklands of the Sahel (Bayala *et al.* 2014), and the dehesas of Spain and montados of Portugal (Olea and San Miguel-Ayanz 2006), the Nordic and Baltic countries' traditional rural biotopes were formed from traditional agri-pastoral practices, are rich in biodiversity, provide important habitat for rare and endangered species and are living repositories of cultural and natural heritage. It has been asserted that semi-natural habitat types share many of the qualities of pristine habitats and, within a heterogeneous landscape structure, provide supporting habitats (in some cases the only habitats) for species whose natural habitat areas have diminished due to e.g. development or suppression of natural disturbance such as fire (Pykälä 2000; Katoh *et al.* 2009). If this is the case, then the importance of semi-natural habitats to biological diversity increases as wilderness areas, and the natural disturbance and endemic species that define such areas, decrease.

2.1.2 History of management in Finland

[3] http://www.ymparisto.fi/default.asp?node=687&lan=fi [retrieved 2008]

Animal husbandry and slash and burn agriculture began on the Gulf of Finland around 4000-4500 years ago, with agriculture/ animal husbandry becoming the primary way of life around 2800-2500 b.p. (Vainio *et al.* 2001; Seppälä 2006; Fig. 1). Cattle were originally kept primarily for manure production (one cow's manure could fertilize ¼ ha of field) and the animals were for the most part poorly nourished (Vainio *et al.* 2001). Fields and homes were fenced in and animals grazed the surrounding meadows (Moisanen & Taskinen 1997: in Vainio *et al.* 2001). Low fodder production from semi-natural meadows resulted in insufficient fertilizer to meet needs for growing field crops in most of the country (Vainio *et al.* 2001). Traditional agriculture in Finland lasted until the end of the 19th century but development varied temporally and by region according to the production strategies adopted (Soininen 1974). Agriculture and animal husbandry were practiced earliest in southern Finland and coastal areas, while slash and burn dominated in the east and a combination of hunting/fishing and animal husbandry as the primary way of life continued longer in the north of the country, which was also the only area of the country with sufficient meadow area to meet fodder needs (Soininen 1974). Regional differences in available meadow area were stark; in 1880, Uusimaa Province had approximately 127 ha of meadow for every 100 ha of field but Oulu Province had 700 ha for every 100 ha of field (Vainio *et al.* 2001). Additionally to fields and meadow, an important element of Finland's farms were (and still are) forests. Tar was an early important export from Finland, but its position was taken over in the late 1800s by wood as a key export item (Peltonen 1992).

Grazing and fodder collection (including coppicing) on seashore meadows is considered one of the oldest forms of animal husbandry practiced in Finland (Salo 1997 in Seppälä 2006). By the 1500s, meadows were fully utilized in many parts of Finland, and from the 1750s to 1900s the majority of farm area in southern and central Finland was used for animal husbandry (e.g. Vainio *et al.* 2001). Pykälä (2000) describes similar variation in agriculture development in Europe at large, including that most land was used for animal husbandry through methods of clearing forests for use as meadows, haying, coppicing and pollarding and, citing Emanuelsson (1988), that these actions resulted in transfer of nutrients into fields.

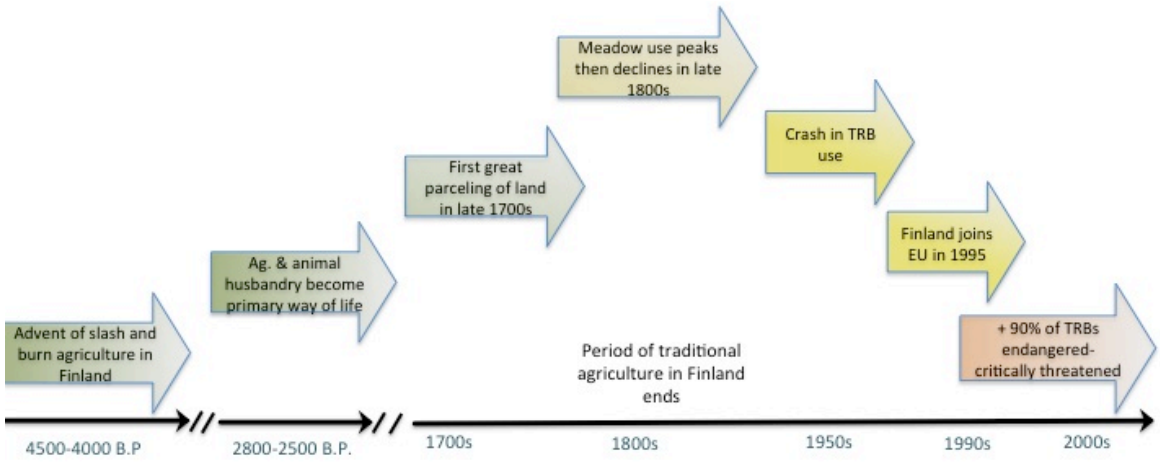

Fig. 1 Summary of development and decline of traditional rural biotopes (TRB) in Finland.

During the period of traditional agriculture in Finland, meadows were divided in parcels (Finnish: sarka, Swedish: skifte) and each farm had its own allotments, which were first hayed before the animals were allowed to graze them. The general parceling out of land ("isojako") began in the late 1700s and was designed to make farms more contiguous and efficient by doing away with the parcel system. The process proceeded in increments and marked the beginning of major changes in Finnish agricultural production (Soininen 1974).

Decline in management of traditional rural biotopes in Finland is punctuated by specific events in Finnish history. Famine in the 1860s was followed by changes in agricultural production, including increased animal product exports and concomitant increased grain imports in the 1870s. The impact of the commercialization of agriculture on farm structure and the economy was significant. Finland's rural society was stratified and included large landowners, small landowners and crofters (tenant farmers) who had an obligation to work for the landowners in exchange for their tenancy (Peltonen 1992). Due to imports, the domestic grain market collapsed in the 1880s, resulting in greater emphasis on dairy production (*ibid*). Landowners responded to the grain crisis and shifting structure of agricultural income by curtailing crofters' traditional rights and increasing tenancy obligations, which resulted in widespread dissatisfaction that would have political repercussions[4] (*ibid*). Finland's most important export products became milk, butter and wood (*ibid*). Sown hay was increasingly grown to support dairy production, and pressure to modernize farming resulted in putting previously untilled meadows to the plow (Soininen 1974; Peltonen 1992; Pitkänen and

[4] Civil war broke out in Finland in 1918. Legislation for liberating crofters and providing them the right to purchase their own their farms was enacted and built upon around this time. Rapid reform was carried out in the 1920s (Peltonen 1992).

Tiainen 2001). Thus, managed semi-natural meadow area reached its peak in the 1800s and began to decline thereafter, with halving of meadow area and doubling of field size between 1880 and 1920 (Soininen 1974). Early data on grazed forest area is largely non-existent, but it is estimated that in southern and central Finland at least half of all forests were grazed in the 1800s and early 1900s and the majority of land in these areas was in animal husbandry at least during the period 1750-1900 (Vainio *et al.* 2001). It is also important to note that increased efficiency and shift to uniformity in the production processes was a central goal of Finnish policy in the 1900s (Pykälä 2001). The large farms of southern Finland were the first to modernize, and Uusimaa Province had the highest rate of meadow loss (51%) during the period 1901-1910 (Vainio *et al.* 2001). Afforestation of marginal and less productive lands as a response to overproduction negatively affected traditional rural biotopes, and slash and burn agriculture decreased over time as it became less sustainable due to increasing population, which shortened the rotation period between plots and resulted in poorer harvests (Tiainen 2001; Vainio *et al*. 2001). Post-war population resettlement[5] and war reparation costs also affected Finland's agriculture structure. Efforts for increasing agricultural production in this period were successful and resulted in overproduction of key staple foods, which in turn lead to the decline of small unproductive farms in the east and north of the country (Hietala-Koivu 2002). Mechanization, improved feeding of livestock, and agricultural policy that concentrated production types to specific areas of the country resulted in major decline of meadow use again by the 1950s, and there was less than ¼ of the meadow area compared to the 1880s (Vainio *et al.* 2001). Forest grazing also declined during the early part of the 20th century and the quality and quantity of traditional rural biotopes continued to decline through the 1950s-1990s as forests were reserved for wood production only and animal production was concentrated to fewer farms and increasingly based on imported feed and field-grown fodder (Soininen 1974; Vainio *et al.* 2001). In 1959 for example, there were 1.56 million hectares of grazed forest (Vainio *et al.* 2001;). Agriculture in the 1970s through 1990s was characterized by regional specialization, with crop production concentrated in the southern part of the country while milk production and forestry became the main source of income in the north and east (Hietala-Koivu 2002). Specialization resulted in overproduction, which was addressed through set-aside and other programs (Pykälä 2000). In 1995, Finland joined the European Union, which required a fundamental agriculture policy change from price supports to area payments (Koundouri *et al.* 2009). These changes resulted in a 57 percent fall in the price of grains (*ibid*). Other changes included intentional reduction in the number of farms

[5] Finland resettled 410,000 people from land ceded to the Soviet Union after World War II.

and increase in farm size (*ibid*; Official Statistics of Finland 2012). It also accelerated loss of livestock on farms (Pykälä 2000). However, conservation measures such as the "multifunctional agriculture" concept, agri-environmental schemes and Natura 2000 also became part of Finland's agricultural policy framework. Currently, there are over 56.5 thousand farms in Finland (Official Statistics of Finland 2012). Average utilized agricultural area of Finnish farms in 2014 was 43 ha and average age of farmers was 50 years (Official Statistics of Finland 2015).

2.1.3 Current status and conservation in Finland

In 1992, just prior to joining the European Union, Finland initiated a large-scale inventory of the status of heritage landscapes in Finland. The study was conducted as regional surveys and focused on distribution, status, and biological values of traditional rural biotopes in Finland (Vainio *et al*. 2001; Pitkänen and Tiainen 2001). The inventory found 18,640 hectares (rounded up to 20,000 ha for valuable sites not identified by the inventory) of valuable traditional rural biotope, or less than 1 percent of the meadows it had at the end of the 19th century (*ibid*). Today, all traditional rural biotope types in Finland are on the scale of threatened-extinct (Raunio *et al*. 2008). A parodox is that Finland sought models and inspiration from larger European countries in the 20th century when it modernized farming, but these more densely populated European countries have actually conserved more of their traditional landscape than Finland (Pykälä 2001). Finland's case is also dire when compared to other Nordic countries: Sweden and Norway, for example, are both estimated to have many times the amount of traditional rural biotope compared to Finland (Pitkänen and Tiainen 2001). A traditional rural biotope expert working group recommended in 2000 a target of 60,000 ha of managed traditional rural biotope by 2010. Finland's failure to achieve the recommendation is explicitly noted in the Rural Development Strategy for 2014-2020 (Finnish Ministry of Agriculture and Forestry 2014).

Because traditional rural biotopes will not survive without policy intervention, an expert group in Finland recommends both increased resources for their management and also increased research on the current status and ecosystem function to fill the large gaps in current scientific knowledge (Schulman *et al.* 2008). The most important policy mechanism for conservation of traditional rural biotopes is the agri-environmental scheme under the European Union's Common Agricultural Policy.

2.1.4 Traditional rural biotopes and the EU Agriculture Policy

Implementation of agri-environmental policy vary between European Union countries. The Common Agriculture Policy has basic-level payments to farmers based on land area under active agricultural management (Pillar I- "single payment scheme") and has additional rural development measures (Pillar II) (EC No. 73/2009). Finland's Rural Development Program for 2007-2013 included three tiers of agri-environment scheme payments: basic (Pillar I), additional (Pillar II), and special agri-environment sub-measures (Finnish Ministry of Agriculture and Forestry 2007). Sub-measures are implemented via special agreements for additional support as 5 or 10 year contracts (Finnish Ministry of Agriculture and Forestry 2011). Special sub-measures of the 2007-2013 Rural Development Program that applied to traditional rural biotope management were a measure specifically for management of traditional rural biotopes and a "landscape and biological diversity" measure, which was frequently applied to traditional rural biotopes. These measures have been combined in the 2014-2020 program.

In considering policy, I focus in this thesis on the extension and inspection services and the special agri-environmental schemes specifically applied to traditional rural biotope management because of their overwhelming impact on management and conservation of the sites. Although they are largely outside the scope of this study, it should be noted that management of Finland's traditional rural biotopes is also affected by the Common Agriculture Policy at large and many other programs that influence agriculture and land use. For example, European Union's Natura 2000 program, Nature and Birds Directives, and European Landscape Convention; Convention on Biological Diversity, and Ramsar Convention on Wetlands have varied levels of overlap and influence on traditional rural biotope management. Natura 2000 in particular is very significant for "Nationally Valuable" traditional rural biotopes. Additionally, national and regional-level administrative structures and legislation for environment, agriculture, forestry and food safety all affect traditional rural biotopes to different degrees.

The reformed Common Agriculture Policy is claimed to have better coverage for environmental sustainability and to link the different types of support better (European Commission 2013). However, there is concern among traditional rural biotope stakeholders and conservationists that high nature value pasturelands of all types are frequently excluded from the Pillar I definition of land in agriculture use, even though they are maintained primarily through pastoral (agricultural) practices (Beaufoy and Poux 2012). To highlight this

issue, 44 stakeholder groups from 9 European countries prepared a document to inform policy makers of the importance of including permanent pastures currently excluded from Pillar 1 subsidies in the new Common Agriculture Policy for 2014-2020 (Beaufoy *et al.* 2011). In their statement, they noted that, "guidance published by the [European] Commission states that if there are more than 50 trees per hectare on a parcel, this land should as a general rule be considered ineligible" for Pillar I support (*ibid*). Significantly, the European Court of Justice has ruled that land managed primarily for landscape management or nature conservation should not be excluded from Pillar I supports (*ibid*). The court stated that land classified as permanent pasture must also be classified as agricultural (*ibid*).

Lack of minimal stocking standards for traditional rural biotopes is also cited as a concern (Keenleyside *et al.* 2014; Pe'er *et al.* 2014). Several scientists also wrote a letter critical of the new "greening" policies of the new Common Agriculture Policy, stating that the greening policies "are so diluted that there is little benefit for biodiversity" (Pe'er *et al.* 2014). They note that the reform allows for 5 percent reduction in permanent grasslands in member countries and for quality reduction in that the reform does not have any management criteria for permanent grasslands (*ibid*). However, individual member states do have increased flexibility to enact national level programs " for habitat, species and ecosystem services conservation (European Commission 2013; Pe'er *et al.* 2014). Pykälä and Bonn (2000) claim that traditional rural biotope management in Finland is mostly non-systematic and that, compared to other western European nations, there are few traditional rural biotopes managed with state funds. Agricultural subsidies are, with a few exceptions, the only funds available to landowners for traditional rural biotope management (*ibid*).

2.2 Holistic approaches relevant to traditional rural biotope management

In the previous sections I presented the background and context of traditional rural biotopes, my research question and research rationale, and the multi- or transdisciplinary nature of such questions in agroecology. In this section, I discuss why integrated tools and holistic frameworks for environmental management should be employed for conservation research and management of traditional rural biotopes, and I introduce key options and concepts that could be applied to traditional rural biotope management.

2.2.1 The need for holistic approaches

Knowledge grounded in evidence of the impacts of management techniques on conservation targets is necessary for effective conservation strategy. However, management of European cultural landscapes has mainly tried to mimic historical land management practices and has been based primarily on experiential knowledge of individual managers (Pullin and Knight 2003; Ausden 2007). The reason for this is cited as lack of scientific evidence on the most effective conservation strategies, and the outcome is implementation of possibly ineffective methods for conservation management (*ibid*).

Primary criticisms of the "replicate past management" model for traditional rural biotopes and cultural landscapes generally include 1) lack of evidence that the management practices are best practices, 2) possibility of misinterpretation or misunderstanding of "traditional" management, 3) that commitment to "old" practices fails to take into account the dynamics of the changing environment at large (e.g. climate change, nutrient loads and acidification, species assemblages and populations), and 4) such management is often prohibitively expensive (Ausden 2007). Best practices for conservation management of traditional rural biotopes should include ways to establish goals and assess how management can best meet those goals. Many conservation scientists argue that widely applicable management strategies for fostering resilience in high nature value farmlands like traditional rural biotopes have not been assessed, and conservation focuses too much on static management strategies at the expense of fostering resilience and adaptation in a changing environment (Plieneger and Bieling 2013; Pe'er *et al.* 2014). Clear lack of research for management is evident: in their evaluation of Common Agriculture Policy and high nature value farmlands, the European Forum on Nature Conservation and Pastoralism[6] states that, "part of the problem is that the national and regional reports evaluating the effects of [regional development programs] often don't include enough information on the implementation and outcomes of specific measures, so nobody really knows what has been achieved on the ground. There are many circular processes of analysis; for example measures that are intended to benefit the environment are then assumed to have benefited the environment, without any actual evidence". Although many countries have improved their management on the ground through national exceptions to "ill-conceived Commission rules", management is also complicated by individual Member Countries' national interpretations of European Union requirements for traditional rural biotopes (Beaufoy *et al.* 2011). For example, national standards on "unwanted vegetation" have in some cases resulted in excessive clearing of shrubs and trees to the detriment of

[6] http://www.efncp.org/policy/assessing-the-new-cap/

biological diversity (*ibid*). Regarding the role of extensive animal husbandry in maintaining biodiversity in European cultural landscapes, Pykälä (2000) states that studies are urgently needed to clarify traditional animal husbandry's importance in "compensating for the lack of natural processes in different ecosystems".

Integrated tools and conceptual frameworks emphasizing knowledge synthesis, stakeholder participation and learning-feedback are increasingly used for addressing complex conservation issues and aim to provide holistic responses by understanding and responding to the multiple drivers of change in a system. Utilization of such tools and frameworks could significantly improve conservation planning and management of traditional rural biotopes. In a special issue of Biodiversity Conservation that focuses on European Grasslands, Habel *et al.* (2013) cite the articles of the journal's special issue to illustrate their criticism of the dominant simplified approach of conservation science that frequently fails to grasp "the complexity of ecosystems and the interaction between conservation goals and human needs". The authors describe three gaps in conservation science and action: the oft-discussed "knowing-doing gap"; the thematic gap between conservation science and the problems faced in conservation; and the disciplinary gap characterized by lack of communication and cooperation between different fields of science (*ibid*). Communication amongst stakeholders, scientific literacy, citizen-science, and sharing of conservation experiences are just some of the proposed solutions to bridging these gaps (*ibid*). I propose that agroecology largely responds to the third criticism. In the next section I present a selection of promising and largely complementary approaches for environmental management and provide examples (where applicable) of how the approach or tool has been used in relation to conservation management of traditional rural biotopes. These tools and frameworks partly respond to the first two gaps described by Habel *et al.* (2013) and are complementary to the agroecology conceptualization of management of agroecosystems, as they support evidence-based management, learning and feedback, stakeholder involvement, and integration of social and ecological system sustainability. I come back to these approaches in the Results and Discussion, where I consider their application in light of the literature and my own data on traditional rural biotopes.

2.2.2 Frameworks and tools for holistic conservation research

Evidence-based conservation management: This approach uses systematic reviews and tests answerable questions using the scientific method and is meant to provide a scientific knowledge base to help decision-makers design and evaluate the effectiveness of management strategies (Pullin and Knight 2003; Sutherland *et al.* 2004). Evidence-based conservation

techniques can be used to inform management, but only if sufficient data exists. For example, Stewart and Pullin's (2006) systematic review of literature on the effects of sheep grazing on lowland meadows in Great Britain found that grazing intensity is highly important but there was a lack of scientific studies of the effects of grazing on taxa other than vascular plants.

Adaptive management: Similar to evidence-based management, adaptive management is a "learning by doing" iterative process that increases system knowledge through a structured feedback mechanism that seeks to improve conservation by building a knowledge base of what management works (Allen *et al.* 2010). Adaptive management is "designed primarily to help managers better understand complex ecological systems by monitoring the results of a suite of management initiatives" (Gregory *et al.* 2006). Monitoring and other data may be used to model scenarios for traditional rural biotopes, such as the effects of woody plant encroachment on meadows (Mairota *et al.* 2014) or understanding and communicating conservation and production interactions in permanent grassland systems (Duru 2013).

Ecosystem services: Defined by the Millennium Ecosystem Assessment (2003) as "the benefits people obtain from ecosystems", the Millennium Ecosystem Assessment developed a framework that classifies ecosystem services as "provisioning, regulating and cultural services that directly affect people and supporting services needed to maintain the other services". Key to the ecosystem services concept is making explicit the link between ecosystem services and human wellbeing. Although traditional rural biotopes generally do not maximize provisioning ecosystem services compared to arable agriculture, they provide cultural ecosystem services in the form of enjoyment of nature and cultural continuity and identity (e.g. Lammi and Ikonen 2000; Plieneger and Bieling 2013).

Social-ecological systems: In the social-ecological system framework humans are considered a part of the ecosystem rather than separate from nature (Berkes *et al.* 2008; Haines-Young and Potschin 2010). Social-ecological framework claims to make explicit the links between the social and ecological components of a system, including drivers of change and responses to feedback (Haines-Young and Potschin 2010). It relies on evidence to understand the multiple system components and is an explicit component of the ecosystem services concept (Millennium Ecosystem Assessment 2003). Understanding and consideration of social-ecological systems is a key component of Plieneger and Bieling's (2013) approach to high nature value farmland/ cultural landscapes management. Operationalization of social-ecological system framework has been developed by, for example, Resilience Alliance (2010)

and UNU-IAS[7] (2014), the latter of which refers to traditional rural biotopes and associated broader landscapes as "Social-Ecological Production Landscapes and Seascapes (SEPLS)". 'Human-environmental systems' (e.g. Seppelt *et al.* 2007; Burkhard and Müller 2008; Gu and Subramanian 2014) and 'coupled human and natural systems' (chans-net.org) utilize the same conceptualization for understanding people-environment system dynamics. "Satoyama Initiative" is based specifically on the conceptualization of Satoyama heritage agricultural systems as a sustainable lifestyle model and is linked to the "Globally Important Agricultural Heritage Systems" program of the United Nations (Berglund *et al.* 2014).

Social-ecological inventory: a method of social-ecological systems inventory described by Schultz *et al.* (2007) as an early-planning tool to ascertain what knowledge is held by local ecosystem stewards and to identify their motivations and management activities. Schultz *et al.* (2007) pioneered social-ecological inventory method in Kristianstad, Sweden as part of a Millennium Ecosystem Assessment sub-Global Assessment. The area includes the largest area of flooded meadows used for haymaking in Sweden and the participatory tool was used to create a shared vision and plan for conservation for multiple stakeholders (*ibid*).

2.3 Social aspects of management

In the Introduction, I referred to Ahnström's (2009) phrase "in the hands and minds of farmers" to convey the importance of farmers' actions and attitudes to the issue of farmland biodiversity. In this section I present key concepts from the literature that I worked with on farmer behavior and decision-making, especially for conservation. The concepts I use are farmer agency, Theory of Planned Behavior, farming styles, and intrinsic and extrinsic motivations. I examine whether my own data supports or develops these concepts in Results and Discussion.

der Snoo *et al.* (2012) observed that, for farmland conservation issues, "we can focus on the conservation questions, but we should reconsider the motivation of farmers in the field of biodiversity and landscape conservation". Interest in socio- psychological approaches for understanding farmer management decisions and conservation activities is growing because random utility / profit maximization models do not explain farmer behavior (Borges *et al.* 2014; Howley *et al.* 2015). Behavioral approaches allow for the recognition of farmers as

[7] United Nations University Institute for Advanced Study of Sustainability

independent environmental managers who often make decisions about the management of environmental resources on their farms independent from the state or other 'official' environmental managers (Kings and Ilbery 2010). The actor-oriented approach to behavior begins with explaining differential responses to relatively similar structural circumstances and assumes that the actors are active participants that process and strategize their dealings with the structures they inhabit (Long 1990). Research in farmer behavior shows that farmers are not only a product of their circumstances, but that *agency* is also an important factor in farmer decision-making (e.g. Long and Van der Ploeg 1994; Busck 1999). In addition to external economic and policy structures, values and self-identity of farmers affect their management decision-making. Previous research on farmers' management and conservation-related behavior indicates that farmers are motivated in part by societal wishes and that they actively make decisions based on non-financial considerations related to a 'care-ethic' (i.e. Beedell and Rehman 2000; Busck 2002; Reeson 2008; Greiner and Gregg 2011). The Theory of Planned Behavior (Ajzen 1991) and the farming styles framework (Van der Ploeg 1994) are two theories that have been used by social scientists for understanding farmer conservation behavior (de Snoo *et al*. 2012). Theory of Planned Behavior considers attitudes, subjective norms and perceived limitations on behavior or actions that can be undertaken. Farming styles theoretical framework, developed primarily by Van der Ploeg (1994), is a framework for understanding the normative ideas of how farming should be done. For the purpose of behavior, it is useful to describe two main types of motivation, intrinsic and extrinsic motivations: "intrinsic motivation is inherent to the individual and may relate to a sense of enjoyment, satisfaction, accomplishment, responsibility or obligation" and "extrinsic motivation is directed by external rewards or incentives such as payments or sanctions" (Reeson 2008). In Article II, I use the intrinsic- extrinsic motivation categorization and explore traditional rural biotope manager behavior in the context of Theory of Planned Behavior and farming styles.

2.4 Ecological aspects of management

The satoyama index for measuring biodiversity in the landscape (see Kadoya and Washitani 2010) shows a practical application for landscape scale biodiversity conservation via heritage land use landcover/landuse type. MYTVAS^2 (Aakkula and Leppänen 2014) findings in Finland also show that traditional rural biotope conservation is important to agricultural

biological diversity. In this section I present some of the complexity in understanding ”best” management practices for biodiversity conservation in grasslands and practical challenges of conservation management in traditional rural biotopes as low-intensity production landscape elements.

Changes in nutrient balance and vegetation height and density are factors that can result in significant changes to the character and biological diversity of traditional rural biotopes. Nutrient balance is affected both by farm-level management, as well as by measures beyond farmers' control. Climate change and airborne nitrogen, flooding events, nutrient runoff from nearby fields and bringing supplementary fodder to the site or by fencing semi-natural meadows together with cultivated pasturelands are sources of nutrients that can alter the flora composition of traditional rural biotopes by favoring fast growing, tall species over traditional meadow species (e.g. Pykälä 2001; Habel *et al*. 2013b; Donath *et al*. 2015). However, plant species density and composition is complex and seemingly affected by a variety of factors (spatial arrangement and isolation, topography, soil, nutrient loads, biogeographical history) in addition to the grazing regime (e.g. Grace and Jutila 1999; Pykälä 2001; Habel *et al*. 2013b). Somewhat paradoxically to the evidence that management of traditional rural biotopes increases biodiversity, plant species density has also been found to be negatively correlated to grazing (e.g. Grace and Jutila 1999; Habel *et al*. 2013b). Grace and Jutila (1999) found that competition appears to be more pronounced as a determinant of plant species composition in unmanaged seashore meadows in Finland compared to managed meadows. Pluess's (2013) meta-analysis of grassland studies found differences in how trait groups were affected in grazed compared to mown sites. In the absence of other management methods to maintain low growth open biotopes, the impact of ceasation of grazing and fodder collection on traditional rural biotopes may be overgrowth and change of flora such that species dependent on poor meadow soils and low growth environments are negatively affected (e.g. Grace and Jutila 1999; Pykälä 2001; Habel *et al*. 2013b).

Emphasis on site biogeographical history by maintaining and strengthening a site's own biological, cultural and landscape qualities is a key part of the management guidelines for traditional rural biotopes in Finland (e.g. Pykälä 2000: Pykälä 2001; Vainio *et al.* 2001). Additionally, an overarching aim is negative nutrient transfer to the sites, so grazing and haying without supplementary feeding or fertilization are the most important management methods (*ibid*).

Pykälä's (2000) observations about management of traditional rural biotopes for biodiversity conservation illustrate the complexity in designing and carrying out management to both meet biodiversity conservation goals and simultaneously be a part of a productive farming system. He states:

> "Some conclusions for nature conservation can be drawn. First, the optimal grazing management system for biodiversity is probably a complicated combination both of continuity (similar grazing pressure over a long time) and stochasticities (variation in grazing pressure, rotational grazing, and abandonment and resumption of grazing) and of different grazing pressures and animals over a variety of spatial and temporal scales. Second, when grazing and mowing are used for maintaining biodiversity, no human-induced nutrient supply (artificial fertilization, supplementary forage, nutrient flow via animal feces from cultivated pastures) should be allowed. This is a difficult goal to achieve because animal husbandry that does not cause nutrient enrichment is largely relegated to history. Nevertheless, this would be most important for maintaining biodiversity in the European agricultural landscape. The grazing system should be prescribed precisely to obtain relevant information on species' response to livestock grazing in different situations."

A key conflict of management for the dual purposes of agricultural productivity and biological diversity for traditional rural biotopes is that grassland productivity is widely understood to be inversely related to species diversity (see Donath *et al*. 2015). It is not clear whether this general rule holds for sites under non-intensive management. Donath *et al*. (2015) found comparable fodder productivity (quality and quantity) in species rich HNV meadows and species poor (low nature value) meadows. Pykälä's description of the practical difficulty of creating biodiversity-optimized grazing strategies in a modern farming context relates both to the Finnish context and the larger European context and has relevance for European Union programs for conservation of traditional rural biotopes and for the ways such programs are interpreted and implemented at the national and sub-national scales.

Assessment of management for species, assemblages and functional traits are complex and important aspects of the conservation science for traditional rural biotopes but beyond the scope of this study (for Finnish studies, see e.g. Pykälä 2001; Pöyry 2007). In Results and Discussion, I present some findings from the interviews on farmers' responses to questions about their management plans and management activities to better understand how management is undertaken and whether such strictly planned management regimes as recommended by Pykälä and others are practiced.

III. MATERIALS AND METHODS

3.1 Study region

3.1.1 Raasepori municipality

I used the intensive examination of one municipality to explore questions of broad importance in traditional rural biotope and farmland conservation. Research was conducted in Raasepori Municipality, Uusimaa Province, in southwestern coastal Finland. Raasepori is located in the hemiboreal floral zone and a defining geological feature of the landscape is post-glacial shore uplift. Because of this post-glacial uplift, seashore meadows in this area are classified as a Finnish Habitat Type of International Responsibility (Schulman *et al.* 2008). Pykälä and Bonn (2000) note that the status of traditional rural biotopes in Uusimaa Province is similar to that elsewhere in the country (poor), but that Uusimaa has an above average amount of meadow area compared to the rest of Finland. Raasepori (Tammisaari area in particular) contains some of the most valuable seashore meadows and other traditional rural biotopes in all of Uusimaa (*ibid*). Pykälä and Bonn (2000) estimate that twenty one percent of Tammisaari land area is traditional rural biotope. Archeological value may also be present: thirty percent of traditional rural biotopes in Uusimaa Province are located in the vicinity of archeological remains and sixty eight percent of these date to the iron age (Seppälä 2006).

In addition to Natura 2000 sites and other HNV farmland throughout Raasepori, the study area includes Skärlandet Landscape Conservation Area in the Ekenäs Archipelago. Skärlandet became Finland's first designated National Landscape Conservation Area in June 2007 (Ekenäs Stad *et al*. 2006). Skärlandet is classified as culturally valuable and includes Natura 2000 and coastal conservation areas (Schulman *et al*. 2008).

During 2009-2010, there were 326 farms in Raasepori Municipality and the dominant primary production type for farms was outdoor crops, followed by cattle and dairy farming (Article I, Fig 2). Average age of Raasepori farmers was 52, slightly above the mean for Finland (Information Centre of the Finnish Ministry of Agriculture and Forestry, hereafter referred to by its Finnish abbreviation, Tike). Average arable land area was somewhat larger in Raasepori (45 ha vs. 37 ha) compared to the rest of Finland. During 2005-2010, 62 people, representing nineteen percent of total registered farms, received special agri-environment schemes. Of these, 21 received special AES payments specifically for management of traditional rural biotopes.

3.1.2 Historical context: regional traditional agriculture

Population and agriculture in the southern coastal region varied over the centuries tremendously (Pykälä and Bonn 2000). During the period of traditional agriculture, production emphasis in western Finland was on field production; slash and burn was not practiced on a broad scale (Vainio *et al.* 2001). In contrast to slash and burn based households, field production farms always had meadows (*ibid*). In the 1700s, meadow parcel area in Uusimaa was 2.5 times that of field area (Finland official statistics cited by Pykälä and Bonn 2000). Animals grazed on wooded pastures and in forests in the summer, and fodder was collected from moors and seashores (*ibid*). In southern Finland, the main problem for field production was shortage of meadows for fodder production for animals to produce manure (Vainio *et al.* 2001). Thus, two-year crop/fallow rotation was an important part of farming in southern Finland. Half of the field area was generally left in green manure/fallow while the other half was most commonly in autumn rye (*ibid*). Fields in Uusimaa were cultivated using horses and, in the west, oxen (Pykälä and Bonn 2000). Uusimaa was affected by the same events described in Chapter 2 that lead to modernization and changes in agricultural production. By 1929, meadow area in Uusimaa was down to six percent compared to that of field area (*ibid*). Pykälä (2001) notes that animal husbandry decreased most significantly in southern and southwestern Finland, which both have the longest history of animal husbandry in Finland and also where the species diversity that has benefited from animal husbandry is greatest. Animal husbandry for management of traditional rural biotopes in the archipelago has also decreased significantly and is complicated in any case by logistics and economics of transporting animals to small sites (Vainio et al. 2001). Research conducted in 1998 (Rauramo & Kekäläinen 2000) indicated that only twelve percent (34 sites) of valuable traditional rural biotopes in Uusimaa were getting subsidies in the summer of 1998. Fewer than 15 of these sites were managed well or satisfactorily (*ibid*).

3.1.3 Traditional rural biotope inventory

Pykälä and Bonn (2000) carried out in the 1990s an extensive inventory of traditional rural biotopes in Uusimaa Province. The inventory covered both immediately before and after Finland joined the European Union (1995) and coverage for traditional rural biotopes is estimated at 80-90% (*ibid*). They found 289 valuable traditional rural biotopes, of which 28 were classified as nationally important. Key findings of the inventory included that many traditional rural biotopes are overgrown and in danger of losing their defining characteristics,

that landowners were largely ignorant of the value of traditional rural biotopes and that animals grazing traditional rural biotopes were often given supplementary feed or pastured together with cultivated land (*ibid*). In Results and Discussion, I present a table comparing my own summary findings based on interviews with those from Pykälä and Bonn (2000).

3.2 Research methods

3.2.1 Data generation

Research was conducted in two steps: postal questionnaires (n=326) to all farms in Raasepori (Article I) and semi-structured in-depth interviews (n=27) with traditional rural biotope managers and owners (Article II). I used statistics of all farms in Raasepori from the Information Centre of the Finnish Ministry of Agriculture and Forestry (Tike) to assess information about Raasepori farms, triangulate potential traditional rural biotope managers and as variables in analyzing data. I sent postal questionnaires to farmers in May 2010 and I conducted interviews during Summer 2010. The process of triangulation and final interviewee selection is illustrated in Fig. 2.

Table 2 Variables, research methods and context for analysis. "Key variables" includes both statistics from Ministry of Agriculture and Forestry's information service and response data from subjects.

	Article I	Article II
Key variables	Farm area and TRB* area, special agri-environment schemes, hunting & fishing, direct sales	TRB*: farm area ratio, management motivations, opinions about TRB value, knowledge of TRB conservation, inspection & extension experiences
Data collection	Postal questionnaires	Semi-structured interviews
Main analysis & discussion context	Conservation policy approaches	Farmer conservation behavior
	Additional to Articles I & II	
	Management behavior and activities,	
	Summary comparison with Pykälä and Bonn (2000)	
	Non-agricultural direct-use ecosystem services	

**traditional rural biotope*

Agricultural statistics (2010) were provided for all farms in Raasepori municipality by Tike. Finnish Agency for Rural Affairs (Maaseutuvirasto) and Finnish Food Safety Authority (Elintarviketurvallisuusvirasto) granted permission for the statistics provided by Tike. Statistics provided basic information about farms and farmers in Raasepori, including contact information, farm area and production type, number of animals and land-use types, and types of special agri-environment sub-measure contracts farmers may have. I used these variables for background information on Raasepori Municipality, triangulation of potential traditional rural biotope managers (Fig. 2), to compare traditional rural biotope managers with non-traditional rural biotope managers and to compare across groups of traditional rural biotope managers.

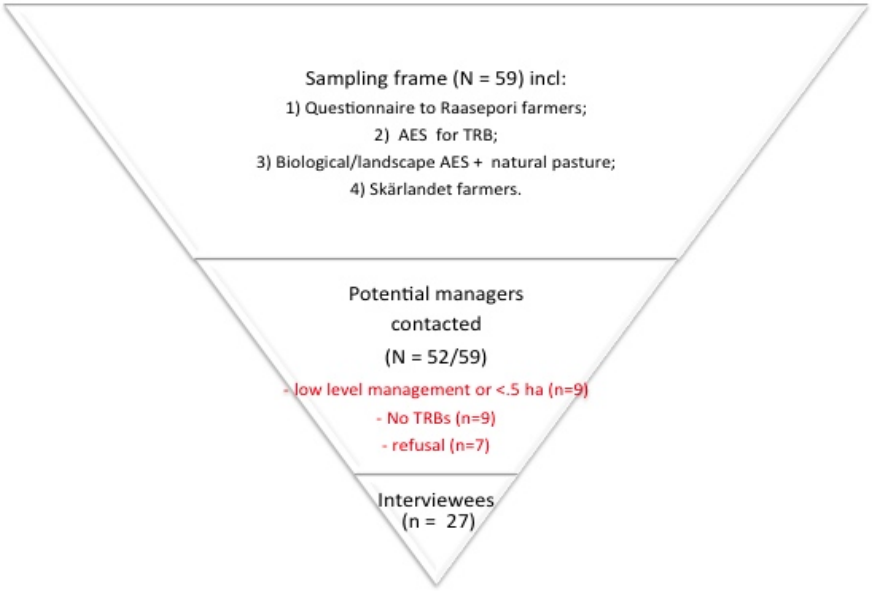

Fig. 2 Process for identifying traditional rural biotope managers for interviews, starting with sampling frame of possible traditional rural biotope managers in Raasepori Municipality. In red are contacted potential managers who were not interviewed for the reasons listed.

Postal questionnaires (Article I) were sent to representatives of all farms in Raasepori Municipality (n=326) that were registered with the Finnish Agency for Rural Affairs. I used the questionnaires to identify farms with traditional rural biotopes and establish basic information about those farms compared to farms without traditional rural biotopes. Questionnaire packets included a cover letter and self-addressed prepaid envelope for returning the completed questionnaire. I sent questionnaires in either Swedish or Finnish or both languages (as determined based on the contact person's name). The response rate for the postal questionnaires was 40%.

Questionnaires asked personal information (e.g. age, education), information on hunting, fishing, and entrepreneurial activities, and about whether the farm had managed or unmanaged traditional rural biotopes (Article I, Table 2). I used personal information to compare farms and their managers with traditional rural biotopes to those without traditional rural biotopes. I chose the hunting, fishing, and economic activities that bring the public to the farm variables for understanding traditional rural biotope managers and whether they differ from non-traditional rural biotope farmers in typical nature-use activities and farm entrepreneurship.

Semi-structured personal interviews (Article II) were conducted with representatives of 26 farms and one business who manage or own traditional rural biotopes. The target population was all Raasepori farmers and farm owners with managed traditional rural biotopes. I identified interviewees through a combination of sources: they had identified themselves as owners or managers of traditional rural biotopes in the postal questionnaire sent to all farms in Raasepori Municipality; they had, during the period 2005-2009, contracts for special agri-environment scheme sub-measures for traditional rural biotopes; or they had during the same period both participated in biological and/or landscape diversity special agri-environment scheme sub-measure and their farm (according to statistics provided by Tike) had the land use type "natural pasture or meadow". Additionally, I included five Raasepori farmers in the Skärlandet Landscape Conservation Area who were previously identified by Raasepori Municipality as having managed traditional rural biotopes. In total, I identified 59 potential traditional rural biotope managers with this method and successfully contacted 52 of these potential subjects by telephone to confirm they had managed traditional rural biotopes and ask if they would participate in interviews. Nearly all interviewees were Swedish-speaking. For clarity and consistency, I hired a native Swedish speaker to conduct interviews in the interviewees' preferred language using the interview guide I prepared. I participated in all interviews.

Interviews lasted from ½ to 2 hours and I audio recorded them with permission of the interviewees (one was written out by hand). I asked interviewees "closed answer" questions but interviewees were able to comment and discuss their answers, and I frequently asked follow-up questions to clarify responses. Major themes of the interviews included: basic demographic information on managers, their farms and traditional rural biotope area; manager knowledge of traditional rural biotope conservation issues; management activities and management plans; experiences and opinions of the agricultural policy environment via

extension and inspection services; and motivations and personal values related to traditional rural biotope management. In asking about motivations, I focused to a large extent on "extrinsic" and "intrinsic" motivations (Reeson 2008; see definition above in section 2.3). Thus, I asked farmers to choose their most important motivations for managing traditional rural biotopes from the following five options: obtaining special agri-environment scheme payments, having "free" fodder for animals (both considered "extrinsic" motivations), keeping animals outside/animal wellbeing, conserving nature/providing habitat for wildlife, and keeping landscape open (all considered "intrinsic motivations"). As with all questions, interviewees were free to give their own responses in addition to the choices presented.

3.2.2 Analysis

Article I: I tested representativeness of the returned postal questionnaires relative to the sample frame with the variables farm size (ha), primary production type and age. I aggregated primary production types into six categories adapted from 2009 agriculture statistics provided by Tike. I compared presence of on-farm alternative income generation (direct sales, farm tourism and farm services) between those respondents that said they have managed traditional rural biotopes and those who said they did not in order to determine whether there were links between direct sales/services and presence of traditional rural biotopes. I also compared the presence of hunting and fishing between the two groups to determine whether they differed in common rural activities and because nature-based activities like hunting have been shown to have influence on conservation activities (Oldfield *et al.* 2003). I analysed results of the postal questionnaire using SYSTAT 12 (2007) and discussed findings in the context of ecosystem services, evidence-based conservation and other conservation approaches.

Article II: I used audio recordings of interviews to transfer responses to a database. Comments and discussion were partially transcribed. I coded quantitative answers and grouped comments, discussion points, and clarifications thematically for use in inductive analysis.

I classified traditional rural biotope managers and owners into two groups in order to determine whether the managers differed in attitude, motivations, experiences or structural factors according to a simple classification of whether or not they used traditional rural biotopes in their farming system. The reason for testing this taxonomy based on the role of traditional rural biotopes was that the previous postal questionnaire research showed that traditional rural biotope managers may be either farmers who use traditional rural biotopes in

their farming or farmers/landowners who do not themselves use traditional rural biotopes on their farms and I thought that potential differences could affect management and be important for improving policy and tailoring extension materials or services to traditional rural biotope manager needs.

I used DebateGraph (http://debategraph.org), a web-based wiki-style social mapping tool, for inductive analysis to identify themes underpinning management motivations and to examine manager qualities and emergent relationships. The main questions explored through this analysis were differences between manager groups and questions about management motivations, including: two most important motivations, manager knowledge about traditional rural biotope rarity, whether that knowledge affects management and how (or why). Although the main focus was on responses to a specific set of questions, I linked relevant comments from throughout the interviews and cross-linked common themes between respondents. An example of how I developed the linkages is presented in Article II Fig. 1.

I tested experience with inspection and extension services and frequency of special agri-environment scheme sub-measures between the two groups using Fisher exact test. "Extension services" refers specifically to agricultural and agri-environment advice from official sources, while "inspection services" refers to special agri-environment sub-measures and other special program-related inspections (for example, Natura 2000). I reported satisfaction with inspections and extension services as percentages according to the manager groups and by a representative sampling of comments describing manager experiences. I presented detailed responses to individual management motivations and opinions about traditional rural biotopes and their conservation items in frequency distributions and constructed a general linear model to test whether there were differences in opinion about the value of traditional rural biotopes between the two groups or according to the traditional rural biotope area to farm area ratio. I used R 2.8.0 software (R Development Core Team 2008) for the general linerar model and SPSS version 19 (IBM Corp 2010) for all other statistical analysis.

I used Likert-scale type items (Likert 1932, cited in Carifio and Perla 2007) for the question "How do managers view traditional rural biotopes and traditional rural biotope conservation?" and the same scale (1-5) for satisfaction with extension and inspection services. Following Carifio and Perla (2007), I treated responses as interval data. Managers gave their two "most important reasons for managing traditional rural biotopes" and I categorized these responses

for analysis as either “extrinsic” or “intrinsic” (Reeson 2008). I used the “extrinsic” and “intrinsic” categories because underpinning drivers of farmer conservation behavior is an important topic in understanding farmer management choices and conservation activities. Extrinsic and intrinsic valuation, alternatively “use value” vs. “non-use value” and “inherent” vs. “instrumental” (Pascual *et al.* 2010; Mace *et al.* 2011), is currently an important topic in the debate on policy-related approaches to conservation that have come about in part due to the growing influence of the ecosystem services paradigm.

I analyzed interview results in the context of The Theory of Planned Behavior (Ajzen 1991) and Farming Styles theoretical frameworks (Van der Ploeg 1994). As described in section 2.3, both theories focus on farmer *agency* in decision-making, rather than structural factors. I examined area (farm area, traditional rural biotope area, and traditional rural biotope area to farm area) in order to determine whether there was any relationship to attitudes about traditional rural biotopes and traditional rural biotope conservation. Because the presence of managed traditional rural biotope on the farm implies an active choice for management, I expected that higher traditional rural biotope to farm area ratio would be correlated to more positive attitude toward traditional rural biotopes and their conservation. Structural differences (farm area, traditional rural biotope area and traditional rural biotope to farm area) between the groups “use traditional rural biotopes in farming system” (so-called “TRB farmers”) and “do not use traditional rural biotopes in farming system” (“non-use TRB owner”) were tested using F-test. Farm area was related to the traditional rural biotope area in a log-linear regression.

Management activities and summary comparison with Pykälä and Bonn (2000): Article II presents only a portion of the subject material covered by the interviews. In order to expand on the thesis theme of manager motivations and policy implications, I present further results from the interviews on management activities. I also present a table (Table 4) comparing my findings with those of Pykälä and Bonn (2000) to examine Raasepori’s traditional rural biotope (and manager) status to that of Uusimaa Province generally around the time Finland joined the European Union to understand how the situation may have developed.

Direct-use ecosystem services: In the interviews, I asked managers about other activities that take place on their traditional rural biotopes, including hunting, recreational activities, wood collection and wild food collection (foraging). Such activities have ”direct-use value” (DEFRA 2007) and I refer to these activities as ”direct-use ecosystem services”.

IV. RESULTS AND DISCUSSION

In this chapter, I present the results of the two articles, as well as some other findings from the interviews not reported in Article II. I reflect on the benefits and shortcomings of the methods I used, especially for analysis, and relate my own findings back to the literature on farmer conservation behavior and agency. I consider whether the findings have relevance to informing policy and extension/advice services for conservation of traditional rural biotopes and especially whether they provide any support or evidence for the holistic management frameworks and tools described in Chapter II. Discussion is followed by final words on the research, including recommendations and ways forward.

4.1 Identifying traditional rural biotopes and their managers

4.1.1 Managers and the farms

In the postal questionnaires, 32% (42 out of 131) of respondents said they have managed traditional rural biotopes, and the number of potential TRB managers rose to 59 when triangulation using agricultural statistics about land use type and special agri-environment schemes were included. However, the actual number of respondents with managed traditional rural biotopes decreased on follow-up in which 52 of the 59 potential TRB managers were contacted by telephone. The reason for exclusion from the interviews is described in Fig. 1. "Hidden" traditional rural biotopes that were not under special agri-environment scheme contracts were alternatively small, the managers chose not to apply for special agri-environment schemes because they felt they did not fulfill the requirements (e.g. "night pasturing" or other supplementary feeding), or the sites were recently taken under management ("trying it out").

Postal questionnaire results showed that traditional rural biotopes were found on farms of all sizes, and farm size was not an indicator of presence of traditional rural biotopes on the farm (1-way ANOVA $F_{d.f.} = 0.931$, $P = 0.397$). There was no difference between respondents and non-respondents according to the three variables tested (farm size, production type, and farmer age). However, the 27 interviewees had an average farm size nearly twice that of

Raasepori farmers generally. This is likely a result of the filtering out of small traditional rural biotope sites and those with low management (< 1x/year).

4.1.2 Traditional rural biotope management history and practices

Total traditional rural biotope area managed by the farmers interviewed was in the range of 774 ha (sum of TRB farmers' area – non-use TRB owners' area) to 913 ha (sum of all traditional rural biotope managers managed area) depending upon what the actual overlap of site (rental or use agreements) between the non-use owners and those renting or using others' traditional rural biotope sites. Seashore meadows and grazed forest were the most common traditional rural biotopes amongst the interviewed managers. This finding corresponds to that of Pykälä and Bonn (2000), but this study had a higher prevelance of other traditional rural biotope types compared to Pykälä and Bonn's 2000 inventory. This is likely due to different methodologies and focus. About half of the managers said their sites had been under continuous or nearly continuous management (break< 5 years). Fifteen of the nineteen managers who reported breaks of five years or more said the sites had been abandoned, usually because of no longer having animals on the farm (Fig. 3a). This finding is in line with the literature generally that abandonment usually is a result of no longer having animals on the farm (Pykälä 2001; Vainio *et al.* 2001). After a period of abandonment, sites that were taken back in to use were associated mainly with farms choosing to renew animal husbandry or with agreements with other farmers to take over the sites (Fig. 3b). Farmers with rented sites were occasionally unaware of the sites' management history.

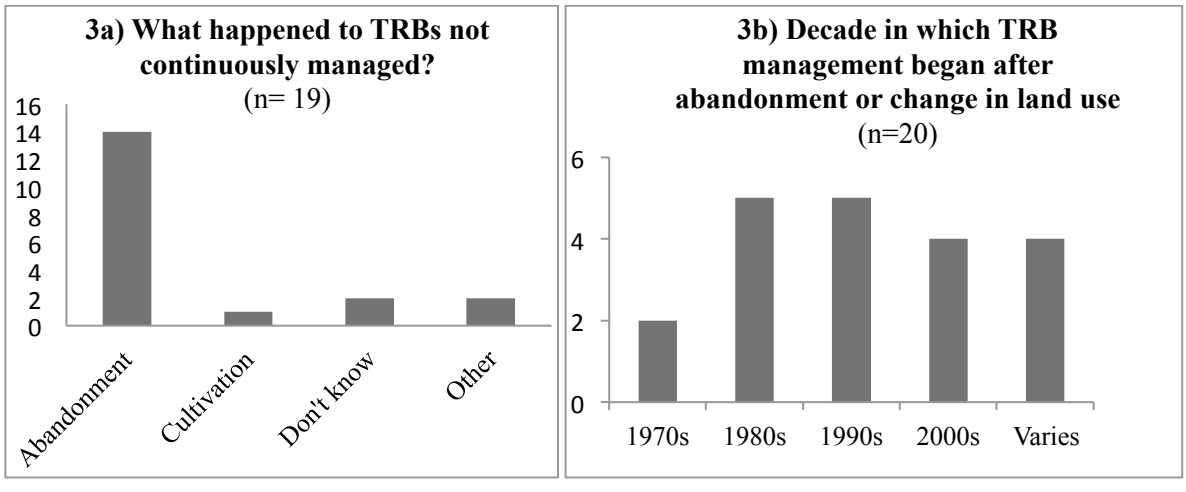

Fig. 3a and 3b Frequency of responses to question about what happened to sites that had breaks in management (3a) and decade in which post-abandoment management was begun (3b).

For future plans, managers mainly indicated that they intended to continue managing the same amount of traditional rural biotopes and have the same amount of animals on their farms over the next five years (Figs. 4a and 4b). Planned changes in management activities on traditional rural biotopes were mainly linked to changes in the number of animals, although improved infrastructure was also mentioned.

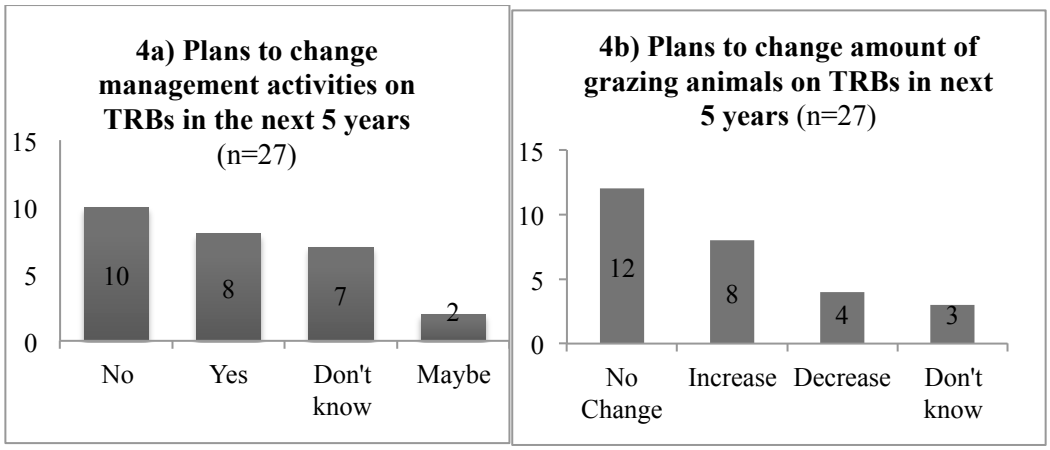

Fig. 4a and 4b Plans under normal circumstances about planned management activities on traditional rural biotope sites (4a) and the number of animals on the farm (4b) in the next five years.

Pykälä and Bonn (2000) state that, "continuous management is necessary. Desired effect cannot be achieved with "one-off management". I assessed whether managers' activities on the traditional rural biotopes are "one-off" activities or systematic management by asking about the frequency of various management activities (Table 3). All but one manager (a retired farmer who no longer has animals and hand-clears the site annually) said that annual grazing takes place on their sites. Haying on sites took place during July-September or "in the summer… when there's time" and was carried out either by hand, machine or a combination of both. Fence maintenance and taking water to the animals were management activities mentioned by interviewees. In line with management recommendations and requirements, few engaged in any kind of drainage management. The interviews provide support of planned, systematic management of the traditional rural biotope sites but it is impossible to ascertain the quality or impact of the management without on-site assessment.

Table 3 Management activities carried out on the traditional rural biotope sites under the interviewees' management or ownership.

Management activity	Number of times activity is done in 5 years						
	1	2	3	4	5 or more	Not relevant	skipped

Clearing	4	4	1	0	17	1	
Coppicing	0	2	0	0	9	17	
Haying					3	22	9

Table 4 is a comparison of my summary findings about management of traditional rural biotopes with those of Pykälä and Bonn (2000). Although comparison must be moderated by understanding of the differences of the two methods, especially that Pykälä and Bonn were much more likely to discuss traditional rural biotope management with owners who were not currently managing their sites or did not have systematic management of their sites, some conclusions can be drawn about developments over the 13-17 years between the two studies. In my study, uncertainty about the future was mainly expressed as uncertainty over farming generally. Additionally, managers had a high level of awareness (and in many cases pride associated with management) about traditional rural biotope rarity and high nature value. There was more familiarity with the special agri-environment schemes for traditional rural biotopes by the 2010 interviews.

Table 4 Comparison of interview findings about traditional rural biotope management with those of of Pykälä and Bonn's (2000) Uusimaa inventory summary results.

Topic	1993-1997 Uusimaa inventory (Pykälä and Bonn 2000)	2010 Raasepori Interviews
Future management	Continued management mostly uncertain.	"TRB managers" tended to consider the entire agricultural context in factoring uncertainty. Grazing was certain for majority of managers. "Non-use TRB owners" often considered management dependent upon relationship or intentions of TRB farmer utilizing the site.
TRB quality	Grazed areas managed in a way that conserves TRB nature values is rare.	*Did not conduct systematic site assessmen*ts
TRB as fodder	Cattle get most of their nutrition from fields.	High level of agreement. High variability of fodder value dependent upon TRB type. Most managers reported that the majority of fodder during the grazing period (ranging from 0-7 months) on the TRBs came from the TRBs.
TRB and other biotopes	Meadows, wooded meadows, and grazed forests are often joined with cultivated pasturelands.	Some managers stated they fence or join TRBs with cultivated pastures or hay fields.
TRBs and external feed	Animals are often given supplementary feed or TRBs are fertilized.	Many managers identified supplementary feeding, night pasturing and fencing TRBs with cultivated pasture as practices they sometimes or always engage in. Intentional fertilization of TRB sites not practiced.
TRBs and eutrophication	Observable eutrophication detrimental to biodiversity often evident in TRBs.	*Did not conduct systematic site assessmen*ts

Management	Typical of meadows is that overgrowth is evident because regular clearing undone.	Unclear. Manager activity questions indicate clearing and other management activities take place regularly, but site assessments not conducted
Management	Typical source of overgrowth in meadows is planting of tree seedlings.	A young farmer (identified through MAVI statistics) had discontinued cattle husbandry and was using the former grazed forest for forestry only.
Landowner interest	"Majority of landowners" interested in conserving and managing TRBs.	Majority of all interviewees interested in keeping TRBs the way they are or "improving management".
Landowner knowledge	"Many" landowners ignorant of TRB value.	High level of awareness of rarity of TRBs, although nature value knowledge not quantified. "Non-use TRB owners" had lowest awareness of rarity.
Economic drivers	"Often" TRB management considered impossible for economic reasons.	Many managers discussed economics or the agri-environment system generally.
Small sites	Under 0.1 ha overgrown sites common in Uusimaa. These small sites probably cover several times the surface area of actual meadows.	Sites > .5 ha not considered. However, farmers with small sites are less likely to have agri-environment schemes, more likely to be "non-use TRB owners".
EU driver	"Often" EU considered a threat to animal husbandry/livestock (karjatalous) and associated TRB management. Many farms discontinuing or already discontinued animal husbandry/livestock (karjatalous).	Mixed. Uncertainty of future European Union policy are a concern. Some farmers, especially with direct sales, are experiencing growth or intending to expand/grow animal husbandry/traditional rural biotope management.
Results: AES application process	Poorly planned application forms and lack of human resources have resulted in AES being given for management that does not guarantee quality conservation.	Many managers with special agri-environment schemes for TRBs said they follow "AES plan + own ideas". Inspectors sometimes “look through their fingers” (at regulation lapses).

The comparison of the two studies shows that management for supporting the nature value of traditional rural biotopes continues to be an area that needs improvement. Pykälä’s (2000) concern that best management practices for conservation purposes are difficult to combine with agricultural goals and needs was supported by the interview results, where managers explained that they follow special agri-environment scheme plans “plus their own ideas” and that inspectors are often flexible in their acceptance of supplementary feeding (mainly fencing with cultivated pastures). Interestingly, however, some managers reported zero tolerance for any deviation from the standard guidelines, despite being in the same municipality and presumably inspected and advised by the same bureaus and personnel.

4.2 Traditional rural biotope managers and farming styles

4.2.1 Diversity and classification

This study showed that traditional rural biotope managers (TRB managers) were diverse according to the role of traditional rural biotopes on the farm. The categories "non-use TRB owners[8]" and "TRB farmers[9]" were useful for examining whether attitudes and motivations for managing traditional rural biotopes were dependent upon whether the sites were integrated into the farming production system, but the categories could not explain farmer behavior. However, a key finding of the study was the TRB farmer sub-category "TRB entrepreneurs[10]". Agency and Theory of Planned Behavior explained study findings to a large extent but only the "TRB entrepreneur" grouping could be considered a farming style according to the farming styles concept (Schmitzberger *et al.* 2005, Van der Ploeg 2010). That the study did not find unified behavior or farming strategies amongst all TRB managers or even within the two broad categories of TRB farmer and non-use TRB owner is in line with assertions by others (e.g. Perry-Hill and Prokopy 2014; Reimer *et al.* 2014) that farmers and rural landowners are difficult to classify according to their behaviors because of the multitudinous factors that go into decision making. However, it is important to note that this was a simplistic, utilitarian, and *a priori* classification that focused on use or non-use of traditional rural biotopes in the farming system and the possibility of traditional rural biotope managers as a "type" or having a "farming style" rather than seeking broadly to identify farmer types who also happen to manage traditional rural biotopes. Classification using socio-psychological / behavioral categories such as "environment", "productivist", "innovation" and other orientations found in the literature (e.g. Boonstra et al. 2001; Howley *et al.* 2015) could further elucidate some of the preliminary findings reported here.

The postal questionnaires showed that farms with managed traditional rural biotopes have high frequency (55% vs. 14%, Fisher: $p < 0.001$) of on-farm sales and services (hereafter referred to as "direct sales") that bring the public to their farms. The association of traditional rural biotopes with direct sales was stronger than, for example, the link to organic farming (only 4 of the 30 managers with direct sales were organic). The direct sales association suggests farmer agency and hints at possible farming styles related to management of traditional rural biotopes, but the interview results nonetheless showed that farmers with

[8] Own but do not use traditional rural biotopes in own farming system;
[9] Use traditional rural biotopes in their farming system;
[10] Farming system is entirely dependent upon traditional rural biotopes.

managed traditional rural biotopes have varied farming strategies, or styles. Thus, the study supports prior findings that "distinct differences exist in farmers' use of nature and the effects of farming styles on biodiversity and landscape" (Boonstra et al. 2001). However, just as "TRB entrepreneur" can be described alternatively as an "innovator", there are suggestions that other managers may fit in to the broad farming styles or behavioral categories often used in the literature. For example, mainly the TRB farmers have direct sales on the farm and, thus, some may belong to the widely used "innovator/entrepreneur" category, if the farm is looked at as a whole. Non-use TRB owners generally had smaller traditional rural biotopes and smaller farms, and these structural differences (additionally to preference/agency) may affect farming strategy and perception of what is possible within the limits of the farm and its resources. This may be especially important to innovation and entrepreneur related behavior, as the literature shows that Finnish small-scale farmers (as well as others) are generally more risk-averse than their larger counterparts (Koundouri *et al.* 2009).

Differences aside, all the managers and groups expressed motivations for managing traditional rural biotopes that indicate a high degree of personal preference and values as influencing decision-making. This supports the Theory of Planned Behavior's proposal that behavior can be linked to attitudes, subjective norms and perceived limitations on behavior or actions (Ajzen 1991). In this case, existential value of traditional rural biotopes was favored over economic reward and preference for open landscape was followed by willingness to undertake management activities specifically to achieve subjective norms such as how the farm landscape should look. Regardless of possible structural limitations, non-use TRB owners' expressed motivations for managing traditional rural biotopes ("wanting the land in use"; "tidy farm and landscape") indicate thinking about the farm environs as a whole and acceptance of non-economic elements of the farm. The expression of "wanting land in use" despite not getting any financial reward for management is similar to findings in the literature that, even within the European Union multifunctional context, many farmers hold an ostensibly productivist orientation that "land should not be idle" (Howley *et al.* 2015). These examples show that, even when the research interest is on a specific element of the farm, focus on whole farm strategy is necessary for understanding behavior and identifying farming styles of farmers.

4.2.2 TRB-entrepreneurs

TRB-entrepreneurs share common strategies of managing a large proportion of traditional rural biotopes, high level of participation and economic dependency on special agri-

environment schemes and having direct sales of traditional rural biotope products. They differ from other TRB farmers in that their farming strategy is wholly dependent upon the role of traditional rural biotopes, whereas other TRB farmers have more diversified farming strategies of which TRB management is only a part. TRB entrepreneurs seem to align closely to the "lifestyle" and "environmental" orientations described by Howley *et al.* (2015).

TRB entrepreneurship is a relatively new farming style that takes advantage of the multifunctional principles of EU agricultural policy (e.g. Cork Declaration; see Losch 2004) and the growth in local foods systems (COM 2013 866 final). Burton and Wilson (2006) report that farmers from non-agricultural backgrounds are more likely to engage in conservation-oriented or alternative farming practices. Thus, it is unsurprising that the TRB entrepreneurs identified in the study were all 'new farmers' who had not grown up on farms. TRB entrepreneurs, as well as others, said traditional rural biotopes were important to the farm image and marketing for direct sales.

4.3 Values, Motivations and Ecosystem services

Research indicates that "subjective norms" are an important part of intention in carrying out conservation behavior on farms (Lokhorst *et al.* 2014). Managers expressed a range of motivations and interests in managing their traditional rural biotopes, and for many of the managers, nature conservation was a secondary consideration or simply a bonus for managing for other purposes. The use/non-use role of traditional rural biotopes in the farm system had no bearing on the motivations for managing traditional rural biotopes. However, higher traditional rural biotope area to farm area ratio was associated with more positive attitude toward traditional rural biotopes and traditional rural biotope conservation (GLM: $F_{1,25} = 6.42$, $p = 0.02$).

A powerful personal preference/subjective norm amongst non-use TRB owners in particular was "tidy landscape". In fact, one farmer expressed that he manages his traditional rural biotope site with a few animals in the summer specifically because it is the first part of the farm visitors see and is visible from the road. An owner of a seashore meadow described that "embarrassment" because of their relatives not being able to practice (motorized) water sports during summer holidays was the reason they did not renew a nature protection status they had previously sought for the area around the seashore meadow. On the other hand, this same

manager chose to manage their seashore meadow to improve the view and seashore access for themselves and their family. These examples show that subjective norms and external pressures exert in some cases powerful influence on management of traditional rural biotopes.

Historically, traditional rural biotopes were managed for a direct benefit, which was fodder production. However, interviews with managers indicated that fodder production is not the primary motivator for traditional rural biotope management for most of them. Rather, the managers are mainly motivated by intrinsic values to manage traditional rural biotopes (Article II, Fig. 3). One-third of postal questionnaire respondents who said they have managed traditional rural biotopes on their farms said that their traditional rural biotopes are used for purposes other than agricultural production, and more than a quarter said that people from off the farm use their traditional rural biotopes (Article I, Fig. 7). Further, results from the interviews about the users of traditional rural biotopes and the non-agricultural activities that take place on the traditional rural biotopes (Fig. 5) show that traditional rural biotopes provide a variety of (mainly cultural) "direct use[11]" ecosystem services. These results, as well as examples above of the influence of subjective norms, values and pressures, show that it is important to consider traditional rural biotopes in a modern context: the ecosystem services they provide, who uses and benefits from traditional rural biotopes, and the motivations for managing traditional rural biotopes.

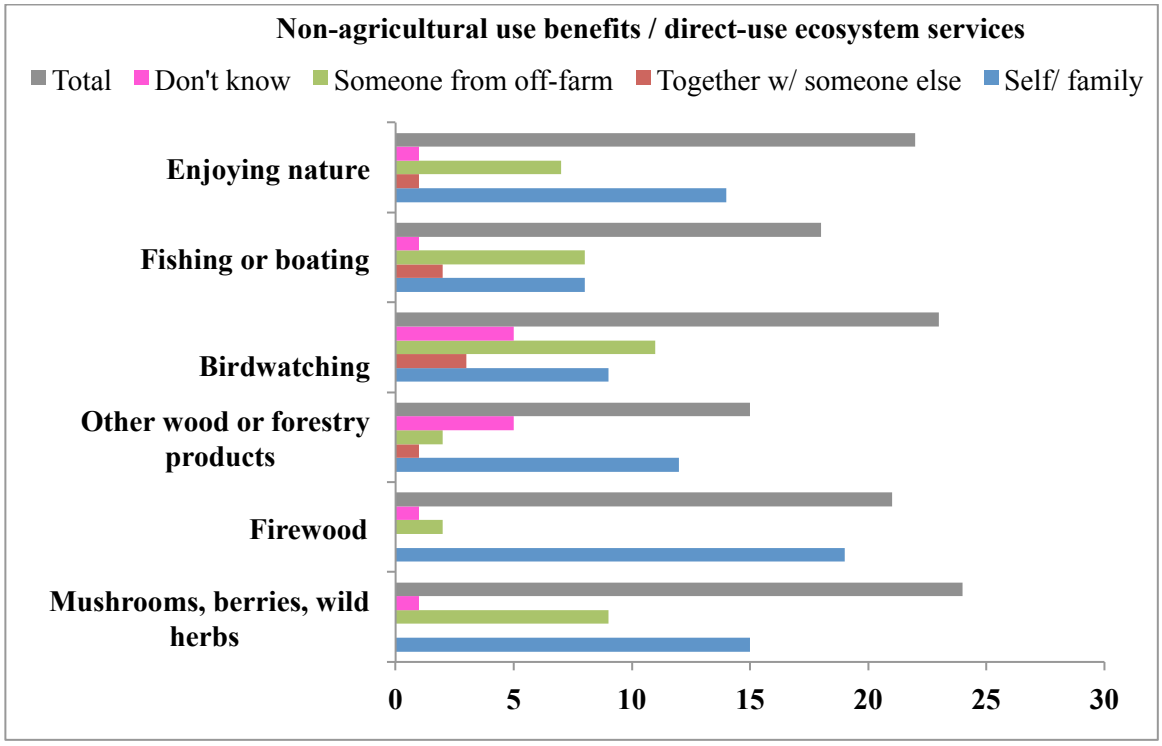

Fig. 5 Illustrates the non-agricultural (and non-hunting) direct-use ecosystem services[11], or benefits, of the traditional rural biotopes as identified by the interviewees. The response "Don't know" was given by managers who were not familiar with all the activities that may take place on rented traditional rural biotopes.

4.4 Management requirements and frameworks

4.4.1 The problem of best practices for management

Management recommendations for traditional rural biotopes put a high emphasis on biogeographic history. However, in practice site level management history is often largely unknown and it is frequently not possible to completely follow general recommendations of historical management (such as haying and coppicing). As a management guide, "historical management" potentially sidesteps the difficult questions of best managment from the perspective of biodiversity conservation goals. Further, the definitions used by European Union member countries for reporting and payments are harmful from a biodiversity and landscape conservation perspective: on the one hand managed traditional grazed forest and wooded areas are regularly excluded from agricultural definitions, while cultivated grassland is frequently included as permanent pasture (Beaufoy *et al*. 2011).

Management findings, together with the expressed desires by some managers to carry out "rehabilitative" clearing of invasive or aggressive species or re-seeding of meadows (all currently forbidden by special agri-environment scheme regulations) and repeated expressions of dissatisfaction that inspectors do not discuss and advise more on management practices show that there is a need for more and improved extension services and cooperation between authorities and farmers, as well as space for the "iterative approach" of adaptive management and evidence-based management. More information is needed on the impact of existing management practices on biodiversity targets, as well as how to meet the dual agriculture production and conservation goals. Results-based conservation schemes may help provide a way forward by promoting flexibility in management approach, although caution is advised (e.g. Burton and Schwarz 2013; Moxey and White 2014).

Navarro and Pereira (2012) present an alternative view of extensive farmland management that is a direct challenge to the premise of this thesis and expert recommendations for

[11] In valuing ecosystem services, direct use value is defined by DEFRA (2007) as actual or planned use of an ecosystem service, incluing consumptive and non-consumptive use.

conservation of traditional rural biotopes. They assert that, despite widespread opposition by scientists and the public, “rewilding” is a legitimate management option for agricultural landscapes facing abandonment and such land management would also provide ecosystem services. Such a position may be indirectly supported by even the traditional rural biotope managers interviewed in this study: although the managers value traditional rural biotopes, they were mostly wary or outright disapproved of legislation restricting land use (e.g. conversion to other uses) for the sites. They did not see traditional rural biotope management as immutable, but as a decision to be weighed against other factors.

The impact of various alternative landuse scenarios (e.g. restoration, abandonment, afforestation via intentional or “passive” rewilding) on ecosystem services and biological diversity is needed to provide an evidence base for informing land use planning and policy and would be absolutely essential before accepting what would be a radical shift in agri-farmland conservation. In addition to understanding the ecological implications of land use intentions, it is important to ascertain the social-economic and political context and ramifications of the land use scenarios. Both social-ecological inventory and ecosystem assessment utilizing an appropriate selection from the many ecosystem services assessment tools (Bagstad et al. 2013) of the alternative land use scenarios would be valuable for informing such a policy discussion.

4.4.2 Common Agriculture Policy and traditional rural biotopes

Participation in special agri-environment scheme sub-measures was highly represented in both studies: 45% of all special agri-environment scheme recipients in the sample frame responded to the postal questionnaire and 70% of the managers interviewed received some type of special agri-environment schemes during 2005-2010. Thus, special agri-environment schemes are highly relevant to the management of traditional rural biotopes in the study region. Most of the postal questionnaire respondents receiving special agri-environment schemes for landscape or biological diversity also had traditional rural biotopes. Managers using traditional rural biotopes in their farming systems had a higher frequency of participation in special agri-environment scheme sub-measures compared to non-use TRB owners (Fisher exact test: $p = 0.025$), but analysis of postal questionnaire respondents showed that area was a factor, with special agri-environment scheme payment recipients having larger farms than farmers not participating in special AES ($t = 3.046$, d.f. = 71.529, p-value = 0.003). Most special agri-environment scheme recipients with traditional rural biotopes also received

special agri-environment scheme payments specifically for traditional rural biotope management.

Caballero (2011) notes that the general trend toward intensification of European Union agriculture continues, despite new policy objectives, and that abandonment and decline of traditional farming systems and, especially, extensive livestock systems, is ongoing. The European Forum on Nature Conservation and Pastoralism[12] states that the CAP reform's new greening measures have brought nothing positive to high nature value farmland management and conservation. Instead, the reform has brought in more bureaucracy and rules without offering any additional support for farmers managing high nature value landscape elements (*ibid*). The effect on Finnish traditional rural biotopes (if any) is difficult to know, but no great breakthroughs or resources for traditional rural biotope conservation have been made available, and slowing of downward trends is probably the best that can be hoped for under current conditions. This study's hypothetical questions to managers about continuing management without special agri-environmental schemes suggest they may continue to perservere even during unfavorable conditions if they can continue farming / animal husbandry: a majority of managers said they would continue managing traditional rural biotopes even without special agri-environment scheme payments, but some managers questioned whether it would be economically feasible in the current agricultural climate and expressed that it's not possible to farm without subsidies in the European Union. Such a response indicates *intention* to manage traditional rural biotopes even in the face of increased pressure (increased bureaucratic pressure possible) or reduced support (not currently the case). Currently, farmers (and extension advisors) will again have to learn how the new rules affect them and how to proceed with applications. Finland is combining the two special agri-environment scheme categories of biological/landscape diversity and traditional rural biotopes into one, which may simplify the relevant scheme to a small extent, although it doesn't address the large inspection and paperwork burden mentioned by many managers.

Reports that the new CAP will likely increase the bureaucracy burden for farmers managing extensive grasslands and other HNV farmlands is particularly negative in light of the manager interviews. Managers interviewed generally accepted inspections as necessary and important, and this finding is in line with Kaljonen (2006) that farmers accept the need for an inspections system but object to the bureaucracy associated with it. However, managers described a wide variety of inspection experiences but almost no visits for extension services. Negative

[12] http://www.efncp.org/policy/assessing-the-new-cap/

comments about inspections, extension services and special agri-environment scheme sub-measures included dissatisfaction with inspectors' decisions, desire to receive extension services or advice together with inspectors' visits, and criticism of the unwieldy bureaucracy of the system-at-large (Article II, Table 4).

Here it is worth noting observations by others (De Snoo *et al.* 2012; Burton and Paragahawewa 2011) that agri-environment scheme mechanisms should consider non-economic incentives, including ways of building status and prestige within the community and embedding social capital and skill generation into the system. This observation suggests that agri-environment scheme mechanisms should emphasize less tangible, but equally valuable outcomes of good stewardship, to farmers and also supports Reimer *et al.'s* (2014) emphasis on the need for focus on long-term impacts and permanent conservation over short-term gains. Such values would make agri-environment scheme mechanisms more comprehensive, providing a greater range of extrinsic and intrinsic value for farmers. This study, which showed managers strongly motivated by intrinsic values but also pragmatic considerations, suggests that focus on non-monetary benefits that increase feeling of satisfaction, pride and accomplishment could further motivate farmers to engage in conservation activities on their farms. Mononen *et al*. (2013) suggest that better incentives for engaging in practices emphasizing agriculture's positive impact could be developed by listening to farmers. Such recommendations would be of tremendous benefit to conservation of traditional rural biotopes in the agricultural landscape.

4.4.3 Merits and pitfalls of the social-ecological systems approach

Janssen and Goldworthy (1996) write that, "Multidisciplinarity is…(often *ad hoc*) compromise between practical problem solving and scientific problem reduction". They go on, "Whether such efforts succeed can only be assessed after the event, but there is usually merit in trying to combine different disciplinary elements to address problems in a new field of science". The grounding for this study was the agroecology multidisciplinary approach to agri-foods systems. I used theory, methods and literature from multiple disciplines to try to address the question, "How can traditional rural biotopes and the farmers who manage them be supported in management for conservation goals and continuity in the agricultural landscape?". The overarching research question was operationalized into sub-questions (the "scientific problem reduction", Janssen and Goldworthy 1996) and tackled through the stages:

identification of the traditional rural biotope managers in the study site and preliminary data collection via postal questionnaire; review and assessment of holistic management approaches that could be viable options and resources; interviews with farmers with managed traditional rural biotopes; and finally, with assessment of the findings in light of existing literature on farmer behavior especially as it relates to conservation activities.

Additionally to the adaptive management and evidence-based management approaches, this study was influenced by the social-ecological systems inventory approach, the most relevant example of which is from Kristianstad, Sweden (Schultz *et al.* 2007). The main ways in which the social-ecological systems approach was utilized in this study was through contact with multiple actors (regional and municipal environment officials, the consultant who carried out the main inventory and planning for Skärlandet Landscape Conservation Area and farmers) and through the quite comprehensive interviews that addressed management, economics, environment outlook, etc. For a comprehensive inventory, the regional authorities overseeing related programs, the municipal veterinarian, the environmental authorities, farmers and potentially other landowners, interested parties, and perhaps NGOs concerned with conservation of traditional rural biotopes would have to be involved via interviews and group discussion about concerns and priorities and how they view the future of the region in regard to traditional rural biotopes in the landscape. Already through the interviews and background discussions with stakeholders leading up to the farmer interviews, it appears likely that there are conflicts in perspective and priorities that would be identified through a social-ecological inventory. An inventory would likely raise questions (and hopefully solutions) about land use, management practices, and animal welfare issues related to traditional rural biotope management.

In addition to the goals of gaining local support and participation and generating knowledge, a main argument for using a social-ecological systems approach is to avoid the "panacea trap" by producing scale and location appropriate solutions, as it is the effort toward universal "optimal" solutions that are often the cause of problems (Oström 2007). The complexity of the social-ecological system and local context for traditional rural biotope management and conservation in the study area is illustrated by an example briefly described in Article II: Finland's strict hygiene regulations, together with the particular context of local stakeholders, created a situation in which the last local slaughterhouse serving local farmers with direct sales closed its doors. As a result, local managers of traditional rural biotopes who depended on direct sales of their meadow meat products experienced a serious bottleneck in their

production system. Managers interviewed said this has had a direct impact on their ability to manage traditional rural biotopes, plan herd numbers and meet customer demand. This is but one example of the importance of the cross-sectoral cooperation in policy and management and it also illustrates Galler *et al.'s* (2015) point that multifunctionality in agri-environment programs are hampered by uncoordinated sectoral management.

The social-ecological inventory shares many of the same elements and is complimentary to other holistic management and assessment approaches, but the role of *ongoing learning* seems less formalized as compared to, for example, the adaptive management approach and the local food system model (Helenius *et al*. 2007) that make an ongoing learning feedback loop explicit to their approaches.

Motivation and attitudes of stakeholders, as well as social dynamics are important components of social-ecological systems approach. There is similarity between social-psychological research on e.g. different rural resident groups (e.g. Perry-Hilland Prokopy 2014), and efforts to understand stakeholder groups in a watershed via social-ecological inventory (e.g. Schultz *et al.* 2007). Social-psychological studies on e.g. the role of building social capital in conservation actions, farming styles and perceptions of self and the environment could provide useful rubric for ordering social-ecological projects, which are mainly concerned with developing knowledge and inclusive frameworks to achieve specific outcomes, including knowledge and capacity building and concrete sustainability or conservation goals (e.g. Berkes *et al.* 2006). An area in which examples from social-ecological system theory would benefit behavioral approaches is in recognizing the importance of culture and different types of knowledge. Burton (2004) criticizes the over-reliance on attitude in behavioral studies and ignorance of social and cultural influence as determinants of behavior. Social-ecological system framework, on the other hand, places strong emphasis on incorporating tacit and cultural knowledge for project process as well as outcome (Berkes *et al*. 2006).

Ramadier (2004) notes that, "it is not the unity (between the disciplinary frameworks), but the coherence of knowledge that is important". Interestingly, Habel and Schmitt (2014), referring back to Lawton (1997) challenge some of the assertions of the evidence-based conservation advocates, stating that "conservation has, is and will be a largely non-scientific activity" related to priority settings of political, aesthetical, societal and economic interests. They do not disagree so much with the idea of narrowing the gaps in science and practice, but rather

advocate acknowledging that nature conservation is driven from "what we love and what we need". This statement actually provides support for the agency ascribed to farmers by much of the literature reviewed here, as well as the social-ecological systems approach and reminds that science alone will not solve conservation issues.

V. CONCLUSIONS AND POLICY/MANAGEMENT/CONSERVATION IMPLICATIONS

Triangulation methods for identifying farmers with traditional rural biotopes were successful and an acceptable (and representative) number of farmers participated in the interviews. The key challenges for "coherence of knowledge" were, from a methodological point of view, with analysis of the interviews and assessment/integration of the tools and frameworks that I purport could improve management of traditional rural biotopes.

The key findings of the interviews were that the managers are mainly motivated to manage traditional rural biotopes based on their own personal intrinsic values and that there is high heterogeneity amongst the managers in terms of structural factors, importance of traditional rural biotopes to the farm production system and, farming styles. The unique farming style of "TRB entrepreneur" was identified and aligns with a more general environmental orientation farming style. Findings generally were consistent with the Theory of Planned Behavior, and this further supports the notion that effective conservation planning requires taking farmer agency and needs into account.

The simple classification of use and non-use framed the research question from the beginning. Although its overall use in understanding managers was limited, it did illustrate the heterogeneity of the managers and the factors that go into their decision-making about traditional rural biotope management. In this way, "coherence of knowledge" was achieved, even if the emphasis on the quantitative approach might be found limiting. However, application of a farming styles rubric and reframing of the research question to "who are the farmers who manage traditional rural biotopes" could open the data up more for those interested in farming styles more broadly and farmer conservation behavior generally.

Van der Ploeg (2010) asserts that the main discourse dominating the debate about the future of farmers and farming is that heterogeneity is unimportant. Such a perspective largely misses

the meaning of multifunctional agriculture and fails to take into account the reality that farmers and farms are important parts of the community and more than just production units. Diversity of farming strategy and farm structural factors should be taken into account in targeting extension services and in designing support mechanisms for meeting conservation needs. Indeed, the disproportionate paperwork-inspection burden placed upon small-scale farmers or farmers with small traditional rural biotopes was cited as a reason for not participating in special agri-environment schemes. Findings of TRB entrepreneurs as a farming style and their importance to traditional rural biotope conservation lend support to the push for the European Union to recognize HNV farming as a separate category of farming for agri-environment support (Caballero 2011).

The comparison between my research findings and that of Pykälä and Bonn's (2000) Uusimaa inventory was useful but comparison is also limited by the differences of approach. For example, I mainly approached traditional rural biotopes through identifying the farmers actively managing sites whereas Pykälä and Bonn's main concern was inventorying the sites themselves, not the managers or owners. My focus for management was on the activities farmers engage in rather than the impact of the management on the sites themselves and the study lacked the site level detail necessary to assess the appropriateness of management practices for different traditional rural biotope types. Such "best practices" studies are sorely needed both to improve management recommendations and extension advice and to assess traditional rural biotope quality.

Managers should be approached as potential partners in traditional rural biotope conservation. TRB farmers and TRB entrepreneurs are probably best reached through strengthening extension services, including within the applications and inspections cycles. Flexibility in allowing managers to test some of their own ideas for management via approved management plans could result in innovative and improved management strategies under an adaptive management-type of strategy. Because the priority for non-use TRB owners is mainly open landscape, they could be encouraged to implement simple practices that improve biodiversity, including timing and type of management for keeping the landscape open.

Many of the concerns and shortcomings brought up in interviews with TRB managers could be addressed through the holistic conservation approaches reviewed in Article I. Managers are interested in receiving extension advice and discussing their own ideas with officials, and this fits well into the adaptive management format. There is also a need for better understanding

of the various ecosystem services traditional rural biotopes provide and understanding of the role of traditional rural biotopes in added-value to direct sales products, farm image and marketing. Efforts to couple the multifunctional values of traditional rural biotopes to products (e.g. WWF Finland 2013) could be useful for encouraging more TRB farmers to enter into direct sales (or semi-direct sales via shops) where their TRB products could receive more recognition and a better market price. Evidence-based recommendations and requirements for management will depend on the biodiversity and landscape conservation goals, but management will is also dependent upon preferences and desired ecosystem services outcomes (e.g. landscape aesthetics, fodder production) and practicalities of management.

Because the choice of managing traditional rural biotopes is mainly one of values, the actor-oriented approach is highly appropriate for addressing questions related to traditional rural biotope management. Farmers managing such sites have an appreciation for traditional rural biotopes, but more work is needed especially on the intersection of external pressures and personal values that affect choices of farming-styles, which ultimately affect farmland conservation elements. For traditional rural biotopes in particular, intangible ecosystem services and the benefits of traditional rural biotopes beyond fodder production and as repositories of biodiversity need to be further evaluated.

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