THE VALUE OF DIRECT-SALES FARMS TO CONSERVATION IN THURSTON COUNTY, WASHINGTON

by

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ABSTRACT

Value of Direct-Sales Farms to Conservation in Thurston County, Washington

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Previous research has identified challenges to preservation of both wildlife habitat and agricultural lands. Additionally, studies have found some land uses are superior to others in improving in-habitat wildlife population metrics by serving as better matrix to support populations in agricultural matrices. Because not all matrix is of equal value as wildlife habitat, research to determine which land uses and users are best situated to help improve matrix function through purposeful action on their private property is warranted. The purpose of this study is to utilize surveys to determine if direct-sales farms are an appropriate focal point for matrix improvement efforts. Direct-sales farmers responded to survey questions regarding their environmental attitudes and habitat conservation actions, as well as their willingness to partner with habitat conservation organizations. The results show a highly concerned and engaged population of farmers. Many farms reported already partnering with conservation organizations and almost all farms reported incorporating some form of conservation action on their property. This research is important for local planning purposes and may help to situate direct-sales farms in Thurston County as a focal point for collaborative efforts between habitat conservation and farmland preservation organizations and government initiatives. Future research could expand to include a spatial analysis of farm location proximity to important habitat. Other follow up research could focus on the effectiveness of this type of analysis in directing the prioritization of cooperative conservation efforts in the matrix.

Table of Contents

List of Figures

List of Tables

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Chapter 1: Literature Review

Introduction

Describing his idea of a “land ethic”, Aldo Leopold wrote that "Conservation is a state of harmony between men and land" (Leopold, 1966). Leopold was one of the most compelling and articulate proponents in the formulation of the wilderness concept as a healthy community of organisms, as opposed to a purely recreational place for human hunting and sport. Yet Leopold eventually came to realize that, in addition to the critical importance of large protected areas, conservation in human-dominated landscapes is essential as well. He focused the last two decades of his life to conservation on small farmsteads, considering it “the oldest task in human history: to live on a piece of land without spoiling it” (Leopold, 1992).

A central question of agroecology is how to reconcile increasing demands for food production with conservation of increasingly at-risk wildlife species and the critical habitats they rely on, while maintaining the economic viability of farms. Loss trends in active farmland and habitat for wildlife has spawned efforts at multiple levels to address both issues. The recent resurgence of small, direct-sales farms may be an opportunity for farmland to be part of the answer to address disappearing wildlife habitat if farm owners are willing to take certain actions.

Global Biodiversity Loss

The Earth’s natural resources are vital to human health and well-being. Biological diversity is recognized as a tremendous asset to human economic and

social development now and into the future (Pearce & Moran, 1994; Pimentel et al., 1997). And yet, species extinctions rates continue to remain high, causing many to declare this era the beginning of the sixth mass extinction event on Earth, and it is largely due to human causes. The World Wildlife Fund (WWF) and the United Nations (UN) have both issued reports in recent years indicating the seriousness of the issue. The WWF's 2008 "Living Planet Report" found global species populations had decreased by 30% since 1970 (Hails, Loh, & Humphrey, 2008). The extinction rate is at least 1000 times higher than normal background rates. A survey of biologists in 1998 suggested that 70% believed at least one-fifth of the world's species would become extinct in the next century (American Museum of Natural History, 1998).

Efforts to address the issue has reached international levels. In 1988 the United Nations Environment Programme (UNEP) began working to prepare an international legal instrument to ensure conservation and sustainability of biological diversity. By 1993 the UN Convention on Biological Diversity, having 168 signatory countries supporting it was ratified as the first major international commitment to address biodiversity loss and human caused species extinctions. These efforts continue, but in many ways have so far failed to meet their objectives. In the 2002 UN Convention on Biological Diversity, 191 of the world's governments pledged to significantly reduce the rate of biodiversity loss by 2010. The 3rd edition of the UN Global Biodiversity Outlook report from 2010 indicated that not a single government had met their biodiversity goals (Secretariat of the Convention on Biological Diversity, 2010).

Biodiversity at the global scale has historically been measured primarily by listing known species, and then calculating the rate at which they are expected to go extinct. Newer measurements also include calculations of a species' gene pool size, number of species, and extent and quality of ecosystems (Secretariat of the Convention on Biological Diversity, 2010). The UN Global Biodiversity Outlook report lists a number of indicators that biodiversity measures continue to decline in each of those categories. On average, despite success in some instances, species previously at risk of extinction are moving closer to extinction (Secretariat of the Convention on Biological Diversity, 2010). The assessed populations of terrestrial and freshwater vertebrate species has declined by nearly one-third since 1970 (Secretariat of the Convention on Biological Diversity, 2010). Although there has been significant progress in slowing the rate of loss in some areas, especially the Amazon rainforest, natural habitats continue to decline in extent and quality in most parts of the world (Secretariat of the Convention on Biological Diversity, 2010).

Human settlement and land use expansion are two primary drivers of biodiversity loss (Secretariat of the Convention on Biological Diversity, 2010) resulting in species relegated to a patchwork of remnant fragmented habitats. Habitat fragmentation, degradation, and loss have adverse effects on biodiversity, and are recognized as the largest contributors to species' population declines (Wilcove, Rothstein, Dubow, Phillips, & Losos, 1998). Habitat loss is the overall reduction in available habitat that supports the species present. Habitat fragmentation occurs when portions of historic habitat range become

disconnected from each other through the incursion of human land uses. The negative effects of increased fragmentation include restricted gene flow, reduced population sizes, changes in species demographics, and ultimately increased extirpation risk (Wiegand, Revilla, & Moloney, 2005).

A primary approach at the national and international level to address threats to biological diversity has been to establish protected reserves where human settlement, resource extraction, or other use is restricted or limited to some degree. The importance of this approach is reflected in the relative success of terrestrial protected area implementation worldwide. Over 100,000 distinct protected reserves, comprising over 12% of the Earth's terrestrial surface now exist, most of those have been established in the last thirty years (Chape, Harrison, Spalding, & Lysenko, 2005). While establishment of protected reserves is one of the most important conservation strategies available, their effectiveness in protecting biodiversity is highly variable depending on a wide range of factors (Chape et al., 2005). Additionally, species range shift as a result of climate change may complicate the effectiveness of stationary protected areas in the next century and beyond (Loarie et al., 2009).

The Matrix

Traditional approaches to the study of fragmented habitat landscapes has treated the matrix, or the space between ideal habitat patches, as uniform and ecologically irrelevant (H. Ricketts, 2001; Vandermeer & Carvajal, 2001). This framework was influenced by two dominant paradigms: island biogeography and

metapopulation dynamics (Gilpin, 1991; MacArthur & Wilson, 1967). Levins coined the term "metapopulation", by which he meant a "population of populations" in a percentage of occupied habitat patches (Levins, 1969). With this concept, he made the influential prediction that persistence of metapopulations may be threatened by either an increase in local extinction or by a decrease in colonization (Levins, 1969). This dovetailed nicely with a key concept in island biogeography that assumed local extinctions and re-colonization from neighboring island populations were unexceptional occurrences (MacArthur & Wilson, 1967). Subsequent research tied increases in local extinctions to decreases in patch size, and decreases in colonization to increased distance between patches.

Because the study of spatially structured populations and communities in fragmented habitats grew out of island biogeography, the matrix has been treated as analogous to the ocean, and ideal patches of habitat to the islands (Vandermeer & Carvajal, 2001). As such, connectivity measurements between remnant habitats has often been modeled as a function of the distance between the fragments alone. Recent research has shown that in addition to protected reserves and conservation of high quality natural habitat, the matrix is also very important to in-habitat biodiversity and species survivability (Donald & Evans, 2006; H. Ricketts, 2001; Jules & Shahani, 2003; Vandermeer & Carvajal, 2001). The matrix is now understood to be variable in quality, affecting species ability to move between habitat fragments and providing habitat itself for many species (Harvey et al., 2008). The matrix represents a continuum of suitability from the ocean between

islands, in which none of the terrestrial island species that migrate could survive, to continuous habitat, in which the matrix is indistinguishable from suitable habitat (Vandermeer & Carvajal, 2001). Most terrestrial matrix quality is somewhere intermediate, representing some level of non-ideal habitat in which an organism would not usually be faced with imminent death if found there.

Matrix quality is assessed by the degree to which it inhibits or facilitates a species ability to survive, migrate, and reproduce. Matrix quality assessment is species or taxa specific, as the specific characteristics of the matrix in any given location will facilitate some species more than others. In general, more intense land uses represent a more significant barrier, and significantly contribute to increased risk of local population extinction (Vandermeer & Carvajal, 2001). Because land use decisions are understood to affect matrix quality, researchers are now studying which land uses represent high quality matrix, provide habitat, and which private land owners are committed to improving these functions through conservation and restoration actions on their property. The matrix should be considered an integral piece of the landscape level conservation puzzle (H. Ricketts, 2001; Jules & Shahani, 2003).

Agriculture

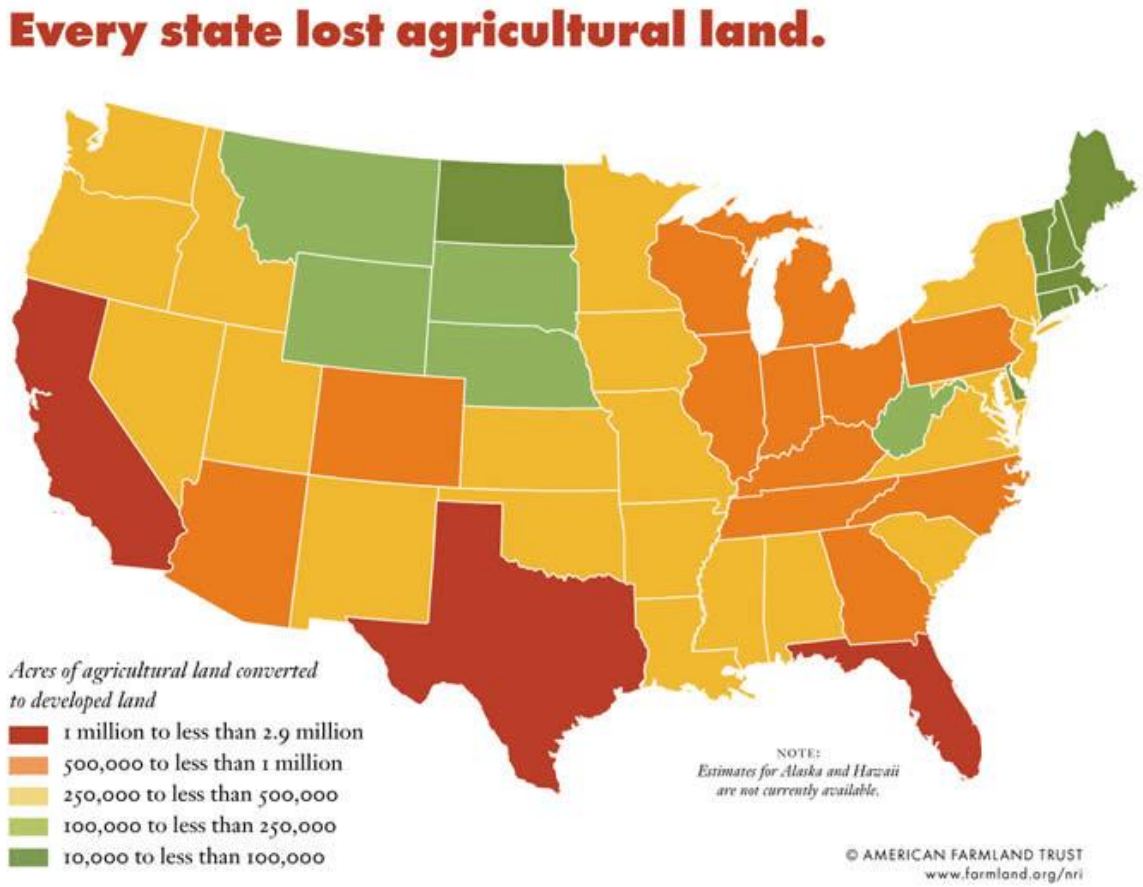
The conversion of natural ecosystems to agriculture has caused more habitat loss than any other land use globally (Gliessman & Rosemeyer, 2010). Habitat continues to be destroyed or degraded to make room for farmland in many areas of the world, particularly in tropical regions. Because of population growth

trends, and increasing wealth in many parts of the world, prominent ecologist Dr. G. David Tilman estimated in 2001 that we will likely need to convert an additional 10 billion hectares of land to agricultural uses by 2050 (Tilman, 2001).

Agriculture accounts for a significant portion of the land use in the United States. According to the "Major Uses of Land in the United States" report by the United States Department of Agriculture's Economic Research Services division, cropland comprises 19.5% (442 million acres) of U.S land use, and pasture/rangeland accounting for another 25.9% (587 million acres) (Lubowski, Vesterby, Bucholtz, Baez, & Roberts, 2006). Because agriculture is such a significant land use, the role of agricultural impact in the matrix is of significant interest to landscape level ecologists and conservation biologists (Brussaard et al., 2010; Donald & Evans, 2006; Dudley, Baldock, Nasi, & Stolton, 2005).

In the United States, agricultural lands are disappearing instead of expanding. The 2010 United States Department of Agriculture (USDA) Natural Resource Inventory reported that nearly 6.5 million hectares of prime cropland have been lost since 1982 (U.S. Department of Agriculture, 2013). These losses are primarily attributable to the conversion of agricultural lands to higher intensity land uses, especially residential development. Over 17 million hectares of land have been developed in the United States in the last thirty years, representing a 58% increase in developed land over that timespan (U.S. Department of Agriculture, 2013). This rapid rate of development, much of it occurring on agricultural lands, is occurring throughout the nation (Figure 1) (U.S. Department of Agriculture, 2013).

Figure 1.1. Developed by the American Farmland Trust using the USDA Natural Resource Inventory data, shows the distribution of farmland loss throughout the United States between 1982 and 2010 ("American Farmland Trust," 2014).



Industrial vs Metropolitan Agriculture

While farmland overall is being converted at high rates to other uses, there are two sizes of farms that are increasing. When separated by size, only large farms of 2000 or more acres, and small farms of less than 50 acres are showing growth (Vilsack & Clark, 2007). This trend is indicative of a significant split between two different kinds of agriculture; large-scale, industrialized agriculture and small-scale agriculture predominantly in metropolitan areas. Increasingly, for farms using conventional agricultural methods, profitability and long-term survival are reliant on farm size, and the efficiency and economy of scale that accompanies it (O'Hara & Stagl, 2001).

Industrialized agriculture, often referred to as conventional agriculture, is a relatively new development in the human-food production dynamic. The Green Revolution post-World War II developed a form of agriculture marked by increased specialization, intensification, mechanization, and reliance on expert knowledge (Brussaard et al., 2010). While this form of agriculture has been very successful at producing more food on less acreage throughout the 20th century, there are some serious concerns about this production system. While focused on efficiency and reliability, it is a system that largely ignores environmental impacts, devalues local knowledge and discourages crop diversification (O'Hara & Stagl, 2001).

The negative environmental impacts of industrialized agriculture are many. In the National Water Quality Inventory conducted in 2000 by the U.S.

Environmental Protection Agency (EPA), states reported that agricultural nonpoint source pollution was the leading source of water quality impacts on surveyed rivers and lakes, the second largest source of impairments to wetlands, and a major contributor to contamination of surveyed estuaries and ground water (U.S. EPA, 2000). Further, the same inputs of pesticides, herbicides, and chemical fertilizers shown to degrade water quality contribute directly to unintended plant, arthropod, and bird deaths. Additionally, the tendency towards large swaths of monoculture, or single species crops, represents a serious challenge to biodiversity, as a single species of plant is unlikely to provide the shelter or food needed by all but a few species.

However, agriculture in metropolitan areas often differs significantly from conventional agriculture. Metropolitan farms are limited in their ability to increase in size due to the mixed use nature of the landscape around them. A farm may be adjacent to light industry, residential zoning, or protected habitat areas or parks. This limitation keeps farms small, combined with a lack of agriculture specific infrastructure like processing and storage facilities, metropolitan farms often grow specialized crops or value-added products like grass-fed beef, free-range pastured chicken eggs, or heirloom tomatoes that you can't find in the supermarket. Additionally, these products are often marketed directly to the consumer through farmers' markets, food co-ops, on-site farmstands and community supported agriculture (CSA) arrangements where consumers invest in the farm before the growing season in exchange for weekly deliveries of whatever is ready for harvest for the duration of the growing season.

In contrast to large-scale, industrialized agriculture, small-scale, direct-sales farms may represent an opportunity for integration of conservation efforts on agricultural land. In addition to the practice of growing diverse crops, which is shown to increase habitat and improve biodiversity measures over monoculture systems, owners of direct-sales farms may be more inclined to participate in habitat conservation and restoration efforts on their land than conventional agriculture farmers (O'Hara & Stagl, 2001).

Direct-sales farms are part of an agricultural counter-movement dissatisfied with many of the problems associated with conventional agriculture, including reliance on large corporations for expertise that simultaneously is meant to ensure reliability and efficiency while devaluing localized, non-credentialed knowledge. Industrialized agriculture relies on expert recommendations that exist outside of place-specific contexts, serving to disassociate farmers from localized cultural and environmental concerns. Small-scale, direct-sales agriculture is a grass-roots effort to establish food systems that value local agricultural knowledge, and serve to reintegrate local cultural and environmental concerns. These farmers engage directly with their community through establishment of food systems that are informed by, and in turn help inform, the social norms of the local culture. Because of this dynamic, environmental awareness and action may be more common on small family farms with direct-sales marketing strategies. Some of that action takes the form of habitat conservation and restoration programs. In the context of continued suburban sprawl, which is a major contributor to habitat loss and high rates of farm acreage loss, coordination

of effort between organizations working to slow the rapid loss of farmland by supporting small-scale farmers, and habitat conservation and restoration organizations, may be mutually beneficial.

Thurston County Ecosystems

Thurston County is home to remnants of one of the most threatened ecosystems in the country. It's estimated that only 10% of the historic extent of South Sound Prairies remain today, and only 3% is still primarily dominated by native prairie plant species (Crawford & Hall, 1997). There are at least 18 plant and animal species that may occur on lands in Thurston County, many of them associated with prairie habitat, that are listed at the state or federal level as being threatened or endangered. Thurston County is currently developing a Prairie Habitat Conservation Plan to preserve the remaining prairie ecosystems these species rely on ("Thurston County Habitat Conservation Plan," 2014). Additionally, many of the rivers and streams are spawning grounds for federally endangered salmon and steelhead populations.

Some of Thurston County's species of concern have recently had status changes with the federal government. The Taylor's Checkerspot Butterfly (*Euphydryas editha taylori*) was listed by the federal government as endangered under the Endangered Species Act in 2013. Also in 2013 the Streaked Horned Lark (*Eremophila alpestris strigata*) was listed as threatened. In 2014, four subspecies of Mazama Pocket Gopher were listed as threatened; the Olympia pocket gopher (*Thomomys mazama pugetensis*), Roy Prairie pocket gopher (*T. m.*

glacialis), Tenino pocket gopher (*T. m. tumuli*), and Yelm pocket gopher (*T. m. yelmensis*). And in 2013, the USFWS proposed to list the Oregon Spotted Frog (*Rana pretiosa)* as a threatened species and to designate critical habitat.

Thurston County Agriculture

Thurston County is a metropolitan county located at the southern tip of the Puget Sound, in Western Washington. The state capital, Olympia, in the northern portion of Thurston County is also the southern edge of the Seattle-Tacoma-Olympia metropolitan area along the I-5 corridor. Agriculture in Thurston county, as in many metropolitan counties, is comprised of generally smaller farms integrated in a diverse landscape among other land uses, including some farms within city limits (Castillo et al., 2013; J. R. Fisher, 2009). An estimated 50% of Thurston County agricultural land either contains or is adjacent to wildlife habitat (J. Fisher & Mitchell, 2009).

Agriculture in metropolitan areas often lacks the ability to achieve economy of scale sufficient to compete with large-scale conventional farms due to the smaller size of producers and a relative lack of processing facilities. Alternative marketing strategies and production of high-value, value-added, or specialty crops help metropolitan agriculture remain economically viable (Heimlich & Anderson, 2001). In Thurston County, farmer's markets, community-supported agriculture (CSA's), food co-ops, and on-site farmstands are popular marketing strategies.

Thurston County contains significant agricultural lands and local farm economy with farmland dispersed throughout the county on a variety of soil types (J. R. Fisher, 2009). Agricultural production importance to the County's economy. The total market value of agricultural production in Thurston County is about $118 million from 1,288 farms, with crops accounting for approximately 42% of the total and livestock and poultry the remaining 58% (Vilsack & Clark, 2007). Thurston County ranks third among Western Washington counties in certified organic agricultural land and in value of direct-sales organic goods (J. Fisher & Mitchell, 2009).

Nationally, over 23 million acres of agricultural land have been lost to urbanization and development since 1982 (Vilsack & Clark, 2007). Thurston County agriculture faces development pressures as the county population continues to grow. Thurston County's farmland is rapidly disappearing. Between 2002 and 2007, the acreage of actively farmed land has dropped nearly in half - from 74,420 acres to 38,718 acres (J. Fisher & Mitchell, 2009). Since the mid-1950s, when Thurston County was primarily farmland, the County has lost over 75 percent of its working agricultural lands (J. Fisher & Mitchell, 2009). A farmland inventory of Thurston County conducted by the non-profit South of the Sound Community Farm Land Trust (SSCFLT) estimates that Thurston County loses approximately 2000 acres of agricultural land per year, with the remaining farmland at risk of being developed (J. R. Fisher, 2009).

Farmland Preservation

Because metropolitan agriculture is expected to represent a more sustainable form of farming, and can provide some habitat and facilitate matrix connectivity, farmland in Thurston County should be preserved. A number of farmland preservation strategies have been implemented in Thurston County. These efforts include attributing Long-Term Agriculture zoning designations, Transfer of Development Rights (TDR), Purchase of Development Rights (PDR), Right to Farm Laws, Conservation Easements, and recently the non-profit South of the Sound Community Farm Land Trust has purchased farmland for the express purpose of keeping that land in agriculture in perpetuity. A number of goals can be achieved through the use of these preservation strategies, including the prevention of sprawl, maintenance of agricultural production, support of the agriculture economy, protection of environmental services, and the maintenance of a diverse landscape that includes rural scenery. Some combination of these strategies is likely to provide more protection than any one strategy could alone (Hellerstein et al., 2002).

Since the Washington State Growth Management Act of 1990, Thurston County has zoned approximately 11,887 acres as Long Term Agriculture (J. Fisher & Mitchell, 2009). Zoning as a farmland protection strategy has a number of advantages. Zoning can quickly provide temporary protection from development until more permanent preservation strategies can be implemented. Zoning can also protect large, contiguous blocks of farmland to protect the agriculture industry from regional or parcel fragmentation. Regional

fragmentation can result in an insufficient market for farm support operations and facilities. Parcel fragmentation can result in a checkerboard distribution of farmland, which may cause difficulties for farmers trying to achieve an efficient scale of operation (Brabec & Smith, 2002).

However, a number of important negatives exist for zoning as a farmland preservation technique. Challenges to the constitutionality of zoning from property rights groups and property owners is a possibility. The Fifth Amendment to the U.S. Constitution states that private property shall not "be taken for public use, without just compensation". Supreme Court rulings have interpreted this to include instances when zoning leaves a property owner with no economically viable use of their property then they should be compensated (Duke & Lynch, 2006). Because of this, attempts to implement farmland protections through zoning in areas most threatened by development are met with resistance from property owners who could stand to gain financially by developing or selling to developers. This represents a serious impediment to implementation as it can create a contentious political atmosphere between elected officials and their constituents (Lopez, Adelaja, & Andrews, 1988). In Thurston County, some property owners being considered for Long-Term Agricultural zoning have argued that development is the only economically viable option due to the rocky, shallow nature of the soils (J. R. Fisher, 2009).

In areas outside of agricultural zoning but not in urban growth areas, large lot zoning is prevalent. This type of zoning allows development at rates of 1 house per 3 to 20 acres. While much of the area under this zoning scheme retains

a rural feel, large lot zoning use is primarily residential, consumes more of the landscape, and can lead to significant farmland loss (Heimlich & Anderson, 2001). Not only can farmland loss occur directly through conversion to residential use in large lot zoned areas, but indirectly as well as the success of working farms can be impacted negatively by the loss of agricultural support structures (Sokolow, 2006). Even though large lot zoning eats up large swaths of land for residential use, since 1994 the average size of large lot development has increased from predominantly 2 to 10 acres to 10 to 22 acres (Mariola, 2005). This trend represents an escalation of farmland and habitat loss. Large lot development is inefficient for both developers and farmland and habitat preservation, and should be avoided. Compact development in urban center and very low density zoning in rural areas best assures both development efficiency and farmland preservation (Heimlich & Anderson, 2001). The Growth Management Act has attempted to address this by encouraging higher density development within city limits and urban growth boundaries, while simultaneously discouraging further development in more rural areas.

Another approach to farmland preservation where development pressure poses a risk is to develop Transfer of Development Rights (TDR) and Purchase of Development Rights (PDR) programs. A TDR program functions by transferring the development rights associated with a property meant to be protected from development to another area more suitable for development. A county will set up a TDR program by defining sending zones, those areas where property owners may choose to make available their development rights, and receiving zones, or

those areas where developers can apply those transferred development rights to achieve a higher density development.

Thurston County adopted a TDR ordinance for farmland preservation in 1995 that designated land zoned Long Term Agricultural as the sending area. Two residential areas were designated as the receiving area (J. R. Fisher, 2009). As of 2008, 35 development rights had been made available by property owners and 14 had been purchased by developers. This resulted in 70 acres being protected by the TDR program to that point (Thurston County Planning Commission, 2008).

In addition to the TDR program, Thurston County is considering re-implementation of a PDR program to help protect those areas outside of the Long Term Agricultural zone. The PDR program in Thurston County lay dormant after 940 acres were protected in the mid 1990's. In a PDR program, government or non-profit organizations purchase development rights from a property owner. The property then loses the ability to develop their land in the future. The value of the development right is determined by subtracting the value of the land if sold for development from the value of the land if sold for agricultural purposes.

A PDR program is often more effective than TDR because while desirable farmland can be targeted for protection, participation by the land owner is entirely voluntary. This helps avoid issues of uncompensated infringement on property rights that zoning may involve, and it helps keep farmland affordable (J. R. Fisher, 2009). The removal of development potential, which the property owners is compensated for at the time of the development rights purchase, means future

sales of the property will be based on the agricultural value of the land only (Duke & Lynch, 2006).

In addition to government initiatives to protect farmland, Thurston County is home to the South of the Sound Community Farm Land Trust (SSCFLT). This non-profit organization's mission is to support Thurston County farmers, and to permanently protect the County's working farmland through a variety of means. To support local farmers SSCFLT produces an annual map with contact information for direct-sales farms to advertise in, they also own some farm equipment that they have available for rent to local farmers at an affordable rate. SSCFLT successfully protected their first farmland through the Community Farm Land Trust model in 2013 with the collaborative purchase of the Scatter Creek Farm and Conservancy in south Thurston County. In addition to the farmland preservation organization SSCFLT, this farm is a collaboration between a local farm (Kirsop Farm), a habitat conservation non-profit organization (The Creekside Conservancy/Heernett Foundation), and another non-profit that serves as a small-business incubator (Enterprise for Equity) that will help potential farmers learn the business of farming. This multiple organization collaboratively owned and operated farm represents a unique example of what a farm can be, and should serve as a community asset economically, environmentally, and educationally.

Evaluating Farm-Owner Conservation Attitudes and Actions

Because Thurston County is home to a number of species that have recently been listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS), the County is developing a Habitat Conservation Plan (HCP). Many of the species of concern in Thurston County can occur on privately owned lands. As the County continues to develop an HCP, information about the potential cooperation of affected land-owners will be important for planners to construct a balanced and effective plan.

For conservation planning to be effective, it must be based on information derived from studies including the entire spectrum of land uses, from wilderness areas to those where people live and work (Dale et al., 2000). Historically there have been relatively few studies focused on settled areas, which indicates a gap in knowledge for making recommendations on ways to mitigate the adverse effects of development on native species (Miller & Hobbs, 2002). Recent research shows that land-owner participation in environmental actions varies among a number of demographic factors and motivations for action are often place-specific (Burton, 2014). Steg and Vlek, in their analysis of how best to encourage environmental behavior, stress the importance of starting with a measurement of current behaviors among the target population (Steg & Vlek, 2009). In chapter 2, I combined the results and methods of previous research to develop a survey aimed at revealing the conservation attitudes and actions of Thurston County Direct-sales farmers.

Sources Cited

American Farmland Trust. (2014). Retrieved May 31, 2014, from http://www.farmland.org/

American Museum of Natural History. (1998). *Biodiversity in the Next Millennium*. New York.

Brabec, E., & Smith, C. (2002). Agricultural land fragmentation: the spatial effects of three land protection strategies in the eastern United States. *Landscape and Urban Planning*, *58*(2–4), 255–268. doi:10.1016/S0169-2046(01)00225-0

Brussaard, L., Caron, P., Campbell, B., Lipper, L., Mainka, S., Rabbinge, R., … Pulleman, M. (2010). Reconciling biodiversity conservation and food security: scientific challenges for a new agriculture. *Current Opinion in Environmental Sustainability*, *2*(1–2), 34–42. doi:10.1016/j.cosust.2010.03.007

Burton, R. J. F. (2014). The influence of farmer demographic characteristics on environmental behaviour: A review. *Journal of Environmental Management*, *135*, 19–26. doi:10.1016/j.jenvman.2013.12.005

Castillo, S. R., Winkle, C. R., Krauss, S., Turkewitz, A., Silva, C., & Heinemann, E. S. (2013). Regulatory and other barriers to urban and peri-urban agriculture: A case study of urban planners and urban farmers from the greater Chicago metropolitan area. *Journal of Agriculture, Food Systems & Community Development*, *3*(3), 155–166. doi:10.5304/jafscd.2013.033.001

Chape, S., Harrison, J., Spalding, M., & Lysenko, I. (2005). Measuring the extent and effectiveness of protected areas as an indicator for meeting global biodiversity targets. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *360*(1454), 443–455.

Crawford, R. C., & Hall, H. (1997). Changes in the south Puget prairie landscape. *Ecology and Conservation of the South Puget Sound Prairie Landscape. The Nature Conservancy, Seattle, WA*, 11–15.

Dale, V. H., Brown, S., Haeuber, R. A., Hobbs, N. T., Huntly, N., Naiman, R. J., … Valone, T. J. (2000). Ecological Principles and Guidelines for Managing the use of Land. *Ecological Applications*, *10*(3), 639–670.

Donald, P. F., & Evans, A. D. (2006). Habitat connectivity and matrix restoration: the wider implications of agri-environment schemes. *Journal of Applied Ecology*, *43*(2), 209–218. doi:10.1111/j.1365-2664.2006.01146.x

Dudley, N., Baldock, D., Nasi, R., & Stolton, S. (2005). Measuring Biodiversity and Sustainable Management in Forests and Agricultural Landscapes. *Philosophical Transactions: Biological Sciences*, *360*(1454), 457–470.

Duke, J. M., & Lynch, L. (2006). Farmland Retention Techniques: Property Rights Implications and Comparative Evaluation. *Land Economics*, *82*(2), 189–213. doi:10.3368/le.82.2.189

Fisher, J., & Mitchell, L. (2009). *Thurston County Farmland Inventory*. Retrieved from http://www.communityfarmlandtrust.org/thurston-county-farmland-inventory.html

Fisher, J. R. (2009). *Farmland preservation in Thurston County*. The Evergreen State College. Retrieved from http://archives.evergreen.edu/masterstheses/Accession86-10MES/FisherJ%20MESThesis%202009.pdf

Gilpin, M. (1991). *Metapopulation dynamics: empirical and theoretical investigations*. Academic Press. Retrieved from http://books.google.com/books?hl=en&lr=&id=xPtEY5N8-agC&oi=fnd&pg=PP1&dq=gilpin+and+hanski&ots=zs_fASxulv&sig=ftvsSL8VYGu0luYLdTK9JzIZjqg

Gliessman, S. R., & Rosemeyer, M. (2010). *The conversion to sustainable agriculture: principles, processes, and practices*. CRC Press.

H. Ricketts, T. (2001). The Matrix Matters: Effective Isolation in Fragmented Landscapes. *The American Naturalist*, *158*(1), 87–99. doi:10.1086/an.2001.158.issue-1

Hails, C., Loh, J., & Humphrey, S. (2008). *WWF: Living planet report 2008*. Aconda Verd WWF. ISBN.

Harvey, C. A., Komar, O., Chazdon, R., Ferguson, B. G., Finegan, B., Griffith, D. M., … Wishnie, M. (2008). Integrating Agricultural Landscapes with Biodiversity Conservation in the Mesoamerican Hotspot. *Conservation Biology*, *22*(1), 8–15. doi:10.1111/j.1523-1739.2007.00863.x

Heimlich, R., & Anderson, W. (2001). *Development at the Urban Fringe and Beyond: Impacts on Agricultural and Rural Land* (Agricultural Economic Report No. 803) (p. 88). United States Department of Agriculture.

Retrieved from http://www.ers.usda.gov/publications/aer-agricultural-economic-report/aer803.aspx#.UqEtF-K7bSk

Hellerstein, D. R., Nickerson, C., Cooper, J., Feather, P., Gadsby, D., Mullarkey, D., … Barnard, C. (2002). *Farmland protection: the role of public preferences for rural amenities* (Agricultural Economic Report No. 815). US Department of Agriculture, Economic Research Service Washington, DC. Retrieved from http://ers.usda.gov/media/458398/aer815_1_.pdf

Jules, E. S., & Shahani, P. (2003). A broader ecological context to habitat fragmentation: Why matrix habitat is more important than we thought. *Journal of Vegetation Science*, *14*(3), 459–464.

Leopold, A. (1966). *A Sand County Almanac: With Other Essays on Conservation from Round River*. Random House LLC.

Leopold, A. (1992). *The River of the Mother of God: and other Essays by Aldo Leopold*. Univ of Wisconsin Press.

Levins, R. (1969). Some demographic and genetic consequences of environmental heterogeneity for biological control. *Bulletin of the ESA*, *15*(3), 237–240.

Loarie, S. R., Duffy, P. B., Hamilton, H., Asner, G. P., Field, C. B., & Ackerly, D. D. (2009). The velocity of climate change. *Nature*, *462*(7276), 1052–1055. doi:10.1038/nature08649

Lopez, R. A., Adelaja, A. O., & Andrews, M. S. (1988). The Effects of Suburbanization on Agriculture. *American Journal of Agricultural Economics*, *70*(2), 346–358. doi:10.2307/1242075

Lubowski, R., Vesterby, M., Bucholtz, S., Baez, A., & Roberts, M. (2006). *Major Uses of Land in the United States* (Economic Information Bulletin No. EIB-14) (p. 54). USDA Economic Research Services. Retrieved from http://www.ers.usda.gov/publications/eib-economic-information-bulletin/eib14.aspx#.UwKBTIW9PSk

MacArthur, R. H., & Wilson, E. O. (1967). *The Theory of Island Biogeography*. Princeton University Press.

Mariola, M. J. (2005). Losing ground: Farmland preservation, economic utilitarianism, and the erosion of the agrarian ideal. *Agriculture and Human Values*, *22*(2), 209–223. doi:10.1007/s10460-004-8281-1

Miller, J. R., & Hobbs, R. J. (2002). Conservation Where People Live and Work. *Conservation Biology*, *16*(2), 330–337. doi:10.1046/j.1523-1739.2002.00420.x

O'Hara, S. U., & Stagl, S. (2001). Global Food Markets and Their Local Alternatives: A Socio-Ecological Economic Perspective. *Population & Environment*, *22*(6), 533–554.

Pearce, D. W., & Moran, D. (1994). *The economic value of biodiversity*. Earthscan. Retrieved from http://books.google.com/books?hl=en&lr=&id=RdH6DRZY0KIC&oi=fnd&pg=PR9&dq=biodiversity+economic+value&ots=7hahjmLRTP&sig=IO2MpKyCJKLFac13xVqukStmoVQ

Pimentel, D., Wilson, C., McCullum, C., Huang, R., Dwen, P., Flack, J., … Cliff, B. (1997). Economic and environmental benefits of biodiversity. *BioScience*, *47*(11), 747–757.

Secretariat of the Convention on Biological Diversity. (2010). *Global Biodiversity Outlook 3*. Montreal. Retrieved from www.cbd.int/GBO3

Sokolow, A. (2006). *A national view of agricultural easement programs: Easements and local planning* (No. 3) (p. 88). American Farmland Trust. Retrieved from http://www.aftresearch.org/research/publications/detail.php?id=e2e10749f40819bc96296ec77ac4e2eb

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, *29*(3), 309–317.

Thurston County Habitat Conservation Plan. (2014). Retrieved June 1, 2014, from http://www.co.thurston.wa.us/planning/hcp/hcp-home.htm

Thurston County Planning Commission. (2008, July 2). Regular Meeting. Retrieved from http://www.co.thurston.wa.us/perm itting/planning%20commission/Minute s/2008/7-2-2008%20pc%20minutes.pdf

Tilman, D. (2001). Forecasting Agriculturally Driven Global Environmental Change. *Science*, *292*(5515), 281 – 284.

U.S. Department of Agriculture. (2013). *2010 National Resources Inventory*. Natural Resources Conservation Service, Washington DC, and Center for Survey Statistics and Methodology Iowa State University, Ames, Iowa.

U.S. EPA. (2000). *National Water Quality Inventory: Report to Congress*. Environmental Protection Agency.

Vandermeer, J., & Carvajal, R. (2001). Metapopulation Dynamics and the Quality of the Matrix. *The American Naturalist, 158*(3), 211–220. doi:10.1086/an.2001.158.issue-3

Vilsack, T., & Clark, C. Z. F. (2007). *U.S. Census of Agriculture 2007*. Retrieved from http://www.agcensus.usda.gov/Publications/2007/Full_Report/usv1.pdf

Wiegand, T., Revilla, E., & Moloney, K. A. (2005). Effects of Habitat Loss and Fragmentation on Population Dynamics. *Conservation Biology, 19*(1), 108–121. doi:10.1111/j.1523-1739.2005.00208.x

Wilcove, D. S., Rothstein, D., Dubow, J., Phillips, A., & Losos, E. (1998). Quantifying Threats to Imperiled Species in the United States. *BioScience, 48*(8), 607–615. doi:10.2307/1313420

Chapter 2: The Value of Direct-Sales Farms to Habitat Conservation in Thurston County, Washington

Introduction

A central question of agroecology is how to reconcile increasing demands for food production with conservation of increasingly at-risk wildlife species and the critical habitats they rely on, while maintaining the economic viability of farms. Loss trends in active farmland and habitat for wildlife has spawned efforts at multiple levels to address both issues. The recent resurgence of small, direct-sales farms may be an opportunity for farmland to be part of the answer to address disappearing wildlife habitat if farm owners are willing to take certain actions. This study is a preliminary attempt to infer the appropriateness of direct-sales farms in Thurston County, Washington to accommodate wildlife on their private operations through various habitat conservation and/or restoration actions.

The Earth is in the midst of an extinction crisis, with the rate of extinction estimated to be between 1000 and 10000 times higher than the natural background rate. Worldwide, habitat loss and degradation are recognized as the most important causes of terrestrial biodiversity declines (Wilcove, Rothstein, Dubow, Phillips, & Losos, 1998). Human land uses, including urbanization, industrialized agriculture, and extractive industries all contribute to habitat loss and fragmentation. Land use changes will continue to be the largest driver of biodiversity loss over the next 100 years (Sala et al., 2000). With additional pressures from climate change, remnant habitats and the ability of species to

move between them, are increasingly important (Cobben et al., 2012; Mantyka-pringle, Martin, & Rhodes, 2012).

Modern day conventional agriculture, typified by large monoculture crops that often rely on chemical fertilizer, herbicide, and pesticide inputs is regarded as a major source of habitat loss (Maron & Fitzsimons, 2007). In fact, wordwide, the clearing of habitat for conversion to agriculture has been identified as the largest contributor to habitat loss from human activity. However, recent trends toward small-scale, direct-sales farms, which market directly to consumers through farmer's markets, community-sponsored agricultural, or CSA's, and on-site farmstands, may open opportunities for integration of conservation efforts on agricultural land. In addition to the practice of farming multiple crops in various arrangements, which is shown to increase habitat and improve biodiversity measures over monoculture systems (Donald & Evans, 2006), owners of direct-sales farms may be more inclined to participate in habitat conservation and restoration efforts on their land than conventional agriculture farmers (O'Hara & Stagl, 2001).

Direct-sales farms are part of an agricultural counter-movement dissatisfied with many of the problems associated with conventional agriculture, including reliance on large corporations for expertise that simultaneously is meant to ensure reliability and efficiency while devaluing localized, "non-credentialed" knowledge (O'Hara & Stagl, 2001). Industrialized agriculture relies on expert recommendations that exist outside of place-specific contexts, serving to disassociate farmers from localized cultural and environmental concerns. Small-

scale, direct-sales agriculture is a grass-roots effort to establish food systems that value local agricultural knowledge, and serve to reintegrate local cultural and environmental concerns. These farmers engage directly with their community through establishment of food systems that are informed by, and in turn help inform, the social norms of the local culture. Because of this dynamic, environmental awareness and action may be more common on small family farms with direct-sales marketing strategies. Some of that action takes the form of habitat conservation and restoration programs. In the context of continued suburban sprawl, which is a major contributor to habitat loss and high rates of farm acreage loss, coordination of effort between organizations working to slow the rapid loss of agricultural lands by supporting small-scale farmers, and habitat conservation and restoration organizations, may be mutually beneficial.

For this research, I surveyed direct-sales farms in Thurston County, Washington to address the following question: How much of an opportunity do direct-sales farms represent to improve connectivity issues between remnant habitat fragments? To answer the larger question, I addressed two sub-questions: 1)What types of conservation/restoration efforts are taking place already? 2)What motivates farmers to undertake conservation/restoration efforts?

Habitat Fragmentation and the Matrix

Human population growth and settlement, and associated land use changes, are associated with global scale habitat fragmentation, degradation, and loss of most natural ecosystems (Sala et al., 2000; Wilcove et al., 1998).

Fragmentation and habitat loss have adverse effects on biodiversity, and are recognized as the largest contributors to species' population declines (Wilcove et al., 1998). Habitat loss is fragmentation is the process by which larger swaths of a continuous habitat become not only smaller, but portions of historic habitat range also become disconnected from each other through the incursion of human land uses. The negative effects of increased fragmentation include restricted gene flow, reduced population sizes, changes in species demographics, and ultimately increased extirpation risk (Wiegand, Revilla, & Moloney, 2005).

Two dominant paradigms inform the theoretical framework of fragmented habitat research; island biogeography and metapopulation dynamics (Gilpin, 1991; MacArthur & Wilson, 1967). Within this framework, landscapes are typically split between habitat fragments and the space in between, or the "matrix". Historically, conservation biology and landscape ecology research often focused on habitat fragments only, and the matrix treated as homogenous and not important to the populations within the fragment. Because the study of habitat fragmentation grew out of island biogeography, the matrix has been treated as analogous to the ocean surrounding the island (H. Ricketts, 2001). As such, connectivity measurements between remnant habitats have often been modeled as a function of the distance between the fragments alone.

Terrestrial habitat fragments do not always act as oceanic islands, and the matrix area does not uniformly inhibit connectivity. Different land uses in the matrix affect species movement differently (Jules & Shahani, 2003). Therefore, effective isolation of a habitat fragment will vary depending on the suitability of

the matrix as a pathway between habitat fragments and distance (H. Ricketts, 2001). Matrix quality is an important determinant of population dynamics and community processes in fragmented landscapes (Jules & Shahani, 2003; Vandermeer & Carvajal, 2001; Wiegand et al., 2005). As matrix quality increases, so too does connectivity between patches of habitat. The ecological quality of the surrounding matrix can be a major determinant of biodiversity dynamics within habitat fragments (Jules & Shahani, 2003). Additionally, beyond serving as merely a pathway between habitats, the matrix itself can be an important source of habitat (Harvey et al., 2008).

Matrix quality can vary not only between land uses, but within categories of land use as well. For instance, not all agriculture is the same. More intensive forms of agriculture are shown to represent a degradation of matrix quality (Donald & Evans, 2006; Harvey et al., 2008; Maron & Fitzsimons, 2007). Additionally, matrix quality will be different for different species. In the matrix/habitat paradigm, matrix is the space species must cross to migrate between habitat fragments. Since different species move differently, and require different landscape characteristics for successful migration, evaluation of matrix quality will vary dependent on the species in question (Prevedello & Vieira, 2010).

My research is informed by this basic understanding of variable matrix quality. If matrix quality is understood to be variable, and certain actions and management decisions people make within the matrix affect matrix quality, the basic question at issue is “Which land uses represent the best opportunity for in-

matrix conservation and restoration work"? I focus this research on direct-sales agriculture in Thurston County for a number of reasons. First, agriculture is one human endeavor at the nexus of human-nature interaction, how we farm says a lot about how we value the environment. Direct-sales farms, by the very nature of their business model and marketing strategies, are more directly accountable to, and often better reflect, local cultural assumptions (Horrigan, Lawrence, & Walker, 2002; O'Hara & Stagl, 2001). Third, Thurston County may continue to experience loss of agricultural lands to development due to human population growth and economic expansion (J. R. Fisher, 2009), so identifying the degree to which our farms contribute to county and state conservation efforts may in turn lead to decisions that further protect farmlands. And finally, many threatened and endangered species occur on private lands and working with landowners, particularly farmers, is an opportunity to expand protection efforts and include more stakeholders in species and habitat conservation (Wilcove and Lee 2004).

Study Area and Methods

Thurston County

To understand the potential and current activities of direct-sales farms to provide wildlife habitat, this study surveyed farmers and ranchers in Thurston County, Washington State. Thurston County is a metropolitan county located at the southern tip of the Puget Sound, in Western Washington. The state capital, Olympia, in the northern portion of Thurston County is also the southern edge of the Seattle-Tacoma-Olympia metropolitan area along the I-5 corridor. Agriculture in Thurston county, as in many metropolitan counties, is comprised of generally

smaller farms integrated in a diverse landscape among other land uses, including some farms within city limits (Castillo et al., 2013; J. R. Fisher, 2009).

Agriculture in metropolitan areas often lacks the ability to achieve economy of scale sufficient to compete with large-scale conventional farms due to the smaller size of producers and a relative lack of processing facilities. Alternative marketing strategies and production of high-value, value-added, or specialty crops help metropolitan agriculture remain economically viable (Heimlich & Anderson, 2001). In Thurston County, farmer's markets, community-supported agriculture (CSA's), food co-ops, and on-site farmstands are popular marketing strategies.

Thurston County contains significant agricultural lands and local farm economy with farmland dispersed throughout the county on a variety of soil types (J. R. Fisher, 2009). Thurston County ranks third among Western Washington counties in certified organic agricultural land and in value of direct-sales organic goods (J. Fisher & Mitchell, 2009). In 2007, Thurston County's farms generated an estimated $117 million in market value sales (J. Fisher & Mitchell, 2009). Additionally, an estimated 50% of Thurston County agricultural land either contains or is adjacent to wildlife habitat (J. Fisher & Mitchell, 2009).

Nationally, over 23 million acres of agricultural land have been lost to urbanization and development since 1982 (Vilsack & Clark, 2007). Thurston County agriculture faces development pressures as the county population continues to grow. A farmland inventory of Thurston County conducted by the

non-profit South of the Sound Community Farm Land Trust (SSCFLT) estimates that Thurston County loses approximately 2000 acres of agricultural land per year, with the remaining farmland at risk of being developed (J. R. Fisher, 2009).

This trend of declining agricultural land due to urbanization mirrors in some ways the decline in important habitat area. As with habitat conservation efforts, a number of government and non-government entities have organized to preserve farmland at the national, regional, state, and local levels. While the motivation for these efforts vary among involved entities, many point to the cultural and economic importance of active farmlands. But also, because of the proximity of wildlife habitat and agricultural lands, there exists the potential for farm owners to participate in conservation programs to maintain that habitat. This situation indicates county preservation strategies should be beneficial to both farmland and habitat for fish and other wildlife.

Methods

To infer the fitness of direct-sales farms as key to a more wildlife friendly matrix, the survey assesses farm owners' concern for the environment in general, the likelihood they would participate in specific actions to improve or preserve habitat, and actions they already undertake. Respondents also identified how long they have been farming, whether or not farming was their primary occupation, whether they considered their farm to be important as habitat for wildlife, and whether they would consider partnering with non-profits to further enhance or preserve habitat on their property.

The survey was sent to 37 farms identified as meeting the selection criteria. Of these 37, 21 advertise primarily vegetable products, while 16 dealt primarily in animal products including meat, dairy, eggs and fiber. A total of 21 participants completed the survey in March and April of 2014. This represented a 57% response rate. Response rates by farm type equaled 62% (n=13) of vegetable farms and 50% (n=8) of animal farms. Survey participants were owners or primary operators of farms in Thurston County listed in the 2013 Direct-Sales Farm Directory produced by South of the Sound Community Farm Land Trust. This population was selected to target farms actively pursuing a direct-sales marketing strategy in Thurston County. Farms listed on the Thurston County Direct-Sales Farm Map but not physically located within the county were excluded. Surveys were created and managed through the web service Survey Monkey ("SurveyMonkey," 2014). The survey was sent four times via email addresses and calls were made to farms to increase the response rate.

The survey included 12 questions, with the last one being an opportunity for open comments. Initial questions were short answer questions. Questions 1 and 2 established the farmer's experience and the longevity of their current farm in years. Question 3 determined if the respondent considered farming their primary occupation. Questions 4 and 5 asked respondents to characterize whether or not they considered their farmland as important wildlife habitat and what types of actions they do to maintain or enhance habitat on their property. Questions 6 and 7 asked respondents to rate on a Likert scale their level of concern for the environment in general, and preservation of wildlife species, respectively.

Question 8 asked respondents to select from categories that they felt were most responsible to address environmental issues from the individual to various levels of government or non-profit organizations. Question 9 asked respondents to rate their likelihood to participate on a scale that included; Unlikely, Unsure, Willing, Likely, Already do, Not Applicable, in the following series of actions; Avoid habitat destruction, Install nesting boxes for birds/bats, Install grassland/prairie habitat, Install wooded or forested areas, Improve riparian areas with native plants, include cover crops, and Limit application of pesticide and herbicide. Question 10 respondents were asked to rate the level of threat from Unlikely, Small, Moderate, Large, or Very Large the following categories of potential threats; Loss of Farmland, Urbanization and Development, Pesticides and herbicides, Monoculture cropping, Lack of conservation on private property, or Lack of priority/efficiency by government agencies. Question 11 asks how likely respondents would be to partner with conservation organizations to better protect or enhance habitat on their farm. Question 12 was an open comment section for respondents to add anything they felt relevant to the issue.

Analysis

The main purpose of the analysis was to identify subcategories within the respondent population that could be better leveraged for conservation actions and to identify the most appropriate categories of farm owners to target for conservation action in the matrix. To accomplish this farm respondents were categorized by products sold (vegetables or animal products), level of experience farming, length of time farm had been in business, and size of farm in acreage.

Each of these various categorizations were compared to responses about willingness to take certain actions, who is responsible for addressing environmental problems, and likelihood to partner with conservation organizations using chi-square, t-tests, one-way Anova, and logistic regression analyses using JMP11 statistical analysis software (*JMP*, 2014). Open ended responses were analyzed using NVivo10 qualitative data analysis software (*NVivo*, 2014) to identify recurrent and central themes in the responses.

Results

Preliminary questions sought to establish the level of experience of the farmer and the longevity of the current farm. Farmers average reported experience was 18.55 years, with no significant difference (p = .9910) between farmers growing vegetables (mean = 18.58 years +/- s.d. = 20.51) vs those in animal husbandry (mean = 18.50 +/- s.d. = 11.86). As expected, some farmers had more experience than on their current farm, and some had much less experience compared to farm existence and may have inherited a long-standing family farm operation. The average length of farm existence among all respondents was 28.9 years, with an average for vegetable farms equaling 13.33 (+/- s.d. = 11.82) years and animal operations 52.25 (+/- s.d. = 64.40). This result was statistically significant with a p-value of 0.05, however this difference may have been due in large part to the presence of two beef farms in operation in excess of 150 years.

While there were few statistical differences between sub-categories of respondents for most other measures, the results do paint a picture of a population

of land/business owners that are concerned about the environment and possess a high level of commitment to taking action to address those concerns. The average reported level of concern for the environment on a Likert scale, 10 being the most concerned, was 9.05 (+/- s.d. = 0.37). Concern for wildlife specifically was only slightly lower but still high with a mean of 8.42 (+/- s.d. = 1.42). In both measures there were no significant differences between farm type (vegetable or animal). A majority of Thurston County farm respondents report that they are already engaging in most of the listed conservation actions in the survey, and a majority of those not yet taking those actions responded that they were either likely or willing to do so for all but two categories (Table 2.1). In addition to the high rates of participation in specific actions, a majority of farms are already partnering with conservation organizations or are willing to do so (Table 2.2).

Table 2.1 Responses from Thurston County direct-sales farms regarding their likelihood to participate in specified conservation actions to enhance wildlife habitat on their farm.

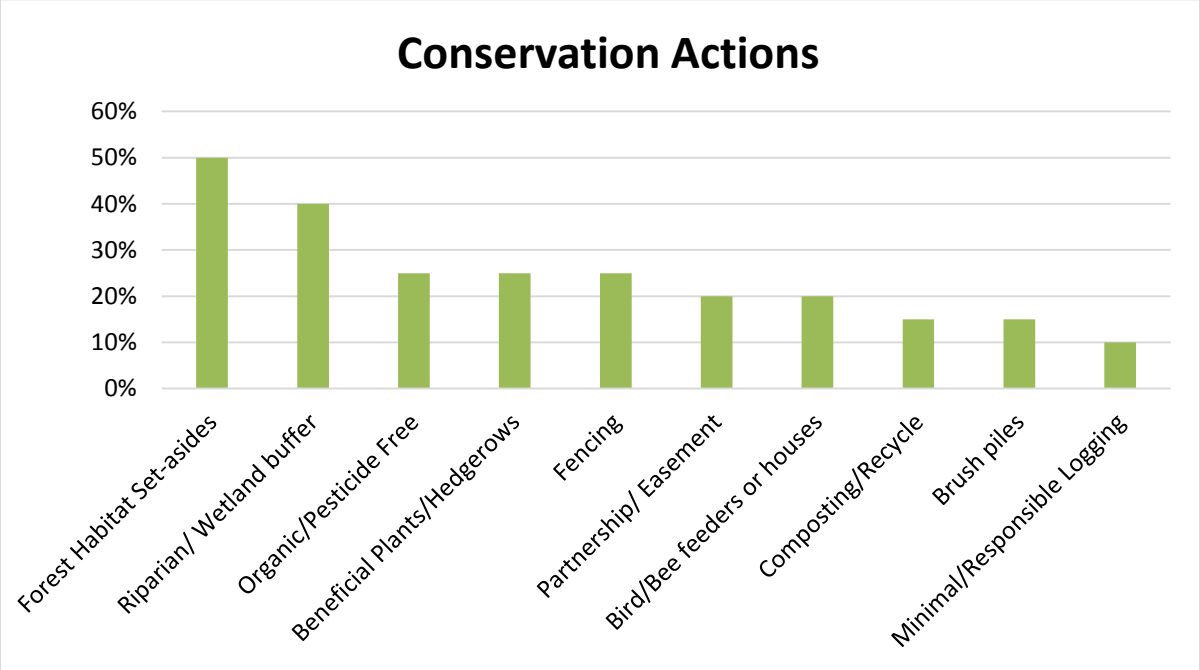
Conservation Action	Already Doing	Likely or Willing	Unsure, Unwilling, or N/A
Limit herbicide/pesticide	90.0%	10.0%	0.0%
Include cover crops	52.2%	30.4%	17.4%
Improve riparian areas	52.4%	38.1%	9.5%
Plant or restore forest	52.4%	23.8%	23.8%
Plant or restore prairie	52.4%	14.3%	33.3%
Install bird/bat boxes	47.6%	47.6%	4.8%
Avoid habitat destruction	81.0%	19.0%	0.0%

Table 2.2 Responses from Thurston County direct-sales farms regarding their likelihood to partner with conservation organizations to enhance wildlife habitat on their farm.

Already Do	Likely	Willing	Not Sure	Not Willing
61.9%	33.3%	4.8%	0%	0%

Quantitative analysis of responses to an open-ended question asking respondents to identify specific habitat conservation actions taken on their farm revealed a wide range of actions (Figure 2.1). The most common response, with half of respondents, was maintenance of forested or wooded sections of their property. The second most common response regarded water quality considerations, including references to riparian buffer zones and wetland enhancement actions. This result is particularly interesting, as it should be expected that not all farms would have rivers or wetlands on their property. Over 25% of respondents referenced organic and pesticide free farming methods. Incorporation of beneficial plants and hedgerows was also referenced by 25% of respondents. Some respondents elaborated that these plants and hedgerows are for the purpose of attracting beneficial insects and providing pollinator habitat. An interesting result was that a quarter of all respondents referenced fencing considerations, choosing to use fencing to keep specific species, like deer and pocket gophers, out of key areas while leaving other areas of their farms accessible. Other common themes were participation in conservation easements or other program (20%), installation of bird or bee feeders and houses (20%), composting and recycling practices (15%), incorporation of brush piles for beneficial insect habitat (15%), and minimal or responsible logging practices (10%).

Figure 2.1 – Qualitative analysis of open-ended responses to a question asking respondents to detail specific conservation actions they are already taking on their farms. Responses grouped by common themes to reveal the most often referenced practice.



Regarding perceptions of whom is most responsible for addressing environmental issues; respondents were most likely to select Self/Individuals (44%). The second most common answer was that a combination of federal, state, and local governments, non-profit organizations, and individuals are most responsible (28%). Local government (12%), State government (8%), Federal Government (4%), and Non-profits (4%) were less likely to be selected. While the results failed to show statistical significance ($\chi^2 = 2.823$, $p = 0.727$), in an analysis of response by farm type, animal husbandry farms tended to favor individual

responsibility to a greater degree (60%) than primarily vegetable farms (33.3%) (Figure 2.2).

Perceptions of Threat to Wildlife

Combined categories of Loss of farmland, urbanization and development were consider the highest threats to wildlife habitat in Thurston County with 90.5% of respondents rating the threat as “Very Large” or “Large”. Alone, farmland loss was perceived as the slightly higher threat with 76.2% of respondents rating it as a “Very Large” threat and 14.3% as “Large” compared to urbanization and development which rated almost as threatening (71.4% Very Large and 19.1% Large). Pesticide and herbicide use was also ranked as a highly threatening practice with 71.5% selecting it as a Very Large or Large threat, 19.1% as a Moderate threat, and 9.5 % as a Small or Unlikely threat. Monoculture cropping, lack of government priority or action, and lack of conservation on private property were the least threatening options with similar rankings of 45 – 60% Very Large to Large, 30 – 40% Moderate, and 10 – 15% Small to Unlikely threats (Figure 2.3).

Figure 2.2

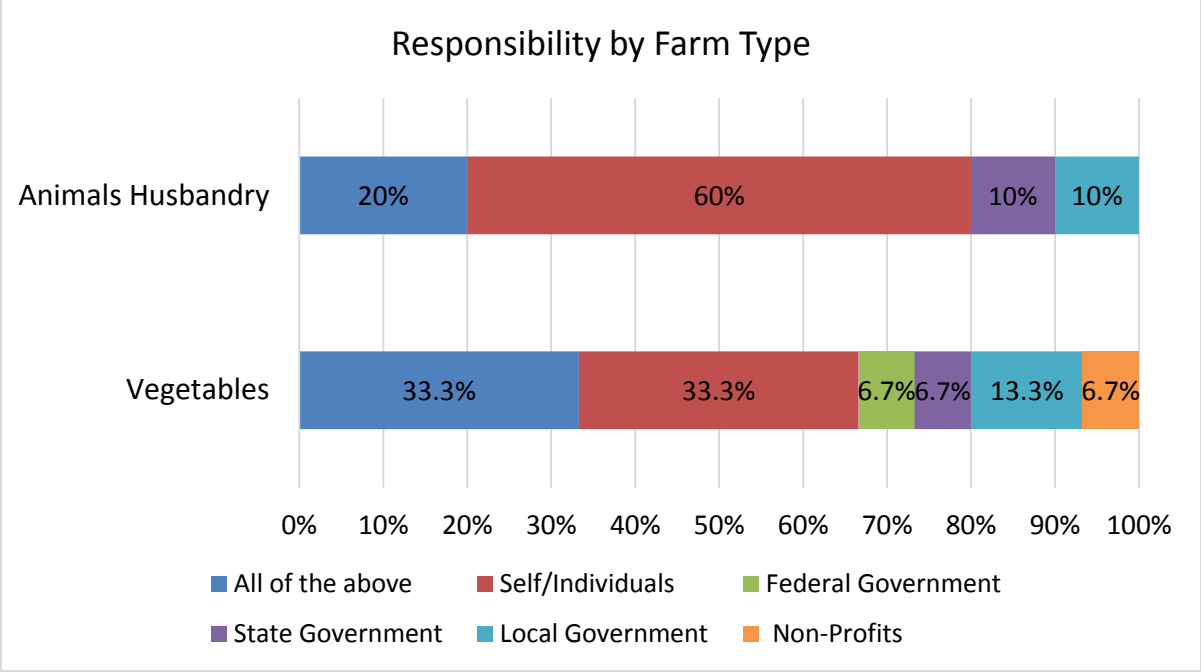
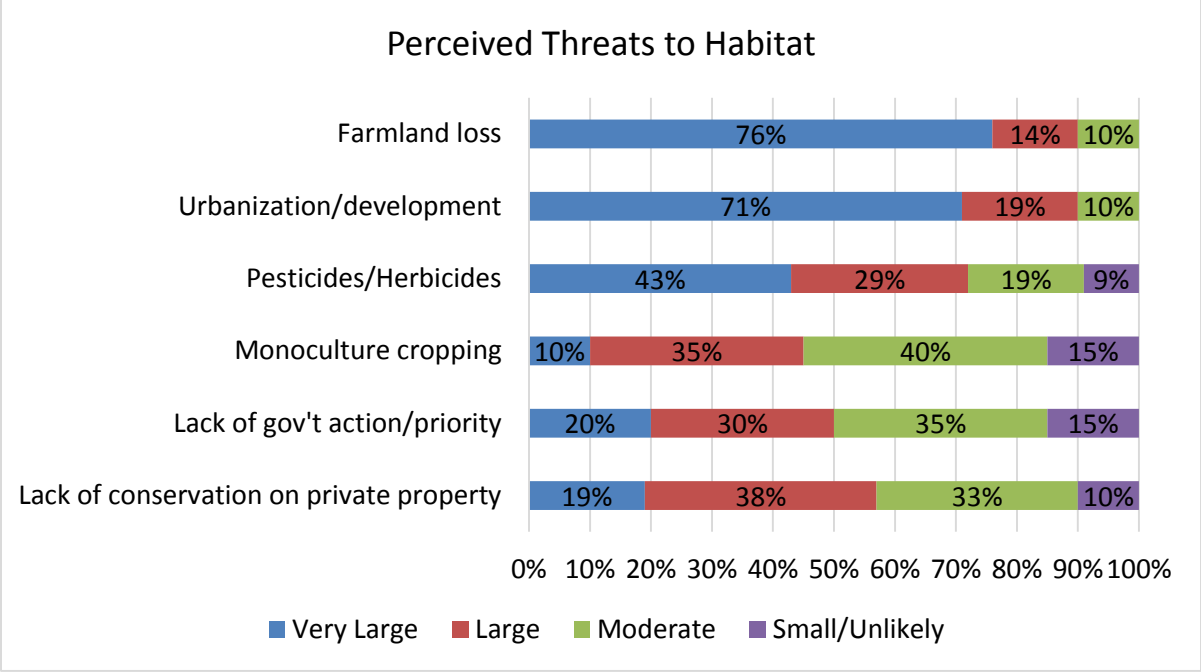


Figure 2.3



Discussion

The results of the survey from this research reveal a high level of dedication to wildlife habitat preservation by direct-sales farmers in Thurston County, Washington. All participants in this study indicate high levels of concern for the environment. A large majority feel that individuals, or a combination of individuals with various levels of government and non-profit organizations, are responsible for taking action to address these concerns. Moreover, respondents are able to specify actions they are currently taking, and actions they would be willing to take, to integrate habitat conservation and restoration on their property as part of their commitment to farming sustainably. The survey participants' levels of concern and conservation action reported here supports previous research that indicates small-scale, direct-sales farms are grounded in locally relevant cultural knowledge that values the environment.

Overall results regarding willingness to take part in specific conservation actions were better than expected. One expected difference can be seen if the listed conservation actions are split between passive actions, like limiting pesticide/herbicide applications or avoiding habitat destruction, vs more active forms of conservation such as planting or restoring forest and prairie habitats, improving riparian areas, and installing nest boxes for birds and bats. Expectedly, vegetable farmers were more likely than livestock to incorporate cover crops ($\chi^2 = 10.28$, $p = 0.02$). 83.3% of vegetable farms reported incorporating cover crops. Cover crops are important to protect bare soil, especially post crop harvest. Additionally they provide habitat and food for insects and small animals. Grazing

operations often utilize other methods, like rotating livestock through different pastures, to ensure soil is not bared.

Citizens and county government of Thurston County show a commitment to preservation of both wildlife habitat and working agricultural land. Thurston County is home to a number conservation organizations and government initiatives that work either to preserve farmlands or habitat. Some prominent conservation organizations already engaging in conservation activites on private farmland in Thurston County are The Nature Conservancy/Center for Natural Lands Management, Creekside Conservancy/Heernett Foundation, The Thurston Conservation District, South of the Sound Community Farm Land Trust, Washington Tilth Producers, and Salmon Safe.

Thurston County continues to apply considerable ongoing effort to balance environmental conservation goals with farmland preservation, economic viability, and accommodation of growth and development in an equitable manner. Since the Washington State Growth Management Act of 1990, Thurston County has zoned approximately 11,887 acres as Long Term Agriculture (J. Fisher & Mitchell, 2009). They have also commissioned studies to detail the feasibility of Purchase of Development Rights (PDR) and have an ongoing Transfer of Development Rights program. Promotion of agritourism, or any activity that brings visitors to a farm or ranch, is key to facilitating economic viability of metropolitan farms, helping to ensure their longevity, while contributing to a deeper connection between populations and their local farmers (Mariola, 2005). Thurston County established an Agritourism Overlay District in 2012, and the

Thurston County Bountiful Byway scenic route through the agritourism district in 2014.

Given the ongoing development of a Habitat Conservation Plan (HCP) by Thurston County as a result of the recent listing as threatened or endangered by the USFWS of a number of south sound species, the investment in farmland preservation by the county may pay off in cooperative land owner participation, according to my research. However, a number of factors need to be considered or studied further for successful HCP development and implementation. Research shows that Endangered Species Act (ESA) listings of certain species, and the effect of that listing on the ability of farmers to effectively operate on their land, sometimes creates an atmosphere of distrust, contention, and even backlash against the species targeted for protection (Steg & Vlek, 2009).

Thurston County's direct-sales farms have already taken concrete steps to administer their lands responsibly for habitat and species preservation in a number of ways. Government agencies and planners may rightly question whether conservation actions on private property are planned, implemented, and executed appropriately for target species of concern. These concerns should be allayed by the high level of collaboration with conservation organizations. Additionally, survey respondents mentioned participating in voluntary conservation programs like the U.S. Department of Agriculture's (USDA) Conservation Enhancement Reserve Program (CREP), receipt of conservation grants from USDA Natural Resources Conservation Services (NRCS) to specifically accommodate Mazama Pocket Gopher populations, and desire for participation in Purchase of

Development Rights (PDR) programs. Given the risk of alienation of a concerned, engaged, and cooperative demographic, information about the environmental attitudes and actions of land-owners, and farmers in particular, is critically important for effective HCP planning and ESA species protection.

Conclusion

Thurston County direct-sales farms both reflect, and help shape, the values of their community. My research indicates that these farms ought to be preserved not only for their significant contribution to the local economy and their central role in maintaining an agrarian identity that values local knowledge, but also their serious commitment to environmental justice and habitat conservation. Direct-sales farm owners show a deep level of environmental concern, a willingness to initiate action, and collaborate with conservation organizations. This land-owner demographic should be considered a valuable asset to many of Thurston County's goals in the near and long-term future.

While my research did not reveal many statistically significant differences between the various subcategories of the respondent pool, this indicates that direct-sales farms as a group are equally committed to habitat conservation and environmental goals, regardless of farm type, size, experience of the farmer, or longevity of the farm. This supports research that concludes localized food systems focus farmers on place-specific environmental and social norms (O'Hara & Stagl, 2001).

Literature Cited

Castillo, S. R., Winkle, C. R., Krauss, S., Turkewitz, A., Silva, C., & Heinemann, E. S. (2013). Regulatory and other barriers to urban and peri-urban agriculture: A case study of urban planners and urban farmers from the greater Chicago metropolitan area. *Journal of Agriculture, Food Systems & Community Development*, *3*(3), 155–166. doi:10.5304/jafscd.2013.033.001

Cobben, M. M. P., Verboom, J., Opdam, P. F. M., Hoekstra, R. F., Jochem, R., & Smulders, M. J. M. (2012). Wrong place, wrong time: climate change-induced range shift across fragmented habitat causes maladaptation and declined population size in a modelled bird species. *Global Change Biology*, *18*(8), 2419–2428. doi:10.1111/j.1365-2486.2012.02711.x

Donald, P. F., & Evans, A. D. (2006). Habitat connectivity and matrix restoration: the wider implications of agri-environment schemes. *Journal of Applied Ecology*, *43*(2), 209–218. doi:10.1111/j.1365-2664.2006.01146.x

Fisher, J., & Mitchell, L. (2009). *Thurston County Farmland Inventory*. Retrieved from http://www.communityfarmlandtrust.org/thurston-county-farmland-inventory.html

Fisher, J. R. (2009). *Farmland preservation in Thurston County*. The Evergreen State College. Retrieved from http://archives.evergreen.edu/masterstheses/Accession86-10MES/FisherJ%20MESThesis%202009.pdf

Gilpin, M. (1991). *Metapopulation dynamics: empirical and theoretical investigations*. Academic Press. Retrieved from http://books.google.com/books?hl=en&lr=&id=xPtEY5N8-agC&oi=fnd&pg=PP1&dq=gilpin+and+hanski&ots=zs_fASxulv&sig=ftvsSL8VYGu0luYLdTK9JzIZjqg

H. Ricketts, T. (2001). The Matrix Matters: Effective Isolation in Fragmented Landscapes. *The American Naturalist*, *158*(1), 87–99. doi:10.1086/an.2001.158.issue-1

Harvey, C. A., Komar, O., Chazdon, R., Ferguson, B. G., Finegan, B., Griffith, D. M., … Wishnie, M. (2008). Integrating Agricultural Landscapes with Biodiversity Conservation in the Mesoamerican Hotspot. *Conservation Biology*, *22*(1), 8–15. doi:10.1111/j.1523-1739.2007.00863.x

Heimlich, R., & Anderson, W. (2001). *Development at the Urban Fringe and Beyond: Impacts on Agricultural and Rural Land* (Agricultural Economic Report No. 803) (p. 88). United States Department of Agriculture. Retrieved from http://www.ers.usda.gov/publications/aer-agricultural-economic-report/aer803.aspx#.UqEtF-K7bSk

Horrigan, L., Lawrence, R. S., & Walker, P. (2002). How Sustainable Agriculture Can Address the Environmental and Human Health Harms of Industrial Agriculture. *Environmental Health Perspectives*, *110*(5), 445–456.

JMP (Version 11). (2014). SAS. Retrieved from http://www.jmp.com/

Jules, E. S., & Shahani, P. (2003). A broader ecological context to habitat fragmentation: Why matrix habitat is more important than we thought. *Journal of Vegetation Science*, *14*(3), 459–464.

MacArthur, R. H., & Wilson, E. O. (1967). *The Theory of Island Biogeography*. Princeton University Press.

Mantyka-pringle, C. S., Martin, T. G., & Rhodes, J. R. (2012). Interactions between climate and habitat loss effects on biodiversity: a systematic review and meta-analysis. *Global Change Biology*, *18*(4), 1239–1252. doi:10.1111/j.1365-2486.2011.02593.x

Mariola, M. J. (2005). Losing ground: Farmland preservation, economic utilitarianism, and the erosion of the agrarian ideal. *Agriculture and Human Values*, *22*(2), 209–223. doi:10.1007/s10460-004-8281-1

Maron, M., & Fitzsimons, J. A. (2007). Agricultural intensification and loss of matrix habitat over 23 years in the West Wimmera, south-eastern Australia. *Biological Conservation*, *135*(4), 587–593. doi:10.1016/j.biocon.2006.10.051

NVivo (Version 10). (2014). QSR International. Retrieved from http://www.qsrinternational.com/products_nvivo.aspx

O'Hara, S. U., & Stagl, S. (2001). Global Food Markets and Their Local Alternatives: A Socio-Ecological Economic Perspective. *Population & Environment*, *22*(6), 533–554.

Prevedello, J. A., & Vieira, M. V. (2010). Does the type of matrix matter? A quantitative review of the evidence. *Biodiversity & Conservation*, *19*(5), 1205–1223. doi:10.1007/s10531-009-9750-z

Sala, O. E., Chapin, F. S., Armesto, J. J., Bloomfield, J., Dirzo, R., Huber-Sanwald, E., … Wall, D. H. (2000). Global Biodiversity Scenarios for the

Year 2100. *Science*, *287*(5459), 1770–1774. doi:10.1126/science.287.5459.1770

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, *29*(3), 309–317.

SurveyMonkey. (2014). Retrieved May 18, 2014, from https://www.surveymonkey.com/

Vandermeer, J., & Carvajal, R. (2001). Metapopulation Dynamics and the Quality of the Matrix. *The American Naturalist*, *158*(3), 211–220. doi:10.1086/an.2001.158.issue-3

Vilsack, T., & Clark, C. Z. F. (2007). *U.S. Census of Agriculture 2007*. Retrieved from http://www.agcensus.usda.gov/Publications/2007/Full_Report/usv1.pdf

Wiegand, T., Revilla, E., & Moloney, K. A. (2005). Effects of Habitat Loss and Fragmentation on Population Dynamics. *Conservation Biology*, *19*(1), 108–121. doi:10.1111/j.1523-1739.2005.00208.x

Wilcove, D. S., Rothstein, D., Dubow, J., Phillips, A., & Losos, E. (1998). Quantifying Threats to Imperiled Species in the United States. *BioScience*, *48*(8), 607–615. doi:10.2307/1313420

Chapter 3: Research Significance and Future Directions

Interdisciplinarity

Agriculture stands at the nexus of human-nature interactions. The way we farm reveals something about the way we value nature. And our environmental values should inform our food productions system. My thesis explored the conservation attitudes and actions of direct-sales farmers in Thurston County, Washington. This research project is applicable to those concerned about habitat conservation, sustainable agriculture, local economies, and land-use planning. Chapter One reviewed the academic literature from a number of disciplines pertaining to the need for the integration of habitats and human land use. Research from biology detailed the seriousness of the current biodiversity loss rate. Conservation biology and landscape ecology detailed the patch/matrix landscape model. Research in these fields dealing with spatially represented species and biotic communities revealed how important matrix quality is to in-habitat population metrics and connectivity between remnant habitat patches. These findings led me to search for a particular land-owner demographic to study conservation attitudes and actions.

Research from agroecology and economics indicates that farmers operating in metropolitan and peri-urban areas are often smaller and may be more likely to utilize a direct-sales marketing model, often as a conscious effort to serve as an alternative to global food productions systems. Borrowing from environmental psychology and economics, agroecologists also predicted direct-

sales farmers would be more strongly tied to the culture of their consumers, are more apt to value local knowledge, social justice, and the environment. As a result of this multi-disciplinary literature, I concluded an evaluation of environmental values and actions among Thurston County's direct-sales farmers was warranted.

Further Research

A number of opportunities exist to build upon the results of my research. Thurston County is home to a number of species of concern that rely on particular habitats to survive. My research revealed local farm owners are conservation minded, and should be considered a key land-owner demographic for habitat conservation/farmland preservation initiatives and organizations. However, my research failed to find statistical differences among the sample population that would allow a prioritization of conservation action based on the factors I measured. A spatial analysis could allow a tailored conservation approach according to adjacent or proximal habitat to farm locations. Spatial analysis of Thurston County's farmland already exists (J. Fisher & Mitchell, 2009; J. R. Fisher, 2009), as does spatial analysis of the County's historic prairie (Crawford & Hall, 1997). Thurston county farmland and historic prairie do coincide, an exploration of the degree to which this occurs, in addition to wetlands, salmonid-bearing streams, and other critical habitat areas would be beneficial. This analysis would help to prioritize conservation projects on private property, and assist government agencies, planners, and non-profit organizations to better allocate resources to achieve conservation objectives.

Any discussion of conservation would be incomplete without the mention of climate change. Temporal analysis incorporating climate change, in addition to spatial data, would aid conservation planning efforts going forward into the future. Research suggests species ranges will shift and biotic community composition may change (Heller & Zavaleta, 2009; Opdam & Wascher, 2004). These factors, in concert with degraded and fragmented habitat, will pose increased extirpation risks for many species. One way to mitigate the climate change risks to species is to facilitate connectivity between habitats. A spatial analysis combined with temporal climate change data could facilitate county and statewide spatial landscape level conservation planning.

While my research shows Thurston County farmers to be environmentally aware, engaged, and active, the results also showed a population concerned about farmland loss and continued economic viability in the face of development pressures and stringent environmental regulations. The recent listing of Thurston County species as federally threatened or endangered brings this particular aspect to the fore of County planning efforts. As Thurston County develops its Habitat Conservation Plan to enforce these ESA regulations on the County's residents, further research on the economic impact of these listings should be conducted. This study's results show this land owner demographic to be highly concerned and open to collaborative conservation actions. Thurston County should consider this segment of private land owners an asset to ESA implementation and look for ways to achieve an integrated species and farmland preservation approach. The County cannot rely on these land owners cooperation if they are no longer

economically viable enough to continue owning the land. ESA implementation through the HCP should proceed with this in mind.

My research integrated two problems, habitat conservation and farmland preservation, and attempted to identify one particular form of human activity that may address both. This research may fall under the broad heading of "sustainable agriculture", but to understand what a sustainable form of agriculture looks like requires integration of multiple fields of research. Because sustainability is itself a concept defined by multiple disciplines, including economics, ecology, social justice, and policy, research about the sustainability of anything is often necessarily multi- or interdisciplinary. My particular research focused primarily on agriculture that utilizes a specific marketing strategy, direct to consumer sales, and so operates within a particular set of economic constraints. Because of the direct-sales marketing strategy, which operates in contrast to the industrial food system that severs cultural and environmental ties in favor of efficiency, I assumed the subjects of my research would be likely to have social and environmental concerns that may manifest in actions that have to be balanced against the economic viability of the business, and more broadly the preservation of farmland in Thurston County. Necessarily then, my research integrated ecological concerns with economic ones in an attempt to inform policies and actions that serve to benefit the agendas of conservationists and farmland preservation efforts through mutual collaboration on our county's direct-sales farms.

My research results confirmed my assumptions, and should serve to place direct-sales farms as a focal point of collaborative habitat conservation and farmland preservation efforts in Thurston County. There exists a number of complicating factors, including newly listed threatened and endangered species under the ESA, farmland remains under threat of development in many places, and as always a limited amount of resources with which to balance many objectives. However, with considerable government interest, the presence of multiple conservation and farmland preservation non-profits, a vibrant direct-sales economy, and as my research shows, an environmentally concerned population of farm owners willing to take responsibility and enact effective, collaborative conservation action on their properties, Thurston County is well positioned to succeed in expanding synergistic efforts to achieve a variety of stated goals.

Literature Cited

Crawford, R. C., & Hall, H. (1997). Changes in the south Puget prairie landscape. *Ecology and Conservation of the South Puget Sound Prairie Landscape. The Nature Conservancy, Seattle, WA*, 11–15.

Fisher, J., & Mitchell, L. (2009). *Thurston County Farmland Inventory*. Retrieved from http://www.communityfarmlandtrust.org/thurston-county-farmland-inventory.html

Fisher, J. R. (2009). *Farmland preservation in Thurston County*. The Evergreen State College. Retrieved from http://archives.evergreen.edu/masterstheses/Accession86-10MES/FisherJ%20MESThesis%202009.pdf

Heller, N. E., & Zavaleta, E. S. (2009). Biodiversity management in the face of climate change: a review of 22 years of recommendations. *Biological Conservation*, *142*(1), 14–32.

Opdam, P., & Wascher, D. (2004). Climate change meets habitat fragmentation: linking landscape and biogeographical scale levels in research and conservation. *Biological Conservation*, *117*(3), 285–297.

Appendices

Survey Questions

1. **How long have you been farming?**

2. **How long has your current farm been in business?**

3. **Is farming your primary occupation?**

4. **Do you think of your farm as important habitat for wildlife?**

5. **Are there actions you take specifically to enhance or protect wildlife habitat on your farm? If so, what are they?**

6. **Please rate on a scale from 1-10, how concerned are you about the environment?**

1 (least concerned)	2	3	4	5	6	7	8	9	10 (most concerned)
◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

7. **Please rate on a scale from 1-10, how concerned are you about the preservation of wildlife species?**

1 (least concerned)	2	3	4	5	6	7	8	9	10 (most concerned)
◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

8. **Who do you believe is most responsible to address environmental issues?**
   - ☐ Self/Individual
   - ☐ Local/City/County Government
   - ☐ State Government
   - ☐ Federal Government Agencies
   - ☐ Non-Profit Organizations
   - ☐ All of the above

9. **Do you already, or would you consider, incorporating the following habitat conservations actions?**

	Unlikely	Not Sure	Willing	Likely	Already Do	N/A
Avoid habitat destruction						
Install nest boxes for birds/bats						
Introduce grassland/prairie habitat						
Install wooded or forested areas						
Improve riparian areas						
Include cover crops						
limit application of herbicides/pesticides						

10. **How large of a threat do you consider the following to wildlife habitat in Thurston County?**

	Unlikely	Small	Moderate	Large	Very Large
Farmland loss					
Urbanization and development					
Pesticides and Herbicides					
Monoculture cropping					
Lack of conservation on private property					
Lack of priority or efficiency by government agencies					

11. How likely would you be to partner with conservation organizations to enhance or preserve habitat on your farm?

- ☐ Already do
- ☐ Likely
- ☐ Willing
- ☐ Depends
- ☐ Unlikely

12. Is there anything else you would like to address regarding this issue?