

MANAGING LAND FOR RESILIENCE: A COMPARATIVE ANALYSIS OF  
CONSERVATION PLANNING AND HOLISTIC MANAGEMENT®

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By

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## ABSTRACT

### MANAGING LAND FOR RESILIENCE: A COMPARATIVE ANALYSIS OF CONSERVATION PLANNING AND HOLISTIC MANAGEMENT®

Alyssa Camilla Hosbach

In a time of change and dwindling resources, how decisions are made for managing private lands is critical for the future resilience of ecosystems. Theories in ecology and natural resource sciences are moving away from a past emphasis on steady-state equilibrium toward embracing dynamic change. A newly applied and pragmatic paradigm informed by resilience theory integrates ecological and social sciences in a systems approach to long-term sustainability based on flexibility and adaptation to change. As the science evolves, new understandings can be applied in natural resource management.

This research explores the degree to which resilience theory is being incorporated into two prominent decision-making frameworks for private land management: the Natural Resources Conservation Service's Conservation Planning framework and Allan Savory's Holistic Management® framework. I began by conducting a document analysis to compare and contrast Conservation Planning and Holistic Management® as they are described in the literature. Next, I analyzed the two frameworks for evidence that they incorporate three applied tenets of resilience theory: managing whole systems, managing for change, and managing for diversity. To ground my research I conducted nine semi-

structured interviews in two California counties: San Luis Obispo and Humboldt. I interviewed ranchers, NRCS planners, and Holistic Management® instructors to gain insight into how the frameworks are implemented on the ground. I found that the frameworks are altogether different in how they approach land management. The Conservation Planning framework incorporates key sustainability-oriented, land management ideas and practices like philosophical understandings of whole systems and diversity management, and practices addressing managing for change and diversity like erosion control and non-indigenous plant control. However, Holistic Management® more thoroughly addresses whole systems, managing for change and diversity, and thus aligns more clearly with current ideas of resilience and how to achieve long-term sustainability.

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## INTRODUCTION

Ensuring that private lands are managed sustainably is a critical issue. More than half of the world's ecosystem services have been degraded and the human species is living beyond its means on a planet with finite resources (Millennium Assessment, 2005). Our survival depends on the stewardship of resources currently being utilized. According to the Natural Resources Conservation Service (NRCS), 59% of land is privately owned in the United States (USDA-NRCS, 2011a). Private lands are critical habitat for wildlife, including endangered species, and they hold an array of resources people depend on such as watersheds, forests, and soils. Thus, the need is ever greater to ensure that landowners manage these natural resources sustainably.

One primary reason for the degradation of natural resources is the perpetuation of the popular view that the earth is in equilibrium and is endlessly productive. We can harvest trees and more will grow back. It snows every winter. The idea that balance, order, and permanence characterize nature is a fundamental, though commonly unexamined, assumption underlying global social, political, and economic functions that depend upon this basic predictability. For example, the paradigm of ever-escalating growth has promoted efficiency and optimization in industrial production processes that depend on the principle context of production remaining stable. Equilibrium approaches require large amounts of energy and resources to keep things stable as well. For instance, industrial agriculture promotes monocultures, which require large amounts of pesticides, herbicides, synthetic fertilizers, and labor in the form of heavy farm equipment to

maintain stable production. In contrast, the reality of constant change is addressed in organic agriculture by using a diversity of crops to enrich the soil and to minimize losses from unpredictable changes like storms, climate change, and pest outbreaks.

Much scientific inquiry into the physical world has been guided by theories such as thermodynamics that seek to explain dynamism, but research has prioritized understanding steady states and equilibria. In contrast, resilience, a relatively recent theory emerging in ecology and applied research, is based on the premise that change is the only constant. Leading systems ecologist C.S. Holling (1973) argued that in ecosystems, resilience is the ability of a system to absorb change without shifting to a new state. Collaborators of Holling have applied these ideas in sustainability science, integrating environmental and social sciences in a systems-based approach to foster flexibility and adaptation to change as underlying requirements for sustainability in the long term (Walker, Anderies, Kinzig, & Ryan, 2006). In this context, sustainability means using resources to meet immediate needs without jeopardizing the ability of future generations to meet their needs (World Commission on Environment and Development, 1987).

Researchers and resource managers seek sustainable land management strategies that can guarantee reduced soil erosion, clean drinking water, productive range, and fertile soils, while maintaining healthy communities and flourishing economies. To reach this level of sustainability, long-term resilience is necessary. Systems-based approaches are a primary example of strategies for land management that flow from a non-equilibrium paradigm that assumes nature is dynamic, unpredictable, and changing

through time. Sustainability scientists advocate managing land as a whole, complex system considering economic, social, and environmental interactions, not simply optimizing management of the various parts, such as a stand of trees or a herd of cattle within that system (Chapin, Folke, & Kofinas, 2009). By managing the parts alone, the greater complexity of interdependencies within managed land is ignored, and thus overall system productivity may be compromised. Sustainability scientists propose that managing for diverse landscapes and with unpredictable changes in mind helps maintain resilient ecosystems, and therefore, the long-term sustainability of civilization (Chapin et al., 2009).

In the United States, several decision-making frameworks for private land management are promoted by federal conservation agencies and non-governmental educational organizations. Two such frameworks are the United States Department of Agriculture Natural Resource Conservation Service's (NRCS) Conservation Planning and Allan Savory's Holistic Management<sup>1</sup>. NRCS started as the U.S. Soil Erosion Service in 1933 in response to the Dust Bowl (USDA-NRCS, 2011a). Today, it is the primary federal agency advising private landowners on natural resources management. The Conservation Planning process is a core component of many NRCS extension efforts and focuses on helping landowners decide the best ways to improve the productivity, sustainability, and profitability of their operations (USDA-NRCS, 2012). In contrast,

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<sup>1</sup> "Holistic Management" is a trademark that has been registered with the national trademark office; therefore, the registered trademark symbol (®) should be appended to the end of each use of the name. For brevity, this thesis omits the registered trademark symbol after "Holistic Management" from this point forward.

what started as the Savory Grazing Method in Africa in the 1970s developed into the Holistic Management framework of today (Savory & Butterfield, 1999). Holistic Management is defined as a decision-making process that gives people the ability to plan the future they want while ensuring that available resources can sustain their goals (Savory & Butterfield, 1999). In 1979, Allan Savory brought the Holistic Management framework to the United States, and it is currently promoted by the private organizations Holistic Management International and the Savory Institute, which address land management and holistic living internationally (Savory & Butterfield, 1999).

Both systems are becoming widespread and both have their advocates among NRCS planners, Holistic Management instructors, and landowners. The question addressed in this thesis is, which of these two frameworks does more to improve the resilience of private lands and therefore the sustainability of land management practices?

This research uses a resilience theory lens to compare and contrast the two frameworks. The first section of this thesis reviews the relevant literature related to current understandings of sustainable land management, Conservation Planning, Holistic Management, and resilience theory. The second section discusses the analysis and interview methods used to conduct this research along with a detailed description of the analytical approach based on three tenets of resilience theory, managing whole systems, managing for change, and managing for diversity, used to compare the frameworks. In the Results and Discussion section, I report on the document analysis I applied to compare and contrast the frameworks as they are presented in the literature. Then, I ground my theoretical findings by discussing answers from the semi-structured

interviews I conducted with framework planners, instructors, and ranchers. Finally, I provide a detailed evaluation of each framework with respect to the three tenets of resilience theory. Integrating my document analysis with interviews focused on the actual experiences of ranchers, planners, and instructors, and discussing these findings in light of the literature review, helped inform my conclusions and recommendations for ways the frameworks could be improved to enhance decision making for resilient and sustainable private land management.

## LITERATURE REVIEW

Through a review of relevant literature in the areas of sustainability science, resilience theory, and rangeland management, this chapter provides a summary of current discussions about ecological services on private lands and equilibrium and non-equilibrium approaches to land management in addition to presenting a systems perspective for managing natural resources.

In the United States, stewardship by private landowners is important to reducing biodiversity loss and the degradation of ecosystem services because 70% of the land is privately owned (USDA-NRCS, 2012). Ecosystem services are the life-supporting, regenerative, and cleansing functions that nature provides (Hackett, 2006; Millennium Assessment, 2005). Services like fresh water, clean air, fertile soils, forestland, wildlife habitat, and open spaces are a few examples of nature's abundance. Maintaining diverse ecosystems contributes to the resilience of ecosystem services (Srivastava & Vellend, 2005). But, as the world's population is growing and consumption increases disproportionately, biodiversity is declining and ecosystem services are being destroyed (Norris, 2008). For instance, between 1960 and 2000, the demand for ecosystem services increased as the world population doubled to 6 billion (Millennium Assessment, 2005). Consumption of goods and services increased at an even faster rate. "Food production increased by roughly 2.5 times, water use doubled, wood harvests for paper and pulp production tripled...and timber production increased by more than half" (Millennium

Assessment, 2005; Walker & Salt, 2006, p. 3). Therefore, the need for managers to steward natural resources is greater than ever.

In order for good stewardship to occur on private lands, land managers need approaches that can absorb or adapt to disturbance and change, such as climate variability, for long-term sustainability. Sustainability means using natural resources to meet society's immediate needs without jeopardizing the ability of future generations to meet their needs (World Commission on Environment and Development, 1987). But, approaches explicitly managing for change are still emerging, as the dominant land management paradigm is more strongly influenced by ideas of equilibrium and predictability.

Assumptions of equilibrium that balance, order, and permanence characterize nature have influenced the science of ecology for many years (Neumann, 2005). Managers have constructed models for resource management upon the fundamental assumptions of equilibrium ecology. But, a new, non-equilibrium ecology has emerged to challenge assumptions of equilibrium with the realities of instability, disequilibria, chaotic fluctuation, and dynamism familiar to landowners (Neumann, 2005).

Equilibrium ecology has dominated the American understanding of land management and continues to influence scientific solutions for resource degradation. For instance, carrying capacity is a term commonly used for preventing rangeland degradation (Neumann, 2005). Its underlying assumptions are based in equilibrium ecology and are still used for management today. The core argument of carrying capacity is that the density-dependent factor of average stocking rates is crucial to plant dynamics

(Neumann, 2005). But, for most environments, especially arid and semi-arid places, this is simply not true (Neumann, 2005).

For example, density-independent factors like climate and physical features are more important in determining vegetation dynamics in arid environments. Since rainfall in arid and semi-arid areas is irregular and droughts are frequent, range productivity comes in erratic pulses. Here, ideas of equilibrium or an average stocking rate are meaningless to land practices due to the unpredictable nature of ecosystems—the average year does not exist and a different approach is warranted (Neumann, 2005). Non-equilibrium ecology has demonstrated that many systems thought to be unstable in terms of equilibrium ecology are actually highly resilient. According to non-equilibrium principles explained by Savory and Butterfield (1999), a dense group of herding animals is necessary to break up hard soils and replenish soil nutrients. The significance is that in a low-forage year, the animals need to move away again more quickly than in a rich year. The vitality of arid and semi-arid rangeland depends on concentrated animal impact in specific time intervals. Reducing stocking to a level of carrying capacity at which a constant presence of some livestock can be maintained does not fulfill this ecological role. Thus, managing lands as if they are in equilibrium is irrational because ecosystems are dynamic and always changing.

Due to implied equilibrium solutions for managing land degradation, land and people may suffer more from efforts to optimize management than if they were left alone. For example, in the United States feed lots allow for the optimization of beef production. Feed lots cram as many beef cattle as possible into confined spaces and feed the animals

an unnatural grain diet for rapid weight gain and taste. Due to overcrowded pens and living in their own excrement, cattle are injected with antibiotics to prevent the spread of disease (Schlosser, 2002). While increasing the economic efficiency of producing beef for market, feed lots incur tremendous energy costs and pollutant loads. For instance, manure, which should be recycled back into soils for its rich nutrient value, becomes a burden to dispose of. These true costs of production are externalities the current economic system fails to factor into production costs and these externalities will make feed lots unsustainable in the long term (Hackett, 2006).

In comparison, beef cattle raised on rangelands can actually improve ecosystem service functioning when grazed carefully (Farley, Schmitt, Alvez, & Ribeiro de Freitas Jr., 2012). For instance, with Voisin grazing, also known as management-intensive grazing, animals are moved from pasture to pasture, mimicking their movements in nature (Farley et al., 2012). This grazing strategy relies on high densities of livestock for short periods of time in pastures divided into paddocks with electrical fences. Never overgrazed, pastures have less soil erosion, better nutrient cycling, the ability to store more carbon, and thus, improved ecosystem service functioning (Farley et al., 2012). Also important is the animals require few or no antibiotics since they are grazing open land. Continual movement from paddock to paddock decreases the time they are exposed to their excrement and provides cattle with forage they were designed to eat. This system of producing beef on rangelands is clearly more sustainable for natural resources and for human health than beef from feed lots.

In terms of resilience theory, sustainability is recognizing where thresholds exist and managing the system in relation to these thresholds (Holling, 1973). Currently, much natural resource degradation occurs where significant investment is put forth in efforts to maintain high levels of production (Walker & Salt, 2006).

A primary problem with ecosystems management in the United States is that it is based on the economic paradigm of optimization. We assume that we can manage for resources independently, find an optimal balance between supply and demand for each output, and, as we do this, we assume that other attributes of the system that produce the outputs remain constant through time (Cox, 1981).

Current practices are focused on optimizing the delivery of particular goods and services by maximizing the production of specific components of the system and controlling others (Hackett, 2006). An example of optimization today is industrial agriculture. Farmers plant monocultures to maximize the output of a desired crop—managing for one plant species and ignoring all other living organisms (Altieri & Toledo, 2011). Growing food this way seems economically efficient, but this method compromises natural resources through waterway pollution, soil salinization, and lost diversity (Rosset, 2011). These externalities or true costs of economic efficiency are not included in food prices.

Maximum Sustained Yield (MSY) is the underlying ideology driving the industrial food and natural resource production systems. MSY is the largest quantity of product that can be harvested from a renewable resource without depleting the productive capacity of the resource system (Hackett, 2006). Some natural resources measured with

MSY are water, fisheries, forests, and pasturage. MSY is an optimization approach that aims to get the system under management into an “optimal state,” and then hold it there (Hackett, 2006).

These equilibrium models tend to ignore the implications of what might be happening at larger scales and usually fail to take full account of changes occurring within the systems at lower levels of organization, risking the future resilience of ecosystems (Walker & Salt, 2006). According to hierarchy theory in ecosystem science, any system is made up of a hierarchy of interconnected adaptive cycles operating at varying scales in time and space (Holling, 1973). A set of main processes controls the structure and dynamics at each scale, which is then linked to a set of hierarchies—called *panarchies* by Gunderson and Holling (2002)—that govern the behavior of the whole system. Ignoring the effects of scale-level interaction is a common reason for failures in natural resource management (Holling, 1973).

For instance, spruce budworm is a moth whose larvae eat the new needles on spruce trees. Sparse foliage on young trees keeps budworm numbers down, as predators are able to see and thus eat the budworms. As trees mature, the foliage becomes denser and the budworm population grows. Every 40 to 120 years, spruce budworm populations explode in localized patches, resulting in the death of up to 80 percent of the spruce trees in a given patch (Holling, 1973). Following World War II, resource managers decided to spray pesticides to control spruce budworm outbreaks in order to minimize the pest’s economic consequences on the forest industry. Without understanding the interaction between the trees and the budworms, moderate doses of pesticides prevented outbreaks of

budworms, but these practices enabled spruce forest foliage across broad regions of North America to mature at the same time. The increased leaf density in the mature forest shielded budworms from predators and the spruce budworm population exploded. Land managers were forced to use more pesticides to prevent further spread of the pests.

The industry had little resilience and pesticide usage was making the problem worse, so ecologist C.S. Holling (1973) devised a solution. His analysis was based on adaptive cycling, where an adaptive cycle is composed of four phases: rapid growth, conservation, release, and reorganization. For instance, the rapid growth phase is characterized by a young forest, and after proceeding through maturity, at 40 to 120 years of stable growth (conservation phase), the cycle enters the release phase where budworms take over. By understanding the forest as an adaptive cycle, land managers were able to use larger doses of pesticides applied less frequently at strategic times over smaller areas, which proved successful (Holling, 1973). Land managers reestablished patchy forests in different stages of growth so predators could help keep budworm numbers down instead of allowing the forest to mature all at once where budworms thrive. Thus, understanding the scale-level interactions within systems can reduce the failures of natural resources management.

Efficiency is a key component of optimization. As defined by Hackett (2006), efficiency is the condition of producing something beneficial or valuable with a minimization of waste. In a production system like a forest or factory, it is efficient to reduce the diversity of species or people who perform the same function. However, reducing this type of diversity, also known as redundancy, exposes systems to failure in

the event of unforeseen disasters. For instance, if the one species that performs a specialized function in an ecosystem or the one person who is trained to perform a particular task in a business dies or suddenly leaves, the system breaks down because no one else can perform the needed function. In most business situations a replacement can usually be found before too long, but when a species goes extinct it can take a long time to develop a substitute. In the meantime, the system may shift into a new state. For example, the sea otter is a primary species that eats sea urchins in intertidal zones. When the sea otter disappeared due to extensive hunting, urchin populations exploded and decimated kelp and other macroalgae, which form the basis of communities in intertidal zones (Mills & Soule, 1993). Without otters to keep the urchins in check, the intertidal system shifted into a new state of reduced diversity. This new state was dominated by urchins, but all of the kelp that provided habitat for fish, and the fish, were gone (Mills & Soule, 1993).

The “paradox is that while optimization is supposed to be about efficiency, because it is applied to a narrow range of values and a particular set of interests, the result is major inefficiencies in the way we generate values for societies” (Walker & Salt, 2006, p.7). Peoples’ perception of value generally does not match this optimization approach either. People value the beauty of natural landscapes and living species, clean drinking water, good recreational experience, and clean air. Yet, economic values for these and other ecosystem services are not fully measured because methods to measure them have not been designed (Hackett, 2006). Optimization distorts the market value of many life-giving services by reducing the time horizons over which value is assessed, discounting

the future, and ignoring values such as public goods that do not have private property rights associated with them even if they contain critical ecosystem services (Hackett, 2006). Viable solutions to sustain natural resources for future generations must look beyond this business-as-usual approach for management and account for the assumptions shaping worldviews leading to resource degradation.

The ruling paradigm—that we can optimize components of a system in isolation of the rest of the system—is proving inadequate to deal with the dynamic complexity of the real world (Sturle, 2011). There is a need for land management approaches that value diversity and redundancy, and are able to incorporate change. Resilience theory offers an alternative perspective and potential insights for sustainable land management practices.

### Resilience Theory

Resilience theory emerged out of systems ecology in the early 1970s thanks to C. S. Holling's classic paper, *Resilience and Stability of Ecological Systems* (Holling, 1973). This paper discussed the relationship between resilience and stability, where models of change were addressed as applied to the structure and function of ecological systems (Walker et al., 2006). Holling was among the first ecologists to understand the importance of nonlinear dynamics, defining resilience as the measure of how far a system can be agitated without shifting into a different regime (Sturle, 2011; Walker et al., 2006).

Resilience theory is based on three fundamental assumptions: 1) Human beings exist within social-ecological systems, 2) Social-ecological systems are complex adaptive

systems, and 3) Resilience is the capacity of a system to absorb disturbance and retain its key functions (Holling, 1973). The first concept—people exist within social-ecological systems—means that people influence and are influenced by ecosystem processes (Cumming, Cumming, & Redman, 2006). This concept indicates that choices landowners make will affect ecosystem processes and, by extension, the environment and society. For instance, it was originally assumed that the earth could absorb all human wastes because people were separate from nature (and further, nature was boundless/endless) (Neumann, 2003). So, people burned fossil fuels, emitted harmful chemicals into the atmosphere, disposed of wastes into landfills, and dumped toxic wastes into the oceans without consideration. Scientists are now validating, through climate change data, shrinking landfills, and polluted watersheds, that the earth is limited in what it can absorb, and that societies influence and are influenced by ecosystem processes. Chapin et al. (2009) argue that under our current economic system, too many ecosystem processes are undervalued and thus degraded in the production process. If these services were better valued and our dependence on them was recognized, we would see the relevance of treating systems as socio-ecological systems.

The second concept—social-ecological systems are complex adaptive systems—means that the emergent behavior of these systems cannot be predicted by knowing the individual mechanics of their component parts. Managing component parts can be seen in efforts to maintain maximum sustained yields (MSYs) in commercial fisheries (Walker & Salt, 2006). The underlying assumption with MSY and fisheries is that future populations of fish will behave as they have in the past—changes will be linear and incremental

(Hackett, 2006). Yet, fisheries, which are also subject to pollution, climate change, and other factors, are failing globally because managing this one part (fish catch) does not mean the overall behavior of the whole system can be predicted.

The third concept—resilience is the capacity of a system to absorb disturbance and retain its identity—provides a cautionary framework for managing social-ecological systems as whole systems functioning over many linked scales of time and space (Gunderson & Holling, 2002). Social-ecological systems have multiple stable states or regimes that are separated by thresholds. A system's living components, which could be fish, people, economies, or a mixture thereof, are adapted to the range of conditions found within a regime. A resilient system is able to absorb a sudden shock without crossing a threshold into an alternate regime that is not likely to be as hospitable to the components of the previous state (Cumming et al., 2006). Proponents argue that resilience is the key to sustainability (Holling, 1973; Sturle, 2011). For example, an organic farm with a variety of crops planted in the same area will have a good chance of economically producing enough yield for market, even if a pest outbreak occurs in one crop. Pests tend to be crop specific, so the other crops will still be harvestable due to crop diversity. In comparison, an industrial monoculture of corn assaulted by an outbreak of pesticide-resistant insects could result in the collapse of the farm due to the lack of resilience from agro-chemical dependence and zero diversity.

According to non-equilibrium ecology, ecosystems, including the human societies within them, are constantly changing. Rather than trying to control change by optimizing yields of single outputs, resource management systems need to be responsive to dynamic

change. A resilience-based approach to private land management would value a broader range of system outputs such as healthy soils, clean streams, and wildlife habitat, and apply fewer optimizing and energy-intensive inputs such as fertilizers, pesticides and single-species crop production that make the system vulnerable to failure.

For example, a landowner has crops growing next to a stream that empties into a small lake that provides his drinking water. Since the land manager uses synthetic fertilizer on the crops, fertilizer is washed into the stream and out to the lake when it rains or the fields are irrigated. Over time, phosphorus concentrates in the lake, which results in phosphorus overload. Crossing this threshold dramatically changes the ecological function of the lake. Among many impacts here, the drinking water supply is lost.

In a dynamic world it is wise to seek management options that incorporate explicit mechanisms for forward-looking monitoring (Gunderson & Holling, 2002). When patterns in the dynamics of change can be identified, opportunities for adaptation emerge. In land management specifically, maintaining functionality without degrading resources is important and therefore understanding how changes affect the ecological, social, and economic aspects of the system is critical (Holling, 1973; Srivastava & Vellend, 2005). Once probable changes and their likely impacts are understood it becomes easier to plan for change and adapt management practices accordingly (Gunderson & Holling, 2002). The Conservation Planning and Holistic Management frameworks claim to offer landowners a way to approach land management not just as a profit-earning enterprise, but rather as a complex system of economics, society, and natural resources (Savory & Butterfield, 1999; USDA-NRCS, 2006, 2011a). Resilience

theory suggests that we live in a very dynamic world and that to persist, resilient socio-economic systems must be designed to absorb change without crossing thresholds into less desirable system states (Chapin et al., 2009).

### Three Tenets of Resilience Theory

When applied to management, resilience theory can be defined in terms of three tenets: managing whole systems, managing for change, and managing for diversity.

The idea of whole systems is central to resilience theory. Human societies rely on the ecological systems they are part of and the ecosystem services that are produced for survival. Ecologists focus on the linkages between components of systems and on flows of energy and resources between them and are thus positioned to see land management systems as functioning wholes rather than focusing on particular components or products. Yet, this is not how natural resource management is traditionally practiced and studied (Hackett, 2006).

Conventionally, in a market economy, landowners are encouraged to focus on resource outputs from the system rather than the system as a whole (Cox, 2007). Economic pressure is exerted to maximize efficiency and continual growth of a few marketable outputs. Studying the interconnections of the whole system at any given scale would reveal that this approach to production cannot be sustained because natural resources are limited. Further, production of any single resource will become more expensive as the limits are approached. A holistic systems perspective in land management would require a landowner to consider a variable range of outputs of a broad

range of ecosystem services. Managing for a broader range of valued outputs, in addition to being more adaptive with regard to ecological functions, widens the range of social and economic linkages of landowners and society and the number of relationships that help to buffer against sudden changes (Holling, 1973).

Change is an integral part of systems thinking. Change is always occurring at some rate and scale, and social-ecological systems are continually adapting to this change. People are good at adapting to small and moderate change that occurs quickly, like the price of fuel and food. Societies are less able to respond to slow changes like population growth or sea level rise (Walker & Salt, 2006). People have difficulty responding to slow or incremental changes because they do not see or directly experience the process themselves. Recognizing incremental change becomes a matter of measurement and belief. Even if people believe in the incremental change, they often also believe there is little they can do to mitigate the changes. Although conventional management strategies treat social-ecological systems as linear and predictable, they are not (Gunderson & Holling, 2002).

Complex adaptive systems can exist in more than one kind of regime and they may have different identities in each. Their function, structure, and feedbacks vary across scale (Holling, 1973). Disturbances or sudden shocks can push these systems across thresholds into different regimes. For example, a lake that has clear water and abundant fish but also an increasing nutrient load may cross an oxygen threshold, meaning it could go from being aerobic to anaerobic to take on a new identity as a murky, algae-dominated water body with no fish.

We cannot predict when complex adaptive systems will cross thresholds or what the exact response will be to human and natural disturbances; but, resilience theory provides insight into why change occurs and how social-ecological systems change over time (Gunderson & Holling, 2002). By understanding how and why the system as a whole is changing, we are better able to develop an ability to work with change, instead of being a victim of it (Gunderson & Holling, 2002).

Diversity plays an important role in the maintenance of a resilient system (Srivastava & Vellend, 2005). Not only is it important that there are more species in the landscape, but also the types of roles each species performs are significant. Functional and response diversity are distinguished in resilience theory (Walker & Salt, 2006). Functional diversity refers to the roles groups of organisms play within a system. For example, in one ecosystem there are some species that eat flying insects, others focus on caterpillars, thus controlling herbivory on the ecosystem's plant species.

For response diversity, there are mixtures of species within each functional group that offer the same service but deliver that service in slightly different ways (Walker & Salt, 2006). What is essential is that more than one species carries out a particular function and that the species from the same functional group each have a different response to disturbances (Gunderson & Holling, 2002). In the case of several aphid-eating species, if the different species each respond in various ways to changes in temperature, pollution, and disease, the probability is high that some will survive the changes and continue to control aphids.

This aspect of diversity, called redundancy, is critical to a system's resilience (Srivastava & Vellend, 2005). Unfortunately, redundancy may be a limiting factor in functional groups that maintain natural and man-made ecosystems because redundancy is perceived to be inefficient. Here, redundancy becomes very important because redundancy increases an ecosystem's response diversity, which in turn increases the resilience of its performance (Srivastava & Vellend, 2005). Closely associated is economic diversity: diversifying one's business so that there are multiple ways to respond to changes in the economy and still make a profit. This is central to individuals trying to make a living in an unpredictable economy. By building redundancy into one's business a person can protect the resilience of their business in a time of economic downturn. For example, if the price of cattle goes down right when a rancher goes to market, the operation will not crumble financially if the rancher has diversified the business. This could be done, for instance, by selling crops or offering hunting or trail riding tours on the land.

In order to assess the degree to which resilience theory is incorporated into prevalent land management frameworks in the United States, I analyzed Conservation Planning and Holistic Management for philosophical and practical applications in which decisions addressing interactions between society, ecosystems, and the economy are made in the context of a holistic systems perspective. Then, I reviewed the frameworks for evidence of explicit guidelines encouraging landowners to monitor for change. Finally, I analyzed Conservation Planning and Holistic Management for philosophical and practical applications in which decisions are made based on the knowledge that

diversity is important to ecosystems and society. Specifically, I looked for evidence that redundancy was important to the frameworks.

## CONSERVATION PLANNING AND HOLISTIC MANAGEMENT

In the United States, several decision-making frameworks for private land management are promoted by federal and non-governmental agencies. Two such frameworks are the United States Department of Agriculture Natural Resource Conservation Service's (NRCS) Conservation Planning and Allan Savory's Holistic Management. NRCS started as the U.S. Soil Erosion Service in 1935 in response to the Dust Bowl (USDA-NRCS, 2012). Today, it is the primary federal agency advising private landowners on natural resource management. The Conservation Planning process is a core component of many NRCS extension efforts and focuses on helping landowners decide the best ways to improve the productivity, sustainability and profitability of their operations (USDA-NRCS, 2012).

In contrast, what started as the Savory Grazing Method in Africa in the 1970s developed into the Holistic Management framework of today (Savory & Butterfield, 1999). Holistic Management is defined as a decision-making process that gives people the ability to plan the future they want while ensuring that available resources can sustain their goals (Savory & Butterfield, 1999). In 1979, Allan Savory brought the Holistic Management framework to the United States, and it is currently promoted by the private organizations Holistic Management International and The Savory Institute, which address land management and holistic living internationally (Savory & Butterfield, 1999). These two frameworks are introduced in greater detail here.

The primary influence on the early development of the NRCS was the father of soil conservation, Hugh Hammond Bennett (USDA-NRCS, 2011a). During the Dust Bowl in the mid-1930s in the United States, the crisis of losing valuable topsoil from agricultural lands in the Midwest was at its peak. Bennett's concern led to the establishment of the Soil Erosion Service, later becoming the Soil Conservation Service in 1935, which helped landowners in the United States restore their lands by planting various perennial species to hold the soil in place (USDA-NRCS, 2011a). Hugh Hammond Bennett saw the land and human populations as interconnected systems. Thus, the Soil Conservation Service taught farmers how to reap a harvest and protect the land at the same time (Bennett, 1936).

To reflect the wide range of the agency's concerns, the Soil Conservation Service's name was changed in 1994 to the Natural Resources Conservation Service (USDA-NRCS, 2011a). Today, NRCS has a mission of conserving the nation's soil and water resources, and working with farmers and ranchers, local and state governments, and other federal agencies to sustain healthy and productive working landscapes. NRCS is guided by the philosophy that private lands need to be conserved and restored so they are more resilient to challenges like climate change. Furthermore, NRCS espouses that science and technology are critical to good conservation (USDA-NRCS, 2011a).

Conservation Planning is defined as a problem solving and management process for natural resources that integrates economic, social, and ecological factors (USDA-NRCS, 2011a). Individual landowners or groups can request Conservation Planning assistance from NRCS to assess their natural resources and goals for land management.

When selected by NRCS for Conservation Planning assistance, landowners usually receive financial help. Under the Conservation Security Program (CSP) created in the 2002 Farm Bill, NRCS utilizes available funds to provide incentives for farmers to pursue conservation and help pay for conservation practices (Johnson, 2004). Under the CSP, NRCS pays farmers to conserve at least one resource on a portion of their farms. Currently, funds are more limited and NRCS has instituted strict eligibility criteria as to which landowners will receive funds.

In contrast to NRCS, Holistic Management arose in response to desertification of rangelands in Africa (Savory, 1983; Savory & Butterfield, 1999). Born out of his passion for big game, Allan Savory worked for the Northern Rhodesian (Zambian) Game Department in Africa in the early 1950s (Savory & Butterfield, 1999). At that time Savory approached biodiversity conservation as the protection of select animal and plant species, believing that the removal of indigenous people from their lands was the best way to protect the animals and plants characterizing the aesthetic beauty of Africa (Savory, 1991).

But, over time Savory noticed that degradation was still occurring even though the people could no longer impact these protected ecosystems. For example, when the colonial governments of Northern Rhodesia (Zambia) and Southern Rhodesia (Zimbabwe) wanted to turn the Luangwa Valley in modern Zambia and the lower Zambezi Valley of modern Zimbabwe into national parks, the governments removed the people living in those areas (Savory & Butterfield, 1999). Shortly after the removal of people, vegetation cover in both parks began to deteriorate. Seeing lands degrade without

human influence caused Savory to question why logically-correct solutions were not working. These observations drove Savory away from equilibrium ecology toward new ideas about dynamic and unpredictable ecosystems. After years of research, including conversations with policy makers and indigenous people, Savory discovered that the spread of deserts and human impoverishment was related to the way people were making management decisions, which was compromising the sustainability of natural resources.

The idea of holism was central to forming the foundation for Holistic Management. South African philosopher Jan Christiaan Smuts influenced Savory in this regard (Savory & Butterfield, 1999). Smuts called for a shift in paradigms about science during the late 1920s. He claimed that all organisms feel the force and shaping effects of the environment as a whole and that humans are one with nature (Savory & Butterfield, 1999; Smuts, 1926). Moreover, Smuts viewed the world as a conglomeration of flexible, changing patterns, which he called wholes. This idea of whole systems enabled Savory to begin to develop a framework for management and decision making, but more knowledge was necessary to understand the ways to reverse environmental deterioration (Savory & Butterfield, 1999).

As Savory observed land degradation in Africa, Europe, and North America, he learned key insights that solidified the foundation of Holistic Management. Savory discovered that environments occur on a continuum from tropical (i.e. non-brittle) to very dry (i.e. brittle) depending on humidity distribution during the year and how fast dead vegetation breaks down. Brittle or non-brittle, environments respond differently to the same influences (Savory & Butterfield, 1999). After observing wild and captive herding

species behavior, he concluded that high numbers of large, herding animals, concentrated and moving as they naturally do in the presence of pack-hunting predators are vital to sustaining the health of brittle lands. Originally people thought large herds destroyed brittle environments, but according to Savory, it is not about the number of animals that damages land, but rather the amount of time plants and soils are exposed to the animals (Savory & Butterfield, 1999; Voisin, 1988). From these insights, Savory and Butterfield (1999) determined that conventional decision-making processes were flawed, so they began to design their own process (Savory & Parsons, 1980).

In the mid-1970s, Savory began testing the Savory Grazing Method, known today as Holistic Management, along with Stan Parsons, the founder of Ranching for Profit (“Ranching for profit,” 2011; Savory & Parsons, 1980). Parsons’ role with Holistic Management was to test the economic and biological validity of this framework (“Ranching for profit,” 2011). Out of Parsons’ research position came a 13-year friendship with Savory where they worked with clients in South Africa to determine if this holistic approach to land management, combining grazing management and animal husbandry with business management, was feasible (“Ranching for profit,” 2011). In 1979, Savory and Parsons brought Holistic Management to the United States where there was high demand for their expertise in rangeland management (“Ranching for profit,” 2011). Then, in 1983 Savory and Parsons parted ways when Stan Parsons opened Ranch Management Consultants and began teaching Ranching for Profit schools where Parsons taught ranchers how to build a sustainable business (“Ranching for profit,” 2011). From

my interviews I discovered that ranchers working with NRCS in Humboldt County were more familiar with Parsons than with Savory.

### Case Study Sites

In the United States, 59% of land is privately owned and 47% of that private land is grazed land (USDA-NRCS, 2003). There are approximately 634 million acres of non-Federal grazing land in the United States with rangeland comprising 401 million acres (USDA-NRCS, 2003). In California, of the total 31.5 million acres of grazing land, 15 million acres are privately owned (Nuzum, 2005). In this study, I compared the use of the Conservation Planning and Holistic Management frameworks for land management in Humboldt and San Luis Obispo Counties in California.

With an area of 2.3 million acres, Humboldt County, California is comprised of beautifully rugged coastlines, dense coastal redwood forests, pastures, inland oak woodlands and mixed conifer forests (US Census Bureau, 2010). Of the 2.3 million acres, 80% is forestlands, protected redwoods, and recreational areas (US Census Bureau, 2010). In a county with a year-round temperate climate, winters can be 32 degrees Fahrenheit or lower on average, but inland temperatures can get much colder. The highest temperature recorded on the coast is 80 degrees Fahrenheit, but the mountain valleys commonly experience temperatures of 100 degrees Fahrenheit or more (“NWS Eureka,” 2011).

Annually, the average rainfall in the driest areas is 40 inches, in contrast to zones of heavy precipitation averaging 100 inches (“NWS Eureka,” 2011). The terrain is too

mountainous to be profitable for agriculture; however, ample winter rains provide ideal areas of lush forage for cattle grazing. There are a total of 487,000 acres of rangeland in Humboldt County, including uplands and bottomlands, of which 419,000 acres (86%) are privately owned (Northcoast Regional Land Trust, 2011). The county's population in 2010 was 134, 623, with the majority of the population living in metropolitan areas surrounding Humboldt Bay (US Census Bureau, 2010).

San Luis Obispo County is located on the central coast of California and encompasses over one million acres of rangelands, comprised of native pastures and forestland ("UCCE San Luis Obispo County," 2011). These rangelands cover almost half the acreage of the county, providing forage for livestock, space for oak woodland forests, and wildlife habitat ("UCCE San Luis Obispo County," 2011). The weather is mild year round, with average winter lows of 46 degrees Fahrenheit and average summer highs of 75 degrees Fahrenheit ("UCCE San Luis Obispo County," 2011). With a much drier climate than Humboldt County, the average annual rainfall for San Luis Obispo County is 20 inches ("The weather channel," 2011). The county's population in 2010 was 269,637 (US Census Bureau, 2010). This results in an average of 81 people per square mile as compared to Humboldt County's 37 people per square mile (US Census Bureau, 2010).

## METHODOLOGY

My interest in Humboldt and San Luis Obispo counties, and my choice to focus my field research here, were a matter of opportunity and convenience. I sought to ground my research by conducting interviews with ranchers, NRCS planners, and Holistic Management instructors. Since I currently live in Arcata, California and Humboldt County has a thriving ranching industry and an active NRCS office, it was convenient to conduct interviews here while attending Humboldt State University. I earned my bachelor's degree in Animal Science from California Polytechnic State University in San Luis Obispo, California, and the time spent there has provided me with important contacts. Specifically, my past professor, Robert Rutherford, is one of the two Holistic Management instructors in the state. He has been very active in extending Holistic Management in San Luis Obispo County.

Initially, while searching for a thesis topic, I was introduced to Richard King who works for the Natural Resources Conservation Service (NRCS) and is also trained as a Holistic Management instructor. To fill a gap in current research, he suggested that I compare and contrast Allan Savory's Holistic Management and NRCS's Conservation Planning frameworks. I decided to take on the challenge in hopes of generating useful research that can help move sustainable land management forward.

Through my analysis I sought to determine how Conservation Planning and Holistic Management are similar and different. I wanted to learn how these frameworks compare when analyzed using a resilience theory lens that addresses managing whole

systems, managing for change, and managing for diversity. Last, I wanted to discover if what the literature proposes reflects to what is actually being applied on the ground.

### Epistemology

Epistemology refers to the philosophy of how human beings come to know (Trochim, 2006). My research is situated in the epistemological tradition of postpositivism. As the core of my research is an analysis of primary and secondary documents, my thesis lends itself to a postpositivist, objective focus.

When positivism was proposed in the nineteenth century by Auguste Comte, “positive” meant collecting and validating factual knowledge by scientific methods (Mackenzie, 2011; Schweizer, 1998). At this point in time, true, factual knowledge had been obscured by the power of the church and state. For proponents of democracy, it was very important to define unbiased and objective approaches for evaluating information to be used in decision making. Positivism contends that the purpose of science is to study what we can observe and measure, and knowledge beyond that is impossible (Mackenzie, 2011; Trochim, 2006).

One key focus of positivism is on eliminating all bias from research to provide accurate data and valid results. Today, positivism is critiqued due to its narrow focus on objectivity and the utilization of the scientific method as a procedure for generating and validating objective scientific knowledge (Schweizer, 1998). Critics argue that there is no such thing as perfect, objective truth because a person professing that truth can never be completely unbiased. Furthermore, positivism as an epistemological framework also

declares that the researcher is the knowledge bearer and the research subject is an object to be studied. This assumption was designed to prevent bias from entering research by establishing distance between the researcher and research participants.

Postpositivism emerged as a critical response and rejection of the central tenets of positivism (Trochim, 2006). Postpositivists argue that all observation is imperfect and has error, and that theory can be changed (Trochim, 2006). Although postpositivists focus on science's version of reality rather than on reality itself, they are not concerned with only using the scientific method to develop truth in an effort to avoid bias (Fischer, 1998). Postpositivists assume that bias cannot be evaded. For instance, they believe that all observations are theory-laden and that people are inherently biased by their cultural experiences, world views, and other experiences that shape who they are. Objectivity is deemed a social phenomenon since no one person can see the world perfectly as it "really" is (Fischer, 1998; Trochim, 2006). Furthermore, recreated by postpositivists, the scientific method is founded on a "coherence" theory of reality that emphasizes the limited and time-space constrained character of knowledge (Fischer, 1998). Some may argue that this weakens the objectivity of the research developed by postpositivists, but this research does not lack rigor (Trochim, 2006). Postpositivists apply rigorous, multi-methodological approaches through which a wide range of both qualitative and quantitative information is taken into account (Fischer, 1998).

In approaching my research, I have attempted to acknowledge my biases, inviting transparency to guide my understanding of what I know and what I learn through data collection and document analysis. A primary benefit of a postpositivist epistemology is

that I was free to form a bond of trust with the ranchers I interviewed and yet maintain an objective mindset while analyzing the literature. According to Anderson (2006), having the freedom to build trust with a research participant is one way to ensure that accurate information is obtained. Although she utilized an indigenous epistemology in her example, Anderson demonstrates the value of trust between researcher and research participant. Anderson (2006) stressed that in order to restore ecosystems and manage natural resources in California it is essential to glean information from Native American elders (or in my case, ranchers who have observed and tended the land for generations). In order for this traditional ecological knowledge to be accumulated, a bond of trust must be formed between the researcher and the elders. If research participants feel objectified, they will be less willing to share their valuable knowledge.

As I approached my research from a dominant, knowledge-producing institution—namely a California State University—including ranchers' first-hand experience provided rich insight into the long-term application of Conservation Planning and Holistic Management.

### Methodology

Methodology is defined as the practice of how we come to know (Trochim, 2006). For my thesis, I used a case study methodology in order to compare and contrast Conservation Planning and Holistic Management. A case study provides a way for researchers to apply theoretical analyses to a case or multiple cases (Wholey, Hatry, & Newcomer, 2010).

I studied private land management in Humboldt and San Luis Obispo counties under the influence of Conservation Planning, Holistic Management, or both. As I analyzed how the two frameworks were applied in these two cases, I determined what was different and similar about them, and the degree to which they encourage management practices that are expected to increase ecological resilience.

A case study is defined in terms of its theoretical orientation, where the emphasis is placed on understanding processes alongside their other contexts (Cassell & Symon, 2004). My theoretical framework, resilience theory, informed and organized my data in terms of managing land for future resilience (Cassell & Symon, 2004). The information gathered by utilizing resilience theory not only produced fascinating details about private land management, but also defined the broader significance of my research (Cassell & Symon, 2004).

Case studies are conducted to incorporate the knowledge and perspectives of participants in the case under study (Tellis, 1997). This is a key aspect of my analysis since I included the knowledge of ranchers, planners, and instructors utilizing the frameworks. Also, common to case study research is the use of multiple methods (Cassell & Symon, 2004). I used multiple methods for my research, document analysis and semi-structured interviews, to have a deeper understanding of the ways Conservation Planning and Holistic Management promote sustainable resource management for the long term.

## Methods

I employed a mixed methods approach for my thesis to improve the validity of my findings (Cassell & Symon, 2004). I focused on document analysis for the bulk of my research, and secondarily used semi-structured interviews with ranchers, planners, and instructors to ground my research. Since I am not an expert in either Conservation Planning or Holistic Management, grounding my document analysis with reference to the actual experiences of ranchers, planners, and instructors helped substantiate my claims for the ways the frameworks could be improved to enhance landowners' awareness of mechanisms for increasing the resilience and sustainability of private lands. In order to compare and contrast documentation on Conservation Planning and Holistic Management, I gathered data from multiple sources including relevant textbooks, handbooks, and official documents from governmental websites. Many of these documents were recommended by professors, planners, and instructors familiar with one or both of the frameworks.

I first analyzed the frameworks side-by-side, describing the similarities and differences I found. I used NRCS's National Planning Procedures Handbook as a primary guide to Conservation Planning and Savory and Butterfield's (1999) text as a main guide to Holistic Management. Following that analysis, I set up a framework from resilience theory using three primary tenets of resilience—managing whole systems, managing for change, and managing for diversity—as indicators of resilience. I utilized the three tenets to search the documents for references to behaviors or guidance in land management that

encouraged managing whole systems, adaptation to change, and managing for diversity. This analytical framework is discussed in more detail below, including a summary of what each tenet is and how I used them to analyze Conservation Planning and Holistic Management.

My interview data came from semi-structured interviews with five ranchers, two Holistic Management instructors, and two NRCS planners. Interview results were used to confirm or challenge findings from the document analysis. All participants in this research were selected based on snowball sampling. I received recommendations from Holistic Management instructors and NRCS planners for potential rancher participants living in Humboldt and San Luis Obispo Counties. I then located participants through internet searches, email communication, and telephone calls. My original contact with the NRCS Ecologist from Petaluma, California was a crucial connection for me because the ranchers knew him personally and therefore granted me interviews on his recommendation. To narrow the scope of potential types of land management, I selected beef cattle production ranchers who utilized Holistic Management or Conservation Planning to make decisions for their land. Interviews were conducted at the ranch or office of the participant, or the Agricultural Center in Eureka, California, and lasted about one hour each.

In San Luis Obispo County, I interviewed one Holistic Management instructor in San Luis Obispo, California and one NRCS District Conservationist in the Templeton, California NRCS office (this NRCS office serves San Luis Obispo County). For Humboldt County, I interviewed a Rangeland Specialist in the Eureka, California NRCS

office. Since no Holistic Management instructors reside in Humboldt County, I interviewed the second Holistic Management instructor from Petaluma, California (also the NRCS Ecologist mentioned above). I interviewed six ranchers: two ranchers using Holistic Management in San Luis Obispo County, two ranchers using Conservation Planning in Humboldt County, and two ranchers from Humboldt County who used both frameworks. Interviews were conducted face-to-face in a convenient location for the participant and they lasted about an hour and a half each.

For each interview I asked participants up to 25 questions. Questions focused on ranchers', planners', and instructors' use and opinions of the frameworks and on the degree to which the three tenets of resilience were integrated into their management. Appendix A contains lists of interview questions asked of ranchers, planners, and instructors.

After transcribing each interview, I re-read through the interview answers searching for common themes. During that process, I also looked for and coded responses that indicated how the frameworks incorporated the three tenets of resilience theory. I created a Microsoft Excel spreadsheet to document and organize my research findings. From the spreadsheet I easily found useful quotes to support arguments in the Results and Discussion chapter of my thesis.

In the following Results and Discussion section, the frameworks are compared and contrasted based on their key components. Then, there is a brief presentation of interview results, which provides insight into how active land managers apply each framework. The last section is a detailed discussion on how each framework addresses

the three tenets of resilience: managing whole systems, managing for change, and managing for diversity.

## RESULTS AND DISCUSSION

Conservation Planning and Holistic Management are dynamic frameworks for land management. Both include prescribed process steps intended to help the landowner to achieve more sustainable land management (Table 1).

Table 1. Summary of Conservation Planning and Holistic Management steps.

<b>Conservation Planning</b>	<b>Holistic Management</b>
1. Identify Problems and Opportunities	1. Whole Under Management
2. Determine Objectives	2. Holistic Goal
3. Inventory Resources	3. Ecosystem Processes
4. Analyze Resource Data	4. Tools for Managing Ecosystem Processes
5. Formulate Alternatives	5. Testing Guidelines
6. Evaluate Alternatives	6. Management Guidelines
7. Make Decisions	
8. Implement the Plan	7. Planning Procedures
9. Evaluate the Plan	8. Feedback Loop

Conservation Planning is a program that helps “reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damages caused by floods and other natural disasters” (USDA-NRCS, 2012). According to the NRCS, Conservation Planning is a problem solving and management process for natural resources that integrates “economic, social, and ecological considerations to meet private and public needs” (USDA-NRCS, 2006, p. 6). The process is intended to help landowners make sustainable land management decisions resulting in public benefits such as “enhanced natural resources that help sustain agricultural productivity and environmental quality” (USDA-NRCS, 2012). These decisions are made through a

planning process focused on landowners and the resources they manage (USDA-NRCS, 2006).

In carrying out Conservation Planning, NRCS staff act as planning consultants to landowners. After landowners are chosen by NRCS to receive assistance, planners conduct research on the landowner's property, which includes aerial photographs, climate and watershed information, historical background, among other information. Also, planners design a map with soil characteristics and boundaries intended to help the landowner make informed decisions. Then, planners visit the landowner's property to identify and document the landowner's natural resource problems, concerns, and opportunities (USDA-NRCS, 2006). While noting problems, natural resource, economic, and social factors are considered (USDA-NRCS, 2006). Since an NRCS planner's goal is to determine potential approaches to addressing a landowner's resource problems, how the planner defines the problems guides the entire planning process.

After identifying the natural resource problems, the planner documents the client's objectives. Landowners describe the desired future conditions of the planning area, including preferred resource uses, decreased resource problems, and enhanced ecological protection (USDA-NRCS, 2006). The objectives may be reviewed and modified during the first phase of Conservation Planning. During the initial site visit, the planner also conducts an inventory and maps the landowner's infrastructure. As a part of this process, the planner records the location of areas in which the landowner would like to test new practices like fencing or gates. In addition, planners collect natural resource, economic, and social information about the landowner's land, which includes an

inventory of soil, water, air, plants, animals, existing crops, livestock type, and available equipment (USDA-NRCS, 2006). This information helps planners to determine the existing resource conditions and to identify problems and opportunities.

Once the planner has assessed the property and considered the landowner's desires, the planner will propose existing resource concerns, which are based on NRCS Quality Criteria. NRCS follows specific Quality Criteria developed by the Regional Water Quality Control Board (RWQCB) with regard to beneficial uses of water for each major basin in the state (Cal/EPA, 2011; USDA-NRCS, 2006). For example, if a watershed has total maximum daily load problems (TMDL) then when NRCS assists landowners they focus on helping develop plans to reduce sediment and design erosion controls. If Quality Criteria are not being met then the NRCS planner deems the resource vulnerable to continued degradation (Cal/EPA, 2011). After this process, the planner and landowner agree upon problems, opportunities, and objectives.

After assessing the landowner's property and goals, the planner analyzes the collected data to determine if current resource conditions are acceptable. Working with the landowner, the planner then formulates alternatives that meet the landowner's objectives while solving identified problems and preventing additional problems from occurring (USDA-NRCS, 2006). Alternatives may include terraces, dams, crop residue management, flood-proofing, easements, or zoning and the alternatives are formulated with the cultural, social, ecological, and economic conditions of the planning area in mind (USDA-NRCS, 2006). At this point, planners develop a list of practices to help the

landowner to achieve his or her goals and a list of practices to apply to resolve resource concerns (USDA-NRCS, 2006).

Next, the planner assesses the potential economic, ecological, and social effects of each alternative (USDA-NRCS, 2006). The alternatives are compared to benchmark conditions (i.e. current conditions of the land) to gauge their likely overall effectiveness in rectifying problems and meeting NRCS's Quality Criteria and the landowner's objectives. After the alternatives are presented, the landowner decides what areas to address, depending on available resources for implementation. Once the landowner decides on an alternative, the planner prepares the necessary documentation. The planner creates a final Conservation Plan to match the agreed-upon alternatives.

Once the Conservation Plan is finalized, the landowner implements the plan under contract with NRCS. Planners provide technical assistance for implementing conservation practices and obtaining needed permits, funding, land rights, surveys, final designs, and inspections for structural practices (USDA-NRCS, 2006). Practices implemented with technical assistance from NRCS are installed according to NRCS standards and specifications. NRCS contends that clients should have enough information at this point to implement, operate, and maintain their Conservation Plan. Occasionally plan revisions may be approved by NRCS.

To complete the process, the planner monitors the plan to ensure clients are achieving the formulated objectives (USDA-NRCS, 2006). For this process to work, the planner stays in contact with the landowner to check if results are meeting the ecological,

economic, and social objectives as well as solving the landowner's initial problems (USDA-NRCS, 2006).

In contrast, Holistic Management is defined as a decision-making process that gives people the ability to plan the future they want while ensuring that available resources can sustain their goals (Savory & Butterfield, 1999). Proponents argue that the Holistic Management model can be used to manage a farm, a city's water supply, one's personal life, a corporation, or any organization. It can also be used to determine the root cause of problems, assess policies, and make research more applicable to management needs (Savory & Butterfield, 1999). To compare Holistic Management to Conservation Planning, only those elements of Holistic Management that apply to private land management were considered.

The Holistic Management framework provides landowners with a systems paradigm that asserts all ecosystems are interconnected and people are a part of ecosystems. The framework helps landowners define what their goals are, formulate decisions, and test those decisions before they are made. Land managers are cautioned to take a conservative approach and assume their approach will require revision. If monitoring the implementation practices shows that the approach is not working as expected, the plan is revised to address the unexpected outcomes.

To learn about Holistic Management, a landowner might take a university class, attend workshops, contact a Holistic Management instructor, purchase a handbook, or do a mixture of these. However, only the information provided in the Holistic Management handbook is considered for this analysis. In the beginning of the handbook, the

landowner reads and learns about four key insights used to underpin the framework for decision making: 1) A holistic perspective is essential in management; 2) Environments may be classified on a continuum from tropical (i.e. non-brittle) to very dry (i.e. brittle) depending on humidity and how quickly dead vegetation breaks down; 3) In dry environments, high numbers of herding animals, concentrated and moving the way they would in the presence of pack-hunting predators, are vital to the health of the lands; 4) Overgrazing is due to the time plants are exposed to animals (Savory & Butterfield, 1999). After learning about these insights, the landowner defines the whole being managed (Savory & Butterfield, 1999). Defining the whole encompasses the identification of who the decision makers are, what physical resources the landowner has (e.g. land, buildings, equipment, and people who influence or are influenced by the landowner's management), and the money available or that can be made from the existing resources (Savory & Butterfield, 1999). During this step, the handbook emphasizes focusing solely on the big picture of what is being managed.

Once finished defining the whole under management, landowners formulate a holistic goal, which informs every significant decision made in the Holistic Management process. A holistic goal includes the objectives of the landowner and is written in three parts (Savory & Butterfield, 1999):

- 1) Quality of life: What people really want and what they want to accomplish together.
- 2) Forms of production: What people need to produce to create their quality of life and to manage an entity.

- 3) The future resource base: What the resource base must be like far into the future to sustain the forms of production specified.

After defining the holistic goal but prior to considering what decisions to make, the landowner learns about four fundamental processes that drive all ecosystems on earth: the water cycle, the mineral cycle, solar energy flow, and community dynamics (Savory & Butterfield, 1999). The holistic goal is founded on these four ecosystem processes. The water cycle, mineral cycle, and solar energy flow align with standard scientific knowledge. Community dynamics, on the other hand, refers to the never-ending development of communities and encompasses collaboration (i.e. symbiosis), complexity of systems, stages of change, underground biological activity, biodiversity, and succession (Savory & Butterfield, 1999). Knowing how ecosystem processes work enables the landowner to understand the inherent complexity of the environment that sustains human life (Savory & Butterfield, 1999).

Once the landowner learns about the earth's processes, tools are provided for managing those processes. Savory and Butterfield (1999) defined anything that enables humans to alter an ecosystem in order to enhance or sustain human life as a tool. In the handbook, the authors discuss eight specific tools: human creativity, money and labor, technology, rest, fire, grazing, animal impact, and living organisms. Money and labor are defined as one tool because neither can be used except through another tool (Savory & Butterfield, 1999). Human creativity and money and labor bracket all the other tools because neither of them can be used on their own to alter ecosystem processes, and one or both are always required in the use of the other tools. Overall, this section of the

framework describes what effects each tool can produce, informing the landowner of the ways to manage ecosystem processes for the future.

Here, two of the more controversial tools—rest and animal impact—will be discussed in detail. Rest is defined as rest from major physical disturbance mainly applying to plants and soils (Savory & Butterfield, 1999). Partial rest occurs when large groups of livestock displaying calm behavior are dispersed on a piece of land and rarely bunch together due to the lack of pack-hunting predators. This form of rest can be found on most rangelands, forests, and national parks where a large portion of the plants and soil surface remain undisturbed regardless of animal presence and grazing. Total rest occurs when all disturbances are removed from a piece of land for a substantial amount of time (Savory & Butterfield, 1999). Using total rest is a common way land management strategies approach restoration on rangelands because ecosystems under management are perceived to operate in equilibrium. The science of plant ecology assumes that plant communities, if undisturbed, progress through a process of succession to a climatic climax or equilibrium state. Thus, total rest would allow vegetation to regrow undisturbed and to reach its climax state. Savory and Butterfield (1999) argued that, depending on an ecosystem's climate and the land manager's goals, rest used in conjunction with the animal impact tool is the best way to restore rangelands.

Animal impact refers to hooves compacting soil, trampling breaking up soil, and animals returning nutrients to the soil through dung, urine, and crushed plants (Savory & Butterfield, 1999). Savory argued that time, as opposed to animal numbers, is the critical factor in trampling to increase the health of the land (Savory & Butterfield, 1999). He

also stated that the number of animals on a piece of land (i.e. stock density) and their behavior (i.e. herd effect) determine whether the results on the land are positive or negative. For example, a high concentration of herd animals bunched or being driven to migrate over a regulated amount of time creates the type of impact needed to break up soils in a brittle environment (Savory & Butterfield, 1999). Protecting soils for the long term requires heavy trampling over a short period to establish plants and litter cover (Savory & Butterfield, 1999). But, trampling that endures for too long can cause damage to plants and soils.

In order to choose a tool to use for altering ecosystem processes, or to determine if an action should be taken, the landowner uses seven questions to test a potential decision for its economic, environmental, and social soundness relative to the holistic goal. These questions are listed in Table 2.

Table 2. Holistic Management's seven testing questions.

1. Does this action address the root cause of the problem?
2. Does this action address the weakest link in the situation? <b>Social:</b> Could this action, due to prevailing attitudes or beliefs, create a weak link in the chain of actions leading toward your holistic goal? <b>Biological:</b> Does this action address the weakest point in the life cycle of this organism? <b>Financial:</b> Does this action strengthen the weakest link in the chain of production?
3. Does this action provide a greater return, in terms of time and money spent, than other actions?
4. Which enterprises contribute the most to covering the overheads of the business (if choosing among enterprises)?
5. Is the energy or money to be used in this action derived from the most appropriate source, and will it be used in the most appropriate way, in terms of your holistic goal?
6. Will this action lead you toward or away from the future resource base described in your holistic goal?
7. How do you feel about this action now? How will this action affect your quality of life and what will it do to that of others?

When these questions are answered, they enable the landowner to see the potential effects of a decision on the whole being managed.

After deciding on the tools to use and the actions to take, the Holistic Management framework provides the landowner with management guidelines (Savory & Butterfield, 1999). Acting as instruction books for using the tools to manage ecosystem processes, the management guidelines are a culmination of what Savory and his team have learned through many years of experience. The first three guidelines are general principles for life: learning and practice- shifting your paradigms; organization and leadership- creating an environment that nurtures creativity; and marketing- developing a strategy in line with the holistic goal. The first guideline, learning and practice, covers the challenges of managing holistically. Savory and Butterfield (1999) claimed that the

landowner will not understand Holistic Management until experience is gained using the framework. The other five guidelines apply specifically to land management: time- when to expose and re-expose plants and soils to animals; stock density and herd effect- using animals to shape the landscape; cropping- practices that more closely mimic nature; burning- when and how to burn; and population management- look to age structure rather than numbers, diversity rather than single species. These guidelines offer extra support to the landowner because the Holistic Management handbook provides examples of each guideline that the landowner can learn from.

The next section of the Holistic Management framework involves three planning procedures: holistic financial planning, holistic land planning, and holistic grazing planning. These planning procedures are additional instruction on how to use the tools for managing ecosystem processes, how to best organize a labor force, and how to manage capital. In brief, holistic financial planning details the annual planning of business finances, holistic land planning discusses the layout of facilities and infrastructure on land, and holistic grazing planning discusses the management of grazing animals (Savory & Butterfield, 1999).

The last thing the landowner does when using Holistic Management is evaluate the decisions made and actions taken. Evaluation is conducted through a theoretical feedback loop and is characterized by four parts: plan, monitor, control, and re-plan (Savory & Butterfield, 1999). The loop signifies that Holistic Management is a continuous planning process based on the assumption that decision makers are wrong, and at any moment a plan may need to be revised (Savory & Butterfield, 1999).

Monitoring the effects of decisions occurs daily in order to catch planning mistakes and address them as needed. If a plan is deviating from the path toward the holistic goal, decision makers must take action to thwart the deviation. In some cases, events are beyond the landowner's control and re-planning is necessary.

### Compare and Contrast

In comparing Conservation Planning and Holistic Management, some major similarities and differences stand out. Both are approaches to land management, and ranching in particular, but the similarity almost ends there. Conservation Planning is a natural resource problem solving and management process, and Holistic Management is defined as a decision-making process that gives people the ability to plan the future they want while ensuring that available resources can sustain their goals (Savory & Butterfield, 1999; USDA-NRCS, 2006). Conservation Planning is specific and limited, while Holistic Management is broadly applicable.

The Conservation Planning framework is a program that landowners sign on to, NRCS creates the plan with input from the landowner, landowners implement the plan with NRCS subsidies, and NRCS monitors the landowner's progress. In contrast, Holistic Management is a framework for decision making that requires landowners to take on the cost of training and implementation themselves.

Since NRCS offers Conservation Planning as a method to assist landowners, planners are paid to walk landowners through the process and to help them make the best conservation decisions (USDA-NRCS, 2006). As NRCS is a governmental agency with

numerous resources, they are capable of giving their clients extra support. Monetary support is a primary incentive for landowners to create and implement a plan with NRCS.

For instance, during an interview, one NRCS planner said:

By utilizing NRCS it certainly saves landowners money, and if they pursue a contract it certainly is saving them money. We are paying 50% to 75% of a project if they have the resources like labor already on their property, and sometimes we are paying for the whole thing.

On the other hand, landowners using Holistic Management do not receive such support for free. For example, Holistic Management users keep track of their paperwork, formulate their goals and ways to achieve them, test their decisions, and pay the total cost for plans they implement. As a private organization without the infrastructure to support their clients like NRCS, Holistic Management does not subsidize and complete the work for landowners. People who want to attend workshops for Holistic Management can get some assistance, but landowners have to pay for training and additional help. Although one would gather that Holistic Management costs a lot of money and time, Holistic Management ranchers I interviewed suggested otherwise. When asked if it costs more to use Holistic Management than other decision-making frameworks, one rancher responded:

It costs more time, but makes more money. It does not cost more...the time you take to make a decision, if you take five extra minutes to five extra days to make a really good decision, it's going to pay huge dividends. No, it's probably the most important asset we have.

Another rancher responding to the same question said:

It costs much less because you have the tools to run it through the model before you ever have to go out and build a fence or move a cow. [Holistic Management] is much more financially sound.

Clearly, NRCS as a major federal agency can provide major financial and physical assistance to landowners, whereas Holistic Management is incapable of offering this level of service; however, proponents of Holistic Management do not seem to think that matters much. In fact, some would argue NRCS's financial incentives are not worth it.

During an interview, one Holistic Management instructor said:

Now one of the things that we know is that there are monies available through federal programs which will help you to pay for those improvements. Those monies always come with strings. In some cases these strings are so severe you might have to allow access to agencies to make sure you are doing what you are supposed to be doing. In a lot of cases they require a significant amount of recording and paperwork which costs money. If your time is worth \$100 or \$200 bucks an hour and you spent two hours filling out the paperwork for that free money, it's not free.

One philosophical similarity between the frameworks is viewing the Earth as one ecosystem. The Conservation Planning literature states that "the Earth is one ecological system, embodying all the smaller subsystems into one interconnected system" (USDA-NRCS, 2006, p. 30). This literature characterizes ecosystems as "interdependent, changing, and cycling," clearly articulating the understanding that ecosystems are unpredictable and interconnected (USDA-NRCS, 2006, p. 30). Similarly, Savory and Butterfield (1999) argued that "people fail to remember that the boundaries that define an ecosystem are artificial," so the authors refer to "one ecosystem, which encompasses everything on our planet and its surrounding atmosphere" (p. 101).

Both frameworks emphasize that all systems are interconnected, but the difference lies in who receives this knowledge. In Conservation Planning, NRCS staff are educated about managing land as whole systems, while in Holistic Management

landowners using Holistic Management learn about whole systems from the handbook and implement their plans with this knowledge in mind. Holistic Management is designed so landowners only need the handbook to start making decisions on their own. But, Conservation Planning is intended for planners to use, who then assist landowners in making decisions. For instance, one NRCS planner said:

I would really like to see NRCS managers train landowners into the Conservation Planning process, so that NRCS is not doing it for you. Explaining the steps to the client would generate a better long-term plan. These are the parts that make it yours.

This difference of NRCS doing all the work for the landowner versus Holistic Management users doing the work on their own is (or may be) partly due to the lack of infrastructure and limited instructors to do educational work for Holistic Management. But, this difference is also a result of the inherent nature of the frameworks. Holistic Management is a framework that requires landowners to be self-reliant and to learn the interconnections between systems and apply that knowledge while managing land. Conservation Planning, on the other hand, is intended to be a planning support system for landowners.

Landowner objectives and natural resources are central to both frameworks but Holistic Management had a broader focus. Conservation Planning focuses on the landowner's desired future conditions for the planning area and the landowner's needs and values for the use, treatment, and management of that area (USDA-NRCS, 2006). Similarly, Holistic Management focuses on the landowner's goals, but the emphasis is

not only on resources, it is on people and economic production as well as setting goals that account for the distant future.

In regard to a landowner's natural resources, Conservation Planning focuses on inventorying or collecting natural resource, economic, and social information about the planning area so planners can best define existing and potential problems. The primary emphasis is on natural resource data. Landowners using Holistic Management also gather data to define their available and potential resources. But, Holistic Management goes further by accounting for all individuals involved in decision making, the available physical resources, available money and money that can be generated from the resource base in the future. Landowners describe these resources when defining the whole they are managing, which emphasizes, yet again, Holistic Management's focus on whole systems. For Conservation Planning the planner collects, documents, and analyzes resource data and targets one decision maker for the property. In contrast, Holistic Management ensures that all individuals who make day-to-day decisions for the land are involved (Savory & Butterfield, 1999; USDA-NRCS, 2006).

Both frameworks evaluate options before implementing a decision. After analyzing the resource data, NRCS planners and landowners formulate and evaluate alternatives to then make decisions on which conservation treatments to implement (USDA-NRCS, 2006). The emphasis is on the current state of the landowner's natural resources and how alternatives will best meet the natural resource goals. Holistic Management has testing guidelines to ensure that landowners think through their decisions for economic, environmental, and social soundness prior to implementation.

Importance is placed on helping landowners think through potential outcomes of decisions, before the decisions are made. While the Conservation Planning approach assists landowners in general terms, in applying Holistic Management, landowners are given more guidance and are tasked to think through every decision with seven testing questions as seen in Table 2. For instance, one Holistic Management instructor, after looking at a flow chart of the Conservation Planning process commented:

The big question is how [does NRCS] make the decisions they do? If you were doing this holistically, those would be questions you ask, social weak link, society and culture, and those are questions that don't get asked...in this process.

Furthermore, Holistic Management offers management guidelines that shape the decisions landowners test because the guidelines give examples of other landowners' experiences with Holistic Management.

Both frameworks focus on monitoring decisions made, but Holistic Management is more thorough. For Conservation Planning, NRCS planners are encouraged to stay in touch with the landowner to check if results are meeting ecological, economic, and social objectives. Yet, monitoring the success of implemented plans is one area NRCS can improve upon. This is supported by one NRCS planner who, during an interview, said:

Where we are our weakest in our planning process is doing evaluations and monitoring, because there is always something else to be doing...In the ideal world you would have enough people to help everyone who wants a Conservation Plan, to follow up with them all, and re-plan with everyone. But that never happens.

After gathering information on the results, planners revise plans if there are unexpected results. But, implementation strategies dictated by the Conservation Plan may only be

revised with approval from NRCS. This is due to the contract landowners make with NRCS when accepting subsidies to implement a Conservation Plan. This results in Conservation Planning having a rigid structure, which can be problematic in a world where flexibility is necessary to counter or adapt to unpredictable change.

Landowners using Holistic Management monitor the effects of decisions made with the theoretical feedback loop: plan, monitor, control, and re-plan. Basically, landowners—under the assumption that they do not know the full effects of decisions made and that ecosystems are unpredictable—monitor for the first indications that implemented decisions are going awry. For example, one Holistic Management instructor clearly articulated the flexibility of Holistic Management when he said:

With Holistic Management, we implement the plan and the minute we see things going haywire, we get back together and create a new plan. We wouldn't feel obligated to stay with this plan.

If implemented decisions are deviating from their goals, landowners re-plan as needed. Landowners can be flexible in changing their plans whenever necessary since they monitor progress daily.

In order to test my findings from comparing the two systems, I interviewed several ranchers, NRCS planners, and Holistic Management instructors about Conservation Planning and Holistic Management. Of the nine participants interviewed, eight identified themselves as having had land management experience prior to using either Conservation Planning or Holistic Management. With the exception of one NRCS planner, all participants said that the framework they used did not cost more than other frameworks and was not expensive to use. All five NRCS participants commented that

landowners were fully involved in forming their Conservation Plan. Due to the self-taught nature of Holistic Management, total involvement by landowners in creating and implementing a management plan was expected.

One of the two NRCS planners explained that at one time NRCS encouraged landowners to participate in Holistic Management workshops before working with NRCS. He said that if landowners took these workshops they would get points, which would increase the likelihood of getting assistance from NRCS:

There used to be almost a requirement, not a requirement but it was advised for landowners to take certain classes like Allan Savory's classes before they worked with us. We'd actually give them points if they had taken a class. Now that's gone away. That was a while ago.

Even though all five NRCS participants acknowledged that Conservation Planning did not offer financial planning, four of the five participants said that Conservation Planning made landowners financially secure. In contrast, all four Holistic Management participants acknowledged that financial planning was included in the framework, though the two ranchers interviewed admitted to not using it as stringently as they could. Furthermore, all four Holistic Management participants said that Holistic Management made landowners financially secure.

Of the five NRCS participants, all had heard of Holistic Management prior to the interview. Conversely, of the four Holistic Management participants, only one instructor and one rancher had heard of Conservation Planning prior to the interview. Of the three ranchers interviewed for Conservation Planning, all three had attended Stan Parson's Ranching for Profit schools. Neither of the two NRCS planners mentioned Ranching for

Profit schools. None of the four Holistic Management participants mentioned Stan Parsons or Ranching for Profit schools.

Even though Conservation Planning is deemed a natural resource management framework, one NRCS planner and one NRCS rancher both commented that the Conservation Planning framework could be used to make decisions for all aspects of life. Both of these individuals had attended Holistic Management workshops in the past.

Two NRCS planners and one rancher stated that there was a stigma associated with Holistic Management. Similarly, one Holistic Management instructor and one Holistic Management rancher also mentioned this stigma in reference to what other ranchers and people thought about the Holistic Management framework. For instance, when asked if she thought there were ways Holistic Management could be improved, one NRCS planner said:

I don't see how you improve on that since it's like a religion. I don't think these people who have been on their land for a long time are doing stupid things with where they have gotten. There must be something to that. Cal Poly promotes it, there must be something to it...It sounded like one of those way out there things for the traditional land manager. I don't know if it still has that stigma.

On the other hand, when asked what his biggest challenge has been while training individuals on Holistic Management, one instructor said:

The new range scientist in the Animal Science department has advocated getting rid of Holistic Management as a required class in the range minor. Especially in California, there is a mode in academia that [Holistic Management] is all a bunch of nonsense; that it's not based in science.

This stigma also affected one Holistic Management rancher when he was first getting started with ranching. He said:

The best [ranchers] thought Holistic Management was nonsense and they had never heard of it. They thought I was a fool, and they tried to help me fail by giving me bad advice. I didn't fail because I limped along trying to use Holistic Management and the concept that it was a decision-making process, and you test the various things you were going to do.

Last, all ranchers, planners, and instructors for Conservation Planning and Holistic Management were asked what their perceptions were of the other framework and if they had critiques of the framework they were using. A variety of responses were given. Two NRCS planners, one NRCS rancher, and one Holistic Management instructor had suggestions for improving the Conservation Planning framework. First, one NRCS planner said:

There is nothing wrong with the planning process...can't think of a better way for the nine steps...It's within the parts of the Conservation Planning process...We are a little bit confined, but that has nothing to do with the planning process. We have constraints as a government agency.

The other NRCS planner suggested ways NRCS could improve when he said:

Biggest issue I had when starting with NRCS was inheriting a lot of plans that weren't well developed... the one thing I've noticed in other field offices and other planners is that we get so program driven and we chase that money so well that we forget what our objectives are. What we are supposed to be doing is we need to plan and that plan starts with the inventory... Spend as much time out in the field as possible.

One Holistic Management instructor who also works for NRCS as a planner stated:

I've come to believe that NRCS would be far more effective in helping landowners if they incorporated parts of the Holistic Management framework they currently do not have or use, and then focus on teaching landowners how to develop their own comprehensive plans that adequately include more than just environmental considerations. The NRCS could still provide its excellent technical assistance from its array of specialists, but the Conservation Plan it helps people develop would be

socially, financially, and environmentally sound rather than just environmentally sound.

On the other hand, of the nine participants interviewed, only the two Holistic Management instructors had suggestions for improving the Holistic Management framework. First, one stated:

A major criticism used to be the cost of attending the trainings. But the trainings are much less expensive than they used to be, and the two Holistic Management books virtually contain the vast majority (and more) of what people will learn in the various courses. The books are relatively inexpensive and are great references too. However, my experience is that most people won't pick up the book and figure it out by themselves... One criticism that I hear from people who go through training is that they can't get help from anyone nearby.

The other instructor said:

A critique would be that the platform upon which it rests is an acceptance of the [four key insights]. If you still believe that the world is made of parts, if you still believe that overgrazing is caused by too many animals, and if you still believe rest restores biodiversity, the framework doesn't really work. You have to get past that and that is a stumbling block in many realms because people don't get past that.

Clearly, the two frameworks are influential and, though they differ, are somewhat complementary. A key question for landowners operating in an increasingly uncertain and variable environment is to what degree do these frameworks help them to manage for the future and enhance the resilience of their lands and operations.

### Do the Frameworks Enhance Resilience?

Based on the literature review, I identified three key tenets or principles of resilience: managing whole systems, managing for change, and managing for diversity. I analyzed Conservation Planning and Holistic Management for philosophical and practical

applications where decisions are made applying these principles to address land management and the interactions between society, ecosystems, and the economy.

As articulated by NRCS, Conservation Planning is a natural resource problem solving and management process (USDA-NRCS, 2006). The focus is on conserving natural resources, which are only one part of whole systems. Yet, NRCS claims that the Conservation Planning framework is concerned with managing “complete systems, rather than just parts of systems” (USDA-NRCS, 2006, p. 7).

Though NRCS does not require planners to teach landowners whole systems management, the planning process encourages planners to maintain a systems perspective while assisting clients. For example, social, economic, and natural resource factors are considered by the planner while identifying problems and opportunities of the land (USDA-NRCS, 2006). Although there is no way to confirm this is actually occurring (it is a cognitive, not physical process), it appears to be a step by NRCS toward managing whole systems. After asking an NRCS planner if they approach land as a whole, interconnected system while creating a Conservation Plan, she commented that planners begin to register the interconnections between problems during the first steps of Conservation Planning. She said that problems are seldom going to be isolated, and as a planner gets more experienced the connections between problems are made more quickly. She gave the following example:

On rangelands people will say, “I have terrible ground squirrel populations that are out of control and I don’t know what’s going on.” From my experience, I know that the land has been over utilized for many years and there is not much cover. Since ground squirrels love big open areas where

there is not a lot of tall vegetation [this is the perfect habitat for them]. [I ask those people complaining about the squirrel populations,] “Did you make the connection that [your over-utilized land] is perfect habitat for the squirrels?” Planners have to make those connections. As you become a better planner you see the connections more quickly.

The bigger question here is whether landowners, not just planners, understand how their decisions can affect the economy, society, and the surrounding environment.

One particular part of the Conservation Planning process that hints at helping landowners manage their land with a systems perspective is embedded in the process of formulating objectives. Planners are to “use this opportunity to help the client think more broadly about the on-site and off-site problems and opportunities for natural resource protection” (USDA-NRCS, 2006, p. 14). Here, I interpret the statement “help the client think more broadly” as the planner discussing with the landowner how systems are connected and what effects one land management activity might have on other aspects of their ecosystem. This is a pivotal idea for systems thinking, but, depending on the planner’s priorities, information about whole systems may or may not be discussed. There is no way to document whether the planner actually helps the landowner to think broadly. Moreover, when this discussion takes place, the focus is still intended to be mainly on the conservation of natural resources and not on linking the landowner’s decisions to society and the economy as a whole.

The first NRCS planner I interviewed argued that experienced land managers already have knowledge about whole systems, even if they do not realize it. She said:

I think [landowners] have a better understanding of the land as a whole system than they think they do. They would sit there and tell you that “I don’t know what this holistic thinking is and all that” but they are thinking about it. Every day they are thinking about how the soil health affects their plants’ health and that translates to how their cattle are doing. They won’t tell you that they really have that knowledge but they do because they have worked on the land and they have been observing for a long time. So they can’t help but have it. We work with a lot of people who are brand new land managers, no they don’t.

This knowledge the planner is deeming a whole systems understanding appears to only focus on the interactions between natural resources, not on the economic and social aspects of whole systems. Furthermore, even the natural resource-focused understanding is admittedly embedded rather than addressed explicitly. According to this planner, if some landowners have a broad systems perspective beyond natural resources, it is not likely to have come from NRCS extension information.

However, Conservation Planning does address the ideas that humans exist within social-ecological systems. NRCS documents state that inventorying resources encourages planners to think through the ways humans interact with the environment (USDA-NRCS, 2006). This is supported by my interview with an NRCS planner. When asked about her opinion of the similarities between Conservation Planning and Holistic Management she said, “Conservation Planning is looking at the whole. We are looking at the resources and we are looking at the human element as well.” Clearly, NRCS staff are making an effort to address the complex reality of managing ecosystems as whole systems, but the sole focus of Conservation Planning on natural resource management limits the agency’s ability to apply a systems perspective to the degree that Holistic Management does. Where landowners fail to think in terms of socio-ecological systems, they may apply

short-term solutions to problems that might require more lasting or in-depth approaches to influence processes or adapt to changes for long-term sustainability. If landowners are only considering resource conservation and immediate economic return, without taking into account the society and natural environment their decisions influence, the landowners are potentially sacrificing the resilience of their land for short-term profitability.

For instance, a landowner decides to plant a ten-acre corn monoculture on an open field and uses heavy applications of agro-chemicals to achieve high yields. This landowner, concerned about keeping the forests on the property intact, uses agrochemicals to increase crop yields on current fields in order to prevent the need to cut down more trees to plant more crops. But, the landowner does not consider how the whole system is affected by this decision. Unbeknownst to the landowner, the agrochemicals are washed downstream into multiple neighbors' water sources and the pesticides and fertilizers seep into the landowner's groundwater. Also, there is decreased diversity on the farm because the pesticides and synthetic fertilizers kill the life forms in the soil. Ultimately, this landowner's decision sacrifices the resilience of the system for short-term profits.

According to NRCS documents, planners analyze natural resource concerns as single issues, but planners acknowledge that this is an artificial perspective when applying land management strategies on the ground (USDA-NRCS, 2011b). For example, during an interview with an NRCS planner, when asked if he approaches the land as a whole system he replied:

I work on ranches with 7,000 acres or more so it is really hard to work on the whole system. But I try to break it down into manageable units. I don't select the manageable units, I talk to the landowner and find out where their priorities are. So, what area on your ranch is of biggest concern? Maybe not as a whole, but certainly with smaller units we try to address the soil, the water, and the animals. We try to address all those issues.

The literature suggests that although NRCS states that planners perform this type of parts-based analysis and that it is artificial, NRCS does not assess whether all employees and landowners understand how to work from a whole systems perspective on the ground. This is due to NRCS's narrowly-defined mission—to get more conservation on the ground. My review of multiple documents on NRCS's policy and interviews with NRCS staff indicate that NRCS's focus is on finding ways to get clients to conserve as many natural resources as possible instead of extending a whole systems thinking based approach to clients.

Ranchers who were interviewed that utilize a Conservation Plan with no prior exposure to Holistic Management were concerned solely with natural resources management, not whole systems. In comparison, the rancher and one NRCS planner who used Conservation Planning and had been exposed to Holistic Management through workshops incorporated ideas drawn from whole systems management in their answers to interview questions.

In contrast to Conservation Planning, Holistic Management, as the name suggests, is founded on the principles of making decisions from a holistic, systems perspective. The first step landowners take before applying the Holistic Management approach is to define the whole they are managing. They consider who is directly involved in

management, what physical resources are available, and what money is available. Listing these three categories as a prerequisite to using Holistic Management teaches landowners to adopt a systems perspective because they have to think through the connections between people, natural resources, and finances. An example of how a Holistic Management rancher thinks through decisions with the whole system in mind was raised during an interview. The rancher said:

With the yellow star thistle, in the conventional sense, the land was telling us that our stocking rate was too high because of too much bare ground. We had a neighbor thinking this was the end of the world and threatening. So, socially we needed to do something about this and biologically we needed to do something. This plant was offering soil covering that my cows did not want to use. How can we pay for this? Economically, that plant feeds goats. The state parks were willing to pay us to use goats to eat star thistle. So the decision economically became a sound one.

Here, this rancher had a weed problem that his neighbor did not want to be affected by, so he thought through the ecological, social, and economic aspects of the weed problem and determined that using goats was the best choice for whole systems soundness.

According to Savory and Butterfield (1999), when landowners document their goals and objectives they describe how social-ecological systems are managed and how their resource base will sustain their goals far into the future. During an interview, a Holistic Management instructor discussed the uniqueness of the holistic goal and how this goal emphasizes whole systems management. When asked what was special about Holistic Management compared to other frameworks for decision making, the instructor said:

Nor am I aware of other [frameworks] that focus on building a holistic goal on ecosystem processes rather than ecosystem parts. Parts don't exist in nature—only whole systems within greater whole systems.

When asked what the key aspects of the framework were that sparked his interest, this instructor said:

The idea that we tend to focus on managing parts despite the reality being that we need to effectively manage the whole involved, which includes finances and human relationships. Focusing on being good at managing parts we are particularly interested in (e.g. cattle, wildlife, grass, finances, family)... explained why it is difficult to find people that are good at managing land and people relationships and their own money. Most people are good at one, some are good at two, but it is rare to find people who are skilled at managing all three, yet that is reality. All of us must manage all of them successfully.

In order to account for the complexity inherent in social-ecological systems, the Holistic Management literature encourages landowners to reflect on the interactions among key systems, ecosystem processes, people, and finances. According to Savory and Butterfield (1999), “Any action taken to affect one of these processes automatically affects them all” (p. 53).

Another example of whole systems management came up when a rancher explained why he used Holistic Management. He said:

I apply Holistic Management because we live in a world composed of wholes. Ranchers intuitively know they are managing wholes. Considering economic concerns, social concerns, their family, and there are animals and plants and water... When I read about Allan's work this was all knitted together so elegantly with the decision-making process. It seemed that there was an overflow of health, families were economically sound, and they were doing well. Why would I do something else?

Savory and Butterfield suggest that before decisions are finalized, landowners go through a series of testing questions that address financial, biological, and social factors

that ensure whole system soundness as seen in Table 2. If a test fails in any of the three areas then the decision maker must readjust their decision so it passes each category.

While interviewing one rancher and asking him if he considers the impacts of management in one area of his land on other resources, on people, and/or the economy, he replied:

Yes we do. Again, the decision making process, the seven questions, facilitate that. It asks very specifically if there is anybody out there who is going to be affected by this and unhappy. You know the ecosystem processes don't stop at your fence line. What are you doing on your land that affects the downstream flow of water, or the spread of weeds that others might be angry about, what will the impact be on regulatory bodies, and how will they be swayed? All of those things come up when using the testing guidelines.

Throughout the Holistic Management framework the repetition of maintaining a systems perspective while managing one's land is a sure indicator that landowners manage whole systems and not parts of systems.

A second key indicator of resilience thinking in land management is how well the approach addresses an unpredictable future and helps the manager adapt to change.

After analyzing the Conservation Planning framework, it is clear that planners, if not landowners, have some understanding that natural systems are non-linear and unpredictable. The Conservation Planning literature states that ecosystems are always changing in a process of succession and that an "ecological system is a dynamic continuum" (USDA-NRCS, 2006, p. 30). But, equilibrium terminology is used when saying that "as an ecological system matures, species stabilize and energy is stored" and when saying "even the most stable ecological systems change" in the face of catastrophic

disturbances (USDA-NRCS, 2006, p. 30). So, while there is acknowledgement that social-ecological systems are subject to change, the underlying understanding is that stability is desirable and systems for the most part change incrementally and in linear fashion. This is a contradiction.

Some hints that Conservation Planning encourages planners to manage for change in light of an unpredictable future are the theoretical considerations of short-term and long-term effects of potential plans, and whether these effects might pose future risks to clients' livelihoods. The Conservation Planning literature states that "human decisions to change land uses...introduction of conservation practices, or management changes can all create far reaching short-term and long-term ecological changes in natural resource communities" (USDA-NRCS, 2006, p. 30). Planners consider the short-term and long-term effects of a plan by determining the client's objectives and collecting data on current natural resource conditions. During this process, planners are to keep in mind that clients make decisions in an environment subjected to risk and uncertainty every day (USDA-NRCS, 2006). But, there is no documentation in Conservation Plans to prove that planners have thought through risks and future scenarios for clients. Moreover, thinking through risks and the effects of plans does not mean planners then adjust their recommendations to manage for change.

Through the interview process key insights arose on how Conservation Planning addresses change and how ranchers address change. First, when asking an NRCS planner if there are ways to account for managing land as a whole system in Conservation

Planning, she responded with an insight that demonstrated her knowledge of ecosystems as unpredictable and non-linear. She said:

A plan is never written in stone, it is a living document. It has to be because things change on the landscape even if their operation never changes. It's not a static environment out there.

This planner is saying that Conservation Plans are flexible since we live in a non-equilibrium world.

Later in the interview, this same NRCS planner responded to a question regarding how Conservation Planning accounts for impacts emerging thirty or more years into the future by saying:

We are looking at planning for resource sustainability. So right there we are saying that we want a cropping system where soil erosion does not outweigh soil formation. So that is definitely something that far off into the future, as long as [landowners] are still following that thirty years into the future. Our Quality Criteria tell us to [plan for the future] in the planning process, that's a very crucial step.

Again, this NRCS planner was saying that as long as landowners are still implementing their Conservation Plan thirty years into the future, then yes, Conservation Planning can account for a long-term time frame. However, Conservation Planning does not offer specific guidelines about managing land thirty years or more into the future. So, while the Quality Criteria NRCS planners use do encourage planners to think about time frames of thirty years or more, it is also clear that landowners are not given particular advice or procedures (such as encouragement to monitor or do five year reviews of their Conservation Plans) that would help them to manage far into the future. In addition,

another NRCS planner, when answering the same question about planning thirty or more years into the future, said:

What we are doing with these roads is we are storm-proofing them for the future, for thirty plus years. With the spring development also, we are providing water for livestock but protecting the riparian areas as well. In the oak woodlands we are trying to reduce catastrophic wildfire. All these practices are geared toward future issues.

From this response, this second NRCS planner articulated that Conservation Planning does manage for the future, at least in light of practices that are implemented for roads and spring development.

In contrast, answers from a rancher with a Conservation Plan, who had also been exposed to Holistic Management before, demonstrated that she understood what it means to manage for change. When asked if Conservation Planning made her more financially secure she stated:

Yes, Conservation Planning makes us more financially secure on many levels because you should be able to forecast the future and have some idea of what your future goals are.

When asked what her key goals in management are she replied:

Recognizing that this ranch has been in my husband's family for five generations, we want to make sure it is in better shape than when we got it. You know we are just temporarily holding it in trust for the next generation.

Her focus is not only on how much profit she can make from the ranch now, but sustaining the natural resources for the future. Although this rancher manages for change, it is unclear how much of her understanding had been influenced by other programs like

Holistic Management. To further emphasize her understanding of change, when asked if her Conservation Plan helps to buffer her land from changes or hazards, she commented:

Yes, it does help us buffer our land because in Humboldt County you don't have droughts but there are seasons when you don't have as much water so the resource is fragile. But with the offsite water development, we got into a position where to a degree it buffers the land.

Thus, in regard to managing natural resources, Conservation Planning does help landowners manage for unpredictable changes, which suggests that there is an underlying assumption that ecological systems are non-linear and dynamic. However, a contradiction arose in the Conservation Planning literature where ecosystems are portrayed as always changing and at the same time as becoming stable—two opposing ideas.

In comparison, analysis of Holistic Management indicates that the framework encourages landowners to manage for change. When landowners consider social, economic, and environmental factors every time they make a decision, they are essentially acknowledging and managing for the interconnections within complex adaptive systems. Walker and Salt (2006) state that complex adaptive systems are non-linear and unpredictable. So, when landowners ensure that decisions pass filters which address each of the three factors making up whole systems, they are better prepared to face unknown changes like a market crash or pest outbreak because they have thought through potential, unfavorable scenarios ahead of time.

Considering the future is inherent in the underlying assumptions of Holistic Management, where decision makers continually think about how the environment can sustain the desired future described in the holistic goal. In fact, unlike conventional

decision making where people think in time frames of 10 to 20 years, landowners using Holistic Management are encouraged to think up to 100 years into the future to meet their immediate goals (Savory & Butterfield, 1999). For example, one rancher, when asked if Holistic Management allows him to consider how his current decisions can/will affect the future, stated:

It's an essential part of the decision-making framework. You can't avoid it given your present options if you are making decisions based on your holistic goal because your holistic goal is something in the future and it has an economic thing—that's a future implication of the present day. In the long term, what your land needs to look like in 100 years to match your holistic goal...[Holistic Management is] inherently future and present oriented. It compels you to plan for the future.

Another example in the Holistic Management literature of managing for change is the sustainability test, which helps landowners avoid negative consequences from making decisions that work well in the short term, but are disastrous in the long term (Savory & Butterfield, 1999). For instance, after being asked how far into the future he plans, another rancher using Holistic Management said:

Our landscape description went 500 years into the future. My grandson and I would like to take an acorn and see it grow into a mature oak tree. That would take about 500 years.

Last, a major part of Holistic Management that demonstrates how landowners manage for an unpredictable future is the feedback loop. The feedback loop is a continuous planning and monitoring process that is used by landowners each time a decision is implemented. Here, the underlying assumptions are that social-ecological systems are connected and change is inevitable. For instance, Savory and Butterfield (1999) claimed that landowners monitor based on “the assumption you are wrong for the

earliest possible warnings so you can re-plan before any damage is done” (p. 54). Since one cannot be certain how a decision will affect complex adaptive systems, change must always be monitored for. In addition, this feedback loop helps landowners manage for change because if the results are not aligning with the landowner’s holistic goal, the landowner can re-plan to accomplish their goals. All four of the individuals I interviewed who use Holistic Management—two instructors and two ranchers—discussed the feedback loop in terms of humility. They all claimed that this framework is a humble approach where the assumption is that the decisions one has implemented on the land are wrong (i.e. people really do not know what the full effects a decision will have on ecosystems) and must be closely monitored in the event of undesired results. For instance, when one rancher was asked why he applies Holistic Management, he stated:

[Holistic Management is] quite different between others. The arrogance that comes with the education system is that we know we are right. With Holistic Management, you assume that you are wrong and monitor for the first indication that you are wrong, then you re-plan. It gives you a whole different mindset.

Additionally, a Holistic Management instructor mentioned humility and the feedback loop when he was asked what is special about Holistic Management as compared to other decision-making frameworks. He said:

One thing that is really special is that it’s a humble approach. We come back to the fact that the minute we’ve made a decision to do something we are always prepared to say, “Oops, I could have screwed up.” I think in other decision-making frameworks, by the time we’ve gone through all the collection of the data we’ve got so much of ourselves invested that our ego is on the line and we got our name at the bottom. We are probably going to miss some of the early warning signs that are telling us that we have made a mistake and we are going to continue to defend what we have done

and try to blow off criticism as irrelevant because it comes back to protecting our egos. We've done that over and over in agriculture.

Unlike conventional decision making where people assume they are correct when implementing decisions, Holistic Management requires landowners to assume they do not know, and thus must closely monitor every decision made (Savory & Butterfield, 1999). Therefore, Holistic Management helps landowners to manage for unknown change by including specific steps that require future and systems thinking.

A final basis for assessing how well mechanisms for resilience are built into the frameworks is the degree to which they emphasize incorporation of diversity.

Studies have shown that there may be a relationship between resilient ecosystems and biodiversity (Srivastava & Vellend, 2005). Biodiversity is the diversity of all life forms in ecosystems, including bacteria, fungi, insects, plants, and animal species, and the roles each species perform (Faith, 2008; Perfecto, Vandermeer, & Wright, 2009). Resilience theory suggests that it is central to manage for diversity and redundancy in order for a system to absorb unexpected shocks. Redundancy in functional roles of species results in different responses to stressors, thus increasing the resilience of an ecosystem to maintain functionality after a disturbance (e.g. climate change, logging, fire, etc.) (Perfecto et al., 2009; Srivastava & Vellend, 2005).

There is specific discussion on the importance of diversity in ecosystem management in the Conservation Planning literature. After a brief summary of how matter cycles through ecosystems, the literature states that "diversity is the product of these...dynamic cycles. It provides stability in the face of changing conditions...diversity

exists...within and among species, communities, and landscapes” (USDA-NRCS, 2006, p. 30). More specifically, the literature asserts that diversity is needed for long-term stability, and healthy ecosystems are characterized by “biological diversity, animal travel corridors, and erosion control” (USDA-NRCS, 2006, p. 30).

Finally, there are categories on a sample resource checklist planners use to document a landowner’s resources that place importance on biological diversity when managing natural resources. The two categories are “Plants” and “Animals—Population,” which discuss the loss of plant and animal diversity, invasive species, loss of habitat, and endangered species (USDA-NRCS, 2006). Clearly, Conservation Planning encourages planners to think about the role of biological diversity in ecosystems management.

During interviews, planners and ranchers mentioned the importance of diversity on the land. One NRCS planner volunteered his insights on diversity when he said, “With forests we thin out the understory. Not to remove the diversity from there, but we try to reduce that fuel ladder.” Though this planner did not define diversity, he appeared to be inferring a variety of plant and animal species. A rancher who is still in the process of creating a Conservation Plan discussed economic diversity when asked if biological and economic diversity are important to his business. He said:

You have to. You can’t put your eggs all in one basket. You need diversity to spread out your income. [Some examples of economic diversity are] hunting on my land and pasturing cattle instead of owning them all so that if the price of cattle goes down someone else owns the cattle and pays you by the month for what the cattle gain. So you are guaranteed to get the money whether the price goes up or down.

Clearly, the NRCS planner and rancher are thinking about biological and economic diversity, but there is no information on whether they think redundancy in social-ecological systems is important. From these responses it is unclear if Conservation Planning influenced the planner's and rancher's thinking, or if this was previously held knowledge.

On the other hand, throughout the Holistic Management framework, diversity measured as species richness or the number of different species is important to holistic decision making. This is found specifically in the discussion of ecosystem processes and management guidelines. Although diversity as a whole is deemed important to this framework, I was unable to find evidence of valuing redundancy—a weakness of this framework. Species richness, while an easily applied measure of diversity, does not reflect the importance of more nuanced definitions of biological diversity for ecosystem function as well as the concepts of functional and response diversity in resilience theory.

When discussing community dynamics, Savory and Butterfield (1999) argued that biodiversity is critical to the long-term sustainability of natural resources. They define biodiversity as the diversity (species richness) of plant and animal species within a community (Savory & Butterfield, 1999). Analogous to the conservation phase of adaptive cycles in resilience theory, Savory and Butterfield (1999) argued that the more diverse and complex communities become, the larger the web of interdependencies becomes. For instance, when asked if Holistic Management makes ecosystems more resilient, one instructor answered:

Everything can be described in terms of one of those four [ecosystem] processes and they are all going on at the same time. What we are finding is that the more complex the community dynamic, the more different kinds of relationships are going on, the more resilience and stability. So, if we have a field out there with only one crop growing, we by necessity have reduced the biological organisms in the soil... You are breaking down the defenses of the plants, pushing down succession to keep this monoculture. When you have sufficient numbers within each population, you have ebbs and flows but you don't have peaks and valleys.

Through his example, this Holistic Management instructor demonstrated his understanding of diversity in regard to a complexity of species in an ecosystem where the more diverse a system is, the more resilient it will be. Moreover, when mentioning ebbs and flows versus peaks and valleys, he is demonstrating how a resilient system (with high diversity) is one where the system will maintain its identity despite sudden shocks (i.e. ebbs and flows), instead of oscillating wildly and potentially approaching a tipping point in response to unpredictable changes (i.e. peaks and valleys).

Diversity is again highlighted under the population management guideline. This guideline is directed toward the management of community dynamics. Savory and Butterfield (1999) suggested that managing for a diverse range of species on one's land is better than managing for a single species. The discussion in this section aimed to demonstrate the importance of managing a diverse community, not just focusing on rare, endangered, or preferred species when managing land. For instance, Savory and Butterfield (1999) argued that "the members of any one species cannot exist outside their relationship with millions of other organisms of different species" (p.456). Not only does this statement show the importance of whole systems, but it also demonstrates that a diverse range of species is necessary to promote a resilient ecosystem because each

species is interconnected with many others. So, when managing populations it is important to account for how the preferred species (e.g. cattle, sheep, etc.) interacts with and enables diversity to flourish within communities. One Holistic Management rancher provided a key example of this. After the rancher said that animal impact was one of the Savory tools he used for management, he continued saying:

Our number one animal impact is wild pigs. The pigs have done more to regenerate oak trees than all the environmental groups put together. And they have done it for free providing profit for the ranch because it is our and California's number one game animal...[It is] a great cash generator.

After the interview, this rancher took me out onto his land and showed me where pigs had rooted around the base of oak trees. He explained that this pig behavior resulted in fourteen different native plant species thriving in the one small area we were looking at, as well as oak seedlings. According to this rancher, wild pigs rooting resulted in an increase in plant diversity. These pigs are not only a positive benefit to the land, but also to the rancher and his profits because pigs are a source of revenue for hunting.

This rancher discussed economic as well as biological diversity. He explained that he not only offered hunting on his land, but also marriage encounter weekends (i.e. workshops on marriage communication), cattle grazing, horseback riding camps, trail rides, farm stay, and land stewardship seminars. Clearly, economic diversity like this can buffer an individual's profits in the event of severe economic downturn.

Through this analysis of the three tenets of resilience, I found that Conservation Planning assumes humans and ecosystems are interconnected, and that these interconnections should be considered while managing natural resources. But,

landowners are not taught the importance of managing whole systems, so there is no guarantee that natural resources will be managed holistically for the long term. In contrast, throughout the Holistic Management framework the repetition of maintaining a systems perspective while managing one's land is a sure indicator that landowners manage whole systems, not parts of systems. In regard to managing for change, Conservation Planning helps landowners manage their resources with future change in mind, which implies an underlying assumption that ecological systems are considered non-linear and dynamic. Similarly, considering the future is inherent in the underlying assumptions of Holistic Management, where decision makers continually consider how the environment can sustain the desired future described in the holistic goal. From this analysis it is also clear that NRCS planners consider diversity important to ecosystems and society. Yet, evidence of valuing redundancy is inconclusive. For Holistic Management, the lack of discussion on redundancy and diversity is a weakness of the framework needing to be addressed more fully. Table 3 is a summary of the main similarities and differences between Conservation Planning and Holistic Management.

Table 3. Comparison summary of main results from analysis of Conservation Planning and Holistic Management.

<b>Aspect</b>	<b>Conservation Planning</b>	<b>Holistic Management</b>
Target Audience	Planner	Landowner
Up-front Cost	Generally less expensive due to subsidies	More expensive due to lack of subsidies
Definitions	More narrowly focused on managing natural resources	More broadly applicable for managing businesses, farms, and all aspects of life
Landowner Objectives	Accounts for change when thinking about the future condition of the planning area	Accounts for whole systems when landowners document people, resources, and economics
Landowner Resources	Emphasis on natural resources	Emphasis on natural resources, decision makers, and money
Evaluation Process	Assist landowners in general terms	Landowners tasked to think through every decision before acting on it
Monitoring Process	Planners encouraged to check in with landowners to see if results are meeting goals; Does not always occur	Landowners use feedback loop to test if decisions are going awry; Occurs on a daily basis
Managing Whole Systems	Planners taught whole systems thinking; Making an effort to manage land as whole systems	Landowners taught whole systems thinking; Evidence this occurs on the ground
Managing for Change	Planners know that natural systems are non-linear and unpredictable; Landowners need instruction on planning for the distant future	Landowners know that ecosystems are non-linear and unpredictable; Seven testing questions promote future thinking
Managing for Diversity	Species diversity is discussed, but no evidence redundancy is important	Species diversity is discussed, but no evidence redundancy is important

## CONCLUSION

My comparative analysis of the Natural Resources Conservation Service's (NRCS) Conservation Planning to Allan Savory's Holistic Management framework indicates that they have similarities in structuring management through formulating goals, identifying resources, and the like; yet, they are altogether different in how they approach land management.

Through my analysis, I discovered that Holistic Management more wholly addresses the three tenets of resilience: managing whole systems, managing for change, and managing for diversity. Conservation Planning does include philosophical aspects (but no practical steps) that point toward an attempt at managing whole systems as well as managing for change and diversity. One of the primary limitations of Conservation Planning is that it is more narrowly focused on training planners to help landowners manage natural resources. The federal mandate of NRCS focuses on getting more natural resource conservation on the ground, and this bureaucratic silo limits more generalized systems thinking. In contrast, Holistic Management, promoted by private organizations and born out of a mindset of managing land as whole systems, does not have the same restrictions. Thus, Holistic Management can be more generally applied to decision making for businesses, everyday living, or natural resources management in a way that also promotes resilience thinking.

Although the Holistic Management handbook does more wholly address resilience, the lack of information on the importance of diversity in regard to the roles various

species perform in a system is a major weakness of this framework. While diversity in terms of the number of species on the landscape was mentioned, functional diversity in regard to redundancy was not discussed. Redundancy is important because it helps buffer systems from major change, thus increasing the resiliency of systems. Thus, this is an area that Savory and Butterfield (1999) need to expand on for improving the sustainability of decisions made through Holistic Management.

In the future, a deeper analysis of Allan Savory's grazing methods as compared to NRCS's grazing recommendations could explore whether Savory's grazing practices can be validated. Second, a thorough analysis of each chapter of Savory and Butterfield's (1999) Holistic Management handbook would be an important step toward determining ways Holistic Management could be strengthened by explicitly incorporating resilience theory into the framework. Third, comparing NRCS's Conservation Planning framework to other governmental programs could provide dramatically different results than were discovered in this thesis.

NRCS has offices in almost every county of the United States. Further, monetary incentives make Conservation Planning affordable for landowners. In contrast, gaining access to the Holistic Management framework usually requires landowners to pay high, upfront costs and expend significant time and energy in learning how to apply the framework. Furthermore, there are few Holistic Management instructors to receive training from. For example, there are only two certified instructors in the state of California. Yet, Holistic Management has much to offer NRCS clients as well.

During a time of unpredictable change and diminishing resources, a resilience theory paradigm is a useful framework for landowners to use. By not teaching landowners how to create and alter their land management plans to adapt to the dynamic characteristics of ecosystems, NRCS is doing their clients a disservice in the event of unexpected changes in the environment. So, it would be valuable for NRCS to require planners to teach landowners how to use the Conservation Planning process on their own. Teaching landowners whole systems management through Conservation Planning would encourage them to be aware of the interconnections between systems on their land. Since NRCS planners create Conservation Plans for their clients, and pay their clients to implement the plans, those clients have less incentive to develop the knowledge about the dynamics of ecosystems and their interrelationships. Using planners as teachers might increase the likelihood of landowners managing their land for resilience, which in turn means landowner knowledge on the ecological function of diversity should increase.

Ensuring ecosystems are resilient is critical in a time of change and uncertainty. More than half of the world's ecosystem services have been degraded, and the human species is living beyond its means on a planet with finite resources (Walker & Salt, 2006). The data I gathered through this analysis provided insight into how NRCS and Holistic Management could help landowners manage resources and ecosystem services more sustainably for the future. Adopting a whole systems perspective, managing for change and diversity can enable landowners to see the multi-scaled complexity of the landscapes they manage and help them to make decisions that ensure natural ecosystems will be flourishing for generations to come. With a resilience thinking mindset, landowners will

not only be concerned about profits for today, but for the sustainability of societies, natural resources, and economies many years into the future.

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## APPENDIX A. INTERVIEW QUESTIONS

For the interviews, I had four different sets of questions I used depending on who was being interviewed: NRCS ranchers, NRCS planners, Holistic Management ranchers, and Holistic Management instructors.

### Questions for NRCS Ranchers

- 1) When did you begin ranching?
- 2) Do you work with NRCS for land management purposes? If so, when did you begin receiving assistance from NRCS?
- 3) Did you have to pay to get assistance from NRCS? Was training of any sort required?
- 4) Did you create a Conservation Plan with NRCS? How was it developed? How involved were you in creating a Conservation Plan for your land?
- 5) Can you give examples of how you apply your Conservation Plan on your land? How has this approach benefitted you? The land? Your family?
- 6) What are your key goals in land management?
- 7) Is biological and economic diversity important to your business?
- 8) Did you manage your land differently before working with NRCS?
- 9) How do you approach financial planning?
- 10) Does Conservation Planning make you more financially secure?

- 11) Do you think it costs more to use Conservation Planning instead of other decision-making frameworks for land management?
- 12) When meeting with an NRCS planner, did he/she explain the Conservation Planning process?
- 13) Does your Conservation Plan allow you to consider how your current decisions can/will affect the future? How far into the future do you plan?
- 14) Do you consider the impacts of management in one area of your land on other resources, on people, and the economy (e.g. grazing on water or wildlife, forest management encroaching on grazing lands, etc.)?
- 15) What types of effects has Conservation Planning had on the people you work with and your family?
- 16) Does your Conservation Plan help to buffer your land from changes or hazards (like drought, flood, fire, etc.)?
- 17) What does NRCS teach or claim that you disagree with?
- 18) Have you heard of Allan Savory's Holistic Management?
- 19) If so, what are your perceptions of Holistic Management as a decision-making process for land management?
- 20) Do you think there are *similarities* between Holistic Management and Conservation Planning? If so, what are they?
- 21) Do you think there are *differences* between Holistic Management and Conservation Planning?

## Questions for NRCS Planners

- 1) Before working for NRCS, what was your experience with land management?
- 2) Are clients involved in forming their Conservation Plan? Examples?
- 3) Is it necessary for your clients to understand managing land as a whole system (ecologic, social, and economic) to make and utilize their Conservation Plan?
- 4) Do you discuss sustainable land management with your clients?
- 5) Are there key aspects about Conservation Planning that you think make it the ideal way to manage land?
- 6) While creating a Conservation Plan, do you approach the land as a whole, interconnected system? Can you give an example?
- 7) How important are non-productive portions of the land to management? Are they included in the Conservation Plan?
- 8) Does Conservation Planning make ecosystems more resilient (able to withstand extreme/variable climatic conditions, fire, flood, drought, etc.)?
- 9) Are there ways to account for managing land as an interdependent system versus managing just parts of the land?
- 10) Do you agree with the way NRCS approaches land management? Grazing land management?
- 11) What has your biggest challenge been while assisting a client with managing their land?

- 12) Does Conservation Planning consistently work the way the literature says it should?  
If not, where does it break down?
- 13) Is it more expensive for land managers to implement a Conservation Plan from NRCS as compared to other land management strategies?
- 14) How does Conservation Planning take into account future impacts, say 30 or more years into the future, on the ecosystems, communities, and economy from decisions made today?
- 15) Does Conservation Planning help ranchers to be more financially secure?
- 16) Have you heard of Allan Savory's Holistic Management framework?
- 17) Do you think that there are *similarities* between Holistic Management and Conservation Planning?
- 18) Do you think that there are *differences* between these frameworks?
- 19) Do you think there are ways that Savory and his team could improve upon the decision-making framework, Holistic Management?
- 20) Do you think there are ways that NRCS could improve their Conservation Planning assistance process?

#### Questions for Holistic Management Ranchers

- 1) When did you begin ranching?
- 2) Do you use Holistic Management? If so, for how long have you used it?
- 3) What training have you received in Holistic Management? When did you receive it?
- 4) Did you have to pay to attend the training?

- 5) Why do you apply Holistic Management? Can you give examples of how you apply Holistic Management on your land? How has this approach benefitted you? The land?
- 6) What are your key goals in land management?
- 7) How do you make land management decisions?
- 8) Did you manage your land differently before using Holistic Management?
- 9) How do you approach financial planning?
- 10) Does using Holistic Management make you more financially secure?
- 11) Do you think it costs more to use Holistic Management instead of other decision-making frameworks for land management?
- 12) What Savory tools do you use to manage your land (technology, rest, fire, grazing, animal impact, living organisms)? Can you give me examples?
- 13) Does Holistic Management allow you to consider how your current decisions can/will affect the future? How far into the future do you plan?
- 14) Do you consider the impacts of management in one area of your land on other resources, on people, and/or the economy (e.g. grazing on water or wildlife, forest management encroaching on grazing lands, etc.)?
- 15) What types of effects has Holistic Management had on the people you work with and your family?
- 16) Does Holistic Management help to buffer your land from changes or hazards (e.g. drought, flood, fire, etc.)?
- 17) What does Savory teach or claim that you disagree with?

- 18) Has NRCS worked with your ranch and helped you develop a Conservation Plan?
- 19) If so, what are your perceptions of the Conservation Planning process?
- 20) Do you think there are *similarities* between Holistic Management and Conservation Planning? If so, what are they?
- 21) Do you think there are *differences* between Holistic Management and Conservation Planning? If so, what are they?

#### Questions for Holistic Management Instructors

- 1) What was your past experience with land management prior to Holistic Management?
- 2) What are some key aspects of Holistic Management that sparked your interest?
- 3) Do you discuss sustainable land management with landowners you work with?
- 4) Are there ways to account for managing land as a whole system versus managing just parts of the land?
- 5) How important are non-productive portions (areas that don't provide resources for people) of the land to management? Are they included in the Holistic Management framework?
- 6) Do you think Holistic Management works the way Savory's text (1999) describes?
- 7) What is special about Holistic Management as compared to other decision-making frameworks?
- 8) Is Holistic Management more expensive for land managers to utilize than comparable approaches? Examples?

- 9) What has your biggest challenge been while training individuals on Holistic Management principles?
- 10) How does the Holistic Management framework take into account future impacts, say 30 or more years into the future, on the ecosystems, people, and economy from decisions made today? Examples?
- 11) Does Holistic Management make ecosystems more resilient (able to withstand extreme/variable climatic conditions, fire, flood, drought, etc.)?
- 12) What are some critiques of the Holistic Management framework?
- 13) Does Holistic Management help ranchers to be more financially secure?
- 14) Are you familiar with NRCS's Conservation Planning framework?
- 15) What are the *similarities* between Holistic Management and Conservation Planning?
- 16) What are the *differences* between the two frameworks?
- 17) Do you think there are ways that Savory and his team could improve upon the decision-making framework, Holistic Management?
- 18) Do you think there are ways that NRCS could improve the Conservation Planning framework?