Social-Ecological Change, Resilience, and Adaptive Capacity in the McKenzie River Valley, Oregon

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This study explores perceptions of long-term residents regarding links between governance, landscape, and community change in the McKenzie River Valley (MRV) in western Oregon and provides a general assessment of factors affecting resilience and adaptive capacity. Residents interviewed indicated that dramatic changes driven by market competition, timber industry changes, increased regulation, and rural restructuring have occurred in both the landscape and community. The changes that have transpired have redefined the relationship between the community and the landscape, moving away from local dependence on timber harvests to an economy focused on tourism and other ecosystem services. In doing so the community has transitioned from one with a logging community identity to one that has begrudgingly become a retirement and vacation community. We found that the social-ecological system (SES) in the MRV is still in the midst of reorganization in the wake of the 1990s Timber Wars. As a result of low institutional capacity, the system is vulnerable to exogenous drivers of change. Using a modified version of Ostrom's (2009) framework for SES analysis, this study recommends policymakers and policy entrepreneurs take three key steps to facilitate enhanced resilience and adaptive capacity: 1) support transboundary management strategies that transcend landownership classifications; 2) tighten system feedbacks to include more local influence; and 3) develop local multilayered institutions organized vertically and horizontally. Future research should explore the potential for collaborative forestry and stewardship contracting to enhance social-ecological resilience in this valley.

Keywords: Amenity migration, community resilience, collaborative conservation, governance, industrial forestry, Northwest Forest Plan, restoration, rural restructuring, stewardship forestry, timber wars, transboundary management, U.S. Forest Service

Rural landscapes throughout the American West are experiencing tremendous change. Over the course of the 20th century many forest ecosystems once filled with diverse stands of timber became fragmented and were replaced with relatively homogenous even-aged harvest units. Communities once supported by sawmill operations and filled with young families have transitioned, or are in the process of transitioning, into retirement and recreation-based communities. Driven by social, regulatory, political, economic, and technological changes this process of rural restructuring (Gosnell and Abrams 2009; Nelson 2001) is spurring questions regarding the short and long-term sustainability and identity of rural America. As Stauber (2001:33) contends, "For some parts of rural America, the slow slide to no longer being viable – economically, socially, or politically – is within sight." In some places, however, communities have found ways to

innovate and adapt with changing structures in order to remain viable (Kelly and Bliss 2009; Sturtevant and Donoghue 2008).

Central to rural restructuring is a shift in the definition of the relationship between humans and the environment, a process that has occurred several times in the relatively short history of habitation of the western American landscape. Past relationships included a boom and bust period of rapid exploitation and settlement during the 19th century; stability and conservation efforts that stretched from the beginning of the 20th century well into the 1960s and 70s; and efforts at preservation and resilience that began in the latter quarter of the 20th century (Kelly and Bliss 2009; Nelson and Dueker 1990). Most recently, the relationship between humans and rural landscapes can be seen as marked by uncertainty as policy makers struggle to implement a complex systems approach that fully recognizes both the ecological and human elements of the landscape.

A growing body of scholarship considers the relationship between human and ecological systems in rural, resource-dependent communities in terms of resilience and adaptive management (Benson and Garmestani 2011; Bone et al. 2016; Chaffin, Craig and Gosnell 2015; Gosnell et al. 2017). A resilience approach recognizes the coupled nature of the natural and human environments and their linked dependency and looks at variables that affect the ability of a system to adapt to change. From a resilience perspective, social-ecological systems (SESs) are complex adaptive systems that may be best managed in ways that promote adaptability and the ability to absorb disturbances. Ecologically this suggests an ecosystem management regime that aims for overall health of ecosystem function as the end goal of management policies, which has the potential to limit resource extraction opportunities and harm resource-dependent human communities. From a social sustainability perspective, this approach has been difficult to implement as rural communities experiment with new ways to remain economically viable in a resource-constrained environment.

This paper uses a resilience perspective to analyze local perceptions of social-ecological relationships in transition in the McKenzie River Valley (MRV) in the west central Cascades of Oregon and identify policy implications. In subsequent sections we review literature on SES resilience and present a framework for analysis along with a description of methods. Next, local perceptions regarding governance, landscape, and community change in the MRV are cataloged. We conclude with a discussion of findings and provide several policy recommendations.

What this study reveals is a disconnect in the trajectories of social and ecological systems and a corresponding need for better institutional support for navigating new relationships between communities and the forest to help cultivate a restoration economy.

Conceptualizing Social-Ecological Resilience in Rural, Resource-Dependent Communities

Resilience scholarship offers a framework for analysis that helps explain forces that aid in facing change and adversity. Here we explore the literature as it pertains to resilience in SESs and specifically in rural, traditionally resource-dependent communities.

Social-Ecological Systems

Anderies, Janssen and Ostrom (2004:18) define a social-ecological system (SES) as "an ecological system intricately linked with and affected by one or more social systems." Inherent in the concept is the recognition that the health and well-being of ecological systems are innately linked to the external forces influencing and attempting to manage their

function (Berkes and Folke 1998).

Ostrom (2009) proposed a multi-level nested framework for SES analysis comprised of four subsystems: resource system, resource unit, governance system, and users. Each of these subsystems is nested within other social, economic, political, and ecological systems and is comprised of a variety of variables found in the literature to affect resilience (discussed below). The interactions that occur between the relevant subsystems produce outcomes that in turn shape the sustainability of the SES in question and reshape the subsystems and their subsequent interactions. By isolating each subsystem and its key variables researchers and policymakers are better able to assess and improve management by targeting efforts at key variables and interactions.

We adapted Ostrom's framework for our analysis of the McKenzie River Valley SES (Figure 1).

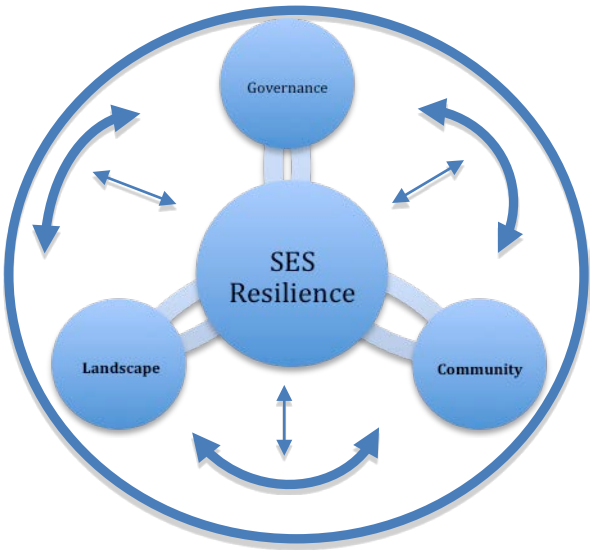

Figure 1. Adapted model for the analysis of social-ecological systems

This model maintains Ostrom's core subsystems but combines the elements of the two *resource* systems into the subsystem *landscape* and expands *users* to include the broader *community* present in the system. This more appropriately allows for the discussion of community changes in contexts not directly tied to its role in resource management.

Community has multiple definitions that represent various dimensions of human relationships encompassed by the term. As Magis (2010) notes, communities include both place-based and relationship-based elements. Included in the geographic element of community are local institutions present in the area. The relationship element focuses on interactions and common beliefs held among local residents. Lee and Field (2005) expand the conceptualization of community to include communities that share common feelings and beliefs but are not necessarily present in the same geographic location. As Donoghue and Sutton (2006) emphasize, this is important for many unincorporated rural areas that nonetheless share a sense of community. We use this latter definition of community to describe the small towns within the MRV, an area that is unincorporated but shares a school, a common history, and relationships with government and social organizations. The *governance* subsystem is discussed in terms of the formal and informal institutional structures that influence decision making regarding both the resource and social systems. In the MRV this includes government agencies, non-governmental organizations (NGOs), the timber industry, market influences, and cultural norms. The *landscape* subsystem includes ecological aspects as well as the built environment. We use this model in conjunction with variables found in the literature for each appropriate subsystem to guide our assessment of the relative resilience of the MRV SES.

SES Resilience

Resilience as a framework for analysis has its roots in the field of ecology and has been de-

fined as a "measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables" (Holling 1973:14). As such, resilience thinking is a way to explain a complex system's ability to confront change. Resilience has four key properties: 1) systems exist in multiple basins of attraction and are nested in numerous temporal and spatial scales; 2) resilience is measured by the amount of disturbance a system can absorb without crossing a threshold into a new type of system with a different function and structure; 3) the process of change is controlled by the system's ability to self-organize; and 4) the ability of the system to build and increase capacity for learning and adaptation is achieved through adaptive management (Gunderson 2000; Gunderson and Holling 2002; Holling 1973; Walker and Salt 2006). Actors can manage for increased resilience in a desired state through incremental changes within the existing SES, or they can seek to deliberately transform the system by pushing it into a new state (Chaffin et al. 2016; Moore et al. 2014).

As Nelson, Adger and Brown (2007) argue, managing for resilience is more likely to produce outcomes that provide for social well-being. Folke (2006:260) summarizes the essence of the concept well: "The resilience approach is concerned with how to persist through continuous development in the face of change and how to innovate and transform into new more desirable configurations." This orientation shifts the management of linked SESs toward policies that manage for change while accounting for the health of ecosystem and the social communities dependent on these systems. At the heart of resilience thinking is an acknowledgement that change and evolution occur as part of complex processes that manifest at and across different temporal and spatial scales (Gunderson and Holling 2002). These cross-scale dynamics are key to understanding resilience and adaptive capacity in the MRV today.

Analyzing SES Resilience

Assessing SES resilience is an emerging field and currently no commonly used methodology exists. SESs contain both designed and self-organized components and are not easily described by indexes used to capture defined and static objects or processes (Anderies, Janssen and Ostrom 2004). Approaches to analyzing the resilience of an SES have incorporated assessments of variables and feedbacks such as institutional capacity, ecological diversity, and social capital (Resilience Alliance 2015). Quinlan et al. (2015) summarize multi-disciplinary approaches and categorize the types of metrics researchers have used in their assessment of resilience.

Gunderson (2000) highlights the importance of institutions in managing SESs for resilience, defining them as the rules and structures that allow people to organize for collective action. For *governance* institutions to be successful (and resilient) he suggests that they incorporate capacities to learn, engage, and promote trust, using local knowledge and common property systems to link people and the environment. Chaffin, Gosnell and Cosens (2014) review the tenets of adaptive governance, noting the importance of a community agreeing upon a 'desired state' for the SES. Butler and Goldstein (2010) characterize the potential for rural, timber-dependent communities to be paralyzed by conflict, landing in 'rigidity traps,' which stop systems from innovating or adapting, thus decreasing resilience. They analyze the emergence of recent forest collaboration as a way to spring rigidity traps and move towards more resilient multi-scalar governance. Benson and Garmestani (2011) argue that there are a number of institutional barriers to managing for resilience associated with the U.S. Forest Service; however Maier and Abrams (2018) observe that in some places,

federal forest governance seems to be shifting towards a social forestry model involving greater participation by local actors, which in some cases may facilitate the emergence of adaptive governance and enhance social-ecological resilience.

Timberlake, Schultz and Abrams (2017) describe some of the variables that national forests have considered in building resilient *landscapes*, including defining ecosystem boundaries, defining geographic scale of landscapes, identifying relevant stressors to the system, and understanding future uncertainties of the system. Resilience of landscapes and ecosystems is often categorized by diversity and overlapping function within a given scale (Peterson, Allen and Holling 1998). Empirical evidence promotes the idea that humans have decreased landscape resilience by removing redundancy from ecosystems and managing for optimization of resource production (Folke et al. 2004).

There have been a number of efforts to assess the resilience of forest dependent *communities*. The Interior Columbia Basin Ecosystem Management Project (ICBEMP) used a community resilience framework for its assessment, defining resiliency as "the community's ability to respond and adapt to change in the most positive constructive ways possible for mitigating the impacts of change on the community" (Harris et al. 2000:7). Its resiliency index included rankings in civic leadership, social organization, economic structure, and physical amenities. Donoghue and Sturtevant (2007) classified the factors contributing to resiliency in forest dependent communities as assets, or types of capital, including both foundational and mobilizing capital. Foundational capital consists of the assets that exist in the community such as infrastructure, natural resources, and economic capital. Mobilizing capital entails organizing human, social, and political capital through social processes that lead to collective action. Similar to Donoghue and Sturtevant's (2007) distinction between assets as foundational and mobilizing capital, Magis (2010) distinguishes assets by their active and inactive or latent capacity. Resilience is distinguished by the community's ability to develop and engage resources in a collective manner to respond and adapt to change. In addition to social capital, scholars observe the importance of strong social networks and multiple scales in building and maintaining resilience (Davis et al. 2017). In our analysis of the MRV, we draw on these themes and indicators of governance, landscape, and community level resilience.

The McKenzie River Valley: A Region in Transition

The McKenzie River Valley (MRV) runs from east to west, stretching from the crest of the Cascade mountain range to the Eugene/Springfield metropolitan area at the southern end of the Willamette Valley (Figure 2). Overall land ownership in the valley is dominated by the federal government, which manages 69% of the watershed (McKenzie Watershed Council 2016). In the upper portions of the valley, land ownership is largely controlled by the Willamette National Forest (WNF), part of the USDA Forest Service (USFS). The lower and middle portions of the valley include a checkerboard pattern of mixed federal/private ownership dominated by the Bureau of Land Management (BLM) and an array of large timber companies. The lower floodplain portion of the basin is almost all private land, much of it in small farms. The structure of land ownership and management significantly affects landscape management strategies throughout the basin (McKenzie Watershed Council 2016).

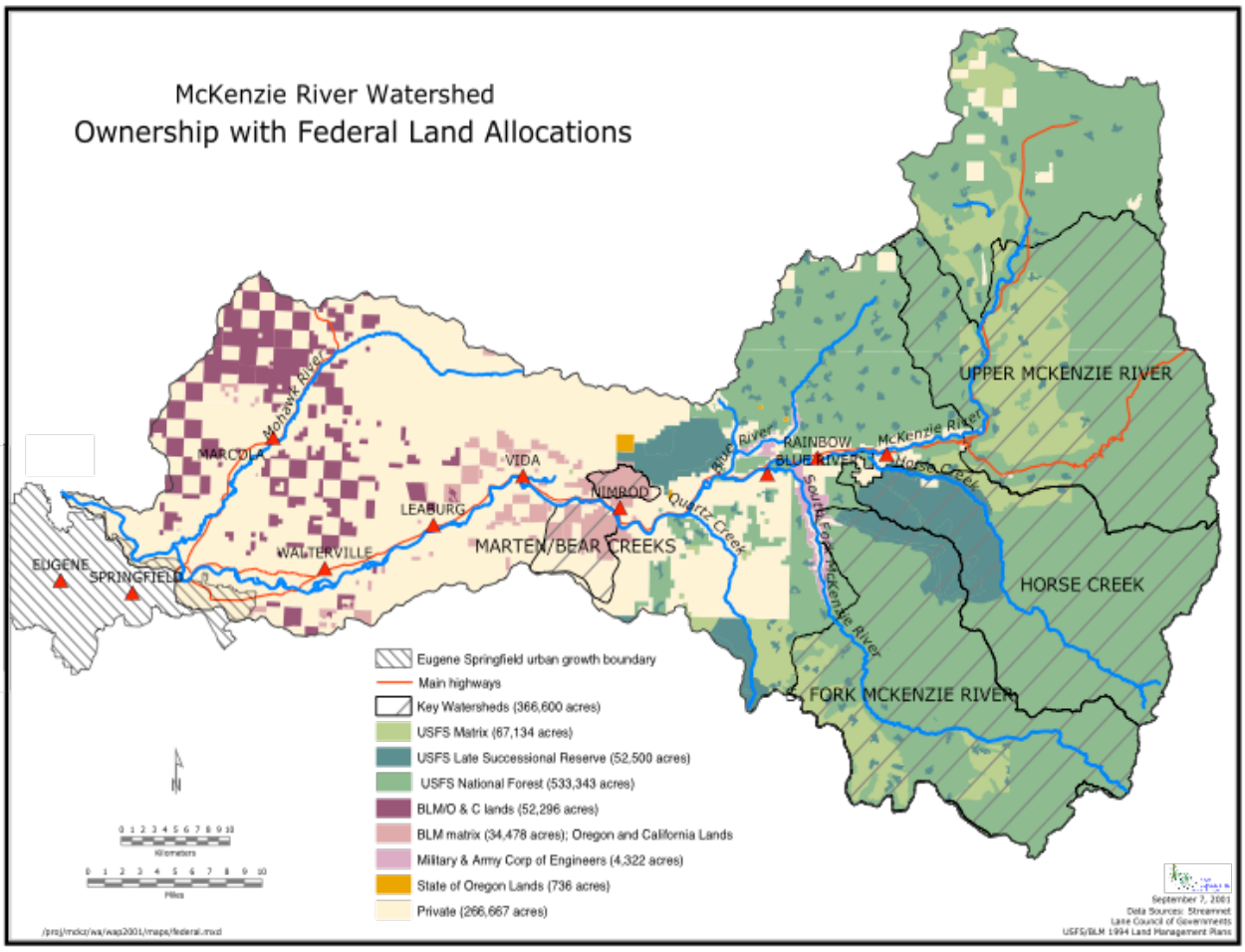

Figure 2. McKenzie River Watershed and Associated Land Ownership

As of 2010 the MRV had a total population of 5,187 (Oregon Communities Explorer 2018). Residents of the upper portion of the valley are employed in resource extraction or resource management and recreation-based economies, retired, or commute to the nearby metropolitan area for employment (Oregon Communities Explorer 2018; Shindler, Steel and List 1996). In 2016, MRV residents' median age was 56.3, much older than the 39.1 median age in Oregon (Oregon Communities Explorer 2018). In 2000, agricultural, forest, fishing, hunting, and mining industry employment accounted for 10.9% of the population in the MRV, while today that number has dropped to 3.8% (Oregon Communities Explorer 2018). MRV communities are all in unincorporated portions of Lane County and lack any local general-purpose governments. Residents have access to county and state support services but those services are located outside of the MRV. Within the MRV, key government organizations include the McKenzie River Fire Department, the McKenzie School District, the McKenzie River Watershed Council, and the USFS. Outside of government organizations, residents rely on an array of local support networks including the local Chamber of Commerce and EASE, a locally supported provider of ambulance and emergency medical services (Preister et al. 2002).

The MRV landscape has long provided a range of ecosystem services that support local communities, including clean water for the communities of Eugene/Springfield, as well as many other communities along the Willamette River. For much of the 20th century residents were able to rely on logging and the building of dams on local rivers to provide living wage jobs. Recreation and tourism have also become key components of the local economy.

Numerous studies have been conducted on the hydrologic, ecological, and biological health of the MRV (Risley et al. 2010), citing a range of concerns. Several local species have been listed as endangered or threatened under the federal Endangered Species Act, including the spring Chinook salmon (*Oncorhynchus tshawytscha*), bull trout (*Salvelinus confluentus*), Oregon chub (*Oregonichthys crameri*), and northern spotted owl (*Strix occidentalis caurina*). Other species such as the western pond turtle are in decline. Some streams that feed into the McKenzie River have water quality issues. Lower portions of the valley face continuing development pressure from the Eugene/Springfield metropolitan area (McKenzie Watershed Council 2016). Despite these concerns many local residents and researchers have emphasized the general health of the MRV (Doppelt et al. 2009; McKenzie Watershed Council 2016; Shindler and Mallon 2006).

Three paradigms have shaped the forest-community relationship over the last century and a half: exploitation and boom and bust settlement; growth and dominance of the timber industry; and forced reorganization related to market forces, technology shifts, and increased regulation that drastically limited timber harvest beginning in the 1980s. In regard to the latter, Pacific Northwest timber interests had to adjust to industry migrating to the southeastern United States and increasing competition from Canadian exports (Machlis and Force 1988). Adding to these industry challenges, regulatory constraints came to a head in 1991 when a lawsuit was filed in federal court to protect the old-growth habitat of the northern spotted owl, listed as threatened under the federal Endangered Species Act in 1990. The legal battles initiated by the spotted owl case eventually led to an injunction on harvests from federal lands. Between 1987 and 2000 timber harvests in USFS Region 6, comprised of Oregon and Washington, were reduced from 6 billion board feet to .5 billion board feet and forest related employment declined dramatically as well (Sturtevant and Donoghue 2008). In 1994 the USFS implemented the Northwest Forest Plan (NWFP) in an attempt to find a balance between timber harvesting and ecosystem restoration, initiating a period of reorganization in the MRV involving new institutional and social dynamics (Maier and Abrams 2018).

Over the last two decades the USFS has suffered from decreasing legitimacy and capacity (Maier and Abrams 2018), though in recent years the agency has attempted to employ a resilience-based approach to ecosystem management and improve its ability to engage with local communities in forest planning (Benson and Garmestani 2011; Bone et al. 2016). Socially and economically, formerly timber dependent communities like the MRV have been subject to "the triad of economic, demographic, and environmental forces combining to reshape the western landscape" in a process of rural restructuring (Nelson 2001:395). Over the past two decades residents of the MRV have been navigating this reorganizing and restructuring transition, with mixed results for social-ecological resilience. This study documents local perceptions regarding the ongoing process of system reorganization.

Methods

The purpose of this study was to explore and understand perceptions of long-time residents in the MRV regarding change in local landscapes and communities. We utilized a flexible design approach that relied primarily on qualitative data gathered through semi-structured interviews with 21 long-time residents of the McKenzie River Valley (MRV). Study participants were chosen using a non-probability purposive sampling technique (Robson 2002) aimed at recruiting individuals who had a significant history living or working in the MRV, and who have knowledge of landscape conditions and how those conditions may have changed over time. Participants included timber industry employees, USFS employees, local landowners and land managers, and long-time residents of the community. They were not selected based on inclusion in any demographic, social, or economic group. The desire to acquire information about changes over time led to a focus on residents who had been of working age at the time the spotted owl was listed under the Endangered Species Act in 1991, transforming forest management practices in the MRV. Interview questions focused on locals' personal histories in the MRV, their relationship to the natural environment (e.g. work in natural resource management, recreation in the national forest, etc.), and perceptions of governance, landscape and community change over time. Interviews were transcribed, recorded, and coded to identify recurring themes and concepts. Data gathered through interviews were supplemented with a thorough review of the literature on key thematic topics, quantitative data received from the U.S. Census Bureau and Oregon Department of Education, and key studies conducted by past researchers in the MRV.

Results

Results from the analysis of the interviews are discussed as they relate to changes in governance, the landscape, the community, and their interactions, the elements contributing to SES resilience (see Figure 1). Since our focus is on resilience of the MRV in the aftermath of the so-called Timber Wars, we begin with perceptions of change in governance, specifically how the NWFP has played out in the MRV. We then document perceptions of social and ecological changes associated with the transformation in governance and how the subsystems have interacted with one another to produce current and future conditions. Each interviewee is given a label to protect their identity. No label is used for more than one individual.

Perceptions of Change in Governance Structure

Governance structure refers to the social and institutional arrangements that influence system rules, practices, and processes. This includes both governmental and non-governmental organizations, regulatory regimes, and market and industry structures. In the description below residents describe both governance structures that reside within the MRV and those that are external to the system. Internal system structures include the various local land management entities that influence landscape conditions. External forces of change in the MRV include market forces influencing the timber industry and top down USFS regulation of the timber industry.

Changes in the Timber Industry

An external force consistently mentioned by interviewees is the influence the timber market has had on management decisions and practices. This is tied to changes in the timber industry that both adapt to and drive changes

in market conditions.

Interviewees described market forces as non-linear, with markets for timber products constantly ebbing and flowing as prices and values change. These dynamics influence decisions on when to harvest, how much to harvest, and what species to harvest. When prices are up, people log; when prices are down, the decisions become more complicated and depend on who owns the land. One local environmental activist described industry thinking: "When the dollar is driving they don't seem to have enough brains to look at the big picture." Almost every interviewee cited the price of timber as a critical factor driving logging decisions.

Many of those interviewed spoke of how changes in the timber industry have influenced landscape management. Changes include the conversion of mills, loss of small timber companies, and changes in technology. One local noted, "There are only nine dinosaur mills [for old growth] left in Oregon" (Environmental activist). With fewer mills capable of handling large timber, further pressure was added to harvest small diameter timber capable of being processed in the new mills. A timber land owner commented:

> In the [late 80s and] 90s, the whole spotted owl thing … I remember thinking as a private land owner that if they lock up all the federal wood, what's that going to do to us. I thought that might be good. Without a lot of wood, would it drive up the price for the private sector, or would it hurt us? Well it has hurt us because there are no mills. There is nowhere to sell old growth anymore.

A few interviewees also highlighted the fact that as access to federal timber declined and competition for available timber increased, it became more difficult for small companies to stay afloat. Several of the interviewees who were loggers have left the timber industry while those still logging have experienced a severe reduction in amount of work. One local truck driver noted how, "It diversified into big companies eating up small companies. Small companies had no way to compete; they were just gobbled up or ran out of business."

Most of those interviewed spoke of the technological transformation that altered the logging process, making timber harvesting more efficient, less damaging to the landscape, and reducing the number of workers needed in the field. These technological innovations also posed challenges for small companies trying to stay competitive. One gyppo outfit operator[1] spoke of the difficulty staying afloat:

> It was hard with all this new logging equipment and everything went to mechanized logging. We didn't want to take that chance to spend a couple of million on logging equipment and not know if we had a job in a few years.

Change in Federal Forest Governance

Virtually all interviewees discussed changes in the USFS which is seen as an external force controlling much of the land in the upper portion of the valley. As one landowner described, in its early years, the USFS "was basically a timber salesman. They were trying to sell all the timber they could sell because that was bringing lots of money into the coffer." In addition to selling timber, the USFS was focused on building or overseeing roads that facilitated timber harvesting and fire protection on federal lands. But as most interviewees agreed, the role and function of the USFS has changed dramatically as political and environmental conditions have

[1] A gyppo logger runs or works an independent small-scale logging operation.

changed. What residents began to see due to pressure by environmental groups and through changes in regulation was an increased focus on active management aimed at landscape restoration and on forest aesthetics, i.e. how the landscape appeared to visitors.

> Their [USFS] biggest area now is recreation and fish and wildlife. . .Sale administration is down pretty low. (Retired USFS employee)

> I think we're trying to do some different things with our management activities that we didn't do in '91 because we were so busy logging. We're doing some wildlife activities on a small scale, trying to restore meadows by cutting trees along meadows. (USFS biologist)

Emergence of Local Forest Governance

A few individuals interviewed discussed their belief in the need for consistent and sustained efforts to bring all MRV interests together to discuss management issues. Several individuals described failed attempts by the USFS to establish a local stewardship contracting program like the one on the nearby Siuslaw National Forest, which has seen great success in engaging the local community in ecosystem restoration involving sustainable forestry. Despite this setback, everyone suggested that the USFS continue efforts to work with the local population and continue discussing shared problems and challenges.

> We've tried some stewardship stuff that hasn't worked out. Well, we need to make it work out and bring all the different parties to the table and have those opinions shared and work through compromise in some fashion to come up with some sort of plan. Not one or the other is going to dominate. Perhaps that is the best way we are going to collaborate. (Former old growth timber faller)

Since these interviews were conducted, the McKenzie Watershed Stewardship Group (MWSG) has been established and has completed one successful stewardship contract with the Willamette National Forest (Cascade Pacific 2018) with others in the works. Planning for this type of timber sale and subsequent expenditures of retained receipts on restoration brings community members together in a governance process aimed at identifying a desired state for the SES and a 'zone of agreement' for how to manage the landscape, theoretically increasing social and ecological resilience at the local scale.

All interviewees agreed that governance change has had a significant impact on landscape and community change.

Perceptions of Landscape Change

When asked about changes witnessed in forests, interviewees discussed several categories of change that have been observed in the MRV, notably: timber density, timber age and species, and threats to the landscape. Local residents were very conscious of who owned what land and were quite clear in delineating landscape conditions based on the ownership characteristics of that land.

Comments about timber density referred both to the overall quantity of timber in the MRV and how timber is distributed across the landscape. For most individuals, changes in timber density are the most dramatic and persistent observed change. As timber harvests began to decline in the late 1980s and were essentially halted on federal land in 1991 to protect the northern spotted owl, the landscape began to change. As was required by law, all clear-cut forested areas were replanted for future harvesting. When

logging was halted on federal lands the replanted timber was left to grow, resulting in a landscape filling in with larger and older trees and increased vegetation in the understory. Almost every individual emphasized the point that there is more timber growing now than they have ever seen before and that much of it is very tightly spaced.

> A lot of those old clear cuts are 40 years old and are in pretty bad shape, heavy density, and need thinning badly. (Environmental activist)

One side effect of changing forest landscape patterns on federal land is a loss of early seral habitat, including open prairies or meadows. As described by this resident, a former logger,

> There's a huge difference on that prairie land from when I was a kid. Those big open meadows are declining like crazy. The trees come in from outside, the seedlings start populating and pretty soon the whole prairie is gone.

Almost regardless of opinion of past and current management practices, interviewees said management needs to be changed to move forward. Beliefs regarding future management practices involved two key changes: increasing logging on federal lands using a mixture of methods and cutting older timber.

Most interviewees expressed the need to increase management intensity on federal lands while recognizing that strategies need to be more holistic than they have been through managing for sustainability and the specific needs of the area. Speaking of what needs to be done differently in landscape management a former gyppo logger and an environmental activist seemed to be in agreement:

> Part of what that means to manage the landscape is to increase the amount of land that is logged, but to do so with a range of techniques that includes thinning. Yeah, don't get me wrong, I like to see more woods than less. I hated seeing a bunch of clear cuts around but if we're talking about thinning, if we're talking about managing our forest to keep it from being so combustible and at the same time having some sort of industry up here then I think that would be great. (Ex-logger and USFS employee)

> There's lots of thinning opportunities. There's lots of old plantations that need fixing. (Environmental activist)

A few interviewees expressed beliefs that for healthy forests, clear cuts needed to be included in management practices:

> The other thing with Douglas fir is it does real well in the open areas so it either has to be logged clean or burnt clean. Then it grows back really well. If you don't do that and let it stand and get old, die of disease and die slowly, you end up with a hemlock forest. (Ex-logger)

Speaking specifically of USFS practices and the reliance on thinning, one logging industry employee stated:

> Forest Service has a problem because all they do is thin. They can't take anything 80 years or older . . . They've got a problem; they're thinning themselves out. What are they thinning for? They're thinning because they can get timber sales through and can get some money back in there, but I know they want a diversified forest but they're thinning and not clear cutting anymore. When they're done thinning

then what?

Several interviewees shared the belief that old trees, not young trees, need to be logged. Old growth is seen as having value for a variety of reasons including ecosystem health and for its existence value but is also seen as 'dead and dying timber' with the greatest commodity value.

> My way of thinking is that the old growth is what you need to be logging. It's good timber, makes good boards, boards without knots . . . When you start logging six to eight- inch stuff you are actually logging your next generation of trees . . . Not to say it needs to be clear cut but it needs to be selectively logged so it looks nice and is healthy and you're going to get much more benefit out of the trees then you are a six-inch pole. (Truck driver)

> The thing about the old growth is it is just going to stand there and rot and die. It would be better to cut it and get nice new little trees than to let it sit there and rot and waste. (Landowner)

It is important to note that not all interviewees mentioned the need to log old growth timber. But most did at least express sadness that what is being logged tends to be the young, small trees.

Most interviewees discussed the developing threat posed by fire as forests on federally managed land continue to increase in density. "Those lands are overstocked and going to need some attention both from disease and fire protection" (Former old growth timber faller). That same concern is not necessarily shared for lands lower in the basin that are subject to continued timber harvests and where the weather tends to be moister and cooler. "Up at the pass that's known, there's lots of dead trees, a high fire risk" but there's a "huge difference in the land moving from federal to private land [in terms of fire conditions]" (Biologist).

Other environmental threats mentioned included impacts to water quality associated with ongoing clearcutting on private lands; for example, streams near logging sites running thick with mud during rainstorms, and residential development in riparian areas.

Interviewees consistently noted that differential environmental changes on the landscape were primarily related to different regulations affecting different types of land owners.

Perceptions of Community Change

Perceptions about changes in the local community are interwoven with changes in environmental governance and associated landscape change in the MRV. Ostrom's model describes the community element of the SES as a set of characteristics directly linked to the resource system. The adapted model used for this analysis incorporates community elements which may be evolving in a manner that makes the link with the resource system more indirect than it once was.

Interviewees' comments about the community can be grouped into three types of change: employment opportunities, demographic shifts, and community social institution disappearances. All respondents echoed a similar story of community change in the MRV that emphasized a loss of young families and an increase of retirees as the timber and resource infrastructure building sectors decline and are slowly replaced by an environment managed for different outcomes.

<u>Changes in Employment</u>

Employment opportunities in the MRV have undergone a dramatic shift. When almost all of those interviewed began working there was an abundance of work opportunities.

One local truck driver recalled, "Before in the 50s and 60s it was work work work, all kinds of work. You could get fired here today and go to work there tomorrow." Most of the jobs people found were in some way connected to the timber industry or dam building on the local river. As one retired USFS employee recalled, "At one time you had six or seven mills between here [Blue River] and McKenzie Bridge. Some of them very small . . . Those are all gone."

A former logger echoed these concerns about changing economic opportunities:

> It used to be we were a more economically vibrant community. With the restrictions on the national forest and with the change in the market and with the changes in demand for wood products this community has gone through quite a transition.

What many described as the new economy in the MRV is based in recreation and tourism. When asked about local employment, one resident community member stated "Well tourism, that's the business up here now; you know guides and rafters, lots more on the river." The problem with the recreation and tourism industry raised by several interviewees is that those sectors do not provide a lot of family wage jobs. Typically, they provide employment or income for a couple of months during the summer but then income drops dramatically in the winter.

Demographic Change

Every interviewee described the MRV as historically settled by working class families. Initially the area was populated with logging families and families of USFS employees. When Cougar and Blue River Dams were being built in the 1960s, the logging community saw a significant influx of families who moved to the area to work on dam construction. As one retired USFS employee stated every family had a "husband and a wife with 2.4 kids and a husband in the woods."

As working-class families left the area, local residents witnessed an influx of retirees and vacation homeowners. The transition has been so dramatic that almost everyone interviewed commented on how the community can now be seen as a retirement community:

> There's virtually no logging families on the river now and there's an awful lot of retired folks. It's become kind of a retirement community. (Logger)

Changes in Social Capital and Network Capacity

Two main themes emerged about transformations of community institutions: changes in the local school and, especially, a loss of social venues to interact with others in the community. Respondents often reported that everyone used to know everyone else. One truck driver who lived in the MRV since the 1940s commented on how it "used to be I knew everybody from McKenzie Bridge to Vida. Now I'm lucky if I know three people. The local family type things that were here for ages and ages have dwindled."

Throughout the interviews, residents mentioned the loss or gain of different venues or events that created a center for community gatherings. Interviewees spent little time talking about current venues and more about the number of places that have been lost to the community. Many focused on the town of Blue River, which once was seen as thriving with a hotel, multiple filling stations, and several restaurants and bars, now perceived as "going backwards" (Land owner and former logger). Another interviewee said somewhat sarcastically, "We'll drink at home alone" (Ex-logger and USFS employee).

Responses provide a glimpse into residents' beliefs regarding the ability for the situation to change in the MRV, with three main ideas emerging: 1) these changes are here to stay; 2) some individuals are interested in being active change agents; and 3) a few organizations exist in the MRV that can facilitate the development of local capacity to adapt to the myriad of challenges facing the valley. Taken together these comments hint at an acceptance of the current loss of social capital and some local capacity to adapt.

Almost all interviewees expressed acceptance of the impossibility of returning to the days when the community was booming and timber was king. For some, this was seen as a good thing. One former old growth timber faller continually emphasized the need for the community to change; speaking of old days he said:

> Those days are gone; at least right now and probably for a good reason cause we were probably not managing the resource as we should back then . . . You have to constantly change to some degree. Take the best thing and work with that. Don't be unwilling to admit you make mistakes.

Several of those interviewed discussed their past participation and willingness to participate in land management discussions with the USFS or other groups.

In sum, resource dependency in the MRV has been replaced by a mix of activities that include traditional work – logging, guiding, and USFS work – with new recreation and service work, as well as an increase in commuting to nearby metropolitan areas that can provide jobs. Young families who were part of a blue-collar logging culture have mostly left the valley and been replaced by retirees and vacation homeowners, shifting the MRV from a logging community to a retirement community. These community changes appear to have resulted in decreased social capital and network capacity, which will take strategic efforts to restore.

Discussion

Results of this research suggest that structural issues are contributing to low community resilience in the MRV. A primary concern is the limited ability of the system to self-organize given the lack of existing local governance structures. Resilience is fostered by the existence of multi-layered governance arrangements that support local decision-making and have the flexibility and capacity to navigate local challenges. Governance in the MRV, an unincorporated area, is for the most part overseen by distant county, state, or federal offices. One of the few local governance institutions at the time of our interviews is the McKenzie River Watershed Council, funded in part by the state to develop place-based restoration projects.

The USFS, private land managers, the BLM, and the Oregon Department of Forestry oversee local land management. This multi-level/multi-sector arrangement limits the ability of the SES to self-organize because, as stressed by interviewees, management decisions are largely influenced by state and national politics on federal land and by corporate interests on commercially owned timber land. Without the ability to influence management decisions locally, the diverse land ownership interests lead to management strategies without a system-wide focus. The lack of local capacity to influence the management of the system limits the system's overall resilience and ability to adapt to future management problems or those induced by forces such as climate change.

Managing for resilience requires focusing on slow moving variables such as institutional structures and processes (Gunderson 2000). A key part of this is enhancing flexibility and adaptability of institutions and

the ability to self-organize (Carpenter et al. 2001). Interviews with long-time residents indicate the MRV SES has been increasingly subject to external forces such as changes in timber market conditions, industry reorganization and mechanization, federal logging regulation, and pressures from rural restructuring and amenity migration. By enhancing the system's ability to self-organize and develop internal capacity to address problems, the residents may be better equipped to adapt to changing ecological and social conditions.

While multiple factors exist that could enhance the resilience of the MRV, perceptions of long-time residents indicate three key issues that may improve the adaptive capacity of the local SES: 1) enhance transboundary land management in the MRV; 2) tighten feedbacks between policy makers and the system; and 3) develop multilayered institutions for system management. Each is discussed below.

Enhance Transboundary Management

Resilience thinking requires that the biophysical, social, and economic components of a region be treated as a single SES (Walker et al. 2009). As shown in the map (Figure 2), the MRV has a variety of landownership types and sits within and adjacent to large sections of public land. Consequently, land management in the basin is divided among several land management organizations that include government agencies like the USFS, BLM, Oregon Department of Forestry, Oregon Department of Land Conservation and Development, Oregon Watershed Enhancement Board, Lane County, and the McKenzie River Watershed Council; private entities such as commercial timber companies and residential homeowners; and non-governmental organizations like the McKenzie River Trust.

As residents indicated, this land ownership arrangement has led to management decisions that have failed to fully account for the fact that the different pieces of land in the MRV function as a linked system and ensure that biophysical, social, and economic portions of the system are coordinated. The most salient example of this came when decisions were made to reduce timber harvests on public land. As most residents interviewed attest, reductions on federal land simply shifted harvests to adjacent private lands, shortening harvest rotations and, in some cases, leading to permanent loss of forest and farmland in favor of increased human development.

Oregon has a rich tradition of building transboundary management institutions. In 1995, for example, Oregon passed legislation allowing local government entities to create local watershed councils. Oregon now has 88 watershed councils composed of local community members who work across jurisdictional boundaries to focus on the health of their watershed. Several of the residents interviewed highlighted the role the McKenzie Watershed Council has played in developing strategies and solutions to protect the health of the MRV watershed.

While Oregon's watershed councils have functioned with varying levels of success, their structure serves as a model for practices that can help facilitate transboundary management within a SES. They include utilizing local knowledge and broad stakeholder engagement, fostering capacities for a system to self-organize, and creating a venue for local decision-making, all key components to a resilient SES. As previously mentioned, the McKenzie Watershed Stewardship Group (MWSG) is a forest collaborative that seeks to support stewardship contracting on USFS lands. This relatively new governance mechanism serves a dual purpose: it prioritizes restoration activities involving treatment of overstocked stands for the purposes of forest health and resiliency and provides income to local logging operators. It also strengthens local capacity to self-govern and

collaboratively work across jurisdictional boundaries toward desired social-ecological futures.

The MWSG was most recently convened by the Eugene Water and Electric Board (EWEB), which relies on the McKenzie River for both power and water resources, to work with the USFS Willamette National Forest. This partnership allows the USFS to enter into long-term contracts that allow funds generated by timber sales to remain in the watershed to be used for other restoration work (instead of going back to the USFS and/or the U.S. Treasury). A pilot stewardship sale in the MRV generated over $100,000 in retained receipts to be used on restoration projects on both public and private lands in the valley. Current partners include state and federal agencies (e.g. Oregon Department of Forestry), private timber companies (e.g. Whitewater Forests LLC), and non-governmental organizations (e.g. McKenzie Watershed Council, Oregon Wild). A brief review of MWSG meeting notes supports the idea that community members are making and evaluating decisions about stewardship contracts, networking with other organizations in the community, and learning from other collaborative partnerships in the USFS system (Cascade Pacific 2018).

Both watershed councils and stewardship groups illustrate the ways in which communities reorganize to build social-ecological resilience through collaborative conservation efforts. By bringing together diverse stakeholder groups to address resource management and restoration projects, communities like the MRV can transform their governance systems, build resilient landscapes, and strengthen social networks.

Tighten System Feedback

Feedback represents the secondary effect of one variable interacting with another. In the context of the MRV, feedback includes changes in timber industry employment, spotted owl numbers, the size of salmon runs, or a variety of impacts resulting from the interaction of variables in the system. A resilience approach focuses on tightness of feedbacks, which refers to how quickly or strongly the consequences of a change in one part of the system are felt and responded to in another part of the system (Walker and Salt 2006). As the resilience literature indicates, if feedback is not tightly linked, the impacts of changes occurring within a SES can be delayed, thus slowing potential management responses.

In the early 1990s, public land managers and organizations shifted their focus to an inclusive set of ecosystem variables, and have made efforts to incorporate the principles of adaptive management. Despite this, there still appears to be considerable distance between policy makers and local circumstances such as declining populations and changing forest conditions that increase local risks. One way to improve resilience of the MRV SES is to build collaboration among the organizations making policies affecting the MRV; there is also a need to clearly understand how local social, economic, and ecological conditions are affected by those decisions. Once again, collaborative conservation efforts like the MWSG prove useful in building resilience through tighter links among community interests at multiple scales.

Build Multilayered Institutions

A consistent theme in resilient SESs is the necessity of multilayered governance structures that are redundant and organized both vertically and horizontally (Anderies et al. 2004; Langridge, Christian-Smith and Lohse 2006; Nelson et al. 2007; Walker and Salt 2006). Without a multilayered SES, resilience can be diminished. For instance, in the MRV, no

local general-purpose governments exist in these unincorporated areas. General governance is provided by the county, and in some instances, the state and federal government. The most active governance organizations in the area are federal and state resource management agencies such as the USFS. While linked vertically, as discussed previously, the link appears to be influenced from the top down, with little local ability to impact management decisions.

Furthermore, the primary governance organizations in the MRV have been focused on ecosystem management in recent years, with little attention to local economic well-being. That appears to be changing, however, with the emergence of the MWSG, with its multiple partners from federal and state agencies, the private sector, and NGOs. The success of the first pilot project described above suggests that progress is being made in managing the landscape collaboratively for improved social, economic, and ecological health. However, there continues to be a lack of local organizations focused on the social and economic health of the community. What residents in the MRV described was an institutional structure that is not fully linked vertically or horizontally to provide for system-wide resilience.

Many of those interviewed expressed an interest or willingness to effect change within the community. This energy is beginning to be capitalized on as groups like the watershed council and the stewardship group emerge. These collaborative entities can fill in the governance gaps present in unincorporated regions and provide a platform for local community members to interact with local, regional and national governance systems. Additionally, these groups provide a structured way in which local people can advocate for improved social and economic conditions. This type of polycentric governance tends to increase resilience.

Conclusion

This study sought to understand perceptions of long-term McKenzie River Valley residents regarding landscape and community change and provide a general assessment of factors affecting local SES resilience. Interviewed residents indicated that dramatic changes driven by market competition, timber industry changes, increased regulation, and rural restructuring have occurred in both the landscape and the community. These changes have redefined the relationship between the community and the landscape, moving away from local dependence on timber harvests to an economy driven by tourism and other ecosystem services including restoration activities. In doing so the community has transitioned from one with an identity as a logging community to one that has begrudgingly transitioned to a retirement and vacation community. As a result of relatively low institutional and organizational capacity, the SES is vulnerable to continued drivers of change from outside the MRV. However, the communities in the MRV have begun to reorganize through collaborative governance structures that may be enhancing resilience and adaptive capacity. In order to facilitate enhanced resilience, policy makers and policy entrepreneurs should take action to ensure transboundary management strategies are put in place, that feedbacks are tightened to include more local influence on decisions, and that adequate support is provided to local organizations to create multilayered structures that interact both vertically and horizontally. Results of this study suggest the need for future research on the array of institutional, organizational, and governance structures affecting the MRV and other unincorporated rural communities in order to identify strategies to better coordinate response to change. Future work characterizing perceptions and beliefs of more recent community residents will increase understanding of how the shift

in demographics is shaping local preferences for landscape and community management.

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