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Restoration of Forest Systems and Rural Livelihoods:
A Partial Resilience Assessment of a Work in Progress

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Background

Wallowa County is located in north-eastern Oregon on the dry side of the Cascade Mountains (Fig. 1). Ponderosa pine forest in lower elevations and mixed conifer are the dominant ecotypes with rangelands and rivers making important contributions to the resource base for rural livelihoods. During the 20th century, forestry, with associated wood products manufacturing, and livestock production were the primary sources of private-sector livelihood, tax revenue and wealth needed to support a diverse small town economy in Enterprise (the county seat), Joseph, Lostine and Wallowa. Fishing, hunting and tourism made small but important contributions to economic diversity in the county. Most of the timber resource was historically harvested off the Wallowa-Whitman National Forest, which is administered by the US Forest Service. Industrial forest ground provided the second largest source of timber, with minor annual harvests generated from small tracts of private family forests.

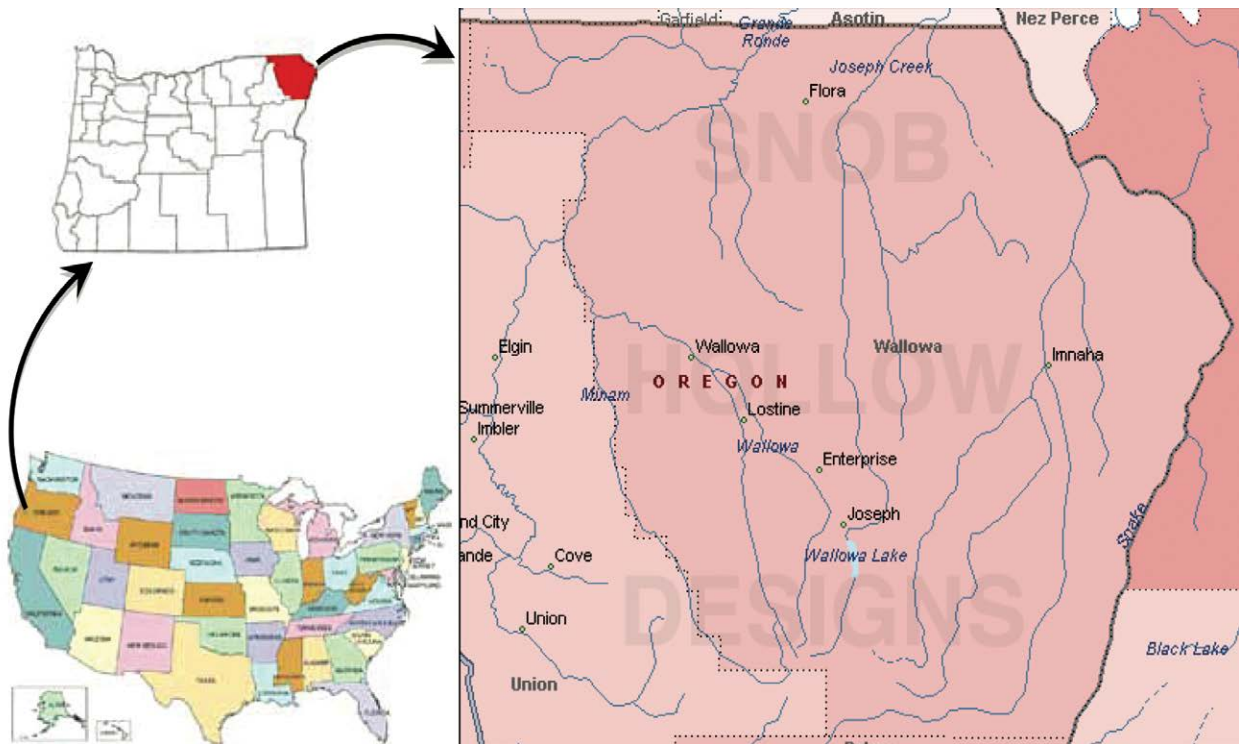


Fig. 1: Location of Wallowa County, Oregon, USA.

The Wallowa-Whitman National Forest, which forms the centerpiece for the story of collapse encompasses 2,392,508 acres, lies in three states (Oregon, Idaho and Washington) and 10 counties and is bordered in Oregon by the Umatilla and Malheur National Forests. The forest has multiple uses that include many kinds of recreational activity, timber harvest, minor non-timber forest product harvest, hunting, fishing and grazing. The forest is part of multiple water catchments draining into the Columbia Basin and has four wilderness areas, making it a complex entity to administer with multiple stakeholders and many competing interests.

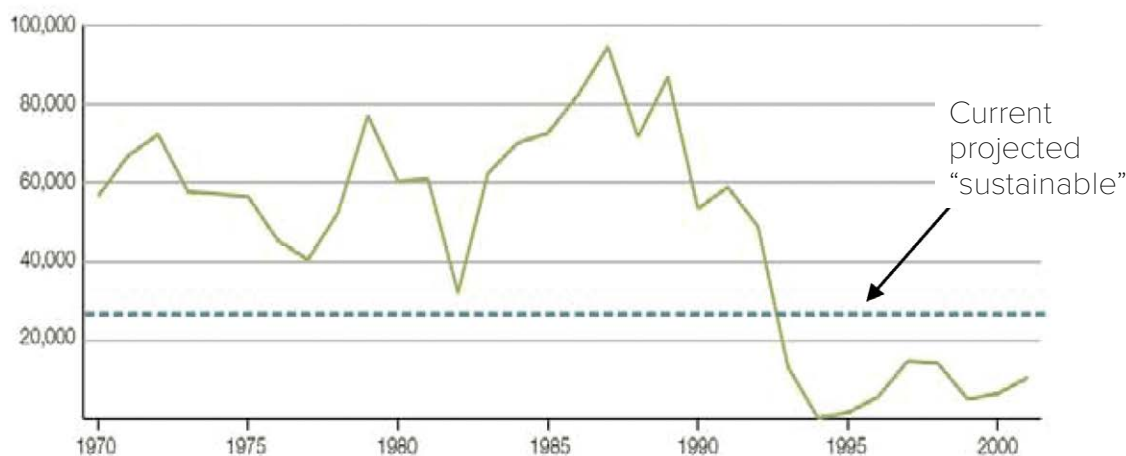
The history and trajectory of change in Wallowa County is similar to changes that affected the timber industry throughout the western US (Swanson & Chapin, 2009). Changes in the Tongass National Forest in Alaska are described in some detail using the four phases of the adaptive cycle (Beier, Lovecraft, & Chapin, 2009). Briefly, the changes in Wallowa County were as follows:

Organization began with the declaration of the Wallowa Forest and Whitman Forest in 1908, and subsequent investment in railroad logging and saw mill facilities, and extends approximately to the post World War II boom in global industrial development. The two forests were formally merged in 1954.

Growth phase information has not been collated for the Wallowa-Whitman but it probably followed the national pattern with high levels of extraction aimed at old growth forest. Timber sales were directed at large over-story Ponderosa pine, Douglas fir and Western larch. The Forest Service earned considerable revenue from timber sales and research was aimed at increasing the efficiency of timber production and harvest.

The conservation phase is illustrated by the timber sales in Fig 2, which remained high but at relatively consistent levels from the 1970's until the collapse began in 1992. The drop in the 1980's corresponds with a recession from July 1981 to November 1982 that reduced home building and the demand for lumber.

The collapse phase was short, beginning with the Endangered Species Act (ESA) listing of Chinook salmon runs in 1992 resulting in a nearly two-year cessation of timber sales from the national forest lands in Wallowa County. Prior to this, timber sales accounted for 60 to 70 percent of the county's annual harvest. The loss of this supply led to closure of three sawmills, in 1995. Two of the sawmills reopened in 1996 on a limited basis before closing permanently in 2001 and 2007 (Christoffersen, 2011).



Features of the collapse were lawsuits brought against the Federal Government by environmental organizations under the Endangered Species Act, a significant drop in Forest Service income (\$37,508,808 in total revenue to WWNF in 1990 fell to \$536,514 by 2012), a reduction in staffing by over 50%, and a significant erosion in the ability of the Forest Service to deliver on its forest management responsibilities. Forest health declined as tree density increased. These stand conditions, coupled with a long-term drought spanning the late 1980's to late 1990's, created ideal conditions for extensive die-off due to beetle infestation and high intensity fires. Healthy Ponderosa pine forest tends to be open with mixed age trees and a good grass cover, a condition that is created naturally by fire. Fire suppression was part of forest management to maximize the sustainable timber yield, but as timber is not being felled, fire is needed to maintain forest health. This presents a management challenge because after 80 years of fire suppression, people have forgotten how to use fire as a tool for forest management. Furthermore, there is less tolerance for smoke from wildfire, and greater risk to homes, property and lives as development has crept into the wildland-urban interface. This situation prevails in forest systems throughout the western US and has led to the emergence of a Fire Learning Network to build fire management capacity in people who earn their livelihood from forests (Goldstein & Butler, 2011). The difficulties of managing complex forest systems through traditional approaches was recognized by the Dean of Forestry at Oregon State University (Salwasser, 2004) who defined the social and ecological complexity of forest systems and the inherently unpredictable nature of the outcome of forest management policies and plans. Some of the thinking based on Holling's (1978) work on adaptive management has been applied to forest management (USDA, 1990) but this is rarely fully implemented because of the high costs of monitoring, and the constraints posed by two decades of legal challenge. Consequently very little is learned about forest system function and dynamics, or the impacts of management on forest systems. Resilience based stewardship is proposed as an approach for dealing with the "wicked problems" that arise from the complexity and unpredictability of ecosystem management (Chapin, et al., 2010) and for the social learning necessary to build an understanding of forest system dynamics, and strengthen adaptive capacity.

Methodology

This case study is based on the three core models of change in complex adaptive social-ecological systems: adaptive cycle and panarchy summarized in Holling (2001); and the thresholds model of Scheffer et al. (2001). The study falls well short of a detailed resilience assessment (Walker and Salt 2006; 2012; Jones, in prep) but uses the core models as a way of broadly describing the changes that have occurred in the "social-ecological system" that is spatially defined as Wallowa County, picking up the story as it applies to the collapse and reorganization of Wallowa County after a brief account of federal forest management. This case is focused on Wallowa Resources, working with local

government, as an innovator and change agent in Wallowa County, its growth as a change agent; its impact on different aspects of the Wallowa County system; and influence on larger scale systems in the region.

A full resilience assessment of Wallowa County as a social-ecological system is scheduled to begin in November 2013 in a participatory process that involves representatives of the major stakeholders. This may be extended to include similar assessments of the adjoining Baker and Union counties that share a part of the Wallowa Whitman National Forest and further afield, depending on how useful forest system stakeholders find the assessment process and the resulting strategy for resilience based forest stewardship.

Interventions and Outcomes

Wallowa County Commissioners and local citizens established Wallowa Resources as a non-profit entity in 1996, as a response to the lumber mill closures and change in the management of Wallowa-Whitman following the ESA listing of salmon. The growth of Wallowa Resources and its work as a change agent established to restore forest management and the timber industry is readily told as a time line account drawn from Wallowa Resources records. Below are key moments in this history that shaped the current innovation process:

1999: Started the Wallowa River restoration program, the first parts of which were completed in 2006 (below).

2000: Worked with Wallowa County's Natural Resources Advisory Committee and the USFS to launch a new Forest Collaborative in the Upper Joseph Creek Watershed, an area of 174,000 acres of public and private land. The collaboration worked over the next 6 years and resulted in:

First timber sales and stewardship contracts on USFS land in Wallowa County to be contracted without legal appeals. Restored 35 miles of native steelhead trout habitat for spawning and rearing. Generated over \$6 million in local economic benefit.

2003: Completed Imnaha Parks Ditch Water Conservation Project, which was the first use of Oregon's Conserved Water Statute in Wallowa County. Project resulted in a threefold saving in irrigation water, maintained hay and forage production with less labor, and identified potential for future micro hydro developments within existing irrigation conduits.

2005: Community Smallwood Solutions LLC formed by WR Community Solutions Inc and 15 local investors to use equipment salvaged from Joseph Timber Company, and create five new full time jobs. This catalytic investment (leveraging local private equity in a community development venture) ultimately became Integrated Biomass Resources LLC (IBR), the current business operating at the Integrated Biomass Energy Campus. IBR employs 20 people with gross sales exceeding \$1.5 million annually (see 2009 below).

2006: Completed the Wallowa River restoration project, the first major river channel re-meander project in Eastern Oregon. The project was completed at 25% of the cost of similar projects in western Oregon with immediate and continuing impact on native salmonid habitat. Within 5 years, the half-mile section of reconstructed river hosted more than 28 salmon redds, where previously there had been none. This project has since been replicated three times on upstream properties creating an additional 2.5 miles of improved salmonid spawning and rearing habitat.

The work of Wallowa Resources and its for-profit subsidiary was selected for analysis as a unique model of small-scale distributed systems tapping biomass, solar and micro-hydro opportunities. Combined renewable energy systems are generating over \$2.4 million in local energy savings.

2013: Finished the Lower Joseph Creek Watershed restoration assessment (190,000 acres) contributing directly to USFS and State of Oregon goals of accelerating the pace and scale of restoration in eastern Oregon.

This seemingly disparate set of initiatives and activities is consistent with the vision of Wallowa Resources and its role as a change agent in a socially and ecologically impoverished setting that requires an integrated, holistic approach to restoration, and one that operates at local, state and national scales.

Wallowa Resources' mission is to develop, promote, and implement innovative solutions to help the people of Wallowa County and the Intermountain West sustain and improve their communities and their lands.

Wallowa Resources implements its mission through three program divisions:

Watershed Stewardship designs and implements forest, range and riparian restoration projects on public and private land,

1. Wallowa Mountain Institute conducts research, education and outreach on land and community stewardship in rural communities, and,
2. Community Solutions Inc. (wholly-owned forprofit subsidiary) provides capital, business services, and technical support to create and support businesses that generate benefits to the community and the environment.

Wallowa Resources also engages in strategic program and policy work at the County, State and National levels, through partnerships with local, regional and national organizations.

Lessons Learned

The Upper Joseph Creek restoration project established many of the principles for collaboration that have become hallmarks of the Wallowa County approach to collaborative conservation, and helped catalyze the formation of collaboratives across eastern Oregon. The restoration project was an exercise in both reflexive action and adaptive management that brought together a large number of stakeholders with different values, perspectives and interests in the Wallowa-Whitman National Forest. These include loggers, foresters, fishermen, ranchers, Native Americans, diverse recreation interests, and environmentalists. The success of the Joseph Creek project was based on Wallowa County's decades long earlier experience in cooperative planning to address issues such as the salmon habitat recovery, forest health, job loss and school enrolment. Wallowa County's Natural Resources Advisory Committee (NRAC), established as a stakeholder advisory body to the county, was expanded to include additional federal and state agencies, private landowners, environmental organizations, community organizations and local businesses. This group guided the development of a restoration plan that laid the foundation for collaborative effort that enabled restoration activity to be undertaken at a larger scale than previously. This approach:

- created efficiencies of scale in resources available to the collaborative;
- overcame some of the obstacles of the ESA and NEPA processes; and
- addressed ecological components such as riparian areas, invasive species, and forest fire risk at scales more aligned with the scale of ecological processes.

A feature of the collaboration was a set of shared stewardship principles to guide the collaborative process and was critical to early success:

- Assess conditions at a watershed level
- Recognize key influence of disturbance-adapted ecosystems
- Recognize historical patterns and current importance of habitat diversity
- Incorporate the social, cultural and economic dynamics of the community
- Address not only the symptoms, but also the causes of poor watershed condition
- Maintain patterns that are within a resilient range for that landscape
- Avoid strategies likely to have high recurring maintenance cost
- Tailor strategies to local conditions
- Define clear, achievable, and measurable objectives
- Use adaptive and flexible management supported by multi-party monitoring

Another key ingredient was a set of agreed principles for collaboration:

- **Be inclusive:** all stakeholders are asked to participate and to be involved. All meetings are open: all information and decisions publicly available.
- **Consensus:** collaborative support was maintained through the process by developing consensus at the outset based on shared Stewardship Principles.
- **Share risk and reward:** all stakeholders were willing to step outside the confines of their self-interests to identify opportunities, which generate meaningful benefits to all parties when risks and rewards are shared.
- **Timely project implementation:** involvement of nonprofit organizations allowed projects to occur quickly due to their role in sourcing grants and contracting work to local businesses, which maintained interest and produced tangible results.
- **Adaptive Management:** a flexible approach to implementation allowed on-the-ground work to change if needed as new knowledge and technique arose.

These operating principles for collaborative endeavor, developed through trial and error are now institutionalized as part of Wallowa Resources' strategy:

“Our work requires the integration of social, economic and ecological issues to identify and implement strategies that will conserve cultural and biological diversity, promote sustainable use, and ensure the fair distribution of benefits. It also requires partnerships collaborative relationships that

- (1) Build consensus on the desired future for our County, its resources and people;*
- (2) Coordinate effort and leverage resources; and,*
- (3) Provide the framework to scale up and address larger regional and national constraints to local sustainability.”*

Despite the successes that have been achieved: relatively large scale forest and river restoration projects; a well developed model for collaborative conservation; job creation; innovation in the harvesting, processing and marketing of wood products, the pace of change is slow in relation to the spatial extent of the problem. Health of large areas of forest continues to decline, local revenues from forest industry are small compared with the pre-collapse years and the county is dependent on state support to maintain social services. The financial collapse of 2008 and generally depressed state of the global economy have had a negative impact on financial support for Wallowa Resources. The development of new technologies for harvesting and processing wood has been under financed. Despite the collaboration, many environmentalists remain wary of efforts to accelerate the pace and scale of essential forest and water catchment restoration work. The provisions of the Endangered Species Act and the National Environmental Protection Act that enables legal challenges of forest restoration treatments to safeguard the public interest are constraining successful re-organization towards a “stewardship economy” development trajectory. The stewardship economy aims to rebuilt jobs and revenue streams around the stewardship of working landscapes to produce food and fiber needed to meet current demands, while maintaining the quality and function of ecosystem services.

Resilience Reflections

Taking a broad-brush resilience perspective of the work of Wallowa Resources and the various Wallowa County collaborative groups they support, resilience is being rebuilt after the 1994-1995 timber industry collapse in a re-organization phase of the adaptive cycle. Success in this phase is determined by the potential of the system: the social, financial, ecological, economic, built and technological capitals available for change and growth. It is also dependent on the presence of stable larger scale systems that can perform the “remember” function by supplying the necessary capitals and components for the system to “bounce back” and assume its former state. The “remember” function is also manifest in the federal laws and policies that empower environmental organizations with few direct connections to Wallowa County, to impede recovery of the social-ecological system around the stewardship of working landscapes. The ability of the system to recover is further determined by fast changing subsystems and their ability to bring about a “revolt” that transforms the system into something different. Failure in the reorganization phase leads to a “poverty trap” where there is insufficient potential for change and the internal regulation of the system, its “connectedness”, is insufficient for the system to either bounce back, or “bounce forward” in a process of transformational change.

The Wallowa County system has developed large amounts of social potential through various collaborative projects and has achieved considerable success on a small-scale in restoring the health of some rivers, forests and river catchments. Coming together is a normal human response in time of crisis and creates opportunity for building resilience. Wallowa Resources acting in its role as change agent with the county Natural Resources Advisory Committee has provided the kind of leadership necessary to build the social potential for either restoration or transformation.

Nevertheless, the inability of Wallowa County system to scale up its restoration work is cause for concern. The “remember” function of larger scale systems is not working well because they too are in poor condition due to the widespread collapse of maximum sustainable yield forestry across the western US that reduced federal management capacity. Some of the ecological potential was converted to money and transferred to the social side of the system in things such as infrastructure, technology and finance. Some has been transferred out of the system to other parts of the US (e.g., the large lumber mills relocated to forests in the east) and some potential has been lost to global timber markets. Despite these losses of ecological potential, there are significant supplies of 10 – 25 inch diameter trees that could support growth of a local timber industry that uses improved logging practice, processing technology, and harvest regimes. Harvesting in these stands would contribute to improved forest health, reduced wildfire risk, and increased ecological diversity. The current legal framework that enables challenges to timber sales and restoration projects is limiting re-investment and the ecological potential continues to deteriorate as restoration projects cannot be brought to a scale that is appropriate to the scale of ecological processes in the forests, and socio-economic needs in the adjacent rural communities.

The Wallowa County system is in an impoverished state and so are the larger systems within which it is embedded. It will be difficult for the Wallowa County system to exit its poverty trap unless the system is transformed. Local level innovation has not been sufficient to generate strong, broad support within the state and national government for reorganizing around a “local stewardship” economy model. Much of the high-level policy debate is polarized between use and no-use resulting in simplistic decision-making that does not favor re-organization in rural communities around natural resource stewardship. Instead state, federal, and private sector investment supports rural transformation with things like retirement communities, recreation and amenity communities catering to high net-wealth, call and service centers, prisons, etc. The use of over 60 national forests (mostly located in the west) for illegal marijuana production is another undesirable consequence of the management vacuum created by the collapse in USFS capacity.

Innovation in preparation for transformation is a large part of what Wallowa Resources does but it is hampered in this work by rigidities in larger scale systems that resist change. Perhaps the most fundamental of these rigidities are those that occur in the human mind that lead to power seeking behavior at the expense of others and entrained ways of thinking and doing. Scheffer and Westley (2007) describe the biological basis of rigidity, which implies that rigidities in the human mind are difficult to overcome because they provide evolutionary fitness. This tendency towards rigidity is manifest in the general reluctance of diverse interest-groups, including larger national environmental organizations that have acquired power in an existing system of policy and law. Change would require that they give up their positions of influence, something they are unlikely to do unless they can find alternative uses for their skills and energy. Catastrophe and crisis may be required to unlock the trap and lead to different ways of believing, perceiving and doing.

Carpenter & Brock (2008) explored poverty and rigidity in a model that showed how strong internal regulation of a system (the over connectedness associated with rigidity) prevents the flexibility needed for adaptation and increases the risk of catastrophic breakdown. This contrasts with poverty traps that are associated with loose connections and prevent the mobilization of resources to solve problems. The model supports the implications of Scheffer and Westley’s (2007) observations that external shock is necessary to create change. The likelihood of shocks occurring due to disease outbreaks, larger and more intensively destructive fires, and changes in species distribution is increasing with global warming and climate change. Management cannot prevent climate change, but it can create conditions that enhance the capacity of forests and people to adapt to that change.

Rigidity that impedes innovation is manifest in the laws and policies that govern land and natural resource use. A system of formal and informal institutions acts as a large scale slow changing system to resist the revolt function of small scale, fast changing systems. The difficulty with most law and policy is that it is based on the false assumption that living systems behave in predictable ways when in fact living systems are complex and unpredictable. This implies the need for extensive law and policy reform so that people can adapt to managing a complex and unpredictable environment. Such a system of laws and policies would for example support local innovation (Ruitenbeek & Cartier, 2001) and devolve much decision making power to local governments. Additional evidence supporting the need for major governance reform is provided by Biggs, Carpenter & Brock (2009) who show that it is difficult to avert systemic

collapse in large-scale systems of any kind. Collapse can be averted at a local level provided there is an adequate monitoring system in place to detect change before a system threshold is crossed, and local managers have the authority to take corrective action. Although US policy is now using the word “resilience”, legal and policy instruments needed to provide local government with authority to manage, do not exist (Benson & Garmestani, 2011). Garmestani et al., (2013) suggest extensive legal reform based on the principles of reflexive law to enable resilience-based responses to environmental change.

Wallowa Resources is playing a leading role in building larger coalitions of organizations with common purpose through DFIZ and RVCC. These coalitions are united in seeking to effect needed legal and policy reform. The persistence of opposition within some environmental organizations to an expansion of restoration, a conservative legal system, and a desire by some county commissioners and industry to return to “the good old days”, constrain legal and policy reforms necessary for building resilience landscapes and communities at the county level.

Conclusions

The Wallowa County social-ecological system is in the reorganization phase of the adaptive cycle but is at risk of remaining mired in a poverty trap. It is also vulnerable to a wide range of shocks associated with climate change and other global scale phenomena such as the high potential for financial collapse and unstable fossil fuel energy costs. Alternative futures for Wallowa County may lie in the direction of further development of tourism, second homes for people from urban centers and land fragmentation for development. These alternatives have not been explored but intuitively seem unlikely to provide a good way forward because of the need for increased physical infrastructure, landscape fragmentation and dependence on urban economies that are also threatened by global change. A conservative “stewardship” development model that maintains the health of landscapes as a sustainable source of renewable resources seems preferable. The actions of the Wallowa County Government and Wallowa Resources have resulted in the emergence of a model for collaborative forest stewardship that enhances the potential of the system for transformational change to a “stewardship” economy.

The lessons that have been learned by Wallowa Resources are being shared with other county level non-profits in Oregon and the neighboring states of Washington, Idaho, Montana, and California. This collaboration is set within a larger collaboration of civil society organizations seeking to develop collaborative management with federal agencies throughout the western US. The rigidity existing in larger scale systems imposes a major constraint on the policy reform necessary to foster resilience building and transformational change in Wallowa County

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