

FOSTERING SOCIAL-ECOLOGICAL RESILIENCE IN THE UPPER KLAMATH  
BASIN: THE NATIONAL RIPARIAN SERVICE TEAM'S CREEKS &  
COMMUNITIES STRATEGY AS AN EMERGING MODEL FOR GOVERNMENT IN  
ADAPTIVE CO-MANAGEMENT

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**Abstract**

Social-ecological resilience theory is part of a new paradigm for understanding and managing complex coupled human-ecological systems. The theory aims to inform explorations of a system's ability to withstand disturbance while maintaining its critical functions. Adaptive co-management has been proposed as a governance mechanism that can enhance resiliency by combining the shared learning components of adaptive management with collaborative and community-based approaches to natural resource management. This new paradigm poses a challenge for government agencies charged with overseeing the nation's natural resources, however, since many still embrace a more traditional centralized, science-based decision making approach. The National Riparian Service Team (NRST or Team), an interagency partnership between the U.S. Bureau of Land Management and the U.S. Forest Service, is an example of a federal agency that is experimenting with this new paradigm. This study draws on concepts associated with resiliency and adaptive co-management as a basis for evaluating one aspect of the NRST's Creeks & Communities Strategy (Strategy), which was designed to address both the technical and social aspects of riparian management across ownership boundaries using a place-based approach to problem solving. Using the Upper Klamath Basin as a case study, we found the NRST to be an effective catalyst for adaptive co-management, at least in part because of the timing of its intervention, which occurred during what we characterize as a phase of reorganization following the 2001 collapse of the social-ecological system. Two major components of the Team's approach are highlighted for their role in promoting adaptive co-management and enhancing the resilience of the Upper Klamath Basin social-ecological system: (1) the concept at the core of the NRST's approach to riparian health assessment, Proper Functioning Condition (PFC), which both provides a qualitative measure of resilient capacity and promotes social learning and joint-fact finding; and (2) the Team's emphasis on collaboration and cross-scale communication, which builds social capital and enhances community capacity to garner resources from other scales. Finally, we suggest that while the NRST exemplifies an effective and important new role for government actors in ecosystem management, there are a number of barriers currently preventing this model from being widely adopted in other government agencies.

**Key Words:** Adaptive co-management, collaborative management, government agencies, resilience, riparian health

## **Introduction**

Among both scholars and resource management practitioners there is a growing recognition that the environmental problems facing the world today cannot be solved solely by regulations and top-down mandates and that, in many cases, effective natural resource management must involve local, collaborative elements and engage those directly impacted and responsible for implementation of natural resource decisions. In this context, federal agencies responsible for overseeing natural resource management in the American West are being pressured to adjust to this new management paradigm and support more bottom-up, place-based solutions. There are a number of barriers to the adoption of these principles, however, including the legacy of the federal government's science-based management model that has guided natural resource decision making for the past century.

Many scholars characterize the evolution of the federal approach to natural resource management in terms of four phases, including facilitation of resource exploitation during the nineteenth century; adoption of conservation principles during the first half of the twentieth century; efforts at preservation through top-down federal legislation beginning in the 1960s and 1970s; and most recently, promotion and support of more collaborative, place-based solutions to conflicts over natural resource management, an approach which began to emerge in the early 1990s (Koontz et al. 2004, Meine 1995, Meine 2009, Nelson 1995).

This most recent phase has been marked by a move toward decentralized governance and an evolving role for federal agencies as newer collaborative approaches to natural resource management gain more prominence and respectability (Wondolleck

and Yaffee 2000). While the federal government has largely been a follower, rather than a leader in these efforts, there have been a series of government initiatives aimed at affirming this new era of decentralized governance. Since 2000, 18 federal agencies have adopted an ecosystem management approach with collaboration as a central tenet (Koontz, et al. 2004); but in many cases, government participation in collaborative efforts is seen as more of a hindrance than an advantage.

We propose that this relatively recent paradigm shift among practitioners regarding effective approaches to natural resource management aligns with current scholarly literature dealing with the nature of social-ecological systems and the role of adaptive co-management in fostering social-ecological resilience, and that these concepts can inform a framework for evaluating efforts by federal agencies to improve their approach to protecting and restoring the natural resources under their purview.

### ***Conceptual Framework: Social-Ecological Resilience and Adaptive Co-Management***

The concept of resilience was first introduced by C. S. Holling (1973) who defined it as the level of disturbance an ecosystem can withstand without shifting to a new stable state and while maintaining its central processes and functions. This was proposed as an alternative to the concept of ecological equilibrium and Clementsian succession for explaining the variation and unpredictability observed in ecosystems. This new way of thinking about ecosystems arose out of some of the failings of conservation era policies, characterized by attempts at tight control of ecosystems, which often resulted in significant ecosystem decline. Holling (1995) explained that attempts to tightly control ecosystems can lead to “systems that are more likely to flip into a persistent degraded state triggered by disturbances that previously could be absorbed.”



Since its early conceptualization in ecology, resilience theory has been expanded to recognize the interconnections between human and natural systems, referred to as social-ecological systems (Berkes and Folke 1998, Levin 1998). There are four general principles of resilience theory which can help explain the structure and function of social-ecological systems: 1) change happens through an adaptive cycle (Figure 1), with natural capital accumulating slowly (*conservation* phase) after a period of *exploitation* until an unpredictable perturbation disrupts the system and causes an abrupt *release* and *reorganization* of the system; 2) processes function across multiple scales in both space and time; 3) multiple stable states exist for a given system, with stabilizing forces enhancing productivity through resource optimization, and destabilizing forces maintaining diversity and resilience; and 4) uncertainty within a system requires flexibility and adaptive management as a tool for maintaining resilience (Gunderson and Holling 2001, Holling 1996, Walker and Salt 2004).

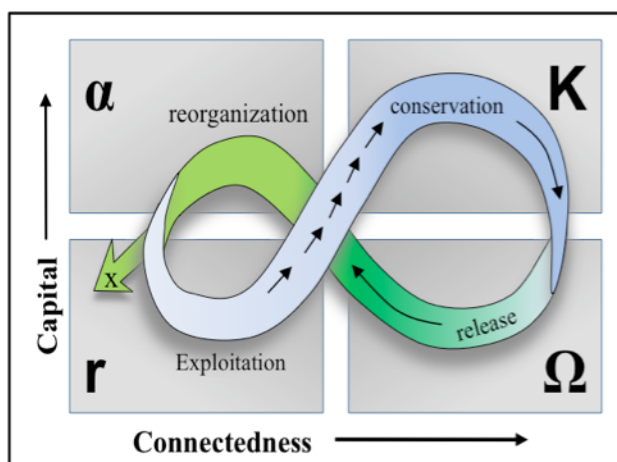


Figure 1: Adaptive Cycle (Modified from Gunderson and Holling 2001)

Adaptive co-management has been suggested as the tool critical to linking the theoretical framework of resilience theory to management actions (Armitage et al. 2009).

The term comes from the combination of adaptive management and co-management (Kofinas 2009). Adaptive management, most simply, can be thought of as “learning by doing” (Walters 1986, Lee 1993). It offers managers a method for moving forward in the face of uncertainty based on their current knowledge of the system and its interactions. The idea is that management can be carried out in such a way that there is an iterative process allowing for the design, implementation, monitoring, evaluation and modification of management actions allowing new knowledge to guide future actions (Lee 1993).

Co-management, or cooperative management, is the sharing of power and responsibilities among local resource user communities and resource management agencies (Hanna 1994). Olsson proposes that adaptive co-management is an *emergent* property of resource management, not an arrangement that can be legislated top-down (2004). This poses a challenging new role for government actors who historically have been focused on regulations and incorporating public participation into a traditional command and control, centralized, and science-based management paradigm that is ill-equipped to facilitate power sharing, collaboration, and joint fact-finding; and which often pays insufficient attention to the human dimensions aspects of resource management.

### ***The National Riparian Service Team***

Riparian areas exemplify the challenges faced by natural resource managers. Because they link freshwater ecosystems and uplands they often face multiple sources of pollution and use demands from both upland and upstream. Furthermore, riparian areas are complex ecosystems with hydrological, biological, chemical, geophysical and

climatic components, creating significant uncertainty for managers. Predictive models have largely failed to capture the complexity of these ecosystems (Walker 2002). Riparian areas almost always cross jurisdictions with any one riparian system traveling through a mix of private, federal, state, and tribal land without regard for political boundaries or the associated differences in management approaches. Because riparian areas cover a large geographic space and provide freshwater, riparian areas often become central to more fundamental conflicts around ecological values. Restoring damaged riparian systems in a holistic, comprehensive way is challenging, requiring cooperative management across public and private lands, often involving several agencies and requiring a combination of technical and social approaches.

Recognizing the shortcomings of federal agency involvement in improving the health of riparian areas around the West, and that “restoration will not happen by regulation, changes in the law, more money, or any of the normal bureaucratic approaches,” (RCS 2002: 5) agency heads from the BLM (Mike Dombeck) and Forest Service (Jack Ward Thomas) signed a letter in 1996 agreeing to implement a program they called *Accelerating Cooperative Riparian Restoration and Management*, which aimed to integrate ecological and social factors in cooperative interagency management and collaboration across jurisdictions involving all affected interests (RCS 2002). To implement the program, the agencies established the National Riparian Service Team (NRST or Team), an interagency team to administer an innovative strategy for riparian management and restoration across the western United States, which they call the Creeks & Communities Strategy. We suggest that the NRST’s mission and activities are, in many ways, consistent with principles associated with resiliency and adaptive co-

management, and that the NRST deserves further examination for its potential as a model for government efforts to enhance resiliency in social-ecological systems.

The Creeks & Community Strategy (Strategy) is comprised of the Team's vision, guiding philosophy and tools and, in short, is aimed at "achieving healthy streams through bringing people together" (RCN 2002). It includes the provision of (1) *scientific and technical information*, including tools for understanding streams based on their functionality and potential; (2) *collaborative tools and information*, including strategies for encouraging problem solving and conflict resolution among diverse stakeholders; and (3) *management tools*, including training in restoration planning and adaptive management to build capacity for effecting 'on the ground change' (BLM et al. 2008, RCN 2002).

Proper Functioning Condition (PFC) is the concept at the core of the Creeks & Communities Strategy and serves as both an assessment tool and a method for communicating stream functions between user groups. Stream assessments, carried out by Interdisciplinary Teams (IDTs), can be used to classify a stream as *nonfunctional*, *functional at risk*, or in *proper functioning condition*. The assessment often serves as a starting point for discussions among stakeholders regarding the diverse values associated with the stream (RCN 2002). The logic model in Figure 2, developed in consultation with other members of our evaluation team and members of the NRST, depicts the envisioned learning and behavior outcomes of the Creeks & Communities Strategy that should result from these technical, social, and managerial components.

To accomplish its goals, the National Team – along with a coordinated network of agency employees comprising State Riparian Teams – hosts trainings and workshops on

topics relevant to their mission, including *Proper Functioning Condition (PFC) Assessment Trainings* and *Grazing Management Trainings*. Some riparian situations require more in-depth involvement, so the Team developed an approach they refer to as *Service Trips*, which involve more long-term, place-based assistance carried out exclusively by the National Team, which is comprised of experts in rangeland management, hydrology, conflict resolution, and the human dimensions of natural resource management (Figure 2).

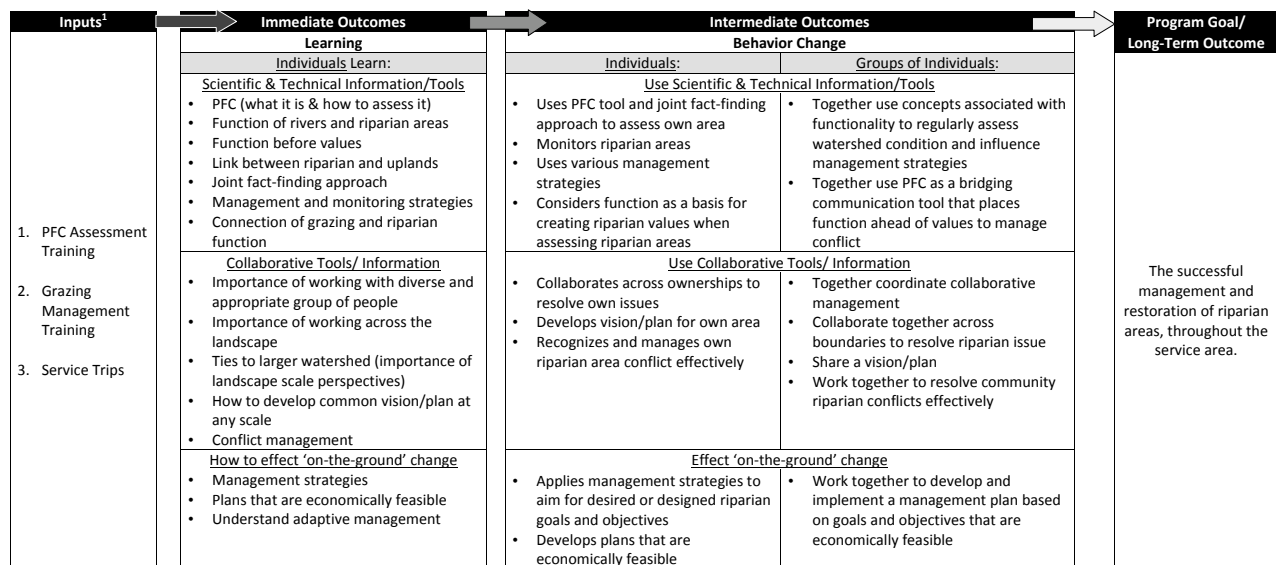


Figure 2: Logic Model for the NRST's Creeks & Communities Strategy

Following a 2003 evaluation of the NRST (Van Ripper 2003) that identified inadequate attention to the human dimensions of riparian management, the NRST increased its commitment to the Service Trip component of the Strategy. Service Trips are usually multi-phased, involving multiple interactions with local stakeholders over long periods of time. A set of principles guides NRST's actions on the Service Trips, including bringing affected interests together to build relationships, developing a

community information base, and empowering people to create change and leverage resources. The length of time, topics covered, and methods used for each Service Trip are highly variable and the NRST adjusts its approach to deal with the specific situation.

The NRST has carried out Service Trips in a number of locales, and this study evaluates the agency's performance in the Upper Klamath Basin drawing on principles associated with resiliency and adaptive co-management. The Klamath is representative of the landscape of controversy associated with riparian management in much of the American West. Tribal water rights, endangered fish species, irrigated agriculture, and hydropower dams all converge to create a complicated science and policy challenge. The NRST was involved in the Basin from 2002 to 2006 and during that time worked to address both technical and social challenges specific to the Basin by building local capacity to problem solve.

In the following pages we describe the purpose of the study and specific research questions and methods; then provide an overview of the NRST's activities in the Upper Klamath Basin. We then present key findings related to the effectiveness of the agency's activities and associated social and ecological outcomes. Our discussion focuses on the ways in which the NRST's approach in the Klamath aligns with principles espoused in the resilience and adaptive co-management literature, and how the NRST approach might serve as a model for government involvement in natural resource management.

### **Purpose and Research Questions**

While theories regarding social-ecological resilience are growing in acceptance, questions continue to emerge about how to apply resilience theory and adaptive co-

management to complex, real world systems. Furthermore, much of the literature has focused on the roles non-governmental actors and bridging organizations can play in fostering resilience (e.g. Folke et al. 2005, Olsson et al. 2007, Koontz et al. 2004) versus the roles government agencies might play. This paper addresses those knowledge gaps by exploring the ways in which adaptive co-management can foster and enhance resilience in a social-ecological system, and the potential role federal agencies can play in facilitating such an approach to management.

The specific questions this paper addresses focus on the effectiveness and outcomes of the Creeks & Communities Strategy as implemented in the Upper Klamath Basin, and relate to the logic model in Figure 2.

- 1) *How effective was the NRST in conveying scientific and technical information to community members in the Upper Klamath Basin and enhancing understanding of riparian function?*
- 2) *How effective was the NRST in catalyzing the use of collaborative tools and information to promote communication across scales, collaboration, and conflict management?*
- 3) *How effective was the NRST in catalyzing an adaptive co-management approach to planning for restoration and improving the health of riparian areas?*

Our discussion then considers the ways in which the National Riparian Service Team's Creeks & Communities Strategy aligns with concepts and principles in scholarly literature dealing with social-ecological resilience and adaptive co-management; and how lessons learned from the Klamath Basin case study can be applied to more general questions about the role of government agencies in adaptive co-management.

## Methods

This study was carried out as part of a comprehensive program evaluation of the National Riparian Service Team's Creeks & Communities Strategy. The evaluation utilizes an explanatory case study framework to relate on-the-ground outputs and outcomes associated with NRST's activities to a theoretical proposition, the program logic model in Figure 2 (Berg 2007, Yin 1994). The full evaluation includes two components: a quantitative survey sent to PFC and grazing training session participants; and in-depth, qualitative, field-based case studies in places where Service Trips were carried out. The Upper Klamath Basin (a.k.a. Sprague River) case, carried out during Summer 2009, served as a pilot for seven additional case studies completed during summer and fall 2010.

For background on the Klamath case we facilitated a full-day focus group with the four Team members who implemented the Upper Klamath Basin Service Trip. We then conducted ten semi-structured interviews with individuals who participated in NRST activities associated with the multi-phased Service Trip there (see Interview Guide in Appendix 1). Two of the interviewees were federal employees, five were private landowners in the Basin, and three were key local partners associated with restoration and conservation non-profit organizations. Five other participants were contacted but declined interviews. All interviews were transcribed and coded using NVivo software to facilitate better understanding of the effectiveness and outcomes associated with the NRST's Service Trip activities. Codes used pattern-matching to identify and organize pieces of information that relate to the theoretic propositions in the logic model and in the scholarly literature (Berg 2007, Yin 1994).



Document analysis facilitated a better understanding of the breadth of the NRST's work around the West and helped put the Klamath case into context. Documents included reports describing other Service Trips and trainings, meeting minutes, assignment completion memos, formal written requests for NRST service, and recordings from other focus groups with Team members dealing with the other Service Trip case studies.

***Study Area: Upper Klamath Basin***

The Klamath Basin spans over 15,000 square miles in south central Oregon and northern California (Figure 3). It is further divided into two sub-basins, the Upper Klamath Basin and the Lower Klamath Basin which are geographically, climatically, and socially very different. The NRST's work in the Klamath Basin took place in the Upper Klamath Basin, in an area known as the "off project lands" – agricultural land (mostly ranching) in the Sprague and Williamson River Valleys that is distinct from the U.S. Bureau of Reclamation's Klamath Irrigation Project.



Figure 2: The Klamath Basin, Showing the location of NRST's work

The physical geography, historic conflict between the four Basin tribes and the irrigation communities, the ESA, and the cumbersome nature of unresolved water rights are all necessary context to understanding the conflicts in the Klamath Basin; but a detailed recounting is beyond the scope of this paper (for background, see, e.g., Doremus and Tarlock 2008, Gosnell and Kelly 2010). Suffice to say that conflicts over the recovery of the fish and other resource management issues came to a head in Summer 2001 when a drought, combined with the poorly timed release of a federal ruling related to the ESA dictating minimum water levels for Upper Klamath Lake and minimum flows in the Lower Klamath River, resulted in the curtailment of water to irrigators on the Klamath Project to allow for in-stream flows for the fish. The irrigation community erupted, holding symbolic ‘Bucket Brigade’ protests and soliciting national support for their economic losses. In the years that followed, there was a massive influx of federal and state resources to help address the Klamath crisis and prevent similar catastrophes from happening in the future; but a growing sense that dollars and isolated restoration projects would be inadequate.

Since it was determined by a number of federal agencies that the health of the aquatic ecosystems upon which the fish depend hinges in large part on the health of the riparian areas in the Sprague River sub-basin; and since recovery would require coordinated management of those riparian areas, the NRST was asked to provide assistance in 2002 by Sustainable Northwest, a nonprofit organization based in Portland that had been working in the Basin.

**Background: NRST in the Upper Klamath Basin**

The NRST's involvement in the Basin primarily centered around two projects, the Yainix Project and the Oregon Watershed Enhancement Board's Watershed Assessment process. Various individuals from the Team, however, have longstanding relationships with community members and have been active in both official and unofficial activities that promote the NRST's approach to riparian management and restoration.

The Yainix Project was initiated by Becky and Taylor Hyde, who were proposing to purchase the Yainix Ranch in the Upper Sprague River Valley, a property with a heavily degraded stretch of river, riparian and upland areas. Their goal was to restore the property and provide a model for ranching that could be applied across the region. The request to NRST had two parts. The first was for technical expertise in the development of a Working Lands Conservation Easement that included a 'duty to restore' the land under easement. The NRST would help develop a method of evaluating and benchmarking ecological outcomes. The second component of the request to NRST was in creating a community dialogue of restoration obstacles and opportunities so that the work on the Yainix Ranch could potentially influence similar coordinated restoration efforts across the region.

The NRST's first attempt at initiating a community dialogue was at a public meeting in Beatty. Tribal members, environmentalists, and landowners were not comfortable being in the same room together at that time, however, and following introductions, nearly all participants left. Based on recommendations from the remaining participants, the Team decided that smaller meetings with individual landowners would be a more effective way to engage locals. These "living room-to-living room sessions"

were coordinated by individuals and the Klamath Basin Ecosystem Foundation (KBEF), a local conservation organization, and ranged from informal meetings with individual landowners to small presentations involving a group of neighbors. According to the NRST, “the purpose of these dialogue sessions was to listen so that the Team could become grounded in landowner needs, help design outreach and assistance, connect with people who would not normally attend a community meeting, and discover ideas for collaboration where trust was lacking among perceived adversaries” (NRST 2009: 53).

Seeing the benefits of partnerships from their work with Sustainable Northwest and others on the Yainix Project, those involved decided to formalize the partnership in January 2005, creating the Working Landscape Alliance (WLA). The WLA is a collaboration of organizations and individuals brought together by the same mission: “to support the emergence of sustainable working ranches and landscapes through restoration and conservation of ecological health, creation of dynamic local and regional economic opportunities, and honoring and engaging the full diversity of people and cultures that share the western landscape” (WLA 2005). From that point forward, NRST involvement in the Klamath Basin occurred as part of the WLA, a unique, hybrid governmental/nongovernmental entity.

In 2005 KBEF called on the WLA to assist with a collaborative effort to complete community-based watershed assessments covering the 33 sub-basins in the Upper Klamath Basin. These were part of the Oregon Watershed Enhancement Board’s (OWEB) watershed assessment program, which, among other things, encourages (and partially funds) local organizations to complete sub-basin level evaluations. Leadership at KBEF felt watershed assessments in their area could be made more effective by

increasing field days and other opportunities for interaction, relationship building and learning. They submitted a request for the WLA to conduct the public outreach component of the assessment process for the Upper Sprague and Lower Sprague-Lower Williamson watersheds.

For each of the watershed assessments the WLA hosted a three-day workshop designed primarily by the NRST. Workshops involved trainings on Proper Functioning Condition, assessment tools, methods for joint fact finding, and monitoring programs. Each month, a 'field day' was held at a strategic location to experiment with the new approach and encourage difficult community discussions about a particular piece of land. After each field day the WLA would organize two or three private landowner visits (at the invitation of those landowners). WLA members would walk sections of stream with the owner and discuss the conditions of their riparian or upland areas and options for management and restoration. This format was used for the Upper Sprague watershed assessment in 2005 and then the Lower Sprague-Lower Williamson watershed assessment in 2006.

Throughout their involvement in the Yainix Project and the watershed assessment process, Team members presented at various meetings and workshops, including the Klamath Watershed Conference in 2004. They also hosted a training session for riparian vegetation monitoring in 2005 and presented at several lunchtime meetings of the Sprague River Working Group, a sub-group within the Upper Klamath Watershed Council.

### *Steps Toward Cooperation*

During this time period (2002-2006) there were several other organizations and individuals working in the Basin, including the Bureau of Reclamation, which hosted a series of “listening sessions” Basin-wide. This was followed by Basin-wide talks during which a facilitator encouraged a group process giving all stakeholders the space to be heard. At about the same time, the Federal Energy Regulatory Commission (FERC ) relicensing process began for the four dams on the Klamath, instigating a series of Basin-wide negotiations partially motivated to stave off the likely lawsuits from such a controversial process. In the ‘off project’ part of the Basin, KBEF and Klamath Watershed Council (KWC) were building relationships between ranchers and building support for restoration on private lands. All of these actions contributed to a culture of growing trust, collaboration, and openness to new approaches to restoration (Gosnell and Kelly 2010).

Between 2006 and 2010 many members of the larger Klamath Basin community worked to develop the Klamath Basin Restoration Agreement (KBRA). The KBRA is a negotiated agreement that outlines a shared vision for water allocation and restoration throughout the Basin. The agreement ensures that more water will be left in-stream for environmental considerations (including the sucker and salmon). In return the irrigation community will be provided with greater certainty in their water supply. Real time reporting and annual reports will be required to assess the performance of the KBRA to facilitate adaptive management in both the short and the long term. The agreement also details plans for restoration of critical riparian areas, outlines Safe Harbor Agreements for private landowners subject to ESA enforcement, and calls for the removal of the four

major dams along the Klamath River (KBRA 2010). This historic agreement was signed by the negotiating parties and several political leaders, including the governors from Oregon and California, in February 2010. While not all stakeholders Basin-wide support the agreement, it represents a significant step towards adaptive co-management in a basin that less than a decade ago was a maelstrom of water conflict.

### **Results: Effectiveness and Outcomes of the Creeks & Communities Strategy**

The larger NRST program evaluation centered around four main categories: 1) effectiveness of approach; 2) outcomes; 3) barriers to success; and 4) suggestions for improvement. This section contains an analysis of the effectiveness and outcomes of the NRST's activities in the Upper Klamath Basin, focusing on the three elements in the logic model (Figure 2).

#### ***Scientific and Technical Information***

When asked about the Team's technical expertise most interviewees perceived the NRST as comprised of leading experts on riparian ecology and range management. A number of landowners and local conservation leaders stated that their overall knowledge regarding riparian and grazing management increased as a result of NRST's involvement in the Basin. They contrasted the NRST's approach to that of other government agencies that promoted very specific management actions rather than a more holistic understanding of the stream system.

The benefits of Proper Functioning Condition as an assessment method and communication tool were widely recognized. For many participants, especially those

without a background in ecology, PFC provided improved knowledge and understanding of riparian geomorphology, hydrology and biology.,

“I now have a conversational level of knowledge about river dynamics that I would not have [without the NRST]. It is actually pretty remarkable ... there is no doubt that I can talk the functionality of creeks and rivers in a much more informed way” (9, Interview 2009)<sup>1</sup>.

While interviewees did reflect on the effectiveness of PFC as a technical tool, they repeatedly emphasized that it was its ability to bridge social and ecological dimensions of riparian management that contributed to the observed outcomes. The NRST’s approach emphasizes that stream function must be achieved before management can focus on values (such as fish habitat or clean water), a concept that participants felt provided a framework for discussing the ecological system free from the values-laden positions normally espoused by stakeholders. In the case of the watershed assessment this allowed for joint-fact finding, providing the common ecological framework to prioritize management actions.

### ***Collaborative Information and Tools***

Participants praised NRST for acknowledging the social and human dimensions of riparian management within a technical framework. The primary audiences for NRST programs in the Upper Klamath Basin were private landowners and tribal members. The NRST was able to effectively connect these historically adversarial entities because of some key components of their approach. First, the Team was seen as encouraging rather

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<sup>1</sup> Each interviewee was assigned a number to protect anonymity.



than fault-finding or regulating. Second, the Team's approach, language, and material were accessible to non-scientists. It resonated with many landowners' local ecological knowledge of streams and riparian functions based on their observations from years of "watching the stream" (2, Interview 2009). Third, field days leveled the power dynamics since they took place on properties and landscapes familiar to the participants, and they allowed for informal discussions between formerly adversarial groups.

Landowners and agency employees alike saw the Team's ability to listen to landowners as critical to their success. This came up in reference to the living room-to-living room listening sessions, the workshops and the field days. Several agency employees reflected on learning active listening skills from the NRST and landowners felt empowered by interacting with technical experts who listened to them.

The most significant outcomes were increased communication and improved relationships between agencies, landowners, and the Klamath Tribes. Because of the way the government had implemented the ESA and other past experiences, many landowners were extremely distrustful and nervous about agency involvement in private lands restoration. Interviewees provided many examples of specific landowners who previously had not allowed any non-ranchers on their land, but who invited the NRST to walk their stream with them and talk about restoration. Several landowners expressed that the knowledge and understanding they gained from the NRST had allowed them to be more comfortable approaching government agencies for help and support. They felt more equipped to understand the merits and risks associated with different restoration projects that are frequently promoted by the federal government.

***Riparian Management and Planning Information and Tools***

In terms of planning and management, the Creeks & Communities Strategy promotes a natural recovery approach to restoration when possible rather than big engineering projects, and several landowners and agency people indicated that they had seen a significant shift in the community's approach to restoration, increasingly turning to natural recovery as a first option. They cited the benefits of the more passive approach they learned about from the NRST, including significant cost-savings, lower risk to landowners, and better likelihood of riparian recovery in the long run.

Many people reflected on changes in their community's attitudes toward restoration, stating that there is now momentum in the Basin for restoration. One interviewee commented,

“There is change happening over time... And people are starting to—there are starting to be little touch points of people who are responding to that, and it kind of builds on itself: They did this [restoration project] here and they did this here and that wasn't too scary. And now we are doing this and they are doing this” (1, Interview 2009).

Another rancher said, “It just seemed to be that one ranch after the next ... was trying to do the same thing” (2, Interview 2009).

The Yainix Ranch conservation easement is one of the most tangible outcomes of the NRST's involvement in the Basin and relates to the Strategy's emphasis on enhancing capacity for riparian management and restoration planning. PFC has been adopted as a benchmark for determining compliance with the terms of the conservation easement.

Unlike most conservation easements, which specify management activities and place

restrictions on the owner, this one is based on ‘affirmative obligation’ to restore the riparian areas to PFC, placing more trust and accountability on the landowners. The PFC and monitoring systems in place are designed to ensure that the riparian area of the property maintains or improves its ecological function. Since the easement was put into place, the riparian area has undergone well-documented dramatic improvements and is now a local example of how a very degraded piece of property can be transformed into a healthy stream and upland while maintaining a viable agricultural operation. Another innovative aspect of the Yainix Ranch easement is that it is held by the Klamath Tribes, which represents a significant step towards improved tribal/non-tribal relationships in the Basin.

While the results of our evaluation were mostly positive, we acknowledge a few limitations associated with our ability to determine outcomes. First, in terms of ecological outcomes, it was difficult to establish concrete linkages between NRST activities and ecological change in the Basin. Many interviewees were reluctant to attribute specific ecological outcomes to the Team because of potential conflation with other factors, environmental regulations, unrelated restoration efforts, and the natural fluctuation of ecological systems. Others cautioned that while they have faith that the NRST approach works, there is a time lag between developing an idea, finding funding, implementing the project, and seeing results, which might not allow observation of outcomes after just four or five years. Many spoke of improvements in the ecological conditions in a vague way, however, for example:

“These guys are taking it right to the ground and we are seeing improvements, real indisputable improvements” (3, Interview 2009).

“My own personal opinion is that this group is—I think they have been one of the most effective means of getting conservation onto the ground” (6, Interview 2009).

“They have certainly had a positive influence” (5, Interview 2009).

Similarly, attributing specific social and political outcomes exclusively to the NRST’s involvement in the Basin is problematic. Several participants suggested that the NRST’s contribution to positive change in the Basin was limited to its ability to leverage and engage local resources and catalyze new, emergent approaches to collaborative resource management. The outcomes listed by participants ranged from those that could be directly linked to NRST, such as improved knowledge and understanding of riparian function and facilitation techniques, to ones that must be seen in a larger context, such as the Klamath Basin Restoration Agreement.

## **Discussion**

With these results in mind we turn now to a consideration of the ways in which the NRST’s principles and strategies are consistent with literature regarding managing for social-ecological resilience. We suggest that the NRST’s Creeks & Communities Strategy represents an effective new model for government in adaptive co-management. The Team’s involvement in the Basin coincided with a period of reorganization, which created space for new ideas on riparian management. Several components of the Team’s approach helped foster adaptive co-management and incorporated key concepts from resilience theory. First, the Team’s assessment tool, Proper Functioning Condition (PFC), allows for the measuring of resilience in riparian ecosystem functions. Second,

PFC provides a communication framework that promotes joint-fact finding, establishes a common vocabulary amongst stakeholders, and acknowledges slow variables. Finally field days, workshops, and facilitation activities allowed for cross-scale idea sharing, promoting better communication between stakeholders and allowing resources to be shared both vertically and horizontally. Many of the outcomes and achievements observed in the Upper Klamath Basin are indicative of emerging adaptive co-management in which the community turns to government agency expertise to help navigate the community-based problem solving process. The NRST's Service Trip component thus demonstrates a new model for government agencies, one based on enabling and facilitating local processes rather than legislating and controlling.

### ***Toward Adaptive Co-Management***

When discussing the Sprague case study the Team expressed concern about the extent to which this Service Trip could represent the NRST approach to Service Trips in general, since it had many 'unique' characteristics, such as the large private lands component, the partnership with the WLA, and the longstanding relationships between members of the Team and members of the community. We suggest, however, that NRST activities in the Sprague, however 'unique', exemplify the Team's flexibility and commitment to adjusting its approach to local conditions to maximize their effectiveness – a sign of inter-organizational adaptability.

### ***Timing and the Adaptive Cycle***

Social-ecological systems are understood to go through four distinct phases, exploitation, conservation, release and reorganization, often represented as an adaptive cycle (Figure 1). The Klamath Basin saw a long period of exploitation and rapid growth

starting with the early white settlement. During this period, as predicted by Holling, connectedness and efficiency increased, aided by the Bureau of Reclamation with the creation of the Klamath Irrigation Project and dams. The conservation phase is marked by rigidity and resources being expropriated and controlled by an increasingly few entities, as was seen in more recent years in the Klamath Basin. The 2001/2002 crises can be seen as the subsequent disturbance (both political and ecological) causing the release of the system. What has followed has been a series of efforts at reorganization, the most noteworthy being the KBRA.

NRST became involved in the Klamath Basin right as the system entered the fourth phase, reorganization. The focus group with implementers revealed that much of the Team's decision to go on a Service Trip when they are requested depends on "ripeness". The adaptive cycle can provide some insight into what is meant by "ripeness". Holling (2001, p. 396) explains, "innovation occurs in pulses or surges when uncertainty is great, potential is high and controls are weak, so that novel recombination can form." The NRST's timing in the Basin and ability and willingness to adapt their strategy to meet the communities where they were was critical.

### ***PFC as a Measure of Resilience***

One of the criticisms of resilience theory is that resilience is difficult to measure and quantify and is often just a descriptive concept (Brand and Jax 2007). We are left trying to identify the *resilience of what?* Tools exist to measure many scientific processes, but thus far efforts have largely been seen as insufficient to measure something as multifaceted, interdisciplinary and place specific as resilience (Cumming et al. 2005, Asah 2008). Many agree that ecosystem function (also defined as key components and

relationships in Cumming et al. 2005) is a good surrogate for measuring resilience (Walker et al. 1999).

The Creeks & Communities Strategy and its focus on PFC as an assessment tool may come close to accomplishing this task, albeit in a qualitative way. It requires an interdisciplinary team to assess the functionality compared to the potential for the system. The definition of a functioning riparian area is directly related to its ability to withstand relatively high flow events (described as 5-, 10- and 20- year events) (BLM 2010). The basis of this logic is that a stream is ecologically functioning if it can dissipate stream energy associated with high flows, filter sediments, capture bedload and aid floodplain development, improve flood-water retention and ground-water recharge, and develop root masses that stabilize streambanks against cutting action. These components are assessed using a twelve-question yes/no checklist. What is more, each item on the checklist has a series of associated quantifications. For example, the Greenline Stability Rating can be used to quantify Number 11: “Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows.” While this might not provide a quantitative and measurable concept that can be used in the ecological sciences to objectively “measure” resilience directly, it does provide managers a useful tool for objectively assessing the critical components of a stream, and determining the ability of riparian systems to withstand disturbance without changing states.

### ***PFC as a Communication Framework for Joint Fact Finding***

Much of the adaptive co-management and resilience literature calls for the sort of shared learning amongst stakeholders that is instigated by the joint fact finding the PFC approach relies on as a communication tool (Armitage et al. 2009, Daniels and Walker

2001, Karl et al. 2007). Interviews with participants supported this view. One of the most notable outcomes we identified was that the community was able to better communicate complex ecological concepts between different user groups. Many used the language of PFC to describe physical changes they had seen to the riparian area. When the consultant released a draft of the Upper Sprague Watershed Assessment, for example, the citizens were outraged that it did not reflect the learning and joint fact-finding that had taken place during the public outreach component of the watershed assessment process. Many felt that they were knowledgeable enough about riparian function to assist with the re-writing of the document and that incorporating the joint-fact finding process was more valuable than a technically rigorous document. Kofinas (2009, p. 86) refers to institutions being called upon to assist in adaptive co-management through this process of shared learning: “Negotiating the differences in worldview between groups sufficiently to achieve effective social-ecological governance may require the development of common vocabulary and mutually agreed upon protocols to establish shared visions of problems.” In the Klamath Basin the NRST was able to effectively encourage this type of common vocabulary and protocol. During one of the interviews a stakeholder explained,

“One way to describe it is there are the technical purists over here and the PFC guys sort of came in over here and these guys weren’t all that thrilled about it but it still didn’t do what they wanted it to do so they went even farther. ... I would say that it is as technically rigorous as it needs to be. And if your goal is to effect change on the ground and within communities, even if the criteria and the parameters are strictly ecological this is still better than this because these guys will sit there and crunch their numbers and run their



models and not a damn thing is happening. Nor will they ever; except journal articles and obscure paper presentations. But these guys are taking it right to the ground and we are seeing improvements. Real sort of indisputable improvements” (6, Interview 2009).

PFC provides a scientific framework and structure to discuss riparian restoration free of values, something that was critical in moving the Upper Klamath Basin communities forward in riparian restoration given the recent conflict. The NRST’s approach is successful at addressing some of the failings of the traditional scientific-expert-as-decision-maker paradigm. PFC provided a toolset for understanding stream processes and communicating between multiple groups, empowering local actors to develop meaningful and locally relevant policies.

One of the most striking things about the NRST’s approach was that it allowed participants to view a riparian area as existing on a continuum of recovery, providing them with the foresight and trust necessary to endure the slower rate of change required by natural (or passive) recovery. One rancher explained how members of the NRST came to their property, explained to them what vegetation they had and what they could expect if they altered their management regime to allow the vegetation to stabilize the stream banks. The NRST’s description of the system’s potential provided them with a conception of an alternate stable state (functional riparian), based on the controlling of slow variables. Many other landowners and restoration consultants praised the NRST for building popular support for more passive, natural restoration resulting in the communities moving away from big-engineering (quick) projects. By understanding the

system's potential and having experience with slow variables, such as vegetation for bank stability, the NRST was able to slow the human scale to match the ecological scale.

### ***Cross-Scale Interactions***

The social-ecological system is composed of many interrelated horizontal sub-components at any one scale (horizontal scale). These scales are posited as nested hierarchies that have influence over each other both from above and below (vertical scale); effective management recognizes this and utilizes the positive influences of scale to maximize resilience. Prior to the 2001 crisis, Upper Klamath Basin horizontal relationships were weak between local actors, e.g. members of the agricultural community, the Tribes, and the state and federal agencies. When describing the pre-NRST conditions in the region many spoke of outright hostility between these stakeholders. As described above, the NRST's first attempt at connecting across horizontal scales was the public meeting in Beatty in which all but 8-10 people stormed out following introductions. The NRST's approach to listening, however, combined with the field days worked to break down some of those barriers and draw diverse (tribal, agricultural, agency) audiences together to discuss riparian restoration.

The value of active listening is well known and discussed in conflict resolution texts (e.g. Daniels and Walker 2001) but often gets overlooked by other social scientists trying to document macro-level trends rather than individual transformation. The NRST strategy in the Klamath Basin was flexible enough to recognize that communication and trust building needed to happen at the individual level, living room-to-living room before larger change could be made Basin-wide. One of the most significant outcomes from the NRST program evaluation was improved relationships between local level actors.

The approach taken with the Yainix Ranch conservation easement is an example of the NRST leveraging resources at one scale with the hope of influencing other scales. It is rare that federal agencies would get permission to put so many resources into one ranch on one piece of private (not BLM or Forest Service) land. Because variables at the smaller scale are capable of changing faster than variables at a larger scale, the Yainix Ranch was seen as a microcosm for restoration in the Basin. The assumption guiding the easement was that instigating change at that scale was possible, and could potentially “scale up” and influence similar projects across the Basin.

There are several other outcomes of the Yainix Project. During part of the conservation easement process those involved decided the Klamath Tribes should hold the easement. This resulted in a series of discussions and eventually relationships and trust between at least a few individuals from the ranching and tribal communities. Although linear causality cannot be drawn, those interviewed felt there was a relationship between these early trust building communications and the vastly improved tribal-nontribal relationships in the Upper Klamath Basin, which helped create space for the formation of the KBRA (Gosnell and Kelly 2010). In this way, one small action by the NRST was able to cross both horizontal and vertical scales, improving communication and building social capital Basin-wide.

The NRST also played a critical role on other landowners’ properties, connecting individuals at one scale with resources and capital at another. Many described restoration projects that came out of informal conversations during the field trip in which a local conservation organization employee was present who could help the landowner write a grant, and a federal employee was there to explain what funding was available. These

cross-scale collaborations continued after the NRST left, but primarily through the agency individuals who had been present during the NRST visits and who had a reputation of working well with private landowners.

The NRST was able to bring with it critical resources not otherwise available to the communities at a time when they were needed. One restoration specialist described how she had been advocating for many of the same grazing management practices promoted by the NRST for years; but because the Team was comprised of well-known Washington-level experts, the message was more effective at reaching the local managers.

“I’ve been screaming that the whole cow in a riparian area is not bad. And all I got was—shut up, you don’t know what you’re talking about. And then to have some big wheels come in and say the same thing—it was like, thank you! So personally they gave me the boost I needed. [To have them say,] ‘Yeah I think you are on the right track’ was great for me personally. Because I thought, well, maybe you’re just nuts because nobody is agreeing with you. And I kept saying these streams will recover if you give them a chance. And all I got was a bunch of hassle. So for me personally that was just incredible” (9, Interview 2009).

In order to assess the extent to which the NRST exemplifies an emerging role for government in adaptive co-management it is critical to look at how the Team’s influence might have been different than that of a similar non-governmental organization. Perhaps most notable is that in the Klamath Basin, the Team was able to meaningfully support local adaptive co-management efforts by providing resources from other scales (top level

riparian experts and conflict resolution processes) that an NGO may not have been able to access as easily.

### ***The NRST as a Model for Government? Possibilities and Limitations***

The innovation demonstrated by the NRST in the Klamath Basin raises questions about the extent to which its vision and approach might serve as a model for other federal agencies involved in natural resource management. The Team's existence within the BLM and Forest Service suggests that there is at least some federal agency support for more collaborative, community-based, adaptive management practices, and the current Administration often uses language consistent with these concepts. We suggest that the potential exists for this model to be "scaled up", influencing the organizational structure and mission of its parent organizations and other land management agencies, especially given the growing interest in new social and ecological paradigms for managing the nation's natural resources (discussed earlier in the paper); and the demand for more effective approaches to engaging the public in management and decision making. The Natural Resource Conservation Service (NRCS), with its long history of providing technical resources to private landowners, is also well positioned to adopt some of the NRST's strategies, assuming the right personnel were involved.

There are a number of potential barriers to scaling up the NRST approach in the federal government, however, both internal and external. First, as a number of Klamath interviewees noted, much of the leadership within the NRST is approaching (or past) retirement age and it is not clear how the Team's work can be carried on within the BLM and Forest Service. During the implementers' focus group, Team members also acknowledged this problem, citing the hiring and promotion process in government

agencies as an enormous barrier to recruiting the kind of leader necessary. They explained that they have little control over the selection process, and that very few supervisors in the BLM and Forest Service have the necessary background in riparian and range management, and even fewer in the human dimensions of natural resource management and conflict resolution.

In addition to the internal limitations within the NRST to sustain its vision and build on past successes, there are a number of broader barriers within the federal government as a whole, including: 1) lack of institutional mechanisms and incentives for collaboration; 2) agency culture; 3) difficulty institutionalizing something as necessarily variable as adaptive co-management; 4) existing procedural obligations and requirements; 5) and lack of trust in the “public” (Cortner et al. 1998, Cortner et al. 1996, Lachapelle et al. 2003, Cheng 2009). The NRST was established in spite of these barriers, but it is unclear whether the Team is an anomaly in the federal government that will fade as the key actors retire; or if it might play a formative role in the shaping of agency approaches to resource management in the future.

## **Conclusions**

We conclude that the NRST’s Creeks & Communities Strategy, as implemented in the Klamath Basin, has proved itself to be an effective new institutional paradigm for federal agencies involved in natural resource management. The NRST was effective because they were able to provide a technical and social framework for the community to gather and understand information about stream function and improve communication through conflict resolution. As a result of their involvement there now exist indicators of

successful adaptive co-management in the Upper Klamath Basin. There is greater trust, communication and coordination between formerly adversarial groups; there are local efforts at community problem solving; the technical knowledge of PFC and stream function has guided decision making both in the OWEB watershed assessment and the Yainix Ranch conservation easement; and there are early signs that on-the-ground ecological conditions are improving. Based on criteria in the scholarly literature, we suggest that the Upper Klamath Basin social-ecological system is more resilient at least in part because of the NRST's work there.

Interestingly, the creators of the NRST never used the language of adaptive co-management and social-ecological resilience theory in their founding documents; but their approach successfully incorporates many of the key aspects from these theories. More widespread government adoption of these principles and concepts has the potential to emerge, provided organizational leaders understand and acknowledge the challenges of managing complex social-ecological systems, and help establish policies and institutions aimed at addressing them.

While this study suggests that the NRST approach is effective at promoting adaptive co-management, further research is needed to determine if and how such a strategy could be institutionalized or incorporated into the larger organizational structure of government agencies. Further research focused on internal and interagency barriers and opportunities for "scaling up" the NRST's Creeks & Communities Strategy could be beneficial in expanding and institutionalizing this model.

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## **Appendix 1: Interview Guide**

### **Introduction**

1. Introduce myself
2. Remind the interviewee about the study, its purpose
3. Remind the interviewee about the NRST's purpose, goals, vision, and specifically the Creeks and Communities Strategy and the purpose of the Service Trips
4. Present interviewee with consent form, go thru briefly, answer any questions, have them sign it, noting whether they agree to be recorded
5. Ask the interviewee if they have any time constraints
6. Provide a brief overview of what I'm going to cover
  - a. Your experience with the NRST's activities in the Sprague (not the stand-alone PFC and grazing trainings)
  - b. Your perceptions of the effectiveness of the NRST's activities in the Sprague, both the technical training aspects and the group facilitation aspects
  - c. Your perceptions of the outcomes related to the NRST's activities in the Sprague – how they've changed you, your community, and the overall health of riparian areas there
  - d. Your thoughts on what might have stood in the way of the NRST achieving the goals of the C&C Initiative in the Sprague
  - e. Suggestions for improving the program

### **Experiences with the NRST**

1. Please tell me about your experience with the National Riparian Service Team in the Sprague.
  - a. When, where, how many interactions?
  - b. What types of activities?
  - c. Why did you participate in an NRST activity/workshop?
  - d. In what capacity did you participate?
    - i. Part of your job, permittee, interested citizen, other?

### **Effectiveness of Activities**

2. How effective were the technical trainings in which you participated in the Sprague? (Do you recall which training activities you participated in?)
  - a. Did the facilitators use a variety of teaching techniques to help you understand the concept of Proper Functioning Condition and the principles of stream restoration? Which teaching techniques were most/least effective?
    - i. In the field, in the classroom, joint fact-finding exercises, visuals, etc.

3. How effective was the NRST's overall approach to conflict resolution/facilitation in the Sprague?
  - a. Were the facilitators able to secure the up-front involvement of **all** relevant stakeholders?
    - i. Those most affected by the situation
    - ii. Those needed to implement the solutions (those in positions of power)
    - iii. People typically considered "underminers"
  - b. Was it a diverse group? (Were tribal members included? Enviro's?)
  - c. Did the facilitators demonstrate a good understanding of the particular ecological, economic and social needs of your community's specific situation?
  - d. Did the facilitators maintain a neutral position?
  - e. Did they create a "safe" atmosphere characterized by non-threatening, respectful communication?
  - f. Were they able to build consensus?
    - i. Regarding the nature of the situation (problem definition)
    - ii. Regarding necessary actions (solutions)
  - g. Did they successfully facilitate relationship-building and networking?
  - h. Did they help establish more trust between and among participants?
  - i. Did they create an environment of mutual learning?

### Outcomes

4. How do you think your interactions with the NRST affected **you**? Please be specific about which aspects of the NRST experience had the most/least impact.
  - a. Knowledge
    - i. Did it impact your understanding of riparian function?
    - ii. Did it impact your understanding of restoration?
    - iii. Did you have any "aha" moments?
  - b. Skills
    - i. Did you gain skills that help you restore your riparian areas?
    - ii. Did you gain skills to help you solve problems?
    - iii. Did you learn skills that help manage conflict?
  - c. Approach to Management
    - i. How have your riparian management actions changed as a result of the NRST trainings? Specific examples?
      1. Use of PFC to assess your stream?
      2. Monitoring?
      3. Grazing management?
        - a. What role does timing, intensity, duration, and frequency play in your grazing practices? Did this change as a result of NRST?
    - ii. Have your interactions with other users/owners/managers of your stream changed as a result of the NRST activities you participated in?

5. Has the **community's** interactions changed as a result of NRST's involvement? Please be specific about which aspects of the NRST experience had the most/least impact.
  - a. Do you feel like there is a shared vision of recovery and how to get there?
  - b. Better coordination between government agencies?
  - c. Better coordination between agencies and private property owners, permittees, stakeholders, etc?
  - d. Can you think of any examples of how problems with creeks have been solved collaboratively?
  - e. In what ways, if any, did the community's interactions with the NRST affect political conditions in the Sprague?
    - i. New partnerships/alliances?
    - ii. Better relations between agencies and permittees and public?
    - iii. Fewer lawsuits or threat of lawsuits to solve problems?
  - f. In what ways, if any, did the community's interactions with the NRST affect its ability to mobilize resources?
    - i. Skills, money, labor, materials, time
    - ii. Examples of grants won due to new community capacity to mobilize?
  
6. Do you think the overall stream environment has changed as a result of NRST involvement in your community?
  - a. Trends in functionality? Moved closer to PFC? DFC? Evidence?

### **Barriers/Constraints**

7. If there have been no changes in any of the above, why not? What do you think might be standing in the way of the NRST achieving its objectives?

### **Conclusion**

8. Do you and/or your community still interact with the NRST and/or use them as a resource?
  - a. If so, for what?
  - b. If not, why not?
  
9. What suggestions do you have for improving the NRST's effectiveness?
  
10. Are there any other relevant topics related to the performance of the NRST in the Sprague that we haven't covered that you'd like to discuss?