

Facing the Adaptive Challenge: Practitioners' Insights from Negotiating Resource Crises*

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Introduction. The paper draws lessons and insights from interviews with practicing resource managers involved in leading diverse groups of constituents through resource management crisis and change. Each of these management efforts was perceived by interviewed practitioners and others as experimenting with new ways to re-couple and renew social-ecological systems. They represent a nested set of local and regional experiments within one institutional context, a state resource management agency that was intentionally trying to reorganize through novel approaches to management and citizen involvement. All of the cases profiled were characterized by involvement of multiple stakeholders with competing interpretations, values, and goals for the resource system, and reflected a conscious design to engage citizens in creating alternative platforms for resource negotiation (Woodhill and Roling 1998). In each case, practitioners were experimenting with learning to function differently, outside of traditional norms of leadership.

The goal of this study was to identify management practices and frameworks that are founded on knowledge and understanding of dynamics in both human and ecological systems, and to identify the key elements contributing to adaptive response. We develop a matrix based on the release and reorganization phases of the Holling adaptive cycle in an attempt to classify the “tacit understanding,” or intuitive guiding principles, which emerged in interviews. These guiding principles were presented primarily as isolated insights, loosely strung together and developed organically over the course of negotiating through a resource conflict or issue. They tended to be tangential or complementary to practitioners’ training in conventional, scientific management methods and focused on the human side of management, of facilitating and orchestrating change rather than directing it. However, some practitioners did articulate principles loosely in an integrated framework, often drawing metaphors from systems and chaos theory,

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organization and change management, and ecosystem management. The paper explores whether and how practices based on these guiding principles contributed to creating adaptive capacity and resilience in social-ecological systems.

Rationale. Conventional resource management has been characterized as a crisis-response model, because in constraining a managed system to optimize for a few narrow targets, it often invites larger and larger external feedbacks which ultimately compromise the resilience of the system. Over time this can lead to the collapse or near-collapse of the resource system itself, generating “crisis” in the social, political, and economic system as well as the ecological system. Many authors have explored the ways in which social and ecological systems and the resilience of such systems is therefore linked and coevolutionary. Our resource management systems have been changing almost as rapidly in this century as the resource systems themselves, but not necessarily in ways that have preserved opportunity and capital. The failures of conventional management—particularly in the modern milieu of globalized economies and societies, and the resulting complex, multiple scale stresses on ecological systems—have led to a widespread search for new approaches which are able to anticipate and cope with such processes while maintaining ecological and social resilience.

Increasingly, the search for new approaches has been manifested by a broadening of science beyond instrumentalist, reductionist approaches to knowledge acquisition and management, exemplified by ecosystem and adaptive management, and to a rediscovery of the diverse spectrum of resource systems based on local and traditional ecological knowledge. In *Linking Social and Ecological Systems*, for example, Berkes et al. (1998) review a variety of socially and culturally evolved management practices and the social mechanisms behind them as they serve to maintain ecosystem resilience. These include practices found in conventional management systems (e.g. monitoring, protection of vulnerable life stages, temporal restrictions of harvest, and protections of specific habitats.) These practices also include many that have historically not been explicit or implicit components of scientific resource management, including nurturing sources and protecting processes of renewal, integrated management and management of ecological processes at multiple scales and for multiple purposes. Increasingly, however, strategies

for incorporating such practices into resource management agencies are being pursued within modern pluralist democracies in an attempt to manage conflicts between competing users, negotiate through and out of social and ecological crisis situations, and avoid or preempt future conflicts and crises.

A major characteristic of both adaptive management and indigenous resource management systems is a focus on learning-by-doing. Experiential learning and reflection is essential because the ecosystems under management are constantly changing. There are no “cookie cutter” approaches that will work for more than one system or for more than brief periods of time. Alternative modes of learning based on repeated iterations of inquiry, planning, experiential learning from actions, reflection, and revision, designed to integrate practice with theory, must be adopted. Brunner & Clark (1997), reviewing existing approaches to implementation, suggest that only a comparative appraisal of current practices holds the potential to generate sufficient learning to successfully deal with the particularity and complexity of local and regional resource systems. They suggest that in order to advance practice-based ecosystem management it is crucial to organize a process for appraising innovative decisions and prototype models that have been implemented in small experiments, perhaps by “document[ing] each selected case according to a checklist of important considerations including actions taken, significant intended and unintended consequences to date, and explanations and assessments of those consequences.” (Brunner & Clark 1997, p 55).

Several scholars have suggested that local level institutions learn and develop the capability to respond to feedbacks faster than do centralized agencies, implying the need for greater decentralization of management learning and decision-making (Westley 1995, Berkes et al. 1998). Multiple, modest experiments (prototypes) have been hypothesized to yield more new learning about a problem than one general design applied widely (Brunner 1994). However, the cross-scale nature of many social, ecological and economic problems, particularly in the modern global economy, creates a simultaneous need to find effective strategies to address linkages across scales. For this reason, we have selected a set of diverse cases representing local and regional experiments in watershed management, forestry, and fisheries within the Minnesota Department of

Natural Resources for a comparative approach to the examination of management practices applied to specific complex problems at nested scales.

As in traditional resource management systems, which have been shown to avoid overharvest by codifying management “rules of thumb” in social and religious belief systems (Gadgil et al 1998), modern resource management practitioners may develop “tacit understanding,” based on practical experience acquired over the lifetime of their career. The tacit understanding of the resource practitioner can be seen as roughly analogous to “native knowledge” in traditional societies, that body of knowledge developed through trial-and-error experience and transmitted across generations through oral tradition and myth. Such knowledge contributes in particular to resilience because a) it is based on a long-term, qualitative understanding of the system and therefore incorporates understanding of the slow variables in ecosystems, b) it includes insight derived from experiences with rare events, or surprise, and therefore help to recognize characteristics of thresholds in order to avoid flips, and c) it is complementary to quantitative monitoring and aids recognition when the system has shifted from being driven by key processes which are essentially linear (such as those occurring from exploitation to conservation) to being driven by non-linear processes (disturbance, release, and renewal).

“Rules of thumb,” or efforts to translate tacit understanding into communicable frameworks or heuristics, however, are articulated through language, which is in and of itself a model for communicating about the world. Thumb rules are necessarily translated into language from the intuitive context-specific understanding derived from observation. In a study of experts and expert systems, Dreyfus and Dreyfus concluded that “one has to abandon the traditional view that a beginner starts with specific cases and, as he becomes more proficient, abstracts and interiorizes more and more sophisticated rules... Skill acquisition moves in just the opposite direction--from abstract rules to particular cases. A beginner makes inferences using rules and facts just like a heuristically programmed computer, but with talent and a great deal of involved experience the beginner develops into an expert who intuitively sees what to do without applying rules” (Capra 1997, p278). These rules, therefore, are presented not as

substitutes for experience, but rather as guidelines for additional experimentation, inquiry, and dialogue.

Crisis and Learning. Many authors have argued that human individuals and groups appear to do the majority of “out-of-the-box learning”, or breakthrough thinking, in response to crisis (Holling 1986; Gunderson, Holling, and Light 1995; Lee 1996). In the adaptive cycle heuristic developed by Holling (1986), “crisis” can serve as a source of renewal, the Schumpeterian “creative destruction” which allows reordering and reorganization of system “capital.” Such “capital” may be present, for example, in the form of the resource base (ecological systems), knowledge, relationships, and values (social systems), or available financial capital (economic systems). The institutional or ecological response to crisis depends both on the “capital” present in the existing system as well as on the unfolding of events which lead to reorganization. In the relatively short periods of rapid change which follow in the wake of creative-destruction, reorganization of component relationships can occur such that the new system that emerges is fundamentally different from the old one (Holling 1986). At this stage, individuals, small influences, and/or random events—what Holling and others refer to as “novelty”—can have a major impact on the configuration of the new system that emerges following crisis. Control strategies and management skills which are effective in traditional bureaucracies and agencies may be inappropriate or counterproductive in this period from creative-destruction to reorganization, or “the back loop.” Facilitating radical reorientation in resource management, therefore, may require development of skill sets and management principles which differ from those which have served conventional resource management.

Objectives. The goals of this study were a) to identify the key elements contributing to adaptive or novel responses to natural resource crises in a set of spatially and temporally nested local and regional examples, and b) to identify and investigate management practices and principles deriving from resource practitioners’ direct experience in facilitating organizational renewal in the Minnesota Department of Natural Resources (DNR). The DNR is a state agency charged with management of Minnesota’s wildlife,

fisheries, water, mineral, forest, and recreational resources, and, in more recent language, its ecosystems and ecological services. The case studies were selected based on testimony by peers and participants that consistently suggested a major shift in approach or understanding had been achieved. In each case, information is based on interviews with practitioners who were largely responsible for implementing each management experiment. The case studies are profiled in Box 1. In interpreting interviews with practitioners, we focus in particular on practices developed explicitly to deal with productively negotiating through crisis and change, the release and reorganization phases, or the “back loop” of the adaptive cycle (Figure 3). We present “rules of thumb” in a matrix based on the release and reorganization phases of the Holling adaptive cycle (Figure 4). We attempt to address several hypotheses proposed in the challenge of understanding dynamics between ecosystems and institutions: that there are ecological and management practices that contribute to resilience and adaptive response in linked social-ecological systems; that such practices serve to “put the brakes on release” or “conserve memory and opportunity for renewal” during reorganization; that processes are nested at multiple scales; that self-organization plays a critical role during renewal; and that qualitative knowledge complements conventional quantitative data in helping to assess the status of systems and to determine appropriate context-contingent responses during reorganization and renewal.

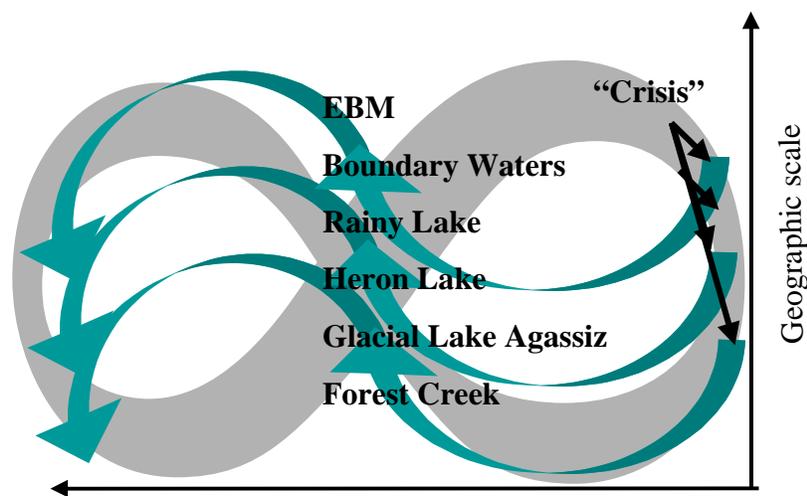


Figure 1. DNR ecosystem management case studies at multiple scales.

Background and institutional history

What do resource managers manage?

Resource managing agencies have at best only limited control over the interactions between society and nature (Figure 2). Considerable linkages between society and nature occur independently of any management arena. In a complex democratic society with private ownership of land and capital governing the production of public and private goods, interactions between society and the ecosystems they inhabit occur are governed at the level of the entire systems. Most of the structuring linkages occur well outside the sphere of government or bureaucratic regulation. Consequently, few “resource managers” in the U.S. today actively manage resources, and are instead engaged in managing organizations, staff, and human use. More than ever, as others have observed, resource management is people management (Gerlach 1995; Berkes et al 1998).

In the late 1970s, resource management theory began to shift from control of the resource to regulation of human demand. Changes in the orientation of federal agency programs paralleled changes in state agency programs in many parts of the U.S. as well as grassroots efforts at the local level to incorporate ecosystem management principles as

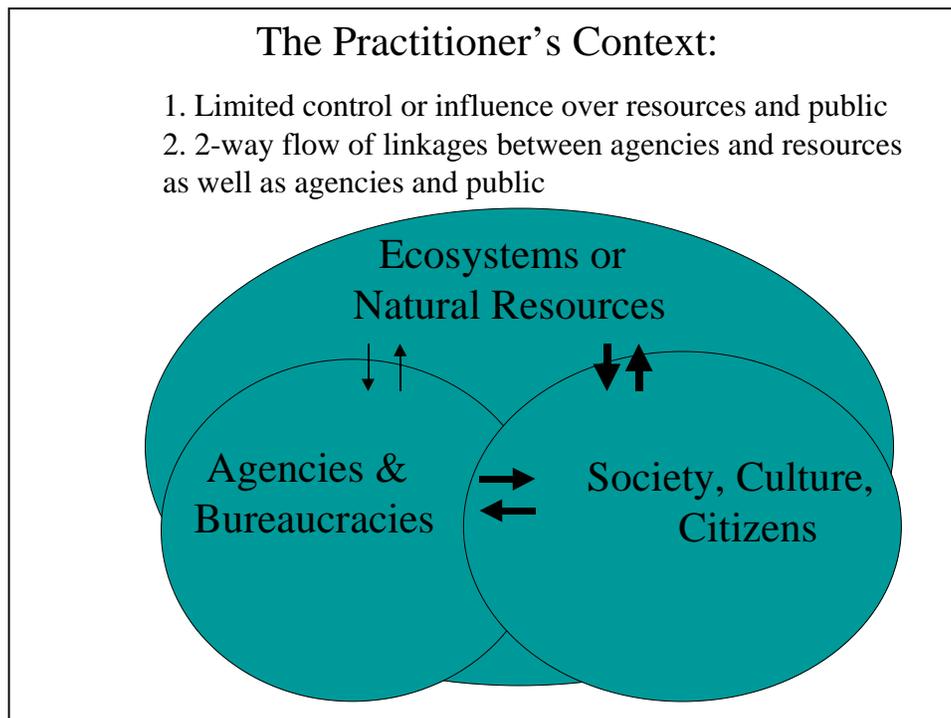


Figure 2. The Resource Management Practitioner's Context

well as public participation in resource management decision-making. In Minnesota, the shift to ecosystem-based management began officially in 1995, but the groundwork for such a shift had been in the works for decades. As at the federal level, the impetus for change had largely come from outside the agency, in the form of pressure exerted in the political arena by adversaries, the chaos of alternating political administrations, and the internal contradictions that are the nature of linearly evolving bureaucracies.

In Minnesota, state agency resource management had its roots in a long political struggle to end the rapacious commercial and private exploitation that in less than one hundred years had resulted in widespread deforestation, driven dozens of fish and game species to commercial or local extinction, and drained and channelized millions of acres of wetlands and streams. The Minnesota Department of Conservation was created in 1931 when four units of state government -- forestry, game and fish, drainage and waters, and lands and timber-- were combined. These early commissions and departments, set up in the late 1800s to deal with rapid settlement and exploitation, had performed unevenly, and had at times exacerbated the destruction of the state's natural resources. The new Department of Conservation was marked by ambitious attempts to stem the tide of resource losses and to foster a developing conservation ethic. In 1971, the name of the agency was changed to better reflect the DNR's broadening responsibilities.

Over the years, the various departments of the DNR had evolved close working relationships with their primary constituent groups, resulting in internal fragmentation of goals and activities and lack of communication among and between the different divisions of the agency. Based on shared specific agendas, the tight coupling of stakeholder groups with their respective agency counterparts -- section of fisheries with angling groups, wildlife management with sportsmen's organizations, Division of Waters with lake associations, forestry with timber interests, and parks with recreational users-- led to poor coordination of messages and activities and sometimes pitted the divisions against each other. This fragmentation was also evident at a larger scale, between the DNR as a whole versus other state agencies such as the Minnesota Pollution Control Agency (MPCA) or the Minnesota Department of Agriculture (MDA). The agency had become a magnet for conflict, both internally between departments working at cross-purposes and externally with various stakeholders. Although public opinion surveys

showed that the “silent majority” of state residents essentially approved of the agency (Kelly and Sushak 1995), the DNR suffered from a serious erosion of trust and downright hostility among specific constituent groups, particularly farmers and loggers in the rural areas of the state.

In the 1970’s and the 1980’s, agency initiatives had focused on resource assessments and planning initiatives, in addition to the traditional single-target management activities. In the late 1980s, managers and other individuals interested in planning approaches began experimenting with roundtables on various resource issues and the first wave of public and private watershed partnerships. It wasn’t until the early 1990s, under a new administration, that the agency began to seriously study alternatives for fundamental reorganization. The agency developed a hierarchical system for classifying the state’s ecosystems and ecological communities, and initiated strategic planning efforts based on these ecological units. In 1995, DNR outlined a plan to adopt the ecosystem approach as a way to redesign its basic organizational structure and operating principles. “Ecosystem-based management” encompassed a set of strategies for developing integrated planning processes and building teamwork at all organizational levels, greater budget flexibility to foster shared responsibility for common goals, and increased use of partnerships to foster interdisciplinary collaboration within the agency, between the DNR and other state agencies, and with citizens and communities. The agency initiated pilot projects for multiple use, ecosystem-based natural resource management in two of the ecologically defined regions; consolidated integrated planning and budgeting activities and ecological support services; developed statewide natural resource forums to convene citizens, agencies, and other organizations for sustainability dialogues organized around forestry and agriculture; and created Regional Environmental Assessment Teams to facilitate coordination and collaborative decision-making earlier in project planning to develop better working relationships with local units of government. The agency also continued and expanded a roundtable process it had used to resolve contentious issues as they arose, including experimental game and fish regulations, delisting the wolf as an endangered species, and old-growth forest management. The roundtable process brought stakeholder representatives from all sides of an issue together at regular intervals for facilitated meetings to review the science of an issue, discuss

policy, and develop consensus or compromise recommendations for resolution of the issue.

These changes form the context for the case studies outlined in Box 1. They represent forestry, fishery, and agricultural issues and cover a range of scales and ecological areas of the state. At the state and federal level, strong leadership by state foresters helped to resolve the controversy over logging and road-building in the Boundary Waters Canoe Area Wilderness in the late 1970s. The resulting changes in forest management and forestry paradigms, from extensive harvest to intensive forest management, have been accelerated through a series of public input processes which led to improvements in forest management, attracted economic investment in forestry and tourism, and stemmed the tide of conflict. At regional scales, the Rainy Lake fishing roundtable and the Heron Lake watershed project highlighted the ability of diverse groups of constituents to reach innovative, science-based decisions for resource management based on negotiated consensus. Because such decisions involved a broad base of stakeholder participation and perspectives, they proved to be more resilient in the face of sound-byte attacks in the political arena that had frequently derailed decisions made by DNR scientists in isolation. At the local level, the Forest Creek trout habitat improvement project highlights how a facilitated public input process that is committed to being open, fair, and respectful can resolve long-standing community conflicts, develop consensus on a detailed resource management plan, and generate a shift in focus from single-use, single-species management to balanced multiple use management.

BOX 1. CASE STUDIES FOR PRACTITIONER INTERVIEWS

*Forest Creek*¹.

The issue. Angling groups wanted a popular trout stream in a local state park in the Mississippi bluffslands to be managed for trophy fishing, but many other stakeholders were concerned about the potential impacts of habitat improvement (HI) projects on other uses and values for the park and the perceived overall imbalance in values for the park. HI represents a single-use management strategy which has been used successfully for 30 years in southeast Minnesota to satisfy public demands for quality trout fishing. It has been most successful with non-native brown trout, for which habitat requirements are

¹ Real name changed until participants have had a chance to review due to concerns about re-opening conflict.

better understood than for the native brook trout. HI serves as a “bandaid” approach--stabilizing banks and engineering cover for fish--given managers’ limited ability to address the ultimate causes of stream degradation in the watershed. Over the years, however, as uses and values for the park had broadened, concerns had been raised by other recreational users, some anglers, horseback riders, archaeologists and birders, regarding the impact of trout HI projects. Concerns pertained both to the broader local ecology, particularly state and federally listed threatened plants and animals, as well as cultural values such as archaeological sites and artifacts present in state park lands.

The challenge: In handling the proposed habitat improvement project, DNR staff wanted to avoid a repeat of a contentious battle over another stream which had occurred a few years earlier. That battle had led to significant and lingering controversy, negative publicity for the DNR, internal conflict within the agency, enormous costs in terms of time and attention, and an outcome not widely perceived to have been positive. When several trout associations approached DNR with a proposal for a habitat improvement project, managers knew they needed to do things differently. DNR’s new regional management team brought in fresh leadership. A new, temporary acting manager created a facilitated process that was fair, open, and flexible. A critical change was devolving the authority and accountability for the final decision-making to the on-the-ground managers and to the process.

The outcome: After only 8 months, an agreement was reached that satisfied all parties and soothed over leftover community tensions. “Memory,” in the form of working relationships and information about system hydrology gained in resource assessments, persisted long enough to defeat a quarrying operation subsequently proposed at a nearby farm which would have severely affected the hydrology and water quality of the stream in question.

Rainy Lake Fishing roundtable.

The issue. Rainy Lake and Rainy River straddle the U.S.-Canadian border, and present special problems of international coordination and management. The Rainy Lake resort economy on both sides of the border depends on good fishing to attract tourists/anglers. Although regulations in the 1980s had put an end to commercial fishing in the lake, total catch and average size had continued to decline in the years leading up to the roundtable process, displaying the classic signs of an overexploited fishery. Around the same time, DNR had cut back on stocking in natural walleye lakes based on internal research showing annual stocking was a waste. Resort owners and anglers, convinced DNR was the problem, demanded more stocking.

The challenge. Developing science-based consensus with stakeholders and resort owners that catch limitations, along with mitigation of water quality and water level impacts caused by the operations of two paper mills, rather than stocking, were necessary to improve fishing.

The outcome. DNR built support for experimental catch regulations by involving stakeholders in research, modeling, and experimental design. Involvement in the research and modeling process and in the final management decisions built broad-based support for the policy. Catch rates and sizes improved after experimental regulations based on roundtable recommendations were implemented. Today, the recreational fishery shows signs of a healthy recovery, and anglers have praised the slot limits.

Ongoing negotiations with stakeholders from both sides of the border seek to resolve issues over water levels.

The Boundary Waters Canoe Area Wilderness controversy: From extensive harvest to intensive forestry

The crisis. The forestry profession and lumber industry were lock step in agreement that it was necessary to manage the wilderness area for timber, despite strong public opposition at the state and national level. They were still building roads, using herbicides, and taking other actions that were inconsistent with wilderness law and public opinion, despite data showing there was abundant timber available outside of the BWCAW.

The challenge: How to break through the rigid, conventional forestry paradigm carried by commercial and government foresters to accept their own data showing that a shift from extensive exploitation to intensive forestry practices could provide an adequate volume of timber without the need to harvest timber in the wilderness area.

The outcome: Public opposition and convincing testimony from state foresters using the Forest Service's own data countered the federal agency testimony that harvesting in the wilderness was scientifically or economically necessary. Following a Congressional mandate ending harvesting and road-building in the BWCAW, the timber industry and professional foresters began shifting from extensive to more intensive forestry practices, longer rotations, and adoption of best management practices, with minimal job losses and positive economic impacts in forestry and tourism. In close cooperation with local community concerns, several state parks in historically fire-dependent ecosystems have reintroduced fire management. In 1995, the Sustainable Forest Resources Act created the Forest Resources Council, a 13 member board representing commercial, recreational, scientific, and conservation interests to provide sound management advice to federal, local, state, and county governments.

Agriculture

Heron Lake Watershed Project.

The issue. Various stakeholders were concerned about the decline of the watershed, historically one of the richest wildlife and waterfowl areas in southwestern Minnesota. Various recreational goals and single-target management strategies, such as fishing, public access, and waterfowl habitat, were perceived to be in conflict.

The challenge. Finding a way to resolve multiple, sometimes conflicting goals for a limited resource. The project moved over time to embrace a whole system or watershed approach.

The outcome. Dozens of public and private groups and individuals, including sportsmen's organizations, farmers, local and national conservation organizations, and local, state, and federal government formed a watershed project in 1989 to develop a comprehensive watershed plan, restore wetlands, acquire easement lands, improve water level management, and address nonpoint source pollution. DNR assisted voluntarily in an advisory role. An early "success" story of ecosystem management for the Minnesota DNR.

Preserving prairie remnants in the Glacial Lake Agassiz region.

The issue. Development of land for agriculture had eliminated 99% of the original prairie; DNR and other conservationists sought a strategy for protecting remaining remnant prairies.

The challenge. Conventional agricultural systems in the Midwest rely on extensive inputs and extensive hydrological modifications which have severely impacted and permanently altered the original prairie, savanna, stream and wetland ecosystems. The challenge in the Glacial Lake Agassiz area was how to envision a future which could preserve remaining prairie remnants as well as honor the strong agricultural identity of the region, in a time of social and economic crisis in agriculture and rural agricultural identity, declining agricultural profitability and low international commodity prices.

The outcome. A successful visioning process through a series of facilitated dialogues in which local communities took ownership of their needs and concerns and developed strategies for preserving and stewardship of remaining prairie resources.

Rules of Thumb. Despite practitioners' emphasis on the contextual, improvisational nature of managing resource crises and change, many principles or guidelines emerged repeatedly in interviews. In contrast with conventional paradigms characterized by instrumentalist methodologies for targeted problem-solving, rules of thumb were primarily loose guidelines for managing an organic process while not being overly directive. Direct control in such systems is in fact, not possible given the multitude of interacting, independent agents and the role of chance events.

These “rules”, which complement quantitative, scientific approaches to managing for specific resource outcomes, are geared more at maintaining the parameters and conditions for learning—the conditions for meaningful dialogue, communication, and innovation—than at producing particular outcomes. We categorized the principles as follows (Figure 3):

1. Looking Outward and Inward for Understanding
2. Protecting Capital
3. Detecting and Fostering Novelty
 - a) Mobilizing capacity for inquiry
 - b) Encouraging and amplifying experimentation
 - c) Dampening barriers to learning and renewal
4. Speeding the Contagion

Looking Outward and Inward for understanding. Practitioners identified sensitivity to initial conditions, a focus on slow variables and double-loop learning (Figure 5) as important practices in leading change. Such practices, drawing both from memory and visioning, serve to stimulate reflection on the internal and external sources of current dilemmas and to expand the temporal frame of reference beyond the immediate present. Rather than directing a process, they focused on creating safe spaces for dialogue and learning among diverse players that would allow for “double loop learning.” Such learning involves identifying not just the fast-variable, proximate mechanisms behind current configurations, but the governing values, underlying paradigms and assumptions which structured the previous problem-solving response.

At Forest Creek, the need to be “sensitive to initial conditions” was provided by the lingering conflict over previous habitat improvement projects. The Trout Creek experience had set much of the tone, as many of the players involved had been involved in both projects. Relationships—some positive, but especially negative—had already been formed among individuals in the various agency and stakeholder groups. Initial decisions about the process—internal communication and meetings, setting ground rules for respect in the public meetings, solicitation of informal, one-on-one feedback from key players in advance of meetings, and an open door policy of DNR managers toward inquiries from the public and participants-- were all based on this understanding. Slow variables, such as the history of place, governing values and paradigms, and key driving variables of the system, were identified both as sources of memory as barriers constraining bureaucratic options and social imagination. The agrarian traditions of northern and central European settlers who largely settled Minnesota conditioned attitudes towards resources. Conservation philosophies and local knowledge passed down from small farmers of the Depression-era blended elements of Christian stewardship ethics with elements reminiscent of Leopold’s land ethic (1949). Many second and third-generation farmers recalled their parents’ strong sense of stewardship and farming practices linked to a land ethic, such as the role of fencerows as corridors, habitat, and refuges for on-farm biological diversity. At the same time, these traditions structured rigid paradigms for management of forestry, fish, and game, alternating between an agrarian view of complete human management and control and an entitlement view of

Managing for Renewal: “The back loop”

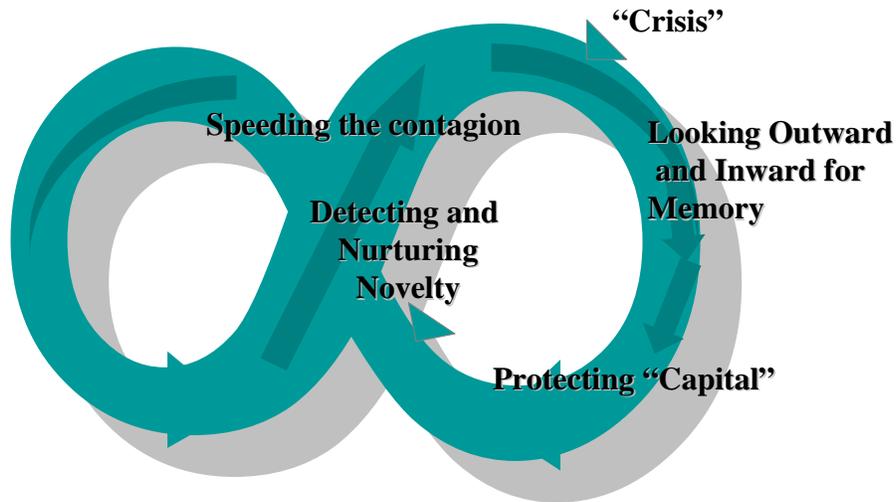


Figure 3. Principles for facilitating renewal through the “back loop”.

the rights of Western culture to fully exploit natural resources wherever and whenever they are available. The agrarian view saw fish stocking and wildlife feeding programs as a DNR mandate. Monitoring data showing such programs to be ineffective at best were to be ignored or mistrusted. The rights-to-nature view saw the efficient liquidation of natural capital on both public and private lands as an economic and moral imperative to sustain growth that was being thwarted by naïve preservationists.

At Glacial Lake Agassiz, dialogues began with facilitated discussions drawing the historical picture of commodity agriculture in the local and global economy. The paradigms, economic incentive structures, information flows, and federal policies which influenced conventional agricultural decision-making were seen as the factors driving prairie loss, as well as farm consolidation, rural depopulation and loss of rural culture, and political pressure on agriculture from urban environmentalists. The state natural resource agency’s long-term focus on hiring technically and scientifically trained staff to fill primarily technical job descriptions, despite a need for communication skills and significant public interaction in many of these jobs, has continued to influence agency “capital” in terms of its relationships with its public “customers.” A long

SPATIAL SCALE

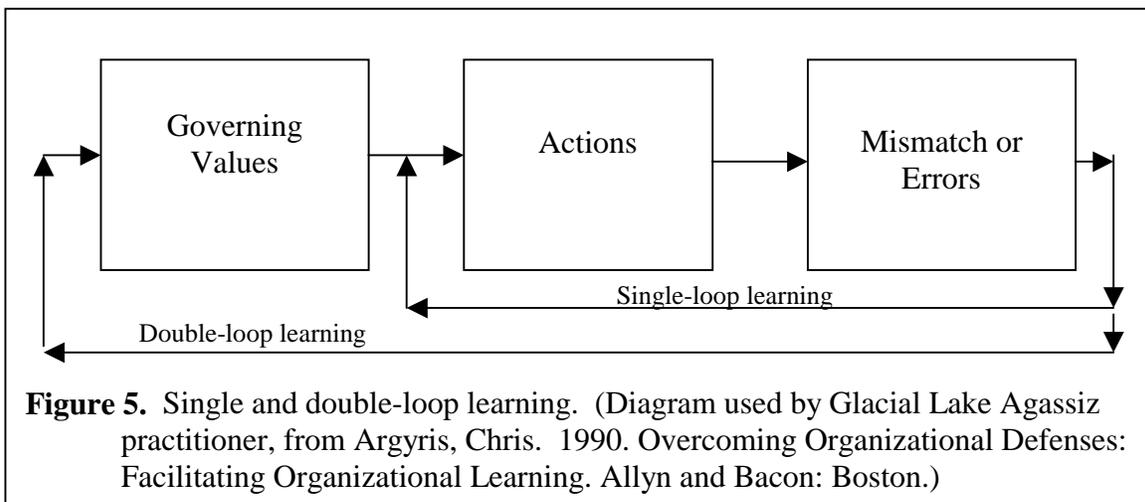
Local

Watershed

State/regional

	Forest Creek	Heron Lake Watershed Project	Rainy Lake Fishing Roundtable	Glacial Lake Agassiz Citizen Forum	BWCA Forests & MN DNR Ecosystem Based Management
Figure 4. Matrix of Practitioners’ “Rules of Thumb”					
Looking Outward and Inward					
- Double loop learning: identify governing values and paradigms; key driving variables	X	X	X	X	X
- Memory: remembering past mistakes	X	X	X	X	X
Protecting “Capital”					
- Thorough resource assessment	X		X		X
- Fair, open, honest process as necessary ingredient for trust building	X	X	X	X	X
- Valuing diversity of perspectives and experience	X	X	X	X	X
- Sense of place, connection to land	X	X		X	X
- Relationship building through shared experience	X	X	X	X	X
Detecting and Nurturing Novelty					
<i>Mobilizing capacity for inquiry</i>	X	X	X	X	X
- Engaging all stakeholders					
- Open process and information flow, listening	X	X	X	X	X
- Development of shared language and understanding	X	X	X	X	X
<i>Coping with surprise</i>	X	X	X	X	X
- Disturbance, crisis, and conflict as change agent					
<i>Encourage and amplify experimentation</i>	X	X	X	X	X
- Devolved decision-making, self-organization					
<i>Dampening Barriers to Renewal and Learning</i>	X	X	X	X	X
- Creating “safe spaces” for experimentation, tolerance of mistakes					
- Minimizing learner’s sense of vulnerability; “respect” for process and individuals	X	X	X	X	X
- Proactive negotiated consensus process; Avoiding charged, polarized settings	X	X	X	X	
Speeding the Contagion					
- Cultivation of networks	X	X	X	X	X
- Vision, leadership, and metaphor	X	X	X	X	X
- Developing readiness at multiple levels-- replication of platforms at local, regional, and state scales	X	X	X	X	X
- Cross-scale interactions	X	X	X	X	X

history of extensive timber exploitation in Minnesota, leading to tight economic and social coupling of state and federal agency foresters with the timber industry, yielded fierce resistance to the wilderness movement’s attempt to bring an end to timber exploitation in the Boundary Waters Canoe Area Wilderness. Such observations seem to lend support to the caricature of the perversely resilient bureaucracy or the Kuhnian notion of nonlinear cycles in dominance of scientific paradigms. During the exploitation phase of the adaptive cycle, the success of linear thinking and control strategies leads to stable configurations of paradigms, management rules, and relationships. Scientists, managers, and other players who have experienced success in this system are likely to resist risking fundamentally new approaches, and to systematically ignore accumulating evidence of impending crisis or failure of the current policy or approach. Past success becomes the motivation for persisting in conservative behaviors. The rigidity of this configuration serves to thwart efforts at renewal, and serves to underscore the observation that the impetus for reorganization generally comes from the “fringe” (Kuhn 1970; Holling et al 1995).



Practices for protecting social and natural capital. The period from reorganization to renewal is rapid, chaotic, and subject to chance events. Events occurring in this phase often lay the foundation for the order that emerges, while innovation emerges from novel combinations of existing social and natural capital. It is critical in this phase to protect

and retain the “raw ingredients”, or social and natural capital—whether in the form of soil fertility or experience-based knowledge and wisdom. Managers expressed a conscious framework for protecting such ‘capital’. Such practices included:

- i) thorough resource assessment, inventory, and monitoring
- ii) valuing a diversity of input, perspectives, and experience
- iii) building on a sense of place: developing local knowledge to build commitment and generate understanding of the system
- iv) developing trust and relationships through fair, open, honest process.

Thorough resource assessment, inventory, and monitoring. Practitioners emphasized the importance of having as thorough as possible a baseline understanding of the system. In every case, scientific surveys played a key role in inventorying existing natural capital. Implementation of thorough inventory and assessment of ecological resources as well as careful monitoring of the fit between agency activities, financial outlays, and outcomes was key to the success of the reorganization efforts in the DNR at all levels. Statewide, federal and state forestry inventory data provided the justification needed to cease harvest of old growth timber in the BWCAW. At Rainy Lake, long-term data on exploitation rates and catch sizes provided input to models assessing the impact of catch regulations on the fishery. The Minnesota County Biological Survey (MCBS), a statewide natural resource inventory which had been initiated in 1987 in order to identify, and map, and facilitate land acquisition to protect rare ecological features and communities, helped practitioners to communicate with citizens at Forest Creek and in other project’s outreach efforts.

At Forest Creek, project leaders augmented MCBS data with a thorough resource inventory and mapping of the archaeological and biological resources of the riparian area. An interdisciplinary team of DNR scientists was assembled and worked closely to develop a detailed GIS depicting the precise locations of each valued resource. These maps were then used to develop the proposed locations for habitat improvement in a way that would be least likely to undermine the value of the creek for other resource values. A key benefit of the resource surveys conducted as part of the Forest Creek project was not just the expanded ecological knowledge base, but the working relationships forged

between the biologists in different disciplines, the stakeholder groups, and the agency managers. The park supervisor, who played a key coordination role throughout the project, organized a series of walking tours for the benefit of any and all interested stakeholders. These walking tours formed the basis for developing a shared understanding of the diverse values people held for the creek. Individual participants credited these tours directly with having enlarged their values for the stream and the park. On one tour, for example, a botanist led the group away from the creek in search of a rare fern which grew only in small patches characterized by a cool microclimate. For the regional fisheries manager, experiencing the collective search for this rare, little-known fern in its unique microhabitat helped to enlarge his own appreciation for the diversity of ecological conditions and values for the park. Before the process, he had never even heard of a Louisiana waterthrush, a forest songbird that was a prime focus of birders' concerns due to its declining numbers in Minnesota and specific nesting habitat requirements of 1-2 m steeply eroding streambanks (precisely those streambanks that arouse the ire and interest of trout stream restoration engineers.) He spoke frequently of the ways in which his personal perspective had shifted and enlarged as a result of the process.

Valuing diversity of perspectives and experiences. Creating adaptive capacity requires valuing diversity and individual experiences for what each component can contribute to the process in the form of knowledge capital. Respect for each individual's right to participate is the cornerstone of facilitation. By creating a climate of respect for differing perspectives and opinions, positive feedback loops are created in which participants move from tolerating diversity to valuing and enjoying it for the role it plays in their own learning process.

Protecting capital was also embodied in a focus during Forest Creek on helping people to perform at the peak of their individual abilities. Part of what had eroded the public's lack of trust in the agency during the Trout Creek controversy was the obvious conflict and disagreement, both about facts and uncertainties, present among agency staff—the nongame biologists versus the fisheries staff in particular. Each of these segments had their own public constituency. In order for each biologist and manager to

present their best work at public meetings, it was necessary to develop consensus within the agency about what was known, what was unknown, and what were the likely uncertainties, as well as to anticipate as much as possible the likely criticisms and concerns that would arise in the meetings. Public meetings regarding the Forest Creek habitat improvement plan were characterized by a well-organized, well-planned agenda that laid out careful time limits, ground rules for respectful interaction, a coordinated and consistent message for the state resource agency, and an inclusive process for assessment, decision-making, and accountability. Agency agreement with respect to the science and the process had been carefully crafted through a series of internal formal and informal meetings and one-on-one conversations carried out within DNR in advance of the public meetings. Careful attention to process in advance allowed the process to become invisible. The knowledge and skills of the agency scientists could then emerge, while the knowledge and concerns of the various non-agency participants would also be honored, heard, and addressed without major damage to relationships.

Fair, open, honest process to establish trust. Woven through all the discussions about protecting capital was an emphasis on the importance of building trust and good working relationships by maintaining a consistently fair, open, and honest process. In complex systems, relationships form the basis for all communication, motivation, and action. Practitioners shared strategies for building relationships, emphasizing the importance of creating opportunities for people involved in an issue to meet and interact socially *in the resource environment*, sharing food, stories, experience, collective learning, and work. Practitioners also emphasized the importance of allowing time and space for relationships and ideas to incubate, and to resist assuming that just because they weren't doing anything, that nothing was happening. They recognized that once the conditions for learning and dialogue were in place, their role was to step back and allow events to unfold.

Building on sense of place and emotional connections. Without exception, practitioners stressed the need for decision-makers to have regular and direct experience of the resource. Such experiences served to build community relationships, experiential context specific knowledge, trust, and passion. The role of science was to serve this process of building connections and local knowledge, rather than the reverse. It was not the

knowledge, per se, but the sense of ownership behind that knowledge, the connection to place embodied in the range of knowledge acquired about a place, that developed commitment to stewardship. Knowledge about the uniqueness of a resource or a place helped individuals to enlarge their appreciation for ecological knowledge, by helping them both to recognize and value diversity and to connect with others' feelings of stewardship and pride for other unique resources in other places.

Detecting and Nurturing Novelty. Folke and Berkes (1998) suggest that self-organization plays an important role both in ordering ecological knowledge and in emergent institutions. Ideas and heuristics emerge over time through dialectic between individuals in a group as well as through the group's interactions with the ecological system. Individuals within stakeholder groups "coevolve" with the ecological system they have formed to address—"self-organization through mutual entrainment" (Folke et al 1988). Stakeholders and planners reframe their understanding of a situation through a kind of dialogue (like those practitioners described), but may be unaware that this is happening (Innes 1996). Self-organization may also play a role in the emergence of "novelty" in terms of non-linear shifts in understanding. Numerous practitioners suggested that their own ideas as well as that of others had evolved as a result of a collaborative process.

Many principles emerged which could be characterized as strategies for creating the conditions for novelty to emerge in the ecological or social system, including principles for anticipating and dealing with surprise or uncertainty, mobilizing capacity for inquiry, capitalizing on surprise, encouraging experimentation, and dampening barriers to renewal and learning.

Mobilizing capacity for inquiry. Mobilizing capacity for inquiry involved engaging all stakeholders in an open, inclusive process, and the development of shared language and understanding. The inclusion of multiple stakeholders in dialogue in each case was seen as bringing more capacity for innovation to the process. According to one member of a regional DNR interdisciplinary team: "Ecosystems are not only more complex than we think, they're more complex than we *can* think. So the more brains you have working on

the problem, the better chance you have of coming out with something that's acceptable to everyone or successful.”

Developing shared language to communicate system metaphors, ecological processes, and community vision is a gradual process that occurs hand in hand with developing relationships and understanding. Collective science-based dialogue, experiential learning, and modeling were used in all cases to develop a shared knowledge base. Practitioners stressed the need to be aware of and avoid use of overly narrow language, such as scientific jargon, especially in the initial stages. In the fisheries roundtable at Rainy Lake, a group composed of lay persons, resort owners, and fishermen gradually developed a firm grasp of jargon used by fisheries scientists as well as the underlying principles. According to the fisheries manager on the project, the roundtable's final report issuing management recommendations for Rainy Lake “could have been written by a biologist.”

Crisis and surprise as agents of change. Practitioners and participants tended to characterize the “time being ripe” in terms of the existence of a threshold level of concern or frustration and the willingness of key people to begin actively searching for new approaches to dealing with a problem. “Crisis” was frequently cited as playing a necessary or sufficient role in spurring action, but was rarely defined. At what scale must crisis occur in order for meaningful learning to occur? Were crises real or socially constructed? Crises shared elements of being both real and perceived, both social and ecological. Glacial Lake Agassiz highlighted economic crisis in agriculture as well as loss of remaining prairie remnants. At Heron Lake, concerns focused on the loss of waterfowl habitat and degraded water quality. At Rainy Lake, concerns focused on the deterioration of the walleye fishery and the impact this might have on the tourism economy. Forest Creek was primarily characterized by a perception of crisis in the social arena. Desire to avoid repetition of the disastrous process at Trout Creek led to an internal reorganization and rethinking of the agency's approach to habitat improvement in state parks. In other cases, concerned groups responded to the perception of impending crisis. The impetus for reorganization of the DNR at the state level emerged

from a convergence of small, medium, and large scale perturbations, none of which individually might have precipitated action.

The difference may lie in the structure of land tenure and management as well in existing social capital. Where such capital exists in the form of strong local or grassroots community ties, an individual motivated to act is more likely to find and “plug in” to an active support network, or a “shadow network” working at multiple scales. By contrast, where people’s lives are relatively isolated at the level of the nuclear family, de-coupled from place and community, as was the case in several of the case studies related to a specific issue such as recreation, more immediate crises are required to spur collective action and generate novelty. The impetus for such collective efforts—the perception of crisis—often arises partially out of fears about being subject to larger uncontrollable forces of globalization and rapid change, partially out of a historical and cultural context of values and political empowerment, and partly via the enabling institutions which support directly or respond to civic action. It depends on the articulation of vision by practitioners involved in leading change regarding the inadequacy of traditional approaches and management roles and the need for new roles.

Coping with ‘surprise’. Practitioners were generally philosophical about the role of surprise and uncertainty, and recognized that not everything could be anticipated. Inclusion of a diversity of perspectives was credited with conferring a level of insurance against the type of unintended consequences generated by narrow thinking. “Keep your eyes open and watch for the unexpected... you just have to be careful about linear tracking on all of this stuff. Having the bigger group... really helps to avoid a lot of the problems.” The conflicts that arose in the case of the early at Trout Creek had come as a complete surprise to the DNR fisheries and park managers. The defensive reaction to surprise allowed the issue to spiral out of control. In broadening input, practitioners were able to better anticipate surprise and take it in stride when it materialized. In this sense, commitment to honoring diverse perspectives serves both to break open renewal cycles as well as to “put the brakes on” release.

In several cases, surprise provided the opportunity for re-evaluating views. At Forest Creek, an unusually severe summer flash flood occurred at a time when resource assessors, in the process of thoroughly mapping the 1.5 mile stream, had begun to get

bogged down in specific, single-purpose plans for each segment of the stream. The flood wiped out several areas of contention and demonstrated the fallacy of micromanagement. In doing so, it facilitated learning and helped to create a more flexible climate for negotiation.

Encouraging and amplifying experimentation. Practitioners saw the involvement of the public as both a challenge and an opportunity. They recognized that reorganization and renewal in particular requires a faster pace of learning and organizational change than agencies typically achieve on their own. Mistrust of government, lack of scientific literacy and/or a common language for speaking about ecology, and poor communication between agencies and the public can serve as obstacles to implementation of management plans. Narrow interest groups of citizens sometimes serve to co-opt and corrupt processes of public involvement. Agencies often feel that they are being hijacked and hamstrung by political controversy. However, loose networks of activist citizens and nongovernmental organizations can serve the role of change agent by regularly lighting fires under the slower moving, task-oriented bureaucracies. Thus, ironically, “slowing down” to broaden the process of planning input, if done correctly, serves to facilitate more rapid fundamental change.

Embedded in the process of facilitating multiple stakeholder dialogues is the responsibility for “dampening” barriers and “amplifying” novelty. How are such choices made? Several practitioners experimented with devolution of the actual decision-making authority, or “leadership from behind” as it has been termed within the agency, but continued to pay close attention to the dynamics of helping people to work through the process collectively. Devolution of decision-making explicitly recognizes the inability of an agency or a manager to truly “manage” a complex system itself. S/he cannot direct change or control change, and therefore must focus instead on creating the conditions for learning and for self-organized contagion. Practitioners often felt the need to articulate a vision or a set of ground rules, but then stepped back to “let self-directed discussions nourish themselves.” At Forest Creek, the regional manager supervised the process at a distance, but devolved decision-making and clear accountability for the final decision on the outcome to the park manager. The park manager, in turn, coordinated communication between biologists involved in the resource mapping and surveys as well as the public.

The practitioner involved most intimately with the Heron Lake watershed project gave the following prescription: (1) Listen, (2) contribute information, (3) sit back and be patient and (4) expect your partners to make good decisions. He added “I can remember thinking: ‘I’m the resource person, I have the training and the experience, *I’m* the only one who is going to be qualified to make the correct decision...[but] actually, if you trust in the process, your partners will make better decisions than you will.” In each case where decisionmaking was devolved to teams or group stakeholder processes, practitioners admitted to having made a leap of faith--and to feeling pleasantly surprised by quality and the scientific soundness of the decision reached. In devolving decision-making and encouraging, practitioners explicitly expressed tolerance for mistakes and the freedom to experiment. The reintroduction of historic disturbance patterns through prescribed burning in one of Minnesota’s largest state parks was planned and carried out entirely at the local level in a process led by the park superintendent.

Practitioners emphasized the improvisational style, the lack of a “master plan” , as a way to encourage experimentation. The primary focus was on “discovery learning”, engaging people in dialogue, observation, and in some cases monitoring in such a way as to allow people to draw their own conclusions. Discussion plays a key role in concept formation, in the development of theory with which to anticipate on the basis of observation, in establishing what is effective and acceptable action, in assessing external information and in coping with the uncertainty (Darré 1985; Roling and Jiggins 1998), as well as in the development of shared values about a system.

Dampening barriers to renewal and learning. Because learning and experimenting with new ways entails risk, an important strategy for practitioners of dampening barriers to renewal is the creation of safe spaces where participants’ sense of vulnerability is minimized, and where mistakes are actively tolerated or even rewarded. Much of this is implicit in already stated principles of facilitation, creation of fair, open, respectful processes engaging all relevant stakeholders, and the importance of establishing relationships built on trust. Agency decision-makers regularly contacted key leaders of stakeholder organizations to discuss concerns and convey information regarding the status of the process. At Forest Creek, an active “open-door policy” for communication

among the agency and the various stakeholder groups was central to dampening barriers. The goal of the open-door policy was “creating safe places where conflict could be managed and learning could take place.”

Many practitioners focused on the importance of “active listening”, or listening for ideas that emerge from the different ways in which people frame problems. Some brought up the paradoxical value of extremists. While extremists can be barriers in the sense of creating strained relationships, gridlock, and barriers to communication, they can also be sources of novelty as the sparks for inducing “crisis” (as opportunity), as the parameters for enlarging the parameters of or the range of options considered, as a source of passion for energizing a process, or even as a common “enemy” helping to unite others. The disastrous Trout Creek experience, for example, had taken such a toll in stress, mental energy, and broken relationships that there existed a “readiness to do things a different way.” Individuals explicitly expressed their desire to avoid a repetition of the previous process to the project leaders at the outset.

A major concern of many of the practitioners was how to handle individuals who were particularly charismatic, powerful, and/or disruptive to the collaborative process. Several members of stakeholder groups at Heron Lake and Forest Creek were known for their tendency to be vocal and disruptive at public meetings, to be manipulative of the agenda, and to interrupt when other individuals were speaking. They were also effective at going outside of the process to achieve their ends, in particular, exerting pressure through the media or local state legislators. In this case, such negative tactics were dampened via a kind of “Tao” of facilitation: individuals who tended to disrupt discussion were encouraged to speak up within their allotted period. Ground rules regarding respect for others, freedom from interruption, and length of time granted to each person’s comments were laid out and agreed upon at the beginning of each public meeting. Such rules helped to diffuse the tension and anxiety experienced by participants who tended to hijack the conversation out of fear that their concerns might not be aired otherwise. Skilled facilitation helped to maintain ground rules and to ease anxieties about the fairness of the process. Practitioners confirmed that an open process that respectfully honors diverse input will be self-censoring. The group itself becomes

the arbiter of the ground rules, and the group will sanction individuals who consistently violate the established norms of respectful input.

Speeding the Contagion

Practitioners worked to ensure that processes of change occurred at multiple scales, from local to regional to institutional. They recognized the need to operate at multiple readiness levels—not just scaling up from the local or imposing top-down processes from the state level. Lessons learned from DNR’s early experiments with ecosystem-based management were shared across scales through internal and external publications within the agency, links with the state university, media coverage, informal communication, and formal exchanges at events and conferences. Several practitioners knew each other or were familiar with one another’s work. Many had read, for example, one practitioner’s publication on “Leading from Behind”, or the report of the Two Futures dialogues in Glacial Lake Agassiz and drew parallels in their own work. Novelty in the social system can thus be seen both as an organic, emergent property of collective work, and as facilitated by lateral diffusion of successful models through informal networks. As one practitioner phrased it “you can’t say that one idea came from here and then it was picked up over here...it’s more like a cloud taking shape. Everyone’s ideas are like little nudges, they’re constantly nudging themselves and others. Some nudges made a bigger difference than others.”

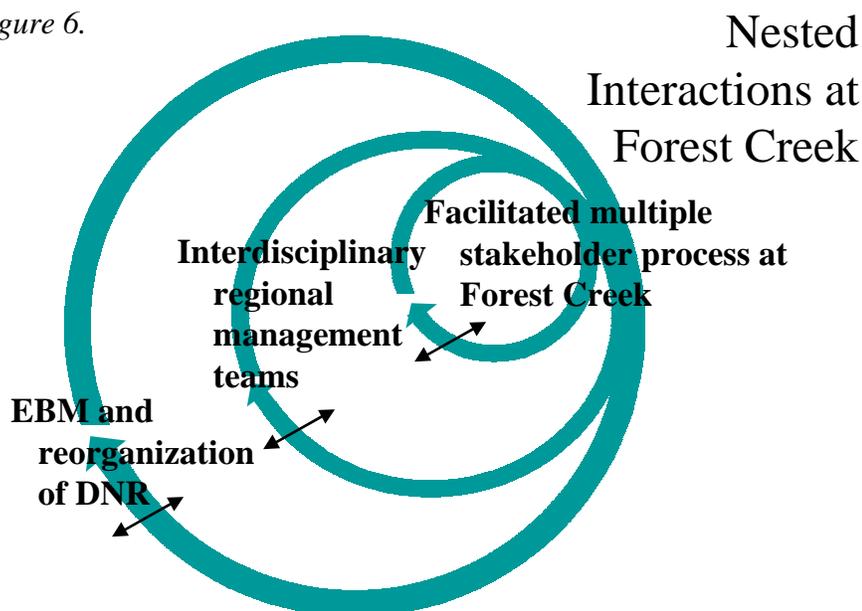
Practitioners felt that the time was ripe for these discussions. National dialogues on ecosystem management and public participation have emerged coincidentally with local grassroots movements for sustainability, autonomy, and self-reliance. Many emphasized the need for patience and understanding of the lag times that follow legwork that has been in the works for decades. Speaking about the Heron Lake watershed project, one practitioner said: “You can only go as fast as local people want to go or can go. If you try to go faster it doesn’t work. We’re almost 20 years later [now] and we really are talking about wetland restoration, riparian buffers, feeder streams, and erosion control.” The implications are problematic from the standpoint of measuring and reporting on outcomes, especially from the point of view of a task-oriented bureaucracy. Some practitioners value the critical role of nonprofit institutions, which can afford to be more patient with these kinds of informal development processes.

Many practitioners emphasized that the process of negotiating resource use itself is often intrinsically rewarding. Participants regularly express a profound sense of satisfaction resulting from learning about the environment or others, with the relationships they developed both with others and with the natural world, and particularly with relationships which had evolved from adversarial to cooperative. At Forest Creek, participants were extremely positive about the learning embodied in the respectful process. Handling small steps well, especially in the initial stages, laid the groundwork for success. Remembering Trout Creek, participants at the initial public meeting over Forest Creek—well-planned and coordinated—went away pleasantly surprised by how smoothly it had been conducted. Early small successes created a snowball effect helping to reinforce the positive feelings participants retained after the plan was developed.

Outcomes.

At Forest Creek, well-coordinated and facilitated public meetings, considerable informal communication, internal review, inventory, and an open discussion process that went on throughout the spring and summer, led to an agreement in less than one year. A public meeting was held at which interested parties agreed to a trout habitat improvement project on 1000 feet of Forest Creek designed to interfere minimally with other values for the creek. Habitat improvement scheduled for implementation in the fall of 1999 was delayed by a very wet summer that prevented the use of heavy equipment in the riparian area. In this sense, the Forest Creek project has had minimal impact on the resource to-date. The creek itself has a one hundred year history of human management and impacts. In what ways have adaptive capacity, ecological resilience, and social resilience been created or preserved? The facilitated process at Forest Creek helped to heal some of the scars created by the Trout Creek process and to create a sense that the community could work together. Quotes from the final meeting included: “At the beginning of this process, I objected to trout habitat improvement projects but the process has been wonderful. You’ve taken everything into account that you can. Trout groups also need to look at landowners to stabilize their runoff and decrease the soil load in the water during floods.” “The best thing about this process is that it was a good illustration of ecosystem-based management. My confidence in people and the DNR has been restored

Figure 6.



by watching this process.” Institutional changes in the DNR that might serve to capture the memories from Forest and Trout Creek and to scale up the learning (Figure 6). The regional environmental review teams and process are in place to replicate the planning process which occurred at Forest Creek in any future settings. During the Forest Creek planning process, the regional coordinator and the regional managers met informally three or four times to review the process on Forest Creek, whenever it was deemed to be “necessary.”

But perhaps the most significant example of a positive outcome at Forest Creek is provided in the form of a threat to the resource that did not materialize. In the fall of 1998, individuals who had participated in the Forest Creek were informed that a quarry operation was proposed on a nearby property. Due to the resource survey that had been conducted, it was known that that land was part of the springshed, or recharge area, for Forest Creek. A quarry operation on the land would have undoubtedly posed a threat to the spring and to the entire resource through alterations of groundwater hydrology or contamination of water quality from the quarrying process. Thanks to the working relationships that had been formed during the Forest Creek planning process between DNR, the park manager, and participants in the process, a few telephone calls were sufficient to arrange a meeting with the landowner on whose property the quarry had

been proposed. After some private informal discussions, conversations with county planners, and internal DNR approval, the landowner was persuaded to sell the land to the DNR for inclusion in the state's registry of important Scientific and Natural Areas (SNAs).

While it is not certain that such an outcome would not have been possible under an alternative scenario, it is unlikely. This outcome raises the issue of unrecognized capital—capital that is invisible until it is eroded. In a memo to a colleague, the practitioner involved in the Forest Creek event commented: “The value of a facilitated stakeholder involvement process is sometimes found in the costly things that don't happen, such as the time and energy that is not spent because the situation does not spin out of control, or the extra meetings that do not happen because the initial processes work effectively. However, it is hard to measure things that don't happen...In comparison to Trout Creek, which took years to resolve, Forest Creek took 9 months to resolve, took approximately 10% as much staff time as did Trout Creek, was resolved through fewer staff and stakeholder meetings, was not highlighted by negative press coverage of the department, did not require special intervention of travel by members of the Commissioner's office, did not damage internal staff or external stakeholder relationships, and left stakeholders commenting on the effective process and satisfactory resolution of the conflict. Few people beyond the region even knew the Forest stakeholder process was happening, compared to the widespread knowledge about the Trout Creek conflict.”

When facilitation or stakeholder involvement is working, it is often invisible. Likewise, when community capital is in place--e.g. civil society or community institutions are able to perform essential social services and cope with small-scale shocks and disturbances--avoided crises, or crises that never materialize, may never be perceived at all. A linear problem-solving approach is unlikely to recognize those crises that do not materialize. Because we lack measures and means of identifying when capital is functioning to maintain resilience, a problem-solving orientation is likely to prevail, identifying problems and proposing radical solutions to small-scale, fast variable problems that may result in cures that are worse than the disease. Sometimes, then, a

focus on what's working, and what resources are in place and functioning, may play a key role in generating solutions to perceived problems.

Today there are of course still significant external threats to the long-term sustainability of the Minnesota's resource base, from suburban, urban, and recreational growth and development to the continuing consolidation of farms, livestock operations, and high input conventional agriculture systems with extensive monocropping. Water quality improvements in agricultural areas of the state have been equivocal, despite local success stories. Ecosystem-based management has been accused of being "vague" and of abandoning traditional hunting and fishing groups, whose license fees once funded the bulk of agency activities, in order to cater to the demands of urban environmentalists, "greens", and "ecology-freaks." But ecosystem-based management as a whole has gained broad acceptance through largely successful efforts to partner with citizens, civic and nonprofit groups, and local, state, and federal government.

Since this research was conducted, the DNR has undergone a change of leadership brought on by a new state political administration. Despite a fairly significant change at the level of the commissioner, central tenets of the ecosystem-based management strategy have been left in place, including strategic planning and roundtable processes, watershed and landscape experiments, regional interdisciplinary teams, the focus on broadening public participation, and other initiatives. The commitment to achieving sustainability has been articulated throughout state government agencies, as well as in numerous grassroots and local organizations. The state's non-agricultural resource economy is strong. Local success stories in fish, game, and watershed management and new approaches to management of sensitive lands and remaining natural communities have attracted positive attention. Long-term planning processes at Heron Lake and Glacial Lake Agassiz and state platforms for discussing agricultural and forestry sustainability have evolved to include new participants and address new challenges. The Heron Lake watershed partnership continues to conceive and implement restoration activities. The walleye fishery at Rainy Lake continues to draw praise, while citizens, state, local, federal, and international entities continue to seek solutions to conflicting goals for water level management. Decision-making platforms at Rainy Lake

and Forest Creek, having met their goals, have been dissolved, freeing capital, while retaining memory in the form of skills, relationships, and knowledge.

Synthesis: Adaptive practices for navigating through “the back loop”

Against Prescriptions: Resource Management as Jazz. Management of complex social-ecological systems is highly context-specific. There are no formulas for “technology transfer” that can be bottled and applied to other resource management problems with assurances of success. Management, especially management of change, is as much an art as a science, and requires continuous re-evaluation and monitoring. The “new” practitioners, as facilitators of learning and change, need different skill sets, including the ability to articulate vision and metaphor for double-loop learning and to create safe, open, and respectful platforms for dialogue, learning, relationship building, and experimentation. Looking outward and inward to understand the roots of crisis, protecting and conserving human and natural capital--the “memory” of the system--through release and reorganization, detecting and nurturing novelty to generate renewal, and speeding the contagion by which adaptive capacity can be replicated and transferred across scales lead to new configurations of social and ecological capital (Figure 7).

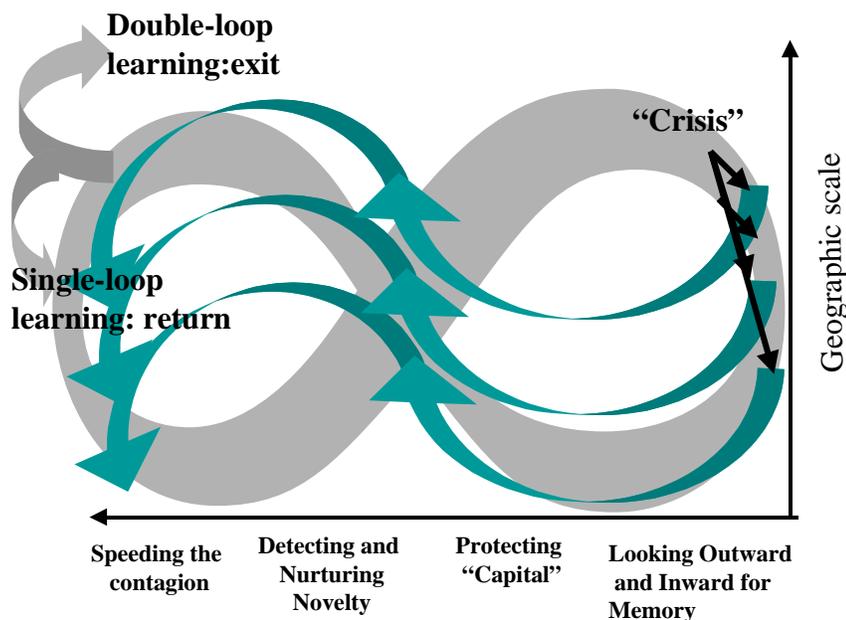


Figure 7. Facilitating adaptive renewal at multiple scales.

Facilitating adaptive learning and renewal involves an explicit recognition of a fundamentally adaptive, iterative paradigm, rather than one of a linear planning and implementation process geared towards efficient reaching of targets specified at the outset. Practitioners do not subscribe to an instrumental view of public participation as a means to broaden the base of public support to counter challenges to bureaucratic power and to liberate themselves from demands of special interests. They view the construction of alternative processes for devolved or shared decision-making as a process valuable as an end in itself inasmuch as it promotes learning and experimentation. They stress the importance of orchestrating diverse, interdisciplinary working groups of scientists, field staff, managers, landowners, and other stakeholders to build platforms for learning about specific issues that can be scaled up to broader problems. Such platforms are a needed alternative to the formalized processes by which most public agencies make decisions. As temporary learning systems, they retain flexibility without additional bureaucratic costs. They generate self-organized adaptive capacity, allowing diverse communities of interest and place to strengthen or renew social, economic, and ecological resilience. Practitioners recognized the role of these broad networks as antidotes to the pattern of increasing conservatism that develops in permanent, specialized, fragmented communities.

Facilitating adaptive renewal also requires complementing quantitative knowledge with qualitative understanding of social and ecological dynamics. It requires balancing soft systems with the hard systems, scientific understanding with human values, the instrumentally rational goal-oriented problem-solving approach with the organic, emergent, self-organized process of facilitated learning and human resource development. Managers focused as much on the human dynamic as on the ecological in seeking to produce adaptive capacity. According to one, “We understand adaptive management as a way of looking at ecology, but the other factors for how we proceed are driven by social, political, and economic forces that need to be looked at in an adaptive way.” In each of these cases, scientific resource data was being obtained and balanced day by day, side by side, hand and hand with a platform for negotiating resource use outcomes contingent upon values, beliefs, and learning. Thorough resource assessment

helped to lay the groundwork for science-based discussion of options, trends, and key driving forces shaping the ecological, economic, and social system at local and regional scales. Open communication, information flow and information quality played a key role in building solid working relationships and mutual trust. By establishing a safe, open climate for dialogue, practitioners were able to facilitate double-loop learning and to begin building capacity for making long-term, fundamental change. The development of networks operating at multiple levels of readiness enabled cross-scale transfer of knowledge and learning. Together, these principles encompass strategies for navigating through crisis in ways which lead to renewal and resilience.

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