4 The Human Dimensions of Stream Restoration: Working with Diverse Partners to Develop and Implement Restoration

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4.1 Introduction

Even with the best plans and assessments, knowledge and work to restore streams is of little value if you cannot get people to implement projects. This chapter will bring in the human element in order to broaden our perspective beyond just the physical and biological aspects of planning and implementing stream restoration. The importance of the role that socio-political concerns play in such efforts was raised in Chapter 1. Humans have clearly played a major role in creating existing conditions in streams, and successfully involving a broad range of people into restoration efforts will likely be key to whether rigorous programs can be implemented and effective.

The traditional New World view is that humans are the source of most problems for streams and that, if human effects could be removed, then everything would return to 'normal.' More contemporary perspectives recognize that humans are, and have always been, an integral part of the ecosystem, and that their actions need to be considered in restoration strategies (Cronin 1996; Cowx & Welcomme 1998). Not only are humans a part of the ecosystem, but if people are properly engaged their support will facilitate restoration efforts often with substantial results (Higgs 2003). Alternately, if stakeholders are not properly engaged, failure is much more likely.

The science of human behavior and how to influence it is not novel, although it has not been consistently applied in stream restoration programs (Higgs 2003). This is not surprising because stream restoration is usually promoted by scientists and agency managers who have physical or biological science rather than social science backgrounds. The tools and techniques in this chapter will enable stream restoration practitioners to better understand the motivations of, and construct effective approaches for, the various types of human-dominated systems within which their programs will either succeed or fail.

Stream restoration occurs at many scales, ranging from working with individual property owners on projects such as streambank protection and riparian revegetation at the smallest scales to whole-basin restoration involving multiple agencies, landowners, and funders over the course of multiple decades. There are tools and approaches outlined in this chapter that will be useful at any of these scales, but some will be more pertinent at the individual project level while others more useful for larger restoration programs. However, individuals are involved at all scales; the regulatory approvals and funding generally

Stream and Watershed Restoration: A Guide to Restoring Riverine Processes and Habitats, First Edition. Philip Roni and Tim Beechie.

require the involvement of some sort of government agency for even the smallest of projects, and larger restoration programs will involve significant negotiation and cooperation among individuals and agencies.

The models introduced in this chapter have been used in other contexts for over 80 years; they have been tested over time and space, and have demonstrated their continuing utility (but see the caution in Box 4.1). Most important and relevant is the agricultural extension model where new ideas and techniques are transferred from university research settings to farmers and communities. The extension model, which was developed in Europe and the United States, has proliferated worldwide.

Box 4.1 A caution about stereotyping

In this chapter there will be numerous cases where we will categorize people's behavior with descriptions that might be interpreted negatively. It is important to avoid stereotyping individuals because it will limit your ability to work with them. Research also shows that people who fit one category in one situation may act differently in others. The categorizations are meant to help and not hinder insight in how to best approach people to increase the likelihood of cooperation.

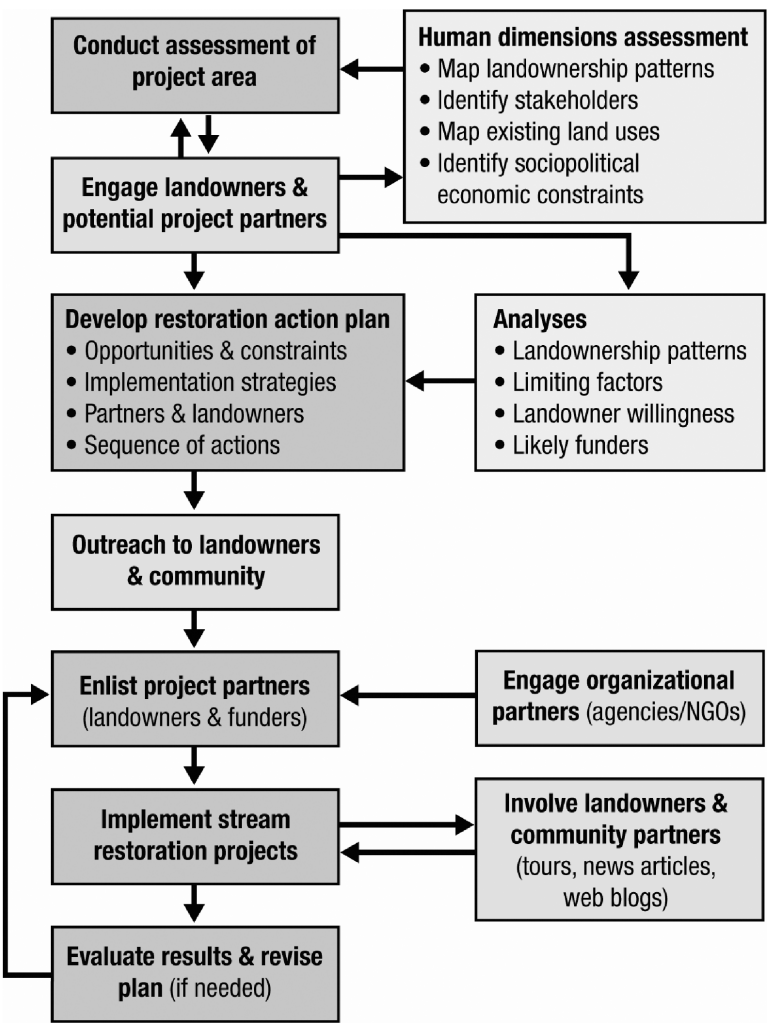

Figure 4.1 Flow chart of steps for incorporating human dimensions in stream restoration planning and implementation.

The original agriculture focus has expanded to include the diffusion of all types of innovations, including the spread of various technologies (e.g. cell phones and personal computers) as well as advances in medicine (Rogers 1995). A second model appropriate to stream restoration is 'social forestry' that arose from the Chipko movement in northern India in the early 1970s (Shiva 1991) and has continued through today (Wiersum 1995). Many of the early social forestry schemes explicitly recognized that the community played a vital role in protecting the integrity of the watershed for its benefits (principally water for direct human use and irrigation). Fitting stream restoration into a larger societal framework in the communities where the work will occur is essential if it is to become accepted and sustained over time. The value of involved communities is that once practices are adopted and become accepted by some individuals, they will be easily replicated and likely require reduced effort over time.

How do we incorporate the human element into stream restoration? Figure 4.1 provides a flowchart of one common approach towards doing so. The value of doing an assessment prior to developing restoration projects has been emphasized in the Chapter 3, but here we assess the human dimension that identifies land ownership patterns, stakeholders, land uses, and other socio-political constraints not discussed in detail previously. This information is then used in developing a restoration action plan to highlight opportunities, develop strategies to engage needed landowners and funding partners and, ideally, identify a sequence of proposed actions needed to implement the restoration plan. Subsequent to the action plan are outreach activities needed to engage these partners and, of course, periodic evaluation of the restoration results to ensure that needed corrective responses are made.

This chapter provides an outline of how to incorporate human aspects into stream restoration. We will discuss this in the context of the interrelationships among individuals, organizations, and geography. The following section covers the socio-political geography of stream restoration, emphasizing the important influence that land ownership patterns have on potential stream restoration strategies. Section 4.3 introduces the idea that stream restoration can be characterized as an 'innovation' in land management, and that effective strategies can build upon existing knowledge of how people accept new ideas. Section 4.4 moves from ideas to organizations and how people perform in them. Section 4.5 presents the implementation of restoration programs as a series of negotiations, where there may be only limited cooperation on the part of the various parties involved. Section 4.6 provides information about further readings that expand beyond what can be covered here, and the chapter concludes with a summary in Section 4.7.

4.2 Setting the stage: Socio-political geography of stream restoration

Understanding property and the rights to property and resources is fundamental in the design and implementation of stream restoration projects. This is especially true as stream restoration moves from simple single-site projects to more complex and area-wide projects in a watershed. All projects are going to take place on some type, or types, of property whose ownership comes with a variety of rights; paying attention to this as projects are developed is likely to increase the potential for success while decreasing the risk that a party with an interest (or a 'stake') in a piece of property will suddenly appear and object to what is being proposed.

4.2.1 Nature of the challenge

There are numerous critiques of stream restoration: many projects are grouped in the upper, headwater reaches without regard for habitat connectivity with downstream reaches (Lake *et al.* 2007); many are focused solely on single species or life stage rather than being ecosystem-process oriented (Beechie *et al.* 2010); and decisions tend to be made on an opportunistic rather than systematic basis (Bernhardt *et al.* 2005). While there are multiple causes leading to this situation, patterns of landownership often influence where projects are placed. There will likely be a mix of ownerships in most watersheds where restoration will occur. Understanding ownership patterns, property rights, and the objectives of various types of owners provides a foundation on which to build an effective approach to enlist cooperation, increase the likelihood that a stream restoration project can be implemented, and reduce the transactions costs (time, treasure, and temper) associated with project design and implementation.

4.2.2 Understanding property and property rights

Although land ownership may seem like a clear and simple concept at first glance, it becomes quite complex when dealing with the types of properties commonly needed to implement stream restoration projects. Because

property rights – and their strength and enforceability – vary by country, making generalizations is hazardous. It is important to recognize that property rights need to be considered in designing stream restoration, and that they can potentially be quite complex. Depending upon the situation, property rights may be different for the surface versus any minerals located beneath the surface. There may be leases, easements or other tenure relationships that need to be considered in planning and project execution. Water flowing through a given property may have different rights associated with its ownership and use; the same situation may exist for wildlife and fish on the property as well. There may be legal and/or traditional aboriginal use rights associated with various resources located on a given piece of property.

Most land ownership systems are based on a sovereign (either king or government) asserting control over territory and subsequently divesting this property through grants or sales. However, there may be residual claims that have the potential to affect your restoration project: for example, the Mabo v. Queensland (No. 2) decision in 1992 in Australia returned lands to aboriginal groups and similar settlement agreements have provided lands to native groups in Canada and New Zealand. Security of tenure is even less certain in many areas of Asia, South America and Africa.

There may be additional legal or traditional – called 'usufruct' – rights to access and use of particular properties or resources on them. The Boldt decision in the United States Pacific Northwest affirmed a claim by the Native American tribes to half of the fish (principally salmon) produced, and gave the tribes a stake in increasing this production through both natural and artificial means (Wilkinson 2000). There may be strongly held views, and in some cases rights, on the part of the dominant cultures to access public lands for recreational use, including vehicular access on roads and off-road vehicle use in streams and riparian areas. In the United States, while the beds and banks of navigable streams and tidelands up to the high tide line are publicly owned, adjacent landowners can control access through their properties.

We generally assume that these various rights are clearly defined, but this is not always the case. Being sensitive to the property rights in your project area is a foundation for sound restoration programs; it is very easy to antagonize landowners and other stakeholders if they feel their rights or interests are at risk from your project. Our experience has been that, even if you have a legal right of entry, taking the 'neighborly' step of asking permission usually sets the stage for a productive interaction as compared to an argument.

4.2.3 Landscapes of restoration

The challenges related to landownership patterns are analogous to those found in conservation and landscape ecology. It is well known that patch size, connectivity, and patch turnover rates influence ecosystem performance (cf. Bennett & Saunders 2010 for a review). The same situation exists when the landownership pattern is placed over these habitats: the size of an ownership has important implications, as does its location in the watershed. Connectivity is important both within and between different ownerships. Turnover rates in landownership have an effect on the long-term prospects and success of stream restoration projects. Stream restoration projects require an understanding of ownership patterns and a strategy for approaching landowners that are most likely to be successful and stable over time.

As early as the 1870s in the United States, John Wesley Powell lamented that the arrangement of governmental subdivisions of watersheds with complex patterns made ecosystem-based management difficult (Stegner 1953). It is common throughout the world that land tends to be owned in larger parcels in the upper reaches of basins, and that this land is more likely to be in some form of public ownership. Historically, land was often subdivided until it reached the smallest economically viable size and so land on steeper slopes is more likely to be in larger parcels compared to gentler-sloped lands. Lowland areas (including valley floors) are often privately owned, of smaller parcel size, and have higher-intensity existing uses such as residential or smallholder[1] agriculture. Even if publicly owned, the ownership in lowland areas may be in narrow strips along stream banks and beds that inhibit a number of desirable types of restoration projects (i.e. remeandering, dike removal, floodplain connectivity).

The costs associated with land acquisition are much greater where higher numbers of smaller parcels are needed for a project. Compulsory acquisition of land

[1]'Smallholders' is a term used to represent landowners with only small parcels of land (from 0.5 ha to c. 20 ha). These are sometimes called 'hobby farms' or 'rural residential', but they may also be subsistence farmers (Netting 1993).

Box 4.2 The Varde River restoration

The Varde River in the southwest Jutland peninsula of Denmark demonstrates the evolution of stream restoration to meet multiple, and changing, objectives over time. Societal desires to have more environmental and aesthetic land uses, as well as legal mandates from the European Union, were catalysts for stream restoration in Danish Rivers (Pedersen 2009). Restoration projects in the Varde River occurred in three distinct phases which had different objectives but in aggregate resulted in restoring virtually the complete stream. The Varde River projects began prior to better-known Danish efforts such as the Skjern River project (Pedersen *et al.* 2007), but continued afterwards and were affected by experiences there and in other areas of Denmark (Pedersen 2009, 2010).

Background. The Varde River has a catchment area of 1092 km^2 with a mean annual flow 16 m^3/s. It is one of nine streams in Denmark with historic Atlantic salmon (*Salmo salar*) populations and contains one of seven relict houting (*Corgonus oxyrhunchus*) populations in the Wadden Sea, which are protected under the EU Habitat Directive (Jensen *et al.* 2003). The Varde is one of the last streams in Denmark where freshwater pearl mussels (*Margaritifera margaritifera*) reside (Kann 2006). These mussels require adequate numbers of salmonids for one of their life stages (Skinner *et al.* 2003). Wetlands and fields in the lower Varde River where it enters the Ho Bugt estuary provide valuable habitat for the corncrake (*Crex crex*), an avian species that was listed in the EU Birds Directive, Annex I (Jensen undated). The significance of the tidal wetlands has resulted in their inclusion as a Ramsar site of international significance as well as being a EU Bird Protection Area and an EU Habitat Site (Frikke 1999).

Pre-restoration conditions in the Varde were similar to those seen throughout much of Europe and North America. Floodplains had been cleared, wetlands ditched and drained, and the river channelized so that agriculture could be practiced (Frikke 1999). In 1921 The Karlsgårde hydropower plant was constructed on a tributary to the Varde (Manøe 2011), and in 1929 thirteen meanders in the Varde below the power plant were cut off to increase the head for the turbines with the spoils used as embankments (Kann 2006). Over 90% of Varde flows were diverted into the Ansager Canal built in 1945 to feed the hydropower facility. Another 38 meanders above Karlsgarde Lake were straightened in the late 1940s and 1950s to increase farmland. Aquaculture ponds were built in the floodplain to take advantage of the return water downstream from the power plant. These practices resulted in environmental effects such as land subsidence, water quality degradation, the loss of both aquatic and terrestrial habitat, barriers and impediments to fish passage, and entrainment of juvenile fish in the canal and fish farm.

Restoration. Restoration projects in the Varde River Valley occurred in three distinct periods (see Figure 4.2). The first, begun in 1995 and completed by 2002, focused on restoring tidal wetlands and floodplain fields in the lower Varde River for the corncrake (Frikke 1999; Jensen undated). Activities began in 1995 with cooperation among the Varde Farmer's Union, Ribe County, the Danish Agriculture Ministry, and the Environment and Energy Ministry to raise groundwater levels and practice 'environmentally friendly' farming in 2700 ha of saltmarshes and meadows governed by the Danish Nature Protection Act (Frikke 1999). The project ultimately resulted in over 250 landowners enrolling over 92% of the land in the project area (Jensen undated). Redistributing farm lands to aggregate cooperating landowners into better habitat lands and entering into 20 year agreements to subsidize farming practices consistent with the corncrake's needs were key project features (Frikke 1999).

A second 2-year restoration phase started in 1999 to create freshwater pearl mussels and Atlantic salmon spawning habitat in 1.4 km of channelized stream just above the town of Varde, but below the power plant. Four meanders were recreated based on historic scar patterns, doubling the length of stream to 2.8 km, and 1500 m^3 of gravel were placed to improve spawning substrate (Kann 2006). Half the funding for the project (c. €270,000) was provided from a conservation group,

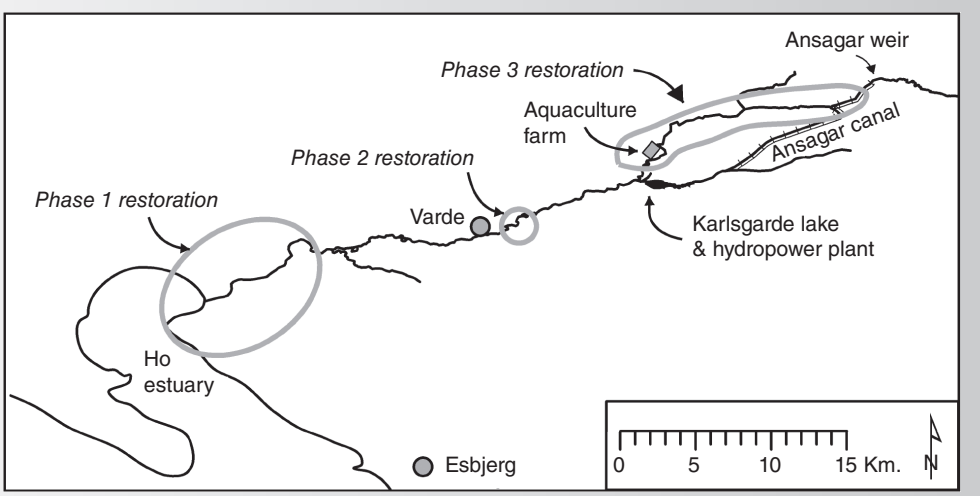

Figure 4.2 Map of the Varde River, Denmark and three phases of restoration.

with the remainder principally from the local county and municipality. Ribe County provided the designs, and Varde Municipality worked with landowners (Kann 2006).

The third phase in the Varde River restoration, began in 2005 and completed in 2010, was the most extensive of the three because it focused on restoring passage for houting to spawn in the upper river while also improving juvenile nursery habitat (Houting Project 2011). This project was identified and prioritized in the National Management Plan for the Houting (Jensen *et al.* 2003) and funded primarily by the EU LIFE program (€4.5 million for the Varde projects) (Strategic Restoration and Management or STREAM 2009). Four years of negotiations with landowners were concluded in 2009 (only two landowners out of 80 declined to participate). The project included remeandering 13 km of stream into 18 km of length, decommissioning of the Ansager Canal and the Karlsgårde power station to restore full stream flows to the Varde for the first time since 1945, and installing screening devices to prevent fish from entering the aquaculture ponds. As a result of this third phase, access to 75% of potential spawning areas was restored, stream flows were restored over 18 km of stream, and the channel embankments that previously limited nursery use of the floodplain were removed.

Lessons learned

1. Phase 1 in the lower, tidal reaches was conceived with the Varde Farmers' Union and explicitly recognized their interests in its third project objective, 'to ensure compensation of the owners or users of the land for any loss of income and to give them a high level of influence' (Frikke 1999). This set the stage for further cooperation.
2. Joint benefits between farmers and restoration practitioners were incorporated in Phase 1 by classifying lands most suitable for farming versus better restored to wetlands, identifying those farmers who were willing to adjust their practices to meet conservation goals, and exchanging lands outside the project area or buying out those who didn't want to participate. It still took almost four years to acquire lands for Phase 3, but in the end the two significant landowners who declined to participate (including the aquaculture farm) did not stop the project. This is in contrast to the Skjern River restoration where land expropriation was ultimately required (Pedersen 2009). The willingness to provide lands for exchange was identified as a key factor in the project success (Elbourne 2009).
3. There was a strong local presence during all three phases of the projects. The initial cooperation of the Varde Farmers' Union and on-the-ground personnel slowly, but steadily, enrolled landowners over six years. Local meetings, newsletters, and other outreach efforts provided assistance (Frikke 1999). Phase 2 brought together a Steering Committee that ixncluded the local municipality, the County, and the Society for Nature Conservation, each of which utilized their comparative strengths to implement the project. Ultimately, the trust between the farmers and local restoration practitioners, who had a good track record, helped achieve the larger Phase 3 project objectives (STREAM 2009).

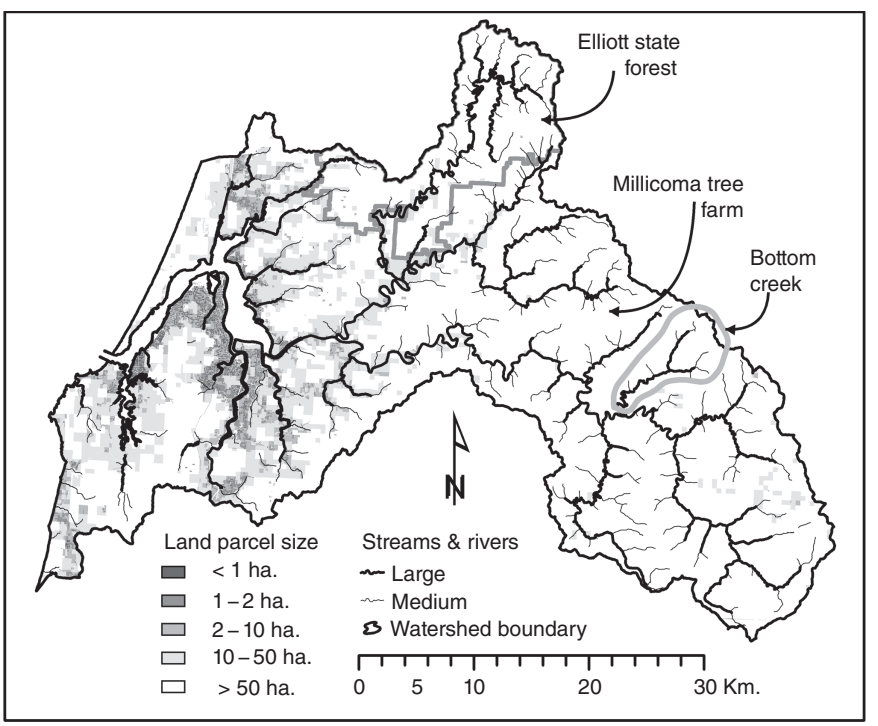

Figure 4.3 Pattern of land ownership in the Coos Watershed in southcentral coastal Oregon, USA showing blocked parcels in the upper basin with smaller parcels along streams and the estuary. As the parcel sizes become quite small, especially along the estuary and in the cities of Coos Bay and North Bend, the area becomes completely black.

for restoration projects (variously known as expropriation or eminent domain) is difficult, always time-consuming, and usually controversial. All these factors may lead to the development of restoration programs with larger landowners, which are thus likely to occur higher in watersheds. The comparative ease in getting projects started is especially apparent during the early phases of stream restoration.

There are significant differences in land ownership patterns in all three of the case studies discussed in this chapter. The Coos watershed on the south-central Oregon coast in the United States has diversity of ownerships, parcel sizes (see Figure 4.3), and land uses including public and industrial timber management, agriculture, smallholder residences, and urban areas surrounding the estuary. That diversity and parcel size decreases lower in the watershed adjacent to the estuary. In this case, the Coos Watershed Association was able to work initially with two large owners in the upper basin (the Elliott State Forest and Weyerhaeuser Timber Company) to build capacity and demonstrate success that could be transferred to other areas of the watershed. Ownership in the Varde Rivers watershed on the Jutland Peninsula in Denmark (Figure 4.2) was primarily private lands in agricultural use (pasture, croplands, and aquaculture farms), although there was additional infrastructure for hydropower generation. It was relatively straightforward to value these properties and identify replacement locations or compensate the private owners whose lands were needed for the restoration projects (see Box 4.2 for the Varde River case study). Finally, the Rio Puerco watershed in the western part of New Mexico in the United States has a highly complex mix of federal, state, tribal, and private ownerships, often with different surface and mineral estates. Its large scale (over 17,000 km^2), overlapping and sometimes competing authorities, and lack of adequate funding have impeded restoration efforts in this watershed over the last 30 years.

4.2.4 Understanding landowner/manager and agency objectives

In addition to understanding ownership geography, an awareness of some basic characteristics of each type of ownership will assist in developing an effective strategy to build support for collaborative stream restoration. Table 4.1 shows some of these characteristics for four of the major ownership groups: State/federal, aboriginal, large corporate, and smallholder. Note that while these traits are simplified, they are still valuable to consider when assessing potential approaches. Each of these four ownership types presents advantages and disadvantages when creating a stream restoration program or project.

In many cases governments have the capacity, time, knowledge, and resources to implement the projects although they may have difficulty building a consensus within their own organization on the most effective restoration approach on lands they own or control. They are also likely to own much of the infrastructure (roads and water control) affected by a project. In many cases, governments also play a regulatory role both in projects on their lands as well as other ownerships, and there may be multiple layers of government that have the potential to affect a stream restoration project.

Depending on the country and tribe, aboriginal ownerships may be managed by an outside federal agency or one within the tribal organization. In either case, most decisions are made by a council whose membership and leadership is either elected or appointed through traditional means. If more than one tribe's property is involved, each one needs to be included in the partnership; do not expect that one tribe will speak for another. Social structures in tribal communities and governance are complex, and it is likely that it will take concomitantly greater time to get projects approved. While stream restoration is often consistent with tribal values, you will need to be very diplomatic in approach and will typically need approval from the traditional elders to be successful. However, as you will see in the Rio Puerco Case Study, working with tribes in their project area has been one of the most successful and rewarding experiences they have had.

The benefit of working with large corporate ownerships, whether in timber, agriculture, or mining, is that when they decide to do something they usually want it done quickly, safely, and with a minimum of disturbance to their core operations. As we will see below (and in the Coos case study), when your interest and theirs coincide it is possible to build a highly successful restoration program. However, large corporate owners will expect a comparatively high standard of sophistication, expertise, and professionalism on the part of restoration proponents.

Relationships and trust are crucial for success in approaching small holders of farms, timberlands, and home sites. These smallholdings may have some of the most intensively used land in any category, and their owners may have limited ability and knowledge to manage them in ways consistent with good stream qualities. Although smallholders present challenges, their location in a watershed often requires their participation

Table 4.1 Land management characteristics among various types of ownerships.

Characteristic	State/federal agency	Aboriginal	Large corporate: timber, agriculture, mining	Small holder: non-industrial timber/ agricultural/rural residential
Organizational culture	May be agencies with overlapping authorities or purposes	Strong traditional, cultural focus; often tension between revenue-generating interests and other uses	Attuned to corporate culture; relationships are important; limited time to assist with projects; need to be self-sufficient: 'no hassle-no drama'	Reputation as good land steward is important; limited available area means that meeting their land management objectives is critical
Decision-making process	Multiple levels of review and approval; set procedures and regulatory requirements	Often complex, lengthy and incomprehensible (at least to outsiders) decision-making processes	May be made at the local level, or may need to go up their hierarchy. As more trust is gained, the decision is likely to be made at closer to the local level	Trust and credibility necessary to start building relationship; may need to involve family members.
Timescale	Long lead times	Deliberate, not fast	Fast to act: 'get-it-done' mentality	Generally relatively quick
Budgeting	Needs to fit into their budget cycles	Funds will probably be provided by third party	Identified benefits – bottom-line driven	May have limited ability to cost-share.
Project implementation	Often eager to provide assistance – 'multiple cooks' dilemma	Desire, but not necessarily the capacity, to manage their own resources	Will want to have control, or at least oversight, over project implementation, whether directly or through their approved contractors	If they own equipment, may want to provide services and may want to be compensated for this; otherwise, will probably want you to manage
Stakeholder involvement	May require public notices and other stakeholders to be involved	There may not be a single, consistent approach among groups; may have rivalries	Want to be seen as good managers and neighbors; otherwise not likely to be great except if your project conflicts with other existing uses such as fishing or OHV use	Concerned with how neighbors view collaboration

in stream restoration activities. These landowners will likely need different strategies to engage them in stream restoration.

4.2.5 Why understanding socio-political geography is important

The challenge of constructing a restoration project increases for every additional landowner whose permission is required. Objections from landowners have stalled projects, reduced opportunities or stymied restoration programs in a number of places, including Denmark (Pedersen 2010) and the United States (Alexander & Allan 2007). If you cannot obtain voluntary access to needed property, you may be reduced to more coercive measures such as expropriation or condemnation, which both take more time and are politically more difficult. Ultimately, coercive measures may actually make the

proposed project – or subsequent projects – impossible, as we saw in the Varde River case study from Denmark.

We will go into more depth in the remainder of this chapter on ways to approach these different constituencies for stream restoration; however, lessons to keep in mind include the following.

1. It is likely that the stream restoration project that you are considering will occur on someone else's property; even if it is primarily on your property, others may have some sort of interest (i.e. hunting, fishing, or recreation access) in its outcome. It is also important to recognize that your project may have some effects on adjacent properties or in the larger region (e.g. there may be a 'tipping point' where an activity such as agriculture or forestry collapses if insufficient landowners participate to maintain supplier and purchaser networks). Recognizing these ahead of time may allow you to adequately address them in your plans.

2. Because landownership patterns overlay geomorphological and biological systems, it will be difficult to focus solely on one side of the equation (bio-physical versus socio-political) to create a viable stream restoration program. For the highest success, strategies must be developed that incorporate social, biological, and physical considerations into stream restoration programs.

3. People are important both as participants as well as supporters of stream restoration. People already have considerable interests (property and otherwise) in streams and in the lands that surround them. Only by adequately understanding their interests can we work out how to reconcile our programs. Examples of such interests range from protecting their stream banks from erosion, to maintaining a 'park'-like appearance and being considered a good land steward in the community. Interests such as these, and others, can be used to find common ground when establishing relationships with land owners.

4. Social justice and equity concerns need to be identified and addressed as stream restoration programs expand across the landscape (Hillman 2004, 2005). There may be losers as well as winners in large-scale stream restoration programs. Insuring that both the benefits and the costs of these activities are spread equitably has important long-term implications for the ongoing acceptability of stream restoration in the larger society.

5. While building a large public constituency to support stream restoration is important for long-term sustainability (Spink *et al.* 2010), our immediate interest is to focus on tools and techniques to work with the primary partners who will determine the success or failure of individual projects. Long-term sustainability is built on a record of individual successes. In the concluding section of this chapter we will provide suggestions for further reading to gain an understanding of these broader issues.

4.3 How stream restoration becomes accepted

Stream restoration is still in its infancy in the larger forum of natural resource management (Higgs 2003). In the United States, dust storms and loss of prairies at the beginning of the Depression provided the impetus for early upland restoration efforts (Chapter 1; Higgs 2003). Many restoration actions are as yet unproven, although promising (see Chapter 5). In this respect these restoration techniques can be considered innovations or experiments. Stream restoration practitioners have the challenge of convincing others of both the need for the actions they are proposing and the efficacy of those actions. We are assuming in this discussion that the decision to adopt a stream restoration project is an individual action, and not a collective or authoritative action. These decisions will be made by individuals who are acting within organizations – agencies or corporations – as well as by private landowners. While these individuals have their own characteristic traits (but recall the cautions in Box 4.1), their actions will also reflect their organization's culture, needs and interests, and decision-making processes.

Effectively targeting your investments of time and resources where they are likely to be most successful will accelerate the acceptance of stream restoration programs, while reducing frustration and ameliorating conflict. There are specific situations where you will need to interact with, and try to persuade, a wide range of different types of individuals to cooperate[2] with your plans. Understanding individuals' traits should allow you to evaluate whether it is worthwhile to make an investment to persuade them to cooperate and, if so, what to expect.

[2]'Cooperate' means that the other party does not resist what is being proposed, and may assist in your efforts. 'Collaborate' goes beyond this to reflect jointly working together to achieve a common goal.

We will start by examining how innovations gain acceptance and how to understand the likelihood that different individuals will be receptive, and in the next section focus on organizations themselves. Section 4.3 is based largely on the pioneering work of Everett Rogers (1995) as found in four editions (since 1962) of his *Diffusion of Innovations*.

4.3.1 Restoration as innovation

The process of asking someone (or some agency) to implement a stream restoration project is not unlike marketing a new product or innovation. In this context, the 'product' is a new alternative, a new means of solving problems, or simply a new idea (Rogers 1995). The entity that you are requesting to cooperate may or may not know about either the need for the restoration project or the benefits of the specific action you are proposing. The idea may be completely new to them. What is not new is the understanding of how people accept new ideas and products.

To be accepted, a restoration action that is considered innovative must be perceived to:

1. provide a relative advantage to the person or entity over existing techniques;
2. be compatible with existing land uses and practices;
3. not be too complex to understand or use;
4. be testable on an experimental or limited basis; and
5. be observable so that the results can be clearly articulated.

4.3.2 Innovation diffusion through networks

Knowledge about innovations is diffused through networks of interconnected people. New ideas are typically brought into a local network through connections that one member has with other outside networks or sources of information. These ideas are then exchanged among others within the local network through personal connections as well as through more formal mechanisms such as meetings, newsletters, and plans. A way to visualize these networks is that the external connections radiate outward (similar to a star), while the local internal connections form an internal web of interrelationships.

Networks provide a structure that allows communication of ideas to lead to decisions to adopt innovations as well as to validate the adoption of innovations among peers. Within any given network there will be various levels of value given to a member's ideas. 'Opinion leaders' in the network provide a credible source of new ideas, which are typically adopted by their followers over time. However, to maintain credibility, opinion leaders must not stray too far: their ideas must be based on criteria already understood and approved by their followers and peers and assumptions must not be too broad or complicated, as complication implies risk.

4.3.3 Process of innovation adoption

As innovation becomes accepted, its adoption spreads throughout a community in a progression of five stages with sixteen steps (Box 4.3; Rogers 1995). The first stage revolves around an increasing awareness of the innovation or technique, initially with its description followed by a broader understanding of its potential impacts. Once there is general knowledge about a technique, a potential adopter often needs some persuasion prior to making a decision. Your leverage in this second stage is that the potential adopter is open or receptive to consider an innovation's potential. This incremental adoption of restoration practices can be seen in the Coos Bay case study described later in this chapter. By the time a decision is made about whether to adopt a practice, there are really only two choices: try it out, or defer until further

Box 4.3 Innovation diffusion stages

Knowledge stage
1. Recall of information
2. Comprehension of message
3. Knowledge or skill for effective adoption of the innovation

Persuasion stage
4. Liking the innovation
5. Discussion with others
6. Acceptance of message
7. Formation of a positive image
8. Support for the innovation

Decision stage
9. Intention to seek additional information
10. Intention to try innovation

Implementation stage
11. Acquisition of additional information
12. Use on a regular basis
13. Continued use of innovation

Confirmation stage
14. Recognition of the benefits
15. Integration into ongoing routine
16. Promotion to others

(Based on Rogers, 1995)

inducements (information, incentives, etc.) tip the scale. In truth, the initial implementation of an innovation is a trial on the part of the adopter, who is evaluating whether the technique acceptably meets their needs and objectives. Ultimately, the best outcome is that the project is highly successful and that the participating landowner (or agency) gives it a ringing endorsement, expands its use in their own operations, and encourages others in their network to adopt the practice.

4.3.4 Innovation acceptance

The stages of innovation diffusion represent an idealized, linear pattern from first notice to final acceptance in the larger community. However, not all potential recipients of information and persuasion are equally likely to adopt a stream restoration practice when it is newly introduced. Identifying 'opinion leaders' is an important early task because they form the key target audience and are likely considered credible in their own networks. Understanding their characteristics – as well as those of other potential candidates to implement restoration projects – will enable you to be effective in targeting who to enlist for support when introducing innovative stream restoration practices.

The cumulative rate of adoption of innovative practices is widely recognized to take the form of an S-shaped curve where the initial acceptance is slow, then rises rapidly as the practice's visibility and effectiveness become recognized, and then slows again as the majority of people who will adopt the practice already have (see Figure 4.4). The rate of adoption by numbers of individuals at any given period of time resembles a bell-shaped curve that represents a normal distribution with typical statistics such as mean (the amount of time by which half of the people who will adopt a practice have done so) and standard deviation (Rogers 1995). The intervals between the means and standard deviations in the adoption curve have been given names that are now in general usage: innovators, early adopters, early majority, late majority and laggards. It is important to recognize that these categories identify solely the intervals in the normal frequency distribution, and that a particular individual may switch his or her category depending upon the issue at hand. Nonetheless, the categories and descriptions of their characteristics provide a useful insight in targeting potential stream restoration partners by understanding who is – and who is not – a good candidate for investment of time and resources and who is or is not likely to adopt a practice and provide a successful example that will be copied by others.

Innovators are venturesome, willing to take risks and accept that failure is possible. They are often well connected to the outside world (i.e. 'cosmopolitan,' but may

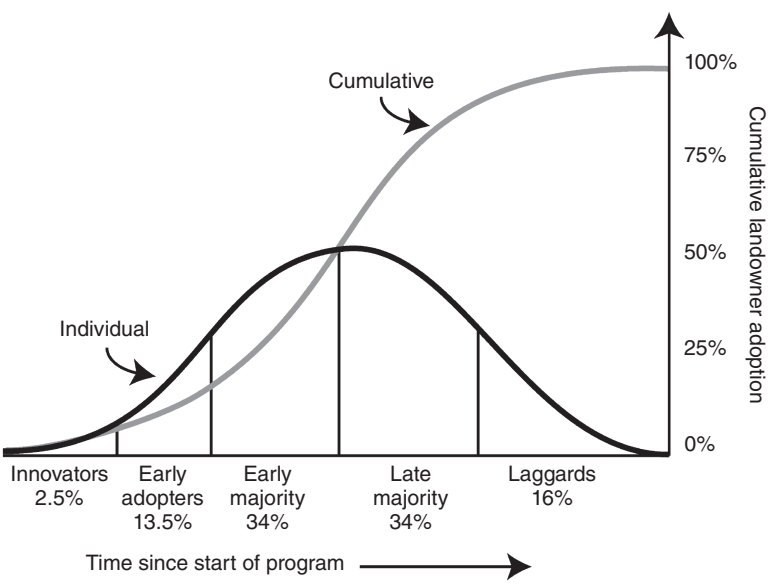

Figure 4.4 Categories of innovation adopters (redrawn from Rogers 1995).

lack integration into the local social system. They tend to have a high level of resources, and are generally able to understand and apply complex technical knowledge. *Early adopters* are often respected local opinion leaders – the 'locals' as opposed to the 'cosmopolitans.' They tend to be upwardly mobile, well-educated and prosperous. Generally, early adopters are empathetic, not dogmatic, and maintain strong contacts with local change agents. Through these contacts with change agents they bring new ideas into their local network. *Early majority* are 'deliberate,' watching to see how an innovation plays out before making a decision, but are not considered leaders. *Late majority* can be thought of as 'skeptical' of new ideas and practices. They generally need to be pushed into accepting the innovation or forced into it for regulatory or financial reasons. *Laggards* are 'traditionalists'; they are almost completely outside the local social networks, and tend to focus on the past. They tend to be suspicious of new practices and of the people who encourage them.

The first three categories of adopters cumulatively represent half of the people who are potentially ever going to adopt a stream restoration project. Of these, the early adopters provide the best investment of time and effort. This is because the innovators, while likely to accept something new, are not considered by the community to be representative, i.e. they are 'outliers' in local social networks. While the early majority will adopt a restoration practice, they will wait until they see others who they respect do it before making a commitment themselves. Adding incentives to encourage participation is one way to accelerate their acceptance.

The final two categories represent people who tend to lag behind others in their willingness to adopt an innovative practice. These types generally give less return on time invested, especially in the early stages of a restoration program, because persuading them will take significant time with little likelihood of success. Recognizing these limitations, however, there are also situations where an effort is justified if their property or involvement is deemed critical to the restoration program. It is important to be aware that different strategies (such as direct payments, regulatory requirements, or ultimately land purchase) may be needed to increase the probability that they will cooperate.

4.3.5 Why understanding innovation diffusion is important

There are specific situations where it is necessary to interact with, and try to persuade, individuals in each of these five categories to cooperate. The descriptions in the previous section characterize the individuals' traits that should allow one to evaluate whether it is worthwhile to make a particular persuasive investment and, if so, what to expect.

While the research shows that the best investment of effort will be to work with early adopters, there are situations where working with innovators may be the best strategy. For example, if one is trying to test out different techniques and knows that some are likely to fail (perhaps even significantly), then an innovator's willingness to take risks and suffer failures makes them a preferable project partner. One would not want to try out something risky with an early adopter because, if it failed for them, the technique and the project proponent will gain a bad reputation, souring later efforts. An early majority person would be unwilling to accept the practice at all because it had not been demonstrated as previously successful.

It is important to recognize that the best potential project sites are not necessarily going to be owned by those most likely to accept and adopt a restoration practice. One must strategize accordingly: if the preferred site is owned by an early majority landowner, then it may make sense to identify that person's social network to find an early adopter to take on a project recognizing that, over time, you will get to your preferred location. If it is absolutely necessary to access a site that is owned by a landowner classified as a late majority or a laggard, then it is important to recognize that voluntary measures and persuasion are unlikely to be quickly successful. In those cases, more forceful approaches such as regulatory mechanisms or purchasing the property may be needed to obtain access.

4.4 Organizations and the behaviors and motivations of those who work for them

Most, if not all, stream restoration programs and projects occur within organizations of one type or another. Often multiple organizations – different levels of governmental agencies, non-profits with various objectives, and sometimes even professional associations – are involved. Understanding who you are dealing with on a personal basis, and especially their motivations, will lead to more productive (and less frustrating) interactions. Understanding different stages of organizations will also assist

in setting realistic expectations in your dealings with them. We will present a matrix of behavioral types and organizations at their different life stages, along with some concepts on how to evaluate their effectiveness. One significant value in understanding these two major concepts (behaviors and organizations) is that you – as a stream restoration practitioner – will be dealing with individuals with specific behavioral types but who are also associated with an organization at its given life stage. Understanding how a particular behavioral type fits into an organization provides insight into whether that person is an outlier in their organization and whether that person can potentially bring support to your project.

4.4.1 Organizational behaviors and motivations

The process of implementing stream restoration projects typically requires supportive interaction with a multitude of players who bring various strengths and limitations to the process. Many, if not all, of these individuals will be working for various institutions, some public, others private. While the previous section characterized individuals' traits based on their acceptance of innovation, this second set of characterizations describes how people function within organizations. Understanding these types with whom you are going to be interacting should help determine the best process to enlist their support or avoid their disapproval.

Government officials'[3] motivations were described as early as the 15th century by the Italian Niccolò Machiavelli (1469–1527). Modern organizational behavior characterizations – particularly for government officials – were made by Max Weber (1864–1920) in the early 20th century and form the basis for the study of administrative organizations (Weber 1962). Anthony Downs classified motivations of officials working for agencies in *Inside Bureaucracy*, published in 1967. It is worth noting that while Downs used the term 'bureaucracy,' he meant any large organization (with some caveats). While there are certainly alternative approaches and much subsequent research, Downs' categorizations continue to be used because they can be so readily observed. We will draw liberally from his descriptions in this section.

4.4.1.1 Motivations of officials

People work for organizations for a number of reasons: because they believe in the work they do; for the pay and benefits; or even because of the situational characteristics of the job such as physical location, co-workers, or ease of work. Downs divides these motivations into two general classes: those people who are purely self-interested (*Zealots* or *Climbers*), and those who have mixed motives (*Advocates*, *Conservers*, *or Statesmen*). Those who are purely self-interested seek benefits only for themselves, while people with mixed motives have a concern for others (or society, or the agency) as well as for themselves. People have varying characteristics that need to be considered in how you interact with them, but generally fall within one of the five following categories.

1. *Zealots* seek power so that they can affect their own view of the world. Often their perspectives of what should be done are relatively narrow, and many times they do not see how what they want fits into the larger picture.

2. *Climbers* are people who are focused on how they can get ahead. In some cases this means that they are very attuned to policy and performance so that they can stand out. When advancement is not forthcoming, these officials may seek to aggrandize their current position to make themselves appear more powerful.

3. *Advocates* are loyal to organizations, policies, and causes and will protect these interests against outsiders who threaten them. They are strong team players.

4. *Conservers* are people who are primarily interested in protecting their security and convenience. They are generally resistant to change if it might affect their current situation. At worst, these are the people who have 'retired in place.'

5. *Statesmen* seek power and authority in furtherance of broad governmental or society or corporate goals; they enjoy being recognized for the influence they wield. Statesmen are likely to mediate well with others of their type, thus sometime confusing personality with job title.

4.4.1.2 Leveraging organizational behaviors

It is important to know who you are working with and figure out what it is that motivates them. What are their goals and objectives? How can you play to that objective

[3]We will use the term 'official' rather than 'bureaucrat' for the same reason as Downs (1967): to avoid the pejorative connotation that bureaucrat has among the general public.

in order to meet your needs? This approach is smart and relevant no matter what field you are in or whose team you are on.

New organizations and initiatives are frequently established or quickly sought out by *zealots*. Zealots have a charismatic vision that enables them to enlist others, motivating their adherents to expend effort and resources to further the cause. Zealots are also useful if a single-minded persistent focus is needed to get a program off the ground. However, zealots are also capable of antagonizing those who may be indifferent or opposed to their ideas.

Climbers can advance the mission of a restoration project if their approach is to attract attention from higher levels in the organization or use their success as a launching point. In this respect, they can be entrepreneurial innovators if it benefits them to create high-visibility programs. Climbers also commonly devote significant efforts to building relationships with those above them in organizational or professional hierarchies. This can be beneficial to advertising one's restoration program, but do not expect climbers to defend the program if they meet resistance from people they want to impress. Climbers are unlikely to exhibit the persistence and staying power needed to sustain a restoration program in the long term. However, they may use their affiliation with a successful program to bolster their reputation as they move up in power.

Once a restoration program is established, *advocates* are the people who are most valuable to sustain it. Advocates are likely to be open to the program within their own work group, especially once they see its virtues. These are the people who will negotiate, design, and build your projects. Advocates will help write briefing papers, prepare project budgets, and sell the program internally. They will be strongly supportive of the program with external entities, and are more likely to be effective in collaborating with outsiders than zealots, especially when seeking joint benefits or compromises are necessary.

While *conservers* are focused on preserving their own status quo, they can be appealed to if a case is made that, to do otherwise, would result in changes to their work environment. In the sense, 'do this or else . . .' may gain grudging acquiescence, a subtler and gentler approach can also be used. For example, if their agency might be threatened by a lawsuit, an implicit suggestion that implementing a specific type of restoration project or program – such as road sediment reduction or fish passage – might be a sufficient catalyst to get them involved. Conservers are also valuable allies when more routine tasks within their job scopes are needed, such as procurement and financial services.

Finally, *statesmen* can help deal with powerful interests who may be needed to support a restoration program. They generally have the tenure, stature, and skills to interact diplomatically with their peers in other agencies. Conflicts, if not resolved, will rise to the statesman level; however, intermediary levels of authority (the conservers and climbers particularly) may resist passing conflicts upwards because it might reflect badly on their performance. Be cautioned, however, that statesmen are likely to trade away things that you think might be valuable (e.g. specific regulatory requirements, enforcement actions, or project components) if, in their opinion, it protects the agency, the government, or high officials.

It is important to build relationships and be aware of the people with whom you are dealing. The caution in Box 4.1 about stereotyping equally applies to identification of bureaucratic behaviors: people may respond differently in different situations, and behavioral characteristics are known to change over time for a number of reasons (age, family responsibilities, wealth, etc.).

4.4.2 Understanding your own and other organizations

How organizations form, sustain themselves and finally renew or deteriorate is important because the stage at which an organization is in can profoundly affect how it approaches projects and conducts itself. As with individual behavior, understanding and accommodating these stages will improve the success of your projects.

There is extensive literature on organization theory and organizational life cycles. In the interest of keeping our discussion to a reasonable length, we will rely on two perspectives. The first is from Anthony Downs and is included in his *Inside Bureaucracy* (1967) that we used in the previous section. The second perspective is from Quinn & Cameron (1983) in their synthesis of nine different life-cycle models (including Downs') with a particular eye towards organizational effectiveness.

Common among most theories is that any organization goes through a cycle of creation, performance and renewal or demise. Quinn & Cameron (1983) put this cycle into four different phases (depicted in Figure 4.5) called entrepreneurial, collectivity, formalization and control, and elaboration of structure. At the end of the cycle there are two alternatives: the organization can renew itself

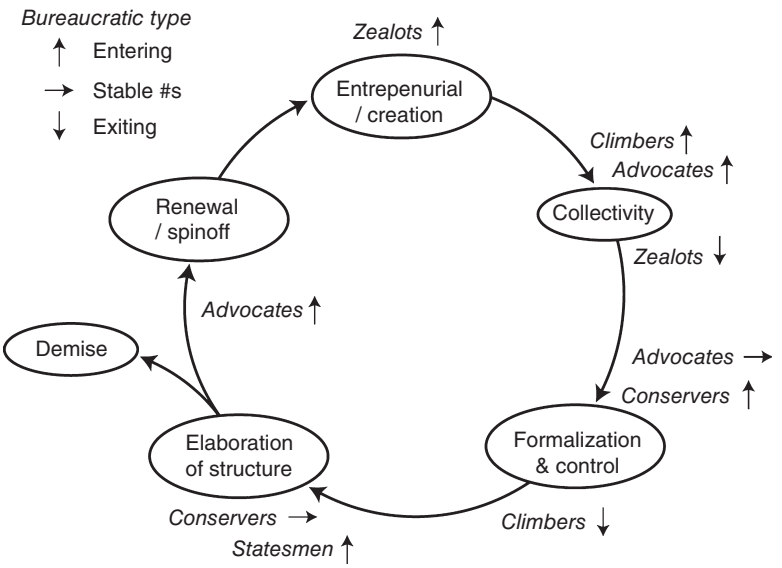

Figure 4.5 Organizational life stages and the various types of behavior of officials typically associated with them.

(possibly spinning off to a new organization), or it can face its demise. Because there is a direct correlation between behaviors of officials in organizations and organizational life stages, the dominant types at any one given stage of an organization are identified in Figure 4.5. At any given stage of an organization, different officials' behaviors are likely to be rewarded while others may be in conflict, thus giving rise to tensions, ineffectual work habits, and difficulty on your part figuring out how to get things done. Understanding these patterns will make your efforts more effective and satisfying.

The *entrepreneurial* phase, also called 'creation' by other authors, begins when an organization is created or breaks off from a parent entity, needing to quickly find or create a 'niche' for itself. Generally, the organization has more ideas than resources at this stage, so gaining needed resources and organizational autonomy are prime activities. Zealots tend to be attracted to organizations in this phase.

Organizations that survive their first stage move into a phase called '*collectivity*' which refers to their rapid growth with a related high level of staff commitment. Innovation and expansion are the focus, with the expectation that products (in our case restoration projects) will be emphasized. The organization has an informal structure, with long hours being willingly expended by staff that place high value in the mission and sense of camaraderie among themselves. Zealots tend to withdraw at this stage, being replaced by climbers and advocates.

As an organization grows during the collectivity phase, it becomes necessary to increase structure and functions. During the *formalization and control* phase an organization emphasizes efficiency and stability. Coordination and communication becomes more difficult as the organization grows larger, thus necessitating formal rules and procedures. Planning and performance measures rise in importance, with more work being done by specialists. Personnel policies – such as regular evaluations and performance rewards – become standardized as it becomes increasingly difficult for everyone to know each other and their relative contributions. Advocates still have important roles, but conservers provide a significant proportion of the workforce.

The formalization and control phase can last a long time, although organizational effectiveness tends to decline as personnel and policies become more entrenched and less responsive to changing conditions. At some point an organization will proceed into the *elaboration of structure* phase, which can be thought of as renewal. This stage emphasizes adaptability to changed (and changing) circumstances, a search for new markets or products and a reflection on the organization's purpose. The outcome

of these actions may result in decentralization or spinoff of organizational units (thus creating new organizations) and possibly, but rarely, a decision to terminate the organization. Statesmen tend to lead organizations at this stage of their life cycle because they are less tied to the minutia of its day-to-day affairs and are more likely to take a broader perspective on how the organization best fits into overall societal needs. However, having inadequate leadership at this stage may lead to the timely (or untimely) demise of the organization.

4.4.3 Why understanding organizational patterns is important

The success of restoration practitioners is often determined by how well they navigate interactions with individuals and organizations over both time and space. Understanding how a particular behavioral type fits into an organization at its life stage provides insight into whether that person is an outlier in their organization, or is likely to bring the organization's support to a restoration project or program. For example, if you are considering partnering up with a *zealot* who is employed by an agency at the *formalization and control* life stage, you should be aware that this person may be viewed as a 'loose cannon' by the employer. While you may enjoy that perspective on a particular aspect of stream restoration, the zealot may have antagonized some other people in their organization from whom you need support. This 'mismatch' between employee motivations and organizational life stages is not uncommon, particularly in governmental organizations where jobs are more secure.

Your organization will be dealing with other organizations in order to get stream restoration implemented; the capabilities and effectiveness of all participating organizations will be tested during this process. For example, if your organization is in the *entrepreneurial* or *collectivity* stage, and your funder organization is similarly situated, it is quite possible that neither organization will be able to effectively manage the financial responsibilities required for large projects. Your organization may not be able to keep the financial records required by the grantor for reimbursement, and the grantor organization may be unable to process payment requests in a timely manner because its systems (human and machine) are not sufficiently sophisticated. Being aware of this in advance could help avoid potential problems. The Rio Puerco Management Committee case study (Box 4.4 and 4.5) provides an illustration of organizational cycles in a very complex restoration environment.

Box 4.4 Rio puerco management committee members

Federal agencies
- Army Corps of Engineers
- Bureau of Indian Affairs
- Bureau of Land Management
- Bureau of Reclamation
- Environmental Protection Agency
- Fish and Wildlife Service
- Forest Service
- Geological Survey
- Natural Resources Conservation Service

Tribal
- Jicarrilla Apache Tribe
- Pueblo of Acoma
- Pueblo of Isleta
- Pueblo of Jemez
- Pueblo of Laguna
- Navajo Nation

State of New Mexico
- Bureau of Mines
- Department of Game and Fish
- Department of Transportation
- Environment Department
- Mid-region Council of Governments
- NMSU Cooperative Extension Service
- State Engineer
- State Land Office
- Cuba Soil & Water Conservation District
- Ciudad Soil & Water Conservation District
- Lava Soil & Water Conservation District
- Valencia Soil & Water Conservation District

NGOs and private
- Albuquerque Wildlife Federation
- Cabezon Water Pipeline Association
- Quivira Coalition
- Sierra Club, Rio Grande Chapter
- Rio Puerco Alliance
- Rio Puerco Watershed Committee
- WildEarth Guardians
- Private Landowners
- Public-at-Large

Box 4.5 Restoring the Rio Puerco: Challenges of coordinating across broad scales and complex ownerships

This case study illustrates the challenges faced both by scale and complex land ownership patterns in restoring a severely degraded, semi-arid watershed. Such a scale and ownership pattern mean that large numbers of parties need to be involved in restoration efforts and, given the slow pace of recovery in arid environments, it is very challenging to sustain a restoration program over time, space, and culture. The Rio Puerco Management Committee's 15 year history aptly illustrates the effects of organization life cycles and the people they attract.

Background. The Rio Puerco was once called the 'breadbasket of New Mexico,' lined with villages and agricultural fields fed by acequias (traditional community-operated irrigation systems) (Scurlock 1998). The watershed has a long history of land-use and property disputes dating to original Spanish colonization in the early 1600s. Land-use practices – principally grazing and road building – have reduced vegetative cover, altered drainage, and reduced riparian vegetation. Climate changes may have originally triggered channel incisions, but land uses have exacerbated these effects leading to significant gullying and high sediment yields. The Rio Puerco is estimated to produce about 6.5 m^3/ha of sediment annually, and its highest recorded suspended solid concentration of greater than 600,000 parts per million places it in the top four sediment producers worldwide and the highest in the United States (Gellis *et al.* 2004).

The 19,000 km^2 Rio Puerco watershed, located in the Southeastern Colorado Plateau Province of the American Southwest Region, has 359 km of streams in four basins and nine sub-basins (Figure 4.6). Wholly within the state of New Mexico, the Rio Puerco drains portions of seven counties,

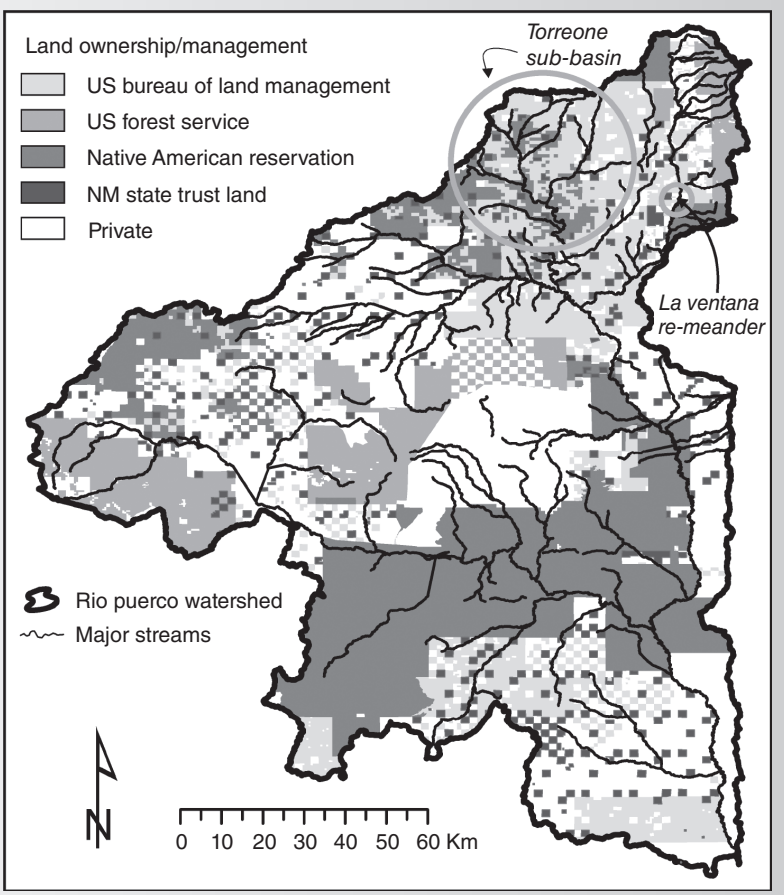

Figure 4.6 Map of the Rio Puerco basin in New Mexico (USA) demonstrating diverse ownership.

contains parts (or all) of six Indian Reservations, federal and state lands managed by four different agencies, and has at least five regional economic development and soil and water conservation districts operating within its boundaries (RPMC 2001; NMED 2010). The RPMC includes these entities, along with many other organizations (see Box 4.4).

The extensive history of restoration planning (see Box 4.6) has been characterized as disjointed, disorganized, largely non-collaborative, and not holistic (RPMC 2001). To overcome this, the original Rio Puerco Committee headquartered in Cuba, New Mexico convinced the United States Congress to pass the Rio Puerco Watershed Act (Act) in 1996 which designated the US Bureau of Land Management (BLM) as the lead agency. The Act also: (1) created the inter-agency and stakeholder Rio Puerco Management Committee (RPMC) to develop and implement a watershed management program; (2) established a clearinghouse for research and an inventory of best management practices and monitoring efforts; and (3) required plans to be based on best management practices. The Act authorized $7.5 million over 10 years (although this amount was never entirely appropriated), and was reauthorized for another 10 years in 2007.

Restoration. The Rio Puerco Management Committee has had numerous successes over its past 15 years, of which four are significant. First, the RPMC has brought parties in conflict over livestock grazing in the Rio Puerco to the same table, and their continuing relationships have consistently been identified as the most important outcome. Honest disagreement among the parties was acceptable, but not personal attacks. Meetings were held in the evening and on Saturdays in local communities throughout the watershed to make it easier for non-government people to attend, and the facilitator was the only person who was paid to be there.

Second, restoration projects were an early priority for the RPMC. Early projects were small: riparian fencing and reseeding. The RPMC's top priority was to remeander a 3.5 km stretch of the Rio Puerco that had been channelized in the mid-1960s to avoid having to build two bridges on State Highway 44 (now US 550). The 1.75 km channelized section doubled the stream gradient, resulting in headcutting and lateral channel widening that is estimated to have contributed almost 850,000 metric tons of sediment since its creation. This US$4.5 million project was completed as a partnership between the RPMC and the New Mexico State Highway Department, with approximately $1 million in funding provided by the USEPA for the channel reconstruction.

Third, the bourgeoning involvement of Native American (aboriginal) tribes in watershed restoration is significant due to both their cultural reticence and the extent and ownership in the Rio Puerco watershed. The RPMC worked with tribal members to reduce the number of horses and burros on overgrazed lands, helped the Navajo community of Torreon to create a Youth Conservation Crew to work on watershed projects, and cooperated with a number of tribes on planning and implementing restoration projects. One RPMC member remarked, 'tribes were here before any of us, and will be the ones who keep this effort going in the long term.'

Finally, the RPMC successfully accessed scientific capacity for assistance in its strategic planning and to evaluate restoration effectiveness. The United State Geological Survey (USGS) conducts studies in the watershed (Gellis *et al.* 2004), hosts a website devoted to Rio Puerco data, and provides monitoring design and analysis for the Torreon restoration. The RPMC supported a graduate student who evaluated Rio Puerco sediment sources that identified road-related sedimentation as the greatest single problem (Pippen & Wohl 2003).

Lessons learned. In Section 4.2 we introduced the idea that organizations (including government agencies) have life cycles that go through various stages and identified various types of personal behavioral characteristics who seem attracted to these different stages. The RPMC illustrates this pattern, and the Act recognized that restoration efforts required at least 10 years. The founder of the RPMC, a BLM District Manager from 1993 to 1998, supported the organization in its entrepreneurial/creation stage. While not entirely a *zealot* – and with some of the characteristics of a *climber* – it was his vision and drive that brought the parties together originally in 1993, and his political acumen that moved the original Rio Puerco Committee to seek the legislation that created the RPMC. During the RPMC's 'collectivity' stage (c. 1998–2001), he recruited additional BLM staff members and the RPMC developed its Action Strategy (RPMC 2001), received its first Congressionally designated funding ($300,000), and was recognized for its collaboration with two national awards (RPMC 2001).

The 'formalization and control' stage occurred during 2002–2005 when the RPMC received significant funding from the USEPA, and a partnership with the New Mexico Department of Transportation allowed it to accomplish is highest priority restoration project. All major participants during this period could be characterized as *advocates* and many are still involved in either the RPMC or the Rio Puerco Alliance (RPA).

The RPMC attained the 'elaboration of structure' life stage when, in 2006, it founded the RPA in order to receive funds from sources that would not fund government agencies. The RPA provided continuity through its board, which was previously lacking as agency representatives on the RPMC cycled through or retired. The RPMC is presently at the fork in the organizational life cycle where it can either renew itself or is likely to cease its operations. The spinoff of the RPA is a sign of renewal, as is the re-convening of the partners that occurred in 2011.

Based on the RPMC experiences, it is possible to overcome both geographic challenges (size and ownership pattern) and cultural barriers to stream restoration. It is however apparent that it takes time, dedication, funding, and the acknowledgment that organizations need to be resilient and entrepreneurial to be successful.

Box 4.6 Timeline of actions in the Rio Puerco

1250	Chaco (Anasasi) culture dies out from overuse of resources and climate change
1599	Spanish Conquistadores arrive in Rio Puerco
1680	Pueblo Revolt drives Hispano settlers out of NM until 1692 reconquest
1693	Hispano settlement begins in the Rio Puerco
1740	Cattle and sheep grazing begins
1760s	Rio Puerco channel incision begins
1846	First Anglo-Americans arrive in New Mexico
1850	New Mexico becomes a US territory
1880s	Rio Puerco channel incision accelerates
1898	Irrigated fields cover 7236 ha and are served by 62 ditches
1912	New Mexico becomes a state
1927	USGS report identifies the Rio Puerco as having significant sediment problems
1978–1984	US Army Corps of Engineers studies watershed treatment as a 'non-structural' alternative to flood and sediment control dams on the Rio Puerco
1985	US Forest Service completes Cibola and Santa Fe National Forest Plans
1986	Bureau of Land Management completes Resource Management Plan for its lands in the Rio Puerco basin
1993	US Bureau of Reclamation begins review and study of Rio Puerco sedimentation impacts on Rio Grande and Elephant Butte Reservoir
1993	Rio Puerco Watershed Committee (RPWC) formed by local stakeholders as a sub-committee of the Cuba (NM) Region Economic Development Board
1996	Rio Puerco Watershed Act of 1996 (PL 104-333) passed; requires management committee and provides $7,500,000 over 10 years to establish restoration program
1997	Rio Puerco Management Committee (RPMC) formed pursuant to PL 104-333.
1998	Rio Puerco identified as a Category 1 'In need of restoration' in New Mexico Unified Watershed Assessment prepared under the federal Clean Water Act (CWA)
1999	Sub-basin prioritization initiated by RPMC
1999	Decision to construct two bridges on US 550 to remeander the Rio Puerco at La Ventana
2001	Watershed Restoration Action Strategy (WRAS) completed and submitted to USEPA to qualify for CWA §319(h) project funding
2006	Rio Puerco Watershed Alliance (RPA) formed
2007	NM Environment Department completes TMDL for Rio Puerco
2007	Rio Puerco Management Committee reauthorized under PL 111-11 §2501 for another 10 years

4.5 Approaches to elicit cooperation

Eliciting and building cooperation among landowners and other restoration project partners is the key to success in the long term. Cooperation can take many forms: grudging acceptance of a proposal; agreeing to help with, but failing to take action; eagerly encouraging and participating in projects; or even to funding stream restoration projects. In many cases, cooperation will ultimately transcend into collaboration, where your partners are actively working to support your goals. While the importance of individual relationships has been emphasized, it is also useful to understand that there are organizational and institutional structures that can aid in the acceptance of stream restoration. In this section we will first begin by highlighting the rise of these institutions, then afterwards evaluate a number outreach, information and communication or environmental education tools that can be used to engage landowners and project partners. We will also discuss more deeply the concept of reciprocity and the lessons that can be learned from theoretical outcomes to build a successful stream restoration program.

4.5.1 Institutions to support stream restoration

The importance of involving the public and stakeholders in decisions, environmental policy, and resources management gained stature after the Second World War (Parkins & Mitchell 2005). In the United States, the requirement for public participation began with passage of the Federal Administrative Procedures Act in 1947, which evolved into the framework for stakeholder 'standing' in legal review of agency actions that was subsequently incorporated in the National Environmen-

tal Policy Act (NEPA) of 1970 and the Clean Water Act of 1973 (Fairfax 1978). The involvement of the public in government decisions in Europe goes back further in certain countries, and for specific issues such as water management and drainage (Enserink *et al.* 2007). Broad policies requiring public involvement within the European Community took force through the Economic Commission for Europe Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (http://www.unece.org/env/pp/documents/cep43e.pdf) (Enserink *et al.* 2007). The Water Framework Directive incorporates this by requiring public participation in its mandatory integrated river basin management plans (European Commission 2000, 2003).

As stakeholders and the general public began to receive legal rights to participate in governmental environmental policies, there became an interest in determining institutional mechanisms that would best achieve these goals. Beginning in the 1980s and accelerating through the 1990s and early 2000s, collaborative groups involving stakeholders, landowners, and agencies developed as a way to bring together interested parties to both meet regulatory requirements to improve watershed conditions, and to build longer-term relationships among the partners (Leach & Pelkey 2001). In the United States, these collaborative groups are commonly called 'watershed councils' (Leach & Pelkey 2001); in Australia they are 'catchment management committees' (Hillman *et al.* 2003); in England and Scotland they may be 'river trusts' (www.associationofriverstrusts.org.uk); 'Wupperverband' in Germany (Moellenkamp *et al.* 2010), and in South Africa 'catchment management forums' (Pollard & du Toit 2011).

While structures and authorities vary widely, almost all groups consist of a broad range of stakeholders (including government agencies) who meet periodically to discuss and negotiate specific watershed conditions, practice consensus-based decision making and, in many cases, may actually implement restoration projects (Leach & Pelkey 2001). There are process outcomes that result from the exchange of views and ability to be heard and influence discussions, and there are content outcomes where improved decisions are achieved through joint problem solving, additional information and making decisions on priorities and projects (European Commission 2003). One important long-term outcome from this process is *social learning* whereby stakeholders, through sharing perspectives and identifying interdependencies among them, improve their ability to identify mutually beneficial outcomes (Bouwen and Taillieu 2004; Pahl-Wostl *et al.* 2008).

4.5.2 Techniques to engage landowners

Given the long and world-wide deployment of the previously discussed agricultural extension model, it is not surprising that numerous techniques to engage landowners in adopting new techniques have been developed and evaluated over the last 50 years. Examples of commonly used techniques, often generally known as 'outreach,' are:

1. demonstration projects;
2. field days and tours;
3. newsletters;
4. displays in public places and at events;
5. talks to community groups;
6. newspaper, radio and television stories;
7. web sites, social media and e-mail contacts; and
8. work with schools and youth groups.

All these techniques can be effective in broadening knowledge about your plans, ideas, and potential restoration projects. There are a number of excellent guides for adapting and applying outreach techniques that can be found on the internet. Because many of these techniques need to be adapted for a specific country, culture, and objective, it makes sense to first look for local practices and experiences to identify preferable methods.

A potential project partner becoming aware of the technique that is being proposed is a pre-condition for them considering its adoption. The general outreach techniques listed above can work within local networks to increase the visibility of a project, while more targeted techniques such as demonstration projects and tours are particularly useful to enlist specific potential project partners. Rosenberg & Margerum (2008), who evaluated how landowners made decisions about whether to implement stream restoration projects, found that family, friends, and neighbors were the most trusted sources of information (particularly for the less well-educated) but that there were also high levels of trust in the agricultural extension network and local watershed groups. Newsletters were considered to be the best communication tool (Rosenberg & Margerum 2008).

Even more targeted outreach can be employed by more direct engagement through individual meetings in a person's home or small gatherings of neighbors, sometimes called 'kitchen table' meetings and 'coffee klatches', respectively. Directly visiting, or being hosted by a local in the area where you want to work, allows for more personal interactions with a targeted audience, allows back-and-forth discussions, and gives your project partners a chance to get to know you as a person rather than just someone trying to get a stream restoration

Box 4.7 Working with Weyerhaeuser

Weyerhaeuser Timber Company (WeyCo) provides an example of a 'push-pull' dynamic that resulted in considerable stream restoration on their 85,000 ha Millicoma Tree Farm in southwestern Oregon, USA the 'push' being their legal compliance requirements and the 'pull' their self-image as a progressive land steward with high standards for its self-directed forest management operations. This push-pull dynamic ultimately provided support for the formation of the Coos Watershed Association (CoosWA) and a joint partnership that has resulted in over US$3,000,000 in stream restoration projects.

Background. The regulatory push on Weyerhaeuser began in the early 1970s as the first significant forest practices laws came into being. Tensions and rancor accelerated during the 1980s as these rules were strengthened and federal Endangered Species Act (ESA) requirements further constrained operations. The pull emerged in the 1990s with their preparation of watershed analyses, creation of the first industrial timberland habitat conservation plan (HCP) to protect the northern spotted owl (*Strix occidentalis caurina*) and marbled murrelet (*Brachyramphus marmoratus*), and ISO14001 environmental management certification. Also reflecting the push-pull dynamic was the 1994 formation of CoosWA in an attempt to avoid coho salmon (*Oncorhynchus kisutch*) becoming listed under the Endangered Species Act. The push-pull tension continues into the 21st century with ever-greater demands for financial and environmental performance in the management of the Millicoma Tree Farm.

CoosWA began putting their plans in place, with a growing appreciation that implementing restoration projects brought a wide range of stakeholders together. The culture that developed in CoosWA reflected its origins: the desire to work cooperatively with landowners and managers to create 'win-win' situations, avoid increased regulatory burdens through its assessments and monitoring, and being very cognizant and respectful of private property owners.

Restoration program. During the formative period for CoosWA, Weyerhaeuser began exploring the potential to place stream restoration projects on the Millicoma Tree Farm. Early efforts reflected common practices at the time: channel-spanning boulder weirs to capture gravel and create spawning habitat; placement of individual or small groups of logs over short stream reaches; and construction of jump weirs to help fish pass perched culverts. Early projects were focused solely on benefits to salmon (see Figure 4.7). Severe floods in 1996 highlighted the need to improve culverts to prevent their failing from being undersized. This recognition of joint benefits to Weyerhaeuser's facilities and fish habitat led to a change in the types of projects, increased the amount of overall expenditures on restoration projects, and altered the cost-sharing proportions to better reflect the comparative benefits to each party (Figure 4.8).

In 2003 another 'push' occurred when Weyerhaeuser was issued a civil citation for inadequate road maintenance and log hauling during wet weather that caused sediment to flow into an adjacent stream. Weyerhaeuser agreed to institute best management practices (BMPs) to prevent sediment from entering streams, which led to a significant expansion in cooperative restoration projects and a change to upgrading whole road systems rather than spot treatments (see Figure 4.7). The Dellwood mainline upgrade, 97 km of riparian-adjacent heavy-use hauling route was the first of these whole-road projects. When Weyerhaeuser began planning in 2006 to move their harvesting operations into the Bottom Creek sub-basin (4622 ha with 23.2 km of fish-bearing streams), CooWA proposed that the project be used as a

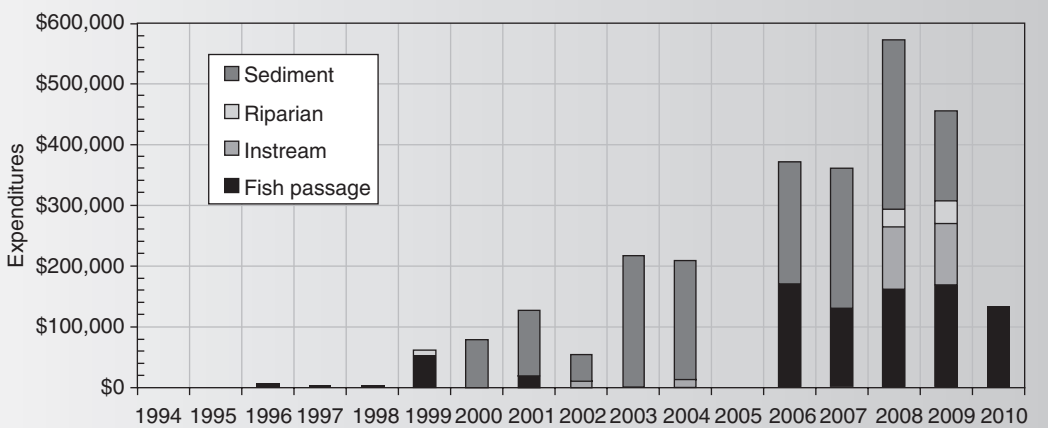

Figure 4.7 Changes in stream restoration project types on the Millicoma Tree Farm, 1994–2010.

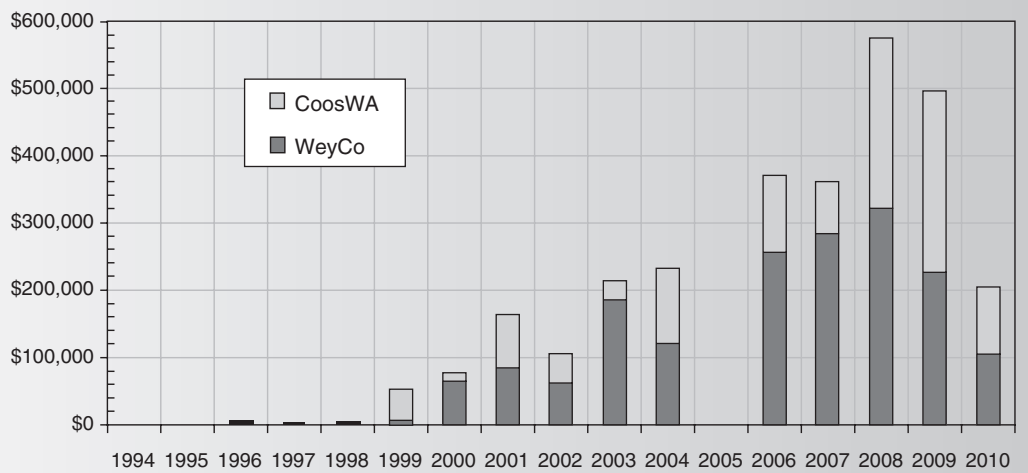

Figure 4.8 Relative contributions of Weyerhaeuser (WeyCo) and Coos Watershed Association (CoosWA) to stream restoration projects on the Millicoma Tree Farm.

demonstration of 'whole watershed restoration.' Projects constructed during 2008–2010 included 47 logjams totaling 462 trees placed over 12 km of streams, decommissioning 1.5 km of unneeded logging roads, five fish passage barriers removed that opened up 5.3 km of streams to anadromous fish, and installing 141 cross drains and 30 culverts on 19.3 km of roads to reduce road-related sediment.

Lessons learned. Weyerhaeuser's strong corporate standards pushed their staff to improve watershed conditions, while CoosWA brought technical assistance (surveys and designs), funding, and a non-regulatory approach. Through this cooperation we have learned a number of lessons about why this partnership is so successful.

1. *Share goals.* Early projects that focused solely on CoosWA objectives were limited in scope and extent. Once Weyerhaeuser's needs in terms of road upgrades were included, cooperative projects expanded rapidly and Weyerhaeuser increased their funding.
2. *Share work.* Coordinating work – in this case logging, road construction, and large wood placement – is highly efficient and leverages each partner's involvement. Trees that are being placed into streams now come from new road and landing construction.
3. *Keep your needs clear.* There may be times in the relationship when one party feels taken advantage of. We learned to better identify the relative fish benefits compared to timber harvest benefits and use that ratio to determine financial contributions.
4. *Not everything will be transparent.* When working with private businesses as partners you have to realize that their internal communications and policies will not necessarily be shared with you.
5. *Look out for each other.* There have been incidents where the strength of the collaborative relationship was demonstrated. For example, during a recent review of a large consolidated restoration grant, the funders initially removed part of the grant that would have built a bridge in order to reduce the cost of the project. However, WeyCo was providing a matching funds for other parts that were not a priority for them. CoosWA successfully appealed the decision since the project was designed as a package.
6. *Keep a clean house.* From the Weyerhaeuser perspective, the relationship has worked well because the watershed council has been very organized in its planning. This allows Weyerhaeuser the lead time that it needs to budget and allocate staff time.
7. *Work to nurture future collaboration.* The collaborative relationships between CoosWA and Weyerhaeuser staff have evolved, strengthened over time, and become part of our mutual working culture, strengthening our stream restoration program as new staff are brought on by both CoosWA and WeyCo.

This case study demonstrates that it is possible to work with a large, multi-national corporation on stream restoration projects when each party's needs and objectives are met. The key to meeting those needs and objectives is to understand the conditions under which your partner operates, and what its expectations for you are. As trust is built through experiences working with each other, there should be a point when both parties are working to support each other's interest without the need for constant reciprocation. Ultimately the working arrangement becomes part of each partners' organizational culture and is transferred through generations of employees as they rotate through jobs related to the restoration projects.

project implemented. This approach allows you to intersect with local networks, providing an avenue for local participants in these networks to become acquainted with stream restoration.

4.5.3 Achieving agreement with project partners

There will come a point in a proposed stream restoration project where you will need to obtain the agreement from project partners, particularly landowners, for project implementation. This section will stress the importance of reciprocity, that is, making sure that the objectives and needs of project partners are understood to ensure they are met as the stream restoration program is developed. In many cases, cooperation can be achieved even if a partner does not necessarily wholeheartedly believe in the cause, as long as that partner stands to gain benefit by working with you. While formal negotiations can achieve this outcome, often on a case-by-case basis, it is also possible to build a cooperative relationship over time by choosing a set of behaviors on your part that will lead to a mutually successful collaboration. The Coos Watershed Associations experiences in the 'Working with Weyerhaeuser' case study (Box 4.7) describes this process with a large multi-national timber company in the Pacific northwest of the United States.

The practice of implementing stream restoration projects is in many ways similar to diplomacy: you want the other party to cooperate so that you gain something you want (or avoid something you do not want). Game theory – which was developed during World War II and used widely during the Cold War – is designed to examine potential decision-making strategies when the actions of the other party cannot be controlled or known in advance (von Neumann & Morgenstern 1947). In application to stream restoration, the results from 60 years of game theory simulations provide insight into how best to work with potential project partners, whether they be agency collaborators or landowners on whose property you want to install a project. This approach may seem inapplicable for stream restoration (see Box 4.8), but we have found it a useful way to evaluate potential choices and strategies.

4.5.3.1 The Prisoner's Dilemma

The principal game theory tool, called the Prisoner's Dilemma, was developed in the early 1950s to illustrate the difficulties in overcoming rational self-interest to obtain cooperation for mutually beneficial outcomes. It is premised on police interrogating two suspects about a crime, each of whom is focused in their own self-interest to receive the least sentence. If the suspects cooperate with each other they can be convicted only of a minor crime due to limited evidence. However, if one or the other confesses and implicates the other one, the confessor receives the little or no penalty while the other serves a long sentence. If both confess, however, they are each convicted and both receive long sentences (Poundstone 1992). In the context of restoration, we frequently work with landowners who usually have their own gains in mind when they cooperate on a project, while at the same time we also have our own goals to achieve. Table 4.2 shows a matrix for the Prisoner's Dilemma in this situation where the 'payoffs' are in net gains (i.e. absent any benefits given to the other party in the project).

Axelrod (1984) described which strategies in the Prisoner's Dilemma are likely to induce stable cooperation. The Prisoner's Dilemma game rules can be largely transferred to the situation facing stream restoration proponents, or at least to those who are working solely on a voluntary basis with landowners and managers: (1) there is no mechanism to make enforceable threats or commitments; (2) there is no way to know what the other player will do on a given move; (3) there is no way to eliminate the other player or leave the interaction; and (4) there is no way to change the other player's payoffs (Axelrod 1984). While these rules can in fact be overcome by various mechanisms (such as legal contracts and easements), other commonly used strategies such as incentive payments are internal and considered in the payoffs shown in Table 4.2.

Box 4.8 Restoration is not a game!

Understandably, the use of the term 'game' to describe strategies to restore streams may seem sacrilegious to those who are devoting their lives and careers to this cause. We can assure you that you are not alone in this. However, we have found the rules and guidelines discussed here to be very useful during the years of implementing restoration projects.

4.5.3.2 Guidelines to build and maintain cooperation

From his simulations, Axelrod (1984) derived four rules that he found consistently lead to desired outcomes:

1. *Don't be envious.* Success is when both partners gain from cooperating. As long as you are getting what you need, the fact that a partner may be gaining even more

Table 4.2 Net gains between parties in the Prisoner's Dilemma of stream restoration.

		Landowner (L)	
		Cooperate	***Defect***
Restoration practitioner (R)	***Cooperate***	L = 2; R = 2 Each party gets the majority of what they want, but not everything.	L = 3, R = 0 Landowner solely benefits but restoration ineffective because landowner commitments not fulfilled.
	Defect	L = 0; R = 3 Restoration implemented, but landowner feels taken advantage of and restoration gets bad reputation.	L = 1; R = 1; Status quo where nobody gains but there is a minimal potential for loss. In some cases, this could even be zero or negative for both parties.

from the relationship does not necessarily mean that you are being taken advantage of. A partner's success is what allows the cooperative relationship to continue and build over time. The proper standard for comparison is what is achievable in the absence of this cooperation.

2. *Be nice!* Do not be the first to withdraw (defect) from cooperating. In the initial phases of the relationship it is likely that a partner will be looking for indications that you will not fulfill commitments. In this respect, reputation is important, as is the likelihood that you specifically – and your organization generally – will stay involved over the long term. If the other party does not think that they will see you in the future, or if you might be replaced by someone else in your organization who might not be agreeable to the existing arrangement, then obtaining cooperation will be more difficult if not impossible. Most landowners desire an ongoing relationship so that if something does not go as planned they are confident that you will be around and willing to fix whatever is wrong.

3. *Reciprocate both cooperation and defection.* If someone cooperates with you it is clearly in your best interest to reciprocate. In the initial stages of a relationship there is an implied *quid pro quo*: 'I help you, you help me.' Over time, as trust is built, there may be less need for a strict accounting of each party's contribution, though some documentation may be helpful in the future. The relationship between the Coos Watershed Association and the Weyerhaeuser Timber Company in the case study provides a good example of how reciprocating cooperation builds over time.

Knowing how to reciprocate if a partner reneges on an agreement or quits the partnership (Table 4.2) is more difficult. The challenge here is to avoid having your niceness misinterpreted as being a 'pushover' or being willing to do anything to establish or maintain the relationship. Remember, the object here is to build cooperation, not create a condition where your potential project partner takes advantage of you or refuses to work with you. If the relationship is on a formal contractual basis it may be possible to enforce compliance. This strategy will probably be more successful with larger organizations and agencies than with individual landowners with whom the personal relationship is more important. In this latter situation, a more passive reciprocation of defection may bring your partner back to the partnership. Examples of such reciprocity would be to decline to participate in future projects with them, allow your partner to be exposed to regulatory burdens (although it is not a good strategy to report them to authorities!), or explicitly and visibly work with others on the same type of projects that the partner desires. The goal in all this is to avoid burning bridges so that you can keep future options for cooperation open.

Your relationship with a new partner may begin by being put into a 'good cop, bad cop' situation, where your partner cooperates with you (the good cop) because you are preferable to the alternative (regulatory enforcement actions). The leverage that you gain in this situation is offset against an implicit reciprocity that you will help protect your partner's interests. Also, be aware that if you are stereotyped with organizations similar to your own, it is in your best interest to make sure that these parties play nice with your partner. All too frequently, a partner will withdraw from cooperation due to the actions of a third party that you have little control over. Part of the 'reciprocation of cooperation' is your willingness to assist

your partner to resolve these difficulties. This approach, however, can frequently take regulatory agencies by surprise and leave them wondering where your loyalties lie. It is important to remember that it is not about taking sides, but rather about getting a restoration program implemented and seeking 'win-win' solutions (Fisher *et al*. 1991).

4. *Don't be too clever!* Other players will be watching for signs of whether you will reciprocate cooperation or not, and therefore your own behavior is likely to be mirrored back to you (Axelrod 1984). Simple is usually preferable to complex to avoid a cycle of increasingly nuanced demands. There are times when elaborate procedural mechanisms are necessary to obtain cooperation in the absence of mutual trust, but the effort in preparing and negotiating such agreements can be large and may not be needed. Some form of agreement and limitation of liability is usually necessary when implementing restoration projects, but once a relationship of trust is achieved this documentation becomes secondary to the mutual interest in moving the project forward and can actually impede progress by siphoning resources and trust.

Game theory and practical experience indicate that it is not beneficial to 'permanently retaliate' when your partner fails to cooperate at some point. One reason that this is not a successful strategy is that it is likely to be reciprocated, i.e. you will never again be able to work with this person. In addition, one's reputation will also suffer when your partner tells others, 'Look what they did to me!' Your interest is in maintaining a reputation for fairness over the long term, which is especially important when other potential partners are watching. Sometimes silence is the best alternative.

4.5.4 Why understanding cooperation is important

The work of Robert Axelrod and other game theorists who have used the Prisoner's Dilemma to examine behavior (ranging from bacteria to humans) provide useful lessons for restoration practitioners. First, stream restoration should not be thought of as a single event (or project), but instead a recurring set of interactions where partners and cooperators meet one another over significant periods of time (usually years, if not decades). The actions taken today can benefit or haunt you and your successors in the future because they may transfer to other natural resource efforts, multiplying the effects of any single project. A recurring cooperative relationship is not necessarily a zero-sum outcome (one person's win is another's loss), but rather should have positive-sum outcomes, i.e. the classic win-win situation for both parties (Fisher *et al*. 1991).

Trust and credibility take time to build, and can easily be lost by unwise actions on your or others' part. However, both parties do not necessarily have to agree on all points for the response to be mutually beneficial. The limited options available to us mean that trust and goodwill are assets worth creating and protecting. It is always a good strategy to 'take the high road.' Make sure that your organization has policies and training to reduce the potential for damage to your reputation. It may be advantageous to allow your partner to get the first benefits from cooperation. Implicit in this approach is the likelihood that the other party will cooperate with you the next time you need something out of a sense of obligation. Just as in the 'be nice' strategy, reciprocity may not occur in all cases but you will still receive more benefits over the longer term by using this approach.

The durability and frequency of interactions leads to the potential for cooperation. The people you are trying to convince to undertake a restoration project need to see you in the community: at the post office, church, or grocery store. There may be an added benefit if you grew up in the community (assuming you did not cause too much trouble in your youth!) because you and your family will have had long-term relationships with the same families with whom you are now trying to work. For example, at the Coos Watershed Association we had been trying to install monitoring equipment in a stream on land owned by a very skeptical dairy farmer. He would only agree to do something when a staff person who had grown up in the neighborhood asked, but would continue to allow the monitoring only at the same site with subsequent staff. When we wanted to change locations and types (i.e. replace a juvenile fish traps with PIT tag antennas), he refused until a new staff member who had gone to high school with his kids asked.

When entering into new cooperative relationships, break larger projects into smaller pieces while trust and reciprocity are built. This allows each party to observe the behavior of the other, to test whether commitments will be fulfilled and to judge if cooperating is in their best interest. The Weyerhaeuser case study (Box 4.7) is an example of how, over the last 10–15 years, restoration projects have become larger and more complex as the cooperative relationship has strengthened by building on a history of smaller successes. It is unlikely that a whole sub-basin restoration program would have been palatable to Weyerhaeuser if it had been the first project proposed.

People will cooperate if it is in their long-term interest to do so, even if it is not necessarily in their short-term interest. The Coos Watershed Association (and the Oregon Plan for Salmon and Watersheds) brought together timber and environmental interests who would not normally cooperate; the timber representatives did not want to see additional limits on their operations if coho salmon were listed as threatened under the United States Endangered Species Act (ESA). They believed that by cooperating in the short-term they would have greater management flexibility in the long-term. By the time coho salmon were listed under the ESA, the timber industry had sufficient commitment to the Oregon Plan that cooperating still appeared a preferable option when compared to defecting and going it alone. Often restoration practitioners think that our project partners – particularly landowners – should allow stream restoration projects on their property because it is the right thing to do. Expecting such altruism is an unrealistic foundation for a restoration program; when it occurs it is wonderful, but it is unlikely to be widespread enough to meet the restoration needs. However, not all benefits that a partner may receive necessarily have to be in monetary terms. Examples of non-monetary values can include your partners' reputation in the community (wanting to be seen as a good land steward by his or her peers) and the aesthetic benefits of vegetated riparian zones and stable stream banks.

It often feels easier to deal with people who are like us because we believe we know how they think and believe we understand their values. Even if this attitude does not stigmatize those who think or act differently, labeling – or stereotyping – unnecessarily limits our opportunities. Modeling results show that we are far more likely to improve our situation by cooperating with those of different perspectives than if we limit ourselves to those who believe as we do. This does not mean compromising our values, but rather placing ourselves in other people's positions to understand their perspectives.

4.6 Moving forward: Further reading in human dimensions of stream restoration

This chapter has provided some fundamental tools and approaches to incorporate the human dimension into stream restoration. However, we have really just scratched the surface of a rich and diverse field of study and practice. For those interested in delving deeper, we offer the following suggestions on further reading and investigation.

4.6.1 Collective action

Over the last 20 years there has been a large and swift rise in the creation of organizations whose purpose is to restore streams and watersheds (catchments). A good, albeit fairly advanced, introduction to understanding organizations with a focus on natural resources is Elinor Ostrom's *Understanding Institutional Diversity* (2005). Ostrom shared the 2009 Nobel Prize in Economics for her work on institutions to manage common property resources, thus there are strong correlations with organizations to advance stream restoration. The *International Journal of the Commons* (http://www.thecommonsjournal.org) is an open-access source for current theory and case studies.

There have been a number of studies of the effectiveness of watershed councils, beginning with Julia Wondolleck and Steve Yaffee's *Making Collaboration Work: Lessons From Innovation in Natural Resources Management* (2000), which provides a good overview. They include a short discussion of the Prisoner's Dilemma and cite Axelrod's (1984) work, but emphasize group formation and group dynamics using a suite of case studies to bolster their points. Paul Sabatier and his colleagues (2005a) in *Swimming Upstream: Collaborative Approaches to Watershed Management* provide a political science-focused evaluation focusing on the critical role that trust plays in successful stakeholder collaborations (recall, however, that we also think reciprocity plays a key role). Sabatier *et al.* (2005b) test various theories based on a quantitative analysis of surveys of watershed councils in California, Oregon and Washington in the United States.

4.6.2 Social capital and the triple bottom line

In its most elemental form, stream restoration builds 'natural capital' by improving ecological function. Both Wondollek & Yaffee (2000) and Sabatier *et al.* (2005b) note the benefits of cooperative actions for stream restoration to build 'social capital,' that network of relationships and trust that allows groups and communities to achieve common goals, and whose loss was described by Robert Putnam in his *Bowling Alone: The Collapse and Revival of American Community* (2000). In Section 4.5.2 we highlighted social learning as a desired outcome from collaborative efforts to implement stream restoration, and the process through which this social learning occurs and builds social capital. We also discussed the importance

of reciprocity and understanding landowners' management objectives, one of which is commonly meeting their economic objectives, i.e. helping them build and maintain *economic capital*, including good infrastructure.

Restoring ecosystems, building social capital and working with landowners to meet their economic (and other) objectives lends itself to placing stream restoration work within the 'triple bottom line' that came out of the business world to account for environmental, economic, and social benefits and impacts from your restoration projects and programs (Elkington 1998). Aronson *et al.* (2007) provide a good introduction and case studies on restoring natural capital. Placing stream restoration in the triple bottom line framework has the added benefit of signaling to your project partners that you care about their concerns rather than being singularly focused on meeting your goals and objectives, which may result in them being more open to hearing your ideas.

4.6.3 Environmental justice

While everyone targets 'win-win' solutions as their ideal outcome, in any large program of stream restoration there are likely to be winners and losers. This is often the case when property is condemned or expropriated to implement projects, and is even more problematic where there is questionable title to the property (cf. Section 4.2.2). Distributive outcomes about who wins and who loses are frequently called 'environmental justice'; Mick Hillman (2004) and his colleagues in Australia and New Zealand have been at the forefront of explicitly considering these effects in stream restoration. Their *River Futures: An Integrative Scientific Approach to River Repair* (Brierley and Fryirs 2008) provides good coverage as well as case studies. Boyce *et al.* in *Reclaiming Nature: Environmental Justice and Ecological Restoration* (2007) provide a broad survey.

4.6.4 Resilience

Restoring 'resilience' or the ability of a system to withstand shocks is an emerging focus for all types of ecological restoration projects, particularly given expected climate changes. Ensuring that economies and communities are also resilient to system shocks is a desirable goal as part of a triple bottom line approach, however. An excellent and broadly encompassing introduction to this idea can be found in the edited volume *Principles of Ecosystem Stewardship: Resilience-Based Natural Resource Management in a Changing World* (Chapin *et al.* 2009). A key tenet in basing restoration objectives to build resilience is the idea of adaptive management. A very succinct and applicable introduction to adaptive management can be found in Walters & Holling (1990), two of the originators of the concept. The open-access journal *Ecology and Society* is a particularly good source for current research on resilience and associated topics such as social learning and adaptive management.

4.7 Summary

Understanding the human dimension in stream restoration is necessary and, if done well, has the potential to accelerate the process of achieving stream restoration goals. It is all too easy to think that progress would be much faster without humans in the equation; not only is that unlikely, but explicitly recognizing the importance of understanding your partners' motivations and objectives will likely increase your potential for success in your restoration program.

We started this chapter by highlighting the value of understanding land ownership patterns and potential ways to approach various types of landowners. Ownership tends to be blocked into larger pieces in upper watershed areas; moving downstream generally increases the number of different landowners you will need to involve in your project, each one of which is likely to own a smaller piece of property. Further, upstream projects may have effects on downstream owners, just as projects may affect adjacent landowners. These potential effects need to be considered during project planning and design, not after implementation.

Stream restoration projects will be considered experimental or innovative or even hazardous to many of the landowners you approach. Understanding how people react to new ideas and the process of adoption will assist in targeting landowners who are more probable to be willing to accept the project, and whose acceptance may lead to their neighbors also joining in the program. Who will be willing to work with you at any given time may mean that the best location for a project may not be the most likely landowner to cooperate, and thus you may have to use other sites first while building acceptance from the landowner at the key location.

Most stream restoration projects involve the cooperation of a number of individuals and organizations. There will be landowners and managers, other organizations who provide funding and possibly technical assistance, and there will be governmental agencies with regulatory authority to assess and regulate the impacts of stream

restoration projects. Organizations of all types (as well as the individuals associated with them) have norms and 'cultures' that typically emerge through their formation stages and direct their reactions. While individuals have their dominant behavioral type within organizations, these people influence, and are influenced by, their peers who they must work with daily and by the organization's culture itself. Understanding cultures and behavioral types will again increase your effectiveness and decrease frustration. Along these lines, although it is critical for all project members to understand the human dimension of their efforts, it can be helpful to ensure that the team includes members who are particularly strong in these social skills and employ techniques such as 'coffee klatches' and 'kitchen table' meetings as a strategy to make strong connections with potential project partners.

Finally, stream restoration should not be considered a single event, but a series of actions that take place over a period of time. Each interaction can be considered a negotiation: you want to do something and you want the other party to cooperate. We identified a game theory model within which to frame these negotiations – the Prisoner's Dilemma – a strategy that has proven to have the best outcomes over the long term. The key concept is that most relationships are based on reciprocity; while perhaps seeming self-serving, this is in fact a stronger approach than expecting continual altruistic behavior from your project partners.

The models, approaches and tools provided in this chapter are widely considered to be classic. Rather than being outmoded or dated, these approaches have stood the test of time across years and various cultures. Applying these concepts and techniques will assist in effectively implementing stream restoration efforts by increasing the effectiveness of getting projects implemented while, at the same time, decreasing the frustration that results when resistance or indifference is met.

4.8 References

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