

Exploring Reinvestment from a Community-Based Watershed Perspective

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SUMMARY. Increasingly, urban and rural communities across the U.S. are looking at ecological systems as capital assets with values that are diminishing as they are degraded. Investments are needed so they can continue to provide ecological services critical to the environmental, social, and economic well-being of the communities.

This paper explores "reinvestment" as term encouraging the development of mechanisms for sustained and long-term investment in "natural capital," as well as the other forms of capital on which communities and society depend. It raises important questions on which there are information gaps, such as the value of ecological services, the level of investment needed to restore and maintain ecological systems, the activities to which investment dollars should be allocated, and where public and private investment dollars might come from. These questions are discussed at national, regional, and local scales, focusing on water—an ecological resource with immense value that connects ecosystems and communities at many scales. The paper presents lessons and reinvestment mechanisms from studies in California's Sierra Nevada ecosystem and community-based efforts in its northernmost drainage, the Feather River watershed. [Article copies available for a fee from The Haworth Document Delivery Service: 1-800-342-9678. E-mail address: <getinfo@haworthpressinc.com> Website: <<http://www.HaworthPress.com>>]

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Urban and rural communities across the U.S. are responding to concerns about environmental degradation, concerns often related to past and present growth and natural resource management practices. Many communities are developing strategies toward "sustainability" by identifying approaches to integrate the long-term viability of ecological, economic, and socio-cultural systems in their own local context, while recognizing links to regional, national, and even international systems. Understanding the relationship between different systems and addressing issues in an integrated fashion is a complex and, at times, overwhelming task. The President's Council on Sustainable Development (PCSD) noted the critical necessity for integrated thought and action in its 1996 report on a sustainable America:

By recognizing that economic, environmental, and social goals are integrally linked and by having policies that reflect that interrelationship, Americans can regain their sense that they are in control of their future and that the lives of each generation will be better than the last. Thinking narrowly about jobs, energy, transportation, housing, or ecosystems—as if they were not connected—creates new problems even as it attempts to solve old ones. Asking the wrong questions is a sure way to get misleading answers that result in short-term remedies for symptoms, instead of cures for long-term basic problems. (PCSD p. 6)

One part of the sustainability challenge is the idea of maintaining the integrity of common assets. Some analysts are beginning to apply economic approaches to concerns about environmental degradation, reframing issues by thinking about ecological systems as economic assets, or "natural capital." Questions about the maintenance of natural capital are approached in the same way as maintaining financial capital (savings and investment), physical capital and industrial plant (infrastructure), and social capital (education, training, civic cohesion and community capacity, etc.). The PCSD also acknowledges the need to think of ecosystems as assets that require long-term thinking and investment to sustain their future capacity:

A country that protects its ecosystems and manages its natural resources wisely lays a far stronger base for future prosperity than one that carelessly uses its assets and destroys its natural capital. A society that invests in its children and communities, equitably providing education and opportunity, is far more likely to prosper than one that does not make such investments and allows the gap between rich and poor to widen. (PCSD p. 6)

The term "reinvestment" affirms ecological systems' capacity, as natural capital, to produce economic value, expressing the need to maintain rather than diminish that capacity. The term describes the financial flows that are generated by an ecological system and returned to that system by those who obtain the economic benefit, often users located "downstream" or beyond the ecosystem's boundaries. The term incorporates both the need for investment in natural capital, so it will not be degraded, and the need to ensure that those who derive economic benefit from an ecological system pay their fair share in maintenance costs.

As analysts explore the idea of natural capital, it is clear there are information gaps that need to be closed. One need is to better understand the economic values of ecological systems. It is one thing to say these systems are critical to sustain life on earth as we know it, it is another to begin to quantify economic values associated with these systems and use this information effectively in policy decision making. A second need relates to the cost of maintaining the integrity of ecological systems. To date, there has been limited focus on the type of ongoing investment needed to maintain healthy, functioning ecosystems. More often, systems become degraded and require extraordinary actions and investments to mitigate the impacts and help them recover. The third need is twofold: to gain a clearer sense of who benefits from the values produced by ecological systems and to create mechanisms through which they can pay their fair share for maintaining those systems.

Economists are only now beginning to look at these information needs. One of their first efforts is quantifying the economic value of ecological services, an approach that encourages symbiotic solutions to economic and environmental issues. "Ecological services" both sustain life and enable the creation of economic value. They include such functions as water production, climate regulation, carbon sequestration, and the maintenance of biodiversity. Robert Costanza of the University of Maryland has estimated that the annual value obtained from the world's ecosystems "services" exceeds \$32 trillion, a value substantially higher than the global annual Gross National Product of \$18 trillion. This estimate includes significant nonmarket values and is thus seen as "soft" in the marketplace and in policy circles. The estimate is useful, however, as a starting point for dialogue and as an educational tool. It is important information for political leaders interested in heightening awareness of the need to maintain natural capital.

CHARACTERIZING REINVESTMENT: WATER IN CALIFORNIA

Reinvestment is an important policy tool when ecosystem values and the economic gains from that ecosystem are high, and when investments can sustain or enhance the ecosystem's capacity to provide these values. Areas

with high carbon sequestration potential; areas surrounded by expensive recreation; areas that generate profitable biofuels, biomedicines, and florals; and water production and flood control areas all are potential candidates for reinvestment mechanisms. California's extremely high water values provide a dramatic example of how important reinvestment can be at the ecosystem and watershed scale. This paper will discuss recent information and initiatives in the Sierra Nevada ecosystem and its northernmost drainage, the Feather River watershed, as a means of exploring reinvestment.

Water supplies are becoming critical in many areas of the arid West, while in the East and South, water-quality concerns are driving new ecosystem management approaches. The California water example makes a strong economic case for maintaining the environmental health of watersheds upstream of large water and hydropower supply dams. The largely federally managed watersheds of California are critical for catching, storing, and channeling low-sediment flows of otherwise dispersed precipitation into elaborate and expensive water supply and hydropower production facilities. Combining the natural (watershed) and manufactured (engineered) infrastructure enables water and hydropower purveyors to produce billions of dollars of wealth through water and power sales. Affordable water and hydropower, in turn, support a vast array of other economic endeavors in California, most notably a multibillion dollar agricultural economy.

Most water supply and hydropower purveyors are accustomed to investing a portion of the profits from their water sales into maintaining the ditches, dams, turbines, and pipelines that harness the watershed's runoff. They are unaccustomed, however, to making similar investments in maintaining the watersheds that actually capture, store, cleanse, and channel the "favorable flows" harnessed for economic uses downstream. This is especially true in situations where the watersheds above the water supply or the treatment facilities are not owned by the water purveyors themselves.

A few water purveyors and hydroelectric utilities in California dedicate a portion of their operation and maintenance budgets to watershed maintenance—if they own a large proportion of the watershed. In other parts of the country, such as Denver, New York City, and Seattle, urban-based water authorities are experimenting with "reinvesting" in the health of watersheds in which they are relatively minor landowners. Through partnerships with other watershed landowners, these downstream water users are attempting to better conserve their water supplies through collaborative, incentive-based watershed-stewardship activities. The historic 1996 New York City watershed agreement, for example, recognizes farming and forestry as preferred land-uses for maintaining and protecting water quality in the Catskill/Delaware watersheds, which provide 90 percent of the City's drinking water. Through intense negotiations with landowner and community representatives

from the upstream watersheds, city, state, and federal officials agreed to invest \$1.5 billion in voluntary, incentive-based measures aimed at maintaining traditional farm and forestland uses, improving land-management practices, and updating community infrastructure, such as roads and septic tanks, in the rural watersheds. This investment in a "natural systems" approach to water-quality protection contrasts with an alternative technical approach which would have required \$5 billion-\$8 billion to construct a filtration plant downstream near the City (Gray 1999).

In California, however, a "tragedy of the commons" best describes the relationship between the mostly federally managed watersheds and their downstream federal, state, and private water users. Although national policy has long recognized the value of federal lands as producers of high-quality water, neither national nor state policy has developed a way to foster investment in maintaining these water-supply watersheds. The 1897 Organic Act that clarified the role of the national forests focused on two primary purposes: "securing favorable conditions of water flows, and to furnish a continuous supply of timber" for the nation (Adams 1993). Since then, a variety of mechanisms has been developed to obtain revenues from timber, recreation, forage, and other resource production activities and reinvest them in restoration and maintenance of federal lands. Examples of these mechanisms include direct payments to local jurisdictions, off-budget trust funds, yield taxes, and user fees. The cost of maintaining federal lands for water production (quality and quantity), however, has been borne entirely by U.S. taxpayers through the federal appropriations process, with little possibility of return compensation. In an era of declining federal revenues, it is appropriate to question whether federal taxpayers should continue to exempt water users from their "fair share" responsibilities for maintaining the watersheds that supply water to California's agriculture, water, and hydropower industries.

THE SIERRA NEVADA ECOSYSTEM PROJECT

The congressionally authorized and funded Sierra Nevada Ecosystem Project (SNEP) developed estimates of the economic values of natural resource activities in the Sierra Nevada ecosystem. As one of the nation's first efforts to estimate economic values for a large-scale ecosystem (20 million acres), the SNEP study broke new ground. Unlike attempts to quantify the market and nonmarket values of the "ecological services" natural ecosystems produce, SNEP estimates are based on direct economic (market-based) values produced by natural resource activities and captured by resource users and beneficiaries. The study examined and compared the value of natural resource production activities related to water, timber, recreation and tourism, and grazing and other agriculture. It found that the Sierra Nevada ecosystem

produces approximately \$2.2 billion worth of commodities and services annually and that water accounts for \$1.5 billion—more than 60 percent of the value. Most of the water values accrue to users of hydroelectricity and municipal and agricultural water supplies, virtually all of whom are located outside the boundaries of the Sierra Nevada ecosystem. Only about 2 percent of the \$2.2 billion in value generated by the Sierra Nevada ecosystem is captured by federal, state, and local governments through direct payments, taxes, and fees and reinvested in the ecosystem or local communities. Public timber production and private recreation provide the largest contributions to federal and local governments both in total dollars and as a percentage of the natural resources' total value. Water production activities generate no money to help to federal and local governments maintain watersheds or communities. The SNEP report found that “additional mechanisms to promote reinvestment are necessary to maintain and enhance the Sierra Nevada ecosystem so that it can continue to provide the socially desirable outputs” (SNEP p. 1057).

The SNEP report refers to the lack of funding for watershed maintenance as an “underinvestment problem.” It suggests “a massive and directed investment of time and money” is needed to sustain and enhance the Sierra Nevada ecosystem and communities, but “compared to the size of the local communities and the value of the natural assets, the cost is small” (SNEP p. 1057).

The report identifies four primary reasons why there has not been greater investment in the Sierra Nevada ecosystem:

- Many attributes of the ecosystem are not valued in a manner that motivates investment.
- Restrictions on exchange prevent value formation for aspects of the ecosystem that generate economic benefit.
- Barriers between agencies and governments prevent efficient responses to economic values where these are known.
- Localities lack the capacity to capture economic surpluses they generate and to then invest these surpluses for ecosystem health and social well-being.

THE FEATHER RIVER WATERSHED

Each of the four reasons for “underinvestment” identified in the SNEP report suggests institutional strategies and mechanisms for attracting more investment. A number of these strategies have been tested in the Feather River watershed over the past 15 years. Various initiatives have been developed through the efforts of the Feather River Coordinated Resource Management (FR-CRM) group, a consortium of 21 local, regional, and national

entities that have been cooperating together since 1985. Their initiatives strengthen local capacity, identify watershed reinvestment mechanisms and priorities, and forge alliances with-groups beyond the watershed's boundaries.

The 3.2 million-acre Feather River watershed is the northernmost drainage in the Sierra Nevada; 71 percent is federally managed as national forests and national park land. The watershed delivers 3.2 million acre-feet of "firm" (e.g., "captured behind the Oroville Dam") water yield to the State Water Project (SWP), which supplies water for the municipal, industrial, and agricultural needs of 20 million Californians. The Feather River watershed delivers 4.6 million acre-feet of unimpaired flow to the famous 1,330.1 MW "Stairway of Power," currently owned by Pacific Gas and Electric Company (PGandE) and the California Department of Water Resources. PGandE serves 600,000 customers using the Feather River hydrosystem as part of its electrical supply grid. The Feather River watershed historically supported a premier timber management and woods products industry, and "Feather River Country" is increasingly attractive for recreational developments. Dr. Jeff Romm, an economist at the University of California at Berkeley, has been quantifying current economic values for the Feather River watershed's environmental services. His preliminary estimates indicate the river provided more than 3.5 million acre-feet of water to hydropower, municipal, and agricultural users in 1996, valued at more than \$400 million. His current research show that, "in certain conditions, riparian and meadow restoration actually can enhance water storage more efficiently than dam augmentation" (Romm, 1999). Other analysts like Dr. Linda Bond, a consulting hydrocologist in Sacramento, and Dr. Rick Kattelman, a hydrologist at the Forest Service's Pacific Southwest research station, estimate that investing in watershed health improvements could provide at least an additional 250,000 acre-feet or, 7 percent more useable water annually, to downstream water users (Bond 1997; Kattelman 1987). These watershed-specific analyses mirror SNEP's earlier Sierra-wide findings and document water as the most economically important output from the Feather River watershed, yet the environmental health of the watershed continues to degrade. There is a clear need for integrated national and state policies that ensure a fair share of the profit from water and hydropower sales returns to the watershed for watershed maintenance and rehabilitation.

Local, Regional, and National Reinvestment Strategies

Reinvestment in community-based watershed management requires strategies that are inherently multi-scale and multi-issue. Watershed management can link local on-the-ground stewardship efforts with regional and national markets and governance structures. Through investment mechanisms for

watershed management, water and forest conservation at the community scale can be integrated coherently within larger economic and environmental analyses and processes. Integration occurs under an overarching theme: All users of natural resources have the opportunity and responsibility to maintain natural, social, and economic assets for future generations, at the ecosystem-, community-, and personal scale. Wherever people live, work and play, watershed management means stewarding natural resources in ways that sustain and enhance them during and after each generation and evolution of uses. In remote rural areas, watershed management approaches will differ from those used in urban or suburban areas. Wealthy areas are likely to use different approaches than high-poverty areas. Ecosystem processes are even different between ecological regions; within a highly altered and urbanized eco-region, for example, the response is different from that in a pristine area.

The FR-CRM is networking to explore multi-scale, multi-issue approaches to investing in watershed management through the California Urban Forest Advisory Council, the California Brownfields Communities working group, the Cal-Fed long-term water solution process, and the Communities Committee of the Seventh American Forest Congress, a national network of organizations focused on the interdependence of forests and communities. The FR-CRM has recently worked with two regional networks, the Sierra Nevada Alliance and the Regional Council of Rural Counties, to develop the following community involvement principles which are relevant to rural and urban settings, and local, regional, and national processes (Box 1).

In 1995, the FR-CRM began to identify the most effective short- and long-term reinvestment activities for maintaining the health of the Feather

BOX 1. Principles of Watershed Community Involvement

- Watershed strategic, annual, and project planning must be open, public, and involve communities in the watershed.
- Community involvement must include a comprehensive and inclusive public education component.
- Watershed restoration and stewardship should reflect a strong component of sustainable local economies and/or revitalization of local communities implementing projects.
- Advisory and/or oversight committees must include members residing in the watershed.
- Watershed groups administering restoration projects must deposit restoration funds in institutions that actively invest in local communities and economic revitalization within the Council's jurisdiction.
- Watershed groups must adopt restoration strategies and plans of action that enhance and create local job and contracting opportunities.
- Watershed policy, restoration and stewardship plans and projects must be consistent with established principles and standards.

River watershed, and to allocate parts of a hypothetical 1995 reinvestment dollar to essential program components. Figure 1 reflects the group's years of experience with implementing site-specific watershed rehabilitation projects, sub-basin and basin-wide water-quality studies and resource-condition assessments, various multiparty investment and financing packages, and 1996-specific reinvestment priorities. It indicates the watershed management activities that need to be funded under a reinvestment program include: watershed rehabilitation projects, planning, economic incentives, critical habitat protection and enhancement, stewardship education, project effectiveness monitoring and watershed trend monitoring, resource condition assessments, job training and development, and testing and evaluation of best management practices (BMPs), with some money set aside for unallocated expenses, such as contingencies or emergencies. The percentages would change over the years but the categories would likely remain the same. The breadth of the activities and relative investment in each recognize that reinvestment efforts must integrate environmental and economic concerns by developing comprehensive assessment information at the outset of projects and comprehensive monitoring information at the conclusion.

Beyond identifying its local reinvestment priorities, the FR-CRM has also developed white papers for community forestry and watershed groups as a means of moving reinvestment strategies forward on a broader, regional basis. Its most in-depth work was sponsored by the Collaborative Learning Circle (CLC), a regional consortium of community forestry and watershed groups in the Pacific Northwest. Table 1, adapted from the 1995 CLC effort,

FIGURE 1. Feather River CRM

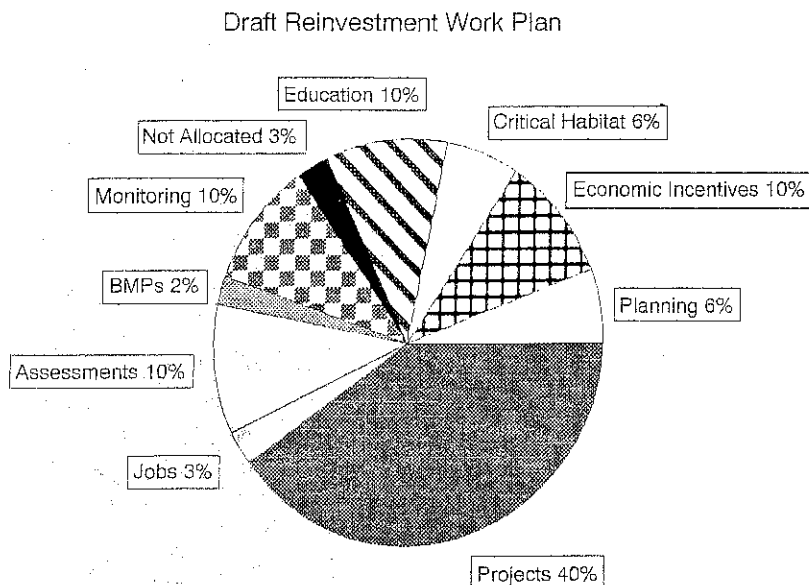


TABLE 1. Reinvestment Objectives and Activities

| Reinvestment Objectives | Reinvestment Activities |
|---|--|
| Safeguarding Sustainability | <p>All-party monitoring (ongoing at all scales) and certification.</p> <p>Developing and integrating measures and monitoring protocols for social, natural and economic capital and condition trends.</p> <p>Endowments for land trusts, acquisition of conservation easements, biotic reserves, species migration corridors, habitat conservation areas, cultural and historical heritage areas, and ecosystem-process study areas.</p> <p>Community "sense of place" heritage conservation areas and downtown revitalization and redevelopment including oral histories and photo archives of historical landscapes.</p> |
| Full Life Cycle Cost Pricing and Full Mitigation of Current Negative Effects | <p>Third-party monitoring of mitigation measures and performance standards.</p> <p>Project impact monitoring at appropriate spatial and temporal scales incorporated into performance bonds.</p> <p>Pollution trading.</p> <p>Debt for nature swaps and revenue bonds.</p> <p>Mitigation banks, habitat conservation banks, forest banks, and water conservation banks.</p> <p>Development transfers.</p> |
| Watershed Maintenance | <p>Watershed analysis: resource condition and trend assessments including resource management history and natural history including historic natural events and tenure or ownership history.</p> <p>Ensuring public access to public land management records and decision-making.</p> <p>Road and trail maintenance, rehabilitation, relocation, and closure.</p> <p>Ditch, dam, diversion, and culvert maintenance, including fish screens, fish and wildlife escapement and passage.</p> <p>Erosion control, waste management, forest fuels reduction, forest density management, restoring hydrologic function to meadows, wetlands, and floodplains.</p> <p>Toxics control, pollution cleanup and abatement.</p> <p>Flood, fire, and storm proofing, livestock management, public access management, poaching and trespass enforcement, and permit and contract enforcement.</p> |

| Reinvestment Objectives | Reinvestment Activities |
|---|---|
| | <p>Critical habitat protection, native species reintroduction, exotic species eradication, restoring habitat connectivity and refugia.</p> <p>Signage and public education.</p> <p>Coordinated implementation plans for interface areas in mixed public and private land ownerships and for interface areas between urban and rural land uses.</p> <p>Resources management and monitoring plans with performance criteria that are responsive to variable and declining budget scenarios.</p> |
| Incorporating Opportunity Costs of Land Conversion to Urban Uses into Land-Use Decision making | <p>Full life-cycle land conversion opportunity costs compared to alternative recreational, forestry, agricultural, and public-trust uses and benefits.</p> <p>Full life-cycle governmental cost- and revenue-streams including flood, fire, and pollution-hazard mitigation, as well as police and fire; public safety; hospitals, schools, and other social services; and public roads, bridges, and buildings.</p> |
| Ensuring Public Benefits on Private Lands | <p>Incorporating public benefits of land and resource stewardship into private landowner incentives, e.g., incentives for carbon sequestration, water banking, habitat conservation, cultural and historic heritage conservation, aesthetics, sense of place, open-space.</p> |
| Consumer Education and Preferences | <p>Certification of products, management plans, managers, and workers for ecosystem sustainability.</p> <p>Pricing systems to include life-cycle of waste management.</p> <p>Life-cycle maintenance of the source ecosystem is incorporated into pricing for users of ecosystem products and services.</p> <p>Pricing systems to include environmental justice impact remediation.</p> |

(Adapted from Collaborative Learning Circle, 1995).

presents a set of reinvestment objectives that might be identified in a particular region—safeguarding sustainability, mitigating current negative effects, maintaining watersheds, and consumer education, for instance—and activities that could help achieve them. County supervisors in the Northern Sierras are considering which of these and other reinvestment strategies might be useful in their region. Local officials and community-based groups generally oppose “one size fits all” policies, financial strategies, and regulatory approaches; these have often been developed without their participation and are not responsive to local contexts. Their opposition has often been misinterpreted as purely antiregulatory sentiment. What many communities are seek-

ing, however, are flexible, broad-based reinvestment strategies, like the set of tools in Table 1, that can be used to finance specific reinvestment activities that fit unique local circumstances.

Lessons from the Feather River Watershed

The FR-CRM has 15 years of experience identifying and testing strategies for reinvestment in watershed restoration and maintenance. Its efforts have met with mixed success, but the lessons learned are instructive for policy development and important for encouraging other communities suffering from acute disinvestment. Although some circumstances are specific to the Feather River watershed, the FR-CRM's approaches to identifying and addressing reinvestment barriers are widely applicable to other areas.

While the FR-CRM has functioned as a collaborative group of organizations and interests focused on the local watershed, it has also recognized the need to form alliances with other community groups and organizations to address broader policy and market-based issues. The capacity of community-based groups to network and collaborate beyond their local boundaries is critical for addressing reinvestment issues that concern distant resource beneficiaries. One of the important dimensions of this networking involves efforts by rural communities, located in the ecosystem providing ecological services, to communicate and cooperate with urban communities that use and depend upon these services.

FR-CRM members have often discussed opportunities for water and hydropower suppliers to reinvest in maintaining the health of the Feather River watershed. Some related issues can be resolved at the community and county levels, but others require state and national involvement. It is clear that negotiations with powerful state and national interests on who reinvests in federal lands cannot be successful without leadership from the federal government. Federal public lands are often the largest holdings in the biggest water-supply and hydropower watersheds in the West. The federal government—executive, congressional, and judiciary branches—has the authority and should exercise its responsibility to encourage and enable water-supply and hydropower purveyors to “do the right thing” by paying their “fair share” for watershed restoration and maintenance. National leadership is especially important for two reasons as deregulation heightens market pressures for electric and water purveyors.

- In the absence of federal policies, individual watersheds are likely to become “stranded assets” as ecosystem restoration and maintenance compete with other investment options in increasingly competitive national markets.
- Specific reinvestment agreements will not be successful if they compromise the financial positions of potential reinvestment partners. Oth-

er competitors in regional or national markets may not have to shoulder a comparable reinvestment responsibility. Effective reinvestment policies, therefore, must recognize the need to "maintain a level playing field" among competing hydro and water supply purveyors. Policies and mechanisms must be neutral at all market scales, from local to national, and must not penalize hydro or water purveyors for acting ethically by paying their fair share for watershed maintenance. Creating a level playing field at the national level is not possible without strong leadership from the federal government.

One economic issue often discussed by the FR-CRM is the difference between the value of the Feather River watershed as an asset and the value of the ecological services it provides. This issue is important because maintaining the ecosystem as an asset is different than optimizing resource use and values. From an economic perspective, the goals for reinvestment need to be clarified and incorporated into financial decisionmaking processes. The asset value is the ecosystem's long-term capacity to provide ecological services, some of which are then used, traded, rented, or sold in ways that are either efficient or inefficient. The value of these ecological services may fluctuate dramatically, such as the price of water during rainy and drought periods. Developing efficient resource use through effective incentive and pricing signals is important for reducing wasteful demands on the ecosystem. However, investing in efficiency alone may be inadequate to ensure long-term ecosystem health—especially in volatile and poorly regulated markets and for seriously degraded ecosystems. Several other economic considerations that the FR-CFM has identified, and that might be important to other community-based watershed efforts, are:

- A reinvestment program must learn how to respond to economic signals such as the aggregate and marginal values of improvements. There is a lot to learn about short-term improvements for specific ecological services as well as how incremental and cumulative improvements affect overall ecosystem health and productivity. These types of issues need to be monitored for adaptive learning.
- Economic evaluations must recognize the time value of water. Hydrologic improvements should be sensitive to the counter-cyclical price patterns for water runoff and storage. A water budget provides an ecological framework for evaluating the time value of water.
- Ecological boundaries and interactions should be recognized when developing economic criteria for reinvestment. Both kinds of analytical systems—the ecological and the economic—should become more integrated through adaptive learning.

- Investment analyses must include risk assessment, and reinvestment strategies must manage for risk. Risks are economic and environmental, short- and long-term, can vary at different scales, and can be reversible or irreversible over time. At this time, risk assessment is poorly developed and needs to evolve in a coordinated way with other reinvestment monitoring elements.

CONCLUSION

Increasingly, urban and rural communities across the U.S. are looking at ecological systems as capital assets with values that are diminishing as they are degraded. Investments are needed so they can continue to provide ecological services critical to the environmental, social, and economic well-being of the communities. "Reinvestment" is a term used to encourage the development of mechanisms for sustained and long-term investment in "natural capital," as well as the other forms of capital on which communities and society depend. Economists are beginning to look at critical questions concerning reinvestment, such as the value of ecological services, the level of investment needed to restore and maintain ecological systems, the activities to which investment dollars should be allocated, and where public and private investment dollars might come from. Many communities believe consistent and adequate levels of investment are needed in restoring and maintaining ecological systems to reverse cumulative environmental decline and quell the growing social and economic demand for ecological services.

Water values in areas such as New York, Seattle, Denver, and the Chesapeake Bay are driving new approaches and mechanisms that allow communities to invest in natural systems to maintain water quality and quantity. In California, ecosystem-scale studies done in the Sierra Nevada and ongoing research and community-based efforts in the Feather River watershed illustrate the importance of reinvestment. The SNEP study estimates that \$1.5 billion in water values are being obtained from the Sierra Nevada ecosystem annually, yet virtually none of that value is returned to the ecosystem to help sustain it. Research in the Feather River watershed indicates similar water values and suggests investments could enhance the system's capacity to provide ecological services.

To be effective, reinvestment must function as a continuous and integrated loop where the economic values of ecological services are recognized and the beneficiaries, both within ecosystem boundaries and beyond, invest a fair share of their economic gains for ecosystem restoration and maintenance. Mechanisms for long-term financial exchange between ecosystem beneficiaries and managers must be developed and remain consistent, yet be adaptable over time. That's because the mix of profitable uses and products, and the

investors and landscape managers, will invariably change over time. The investment horizon is long because processes that degrade, restore, and maintain ecosystems are long—often more than a hundred years in the Sierra Nevada. Reinvestment mechanisms must be perceived as efficient, flexible, and equitable over that long-term investment horizon. Reinvestment dollars will need to be applied to many different kinds of ecosystem stewardship activities at different spatial scales and at different times. These various, sequenced, and cumulative stewardship actions must be planned and implemented openly, and they must be perceived as lawful, necessary, and effective at restoring and maintaining ecosystem capacity. All-party monitoring and adaptive learning must be ongoing to ensure the effectiveness of stewardship actions, to maintain commitments for “fair share” reinvestment by ecosystem beneficiaries, and to build shared knowledge among the ever-changing reinvestment program participants.

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