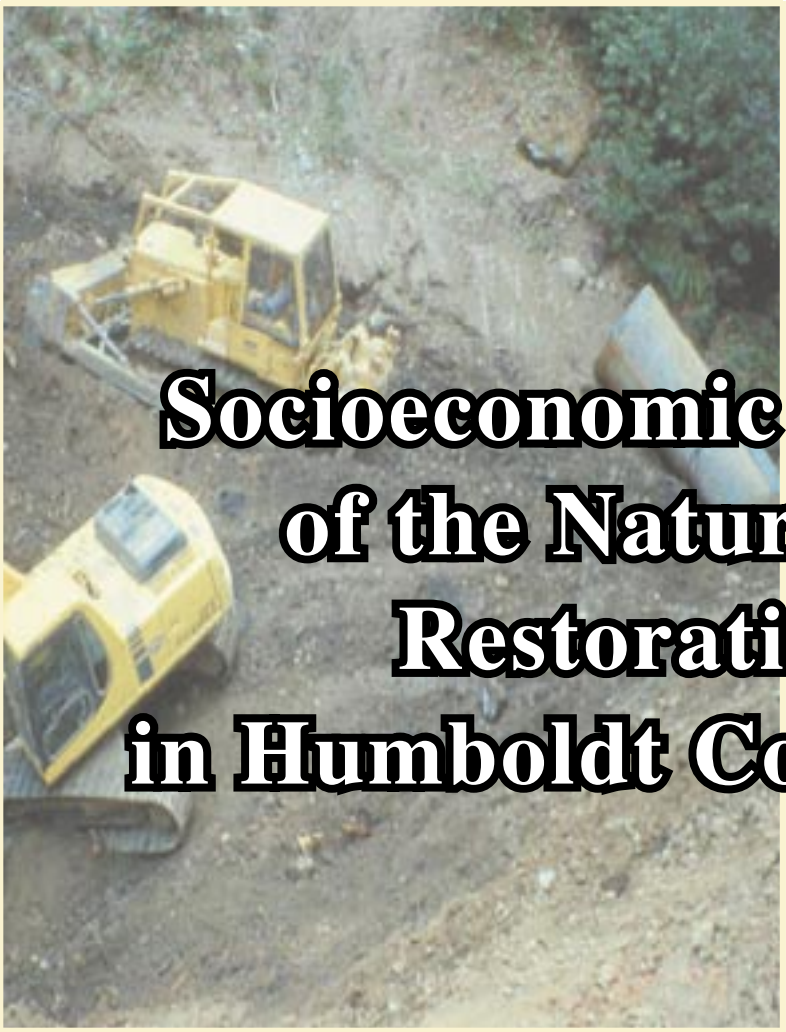

Socioeconomic Characteristics of the Natural Resources Restoration System in Humboldt County, California

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Executive Summary

This study describes the restoration sector in Humboldt County, California and its contribution to the North Coast regional economy. It shows that Humboldt County is at the leading edge of restoration practices and serves as a model for how restoration work can be accomplished. Already, the standardized and codified restoration methodologies that have been developed out of the rich experience with restoration over the last three decades have been used to guide restoration work in other parts of the state and country.

Building on prior attempts to understand the socioeconomic character of the restoration sector, this report describes the size of Humboldt County's restoration sector, in terms of total annual investments in restoration and numbers of restoration-related jobs, and it portrays the institutional infrastructure that has developed to accomplish restoration goals and objectives.

For the purposes of this study, restoration includes 1) upslope watershed restoration activities such as road decommissioning and upgrades/storm proofing, removal/stabilization of landings, landslide stabilization, and other upslope erosion control projects, 2) riparian and instream fisheries habitat improvement projects, 3) invasive exotic species control and removal activities, and revegetation efforts in forest, meadow, dune and estuary ecosystems, 4) restoration of hydrologic flow regimes in stream and estuary ecosystems, and 5) fuels reduction efforts. It also includes the watershed assessments, planning processes, inventories, and monitoring efforts that precede and accompany these efforts. And it includes activities such as training workshops, organizational and business management workshops, and educational outreach and school programs whose goal is to enhance restoration capacity and support.

While the definition of restoration this study employs may appear to be expansive, it becomes less so when we consider what this definition excludes. This study does not consider restoration activities that are embedded within more traditional resource management and extraction regimes, such as road upgrades, stormproofing, and decommissioning associated with the operation of timber harvest plans on industrial timberland ownerships. Nor does it consider activities such as dairy waste management improvements and scientific studies of watershed and ecological processes that are not directly related to restoration project implementation. Inclusion of these activities and investments, while certainly restoration related, would have diluted this study's narrow focus on natural resources restoration as an independent and autonomous field of economic, social, and institutional activity.

Natural resources restoration in Humboldt County is a tightly coordinated, internally coherent, well organized, and complex network of relationships that bind together extremely diverse groups and organizations around the common goal of reinvesting in ecosystem health. This "system" of relationships is comprised of 1) diverse entities linked together within a restoration network, united in their shared commitment to the goals of restoration, 2) explicit and formalized linkages between science and restoration practice and a commitment to an adaptive management learning process, 3) the development and codification of standardized restoration methodologies and the export of specialized restoration knowledge and expertise, and 4) a complex institutional infrastructure (including both "node" organizations as well as higher level "network organizations") that facilitates collective learning and constitutes an effective vehicle for advancing restoration efforts.

The entities within the restoration system include federal, state, and local government agencies, tribes, public and private landowners and managers, restoration nonprofits and watershed groups, private contractors and workers, consulting firms, businesses, and applied research scientists. A complex web of relationships has evolved that links these entities together in a coherent fashion to enable restoration work to take place.

The restoration system in Humboldt County contributes significantly to the local economy. Between 1995 and 2002 it generated more than $65 million for restoration work in Humboldt County. Almost all of this amount came into the county in the form of restoration contracts and grants from state and federal agencies; very little of this amount was used to support the many state and federal government agency restoration jobs and related expenses. In the last three years alone, more than $38 million came into the county for restoration project implementation or for activities directly related to project implementation. In 2002, approximately $14.5 million was generated; this is about twice the value of the commercial fishery landings in Humboldt County and it is greater than the value of some of the county's agricultural products. While restoration work is related to these other resource-based sectors in a synergistic manner, it clearly is an economic engine in its own right.

The restoration system in Humboldt County generates significant local employment. We estimate that natural resources restoration work in Humboldt County in 2002 generated approximately 300 jobs (equivalent to 210 FTE's) in the private and public sectors and within tribal government. Approximately 240 of these jobs are in the private sector (70 are in consulting firms and businesses, 105 in contracting businesses, and 65 within area nonprofits), 45 are in the public sector, and approximately 15 are with area tribes (primarily within the Hupa, Yurok, Karuk, and Wiyot tribal governments).

The restoration system's contributions to the North Coast economy rival or exceed those of other industries. However, important characteristics of the restoration system sharply distinguish it from most industries and illustrate the unique ways in which restoration integrates ecosystem reinvestment, knowledge generation, place-based commitment to environmental stewardship, and community development. In significant ways the restoration sector is rooted within an environmental stewardship ethic that prioritizes ecological health over revenue generation. This stewardship ethic is linked with a strong place-based identity joined with a commitment to restoring key ecosystem elements, whether they be salmon and steelhead runs or thriving native plant and forest communities. In recognition of the interdependence between sustainable livelihoods and ecosystems, a key guiding element within the Humboldt restoration sector has been the search for how to provide quality jobs within restoration while simultaneously (re)investing in ecosystem health and productivity.

Despite the impressive accomplishments and contributions of the restoration system, a variety of barriers and challenges hinder its function and growth. Recommendations that will help address these barriers and challenges include:

- Provide loans and other financial "bridgers" to help restoration nonprofits and contractors avoid the cash flow challenges that they regularly face and that limit their ability to do restoration work.
- Improve coordination among agencies that provide restoration grants in order to improve the complementarity of different grant programs, for example, in terms of grant purposes, terms, conditions, lifespans, and other restrictions.
- Permitting agencies need to continue to ensure compliance with permit and consultation requirements but work in earnest to identify ways to reduce the costly and time-consuming efforts necessary to prove compliance.
- Expand the emphasis on policies and programs that support the provision of quality jobs in restoration.
- Develop more stable funding mechanisms to finance restoration work.
- Continue to develop and improve the funding and policy mechanisms necessary for integrating acquisition, restoration, and management activities on public lands, and restoration and management activities on private lands.
- Remove the inequities between restoration and timber harvesting in the application of regulatory authority governing the heavy equipment work season.

Given the extent of the need, natural resources restoration work in Humboldt County only promises to grow. For example, it is estimated that $150 million of restoration funding are needed to address water quality and salmonid habitat issues related just to the county roads in the five county north state region. Apart from the ever-increasing integration of restoration activities into traditional resource management sectors, simply accomplishing the restoration work related to addressing the challenges of these and other legacy issues suggests the need for the continued growth of the restoration system.

Acknowledgements

This effort would not have been possible without the generous financial assistance provided by the Ford Foundation, the William and Flora Hewlett Foundation, and the Pacific West Community Forestry Center. I would like to express my gratitude and appreciation to those individuals who were directly involved in the research on which this report is based. Don Son, Megan Taylor, Jayme Seehafer, and Donnie Bidlack participated in the data collection process as interns through Professor Steve Hackett's Economics of a Sustainable Society course at Humboldt State University in the Spring semester, 2003. Don and Megan continued to work on this project throughout the summer and autumn months. Andrea Davis of the North Coast Restoration Jobs Initiative of the Alliance for Sustainable Jobs and the Environment explored the extent of local support for and interest in this kind of study through an initial series of conversations with members of the North Coast restoration community. Subsequently, Ms. Davis took the lead on making the numerous phone calls to all restoration-oriented businesses in the region to gather the raw data necessary to determine the current employment levels with the restoration sector. Conversations with members of the steering committee of the Restoration Jobs Initiative during spring 2002 helped to define the scope and scale of this project in its early stages.

Most importantly, I would like to extend my utmost gratitude to the many members of the North Coast restoration community without whose willing participation this study would have been impossible. Even during the height of the busy field season, restoration nonprofit staff, private contractors, and other restoration professionals were, without exception, willing to set aside time to discuss their perceptions and insights about the restoration sector. Whether in offices, at a restaurant or coffee shop, around the campfire, or bouncing along dirt roads to a remote job site, we almost always managed to find a time and place to meet to talk restoration. Their willingness to meet and talk frankly about the structure and challenges of restoration reflects the passion and dedication that members of the restoration community bring to their work.

State, federal, and local agency staff were also invariably supportive of this project and contributed towards it in many ways. Federal, state, and local government personnel willingly provided us with comprehensive information on restoration-related projects and expenditures in Humboldt County. Along with the data received from other sources, their cooperation enabled us to develop a conservative and credible estimate of the total annual flow of funding for restoration in Humboldt County from 1995 through 2002. Many of these individuals also generously consented to meet to discuss in more detail the organization, structure, and operation of the restoration system, with a particular focus on the role(s) they play in restoration. Please refer to Appendix II for a full listing of those individuals who generously contributed their time and expertise towards this project. I would like to thank the following individuals for providing constructive and extensive comments on a draft version of this report: Chris Beresford, Greg Blomstrom, Don Beers, Yvonne Everett, Paula Golightly, Sungnome Madrone, Andrea Pickart, Terry Spreiter, Carol Vander Meer, Jude Waite, and Paula Yoon. Lastly, at Forest Community Research I would like to thank Jonathan Kusel for his support of this project and Joyce Cunningham for her design and layout efforts.

Table of Contents

Figures

Introduction

It is common knowledge to many people on the North Coast that natural resources restoration generates significant amounts of investment and employment. Others would be surprised to know how rich is the local history of restoration and how quickly it has grown to become a multi-million dollar endeavor in Humboldt County. In many respects, the region is at the nation's forefront in terms of the amount of restoration work that has been completed to date and the wealth of experience that has been generated. Despite the impressive track record and extensive local knowledge associated with restoration, we lack a comprehensive understanding of the size and scope of the restoration sector, its institutional and bureaucratic infrastructure, and the numbers and kinds of workers involved in restoration. The lack of information regarding these parameters hampers efforts to advance restoration as a viable economic sector, limits our understanding of the current economic and community benefits of restoration, dilutes our appreciation of the scientific and methodological accomplishments in restoration, and tends to render invisible the complex institutional infrastructure that has evolved within the restoration system.

This report seeks to shed some light on these aspects of the restoration system through a comprehensive and empirical analysis of the current structure and size of the natural resources restoration sector in Humboldt County.[1] Previous efforts have been made to help communicate information concerning the size of the restoration sector. These include a Collaborative Learning Circle-funded study of Humboldt County's environmental restoration industry by the Redwood Community Action Agency (2002) as well as a report by the North Coast Restoration Jobs Initiative on heavy equipment work in restoration in Humboldt County (2003). This study builds on and expands these prior attempts to understand the socioeconomic character of the restoration sector in Humboldt County. Its purpose is simple: to describe the size of Humboldt County's restoration sector, in terms of total annual investments in restoration and numbers of restoration-related jobs, and to portray the institutional infrastructure that has developed to accomplish restoration goals and objectives.

This project evolved from discussions, in various community-based forums such as working sessions of the Collaborative Learning Circle and with members of the North Coast Restoration Jobs Initiative, about the potential usefulness of conducting a comprehensive socioeconomic assessment of natural resources restoration. The groundwork for these recent discussions had been laid much earlier by the sustained efforts of restoration practitioners, beginning in the early 1990s, to convey to diverse audiences and groups an understanding of the economic contributions and significance of the restoration industry on the North Coast.[2] The absence of credible estimates of those contributions, however, hampered their efforts. In spring 2002, with support from the Pacific West Community Forestry

[1] Some of the limitations of this study should be noted from the outset. First, as with any bean counting exercise, some beans invariably get away. Thus, it is inevitable that some of the funds spent on some of the restoration projects in Humboldt County will not be included in our estimate of overall restoration investments. We have made every effort to uncover as many stones as we could to accurately estimate both restoration investments and employment levels in restoration. Within the parameters of restoration used in this study, our estimates are accurate to within five percent; they most likely underestimate restoration investments. With respect to restoration funding, this report does not delve into the specific histories of the different ballot propositions that have been (and still are) used to fund restoration, nor does it attempt to assess the probability of future propositions and legislation that could provide continued support for restoration. While this report discusses issues such as permitting and contracting, it does not provide a detailed analysis of these issues. Our descriptions of the socioeconomic characteristics of restoration in Humboldt County are necessarily partial. In this document, we have not attempted to write a comprehensive analysis of the evolution and current structure of the complex and highly diverse restoration sector. Our view of restoration is conditioned by a variety of factors, including the time and resource constraints on this study and the particular array of individuals and organizations with whom we were able to interact as part of this study (see appendix 1 for a list). Our descriptions of particular organizations and restoration programs are intended to illustrate specific points or themes, they are not intended to constitute a comprehensive overview of all the organizations and programs that work on natural resources restoration in the county.

[2] Many of the individuals involved in those early efforts are still actively involved in the restoration community. They include Ruth Blyther, Ruthanne Cecil, Sungnome Madrone, Nancy Reichard, John Schwabe, and Randy Stemler.

Center, an initial proposal to conduct an assessment in Humboldt and Trinity County was developed. During the summer and autumn, more discussions were held with members of the restoration community about the assessment, the proposal was further refined, and the search for funding began.[3] In January 2003, Forest Community Research received partial funding from the Ford Foundation for the project. Work on the Humboldt County portion of the project commenced soon thereafter. The Trinity County portion of the project was subsequently partially funded by the Watershed Training and Research Center in Hayfork (with support from the U.S. Forest Service Pacific Southwest Research Station). This report concerns only the Humboldt County portion of the original proposal; research on the Trinity County component is still under way.

This report does not attempt to estimate what would be the value of restored watersheds, fisheries, estuaries and coastal environments on the North Coast. Rather, we focus on the current value of restoration assessed through the contributions that current restoration efforts are making to the regional economy, both in terms of dollars brought into the county for restoration and the jobs those dollars support. Clearly, restoration has significant value both in terms of end product – restored and resilient ecosystems – and as process, in terms of the contributions to the regional economy, community building, institutional development and learning that accrue through the process of restoration itself. The focus on the process benefits of restoration draws attention to the complex and dynamic institutional infrastructure that has evolved to accomplish restoration goals and objectives. For restoration doesn't "just happen," rather it takes place only because of the concerted activities of a large number of diversely positioned individuals and organizations that are committed to the values of ecosystem restoration and local community well-being. Consequently, an important aspect of this report is to convey a sense of how restoration "works" in Humboldt County. This provides the basis for arguing that a restoration "system" has evolved from the ground up to achieve restoration goals and objectives, and that sustaining this system is central to enabling restoration efforts to continue.

What activities are considered "natural resources restoration" in this study?

Restoration is an inherently nebulous and somewhat contested term. Keeping in mind that there exist lively debates and significant disagreement within the scientific community regarding the definition, goals, and purpose of restoration, we might nevertheless fruitfully consider William Jordan III's definition of restoration as "the deliberate and active recreation or restoration of historic landscapes or ecosystems defined in terms of the science of ecology" (2000:23). This definition is analogous to the one Eric Higgs proposes, which incorporates the concepts of historical fidelity and ecological integrity (2003:95).[4] These authors also note that in addition to restoration's environmental and ecological value, it also has "…educational, psychological, and social value" (Jordan 2003: 197). Indeed, Jordan suggests that "restoration is…a valuable context in which to create community or to negotiate the relationship between the human community and the larger biotic community" (2000:27). And in the conclusion to his recent book, *Sunflower Forest*, Jordan argues that restoration provides a crucial avenue for transcending the ultimately destructive binary opposition between nature and culture by providing "a way of linking the interests of the natural landscape with the interests and ambitions of human beings who are…responsible for its beauty and well-being" (2003:203). Members of the North Coast restoration community are keenly aware of the ecological and social value of restoration.

These definitions of restoration, while an essential part of understanding the restoration system, still leave unanswered the question of what specific sorts of activities are considered restoration activities in this study. Because one of the purposes of this inquiry

[3] Andrea Davis of the North Coast Restoration Jobs Initiative took the lead on most of this outreach.

[4] For a good summary discussion of some of the ecological issues and debates concerning the definition and purpose of restoration see "Ecological Restoration", Chapter 14 in Meffe, Gary and Ronald Carroll, *Principles of Conservation Biology*.

is to examine the extent to which a cohesive "restoration sector" actually exists independently of the more traditional resource management sectors, e.g. forestry or fisheries management, agriculture, ranching, or dairying, the analysis focused primarily on restoration as an independent field of activity. This analytical perspective provided a lens through which to concentrate attention on the unique set of activities, people, and organizations that are focused primarily or to a large extent on natural resources restoration work, as distinct from resource management or extraction. There are several ways to characterize this work. Some focus on location of the work (upslope, in-stream or near stream), others on how the work gets done (heavy equipment intensive or labor intensive), and others, such as the 23-fold classification system used by the California Department of Fish and Game's fisheries restoration grant program, describe a broad range of restoration activities ranging from assessment and planning, project implementation, monitoring, and other efforts such as public school educational programs and watershed organization assistance.

Restoration activities included in this study fall under the general rubric of fisheries, watershed, and ecosystem (e.g. coastal dune, estuary, meadow, forest) restoration projects. Restoration activities include the assessments and planning that precede implementation and the monitoring that follows it, occurring anywhere from the dune and estuarine ecosystems up through the riparian corridors to the roaded and forested ranges and on up to the ridgetops of the watersheds of Humboldt County. Also included in the category of "restoration" are investments and activities such as support for watershed organizations including capacity building work and school educational programs related to restoration (especially anadromous fisheries restoration) that relate directly to the organizational infrastructure of restoration and its community-based aspects. Restoration activities include 1) upslope watershed restoration projects such as road decommissioning and upgrades/storm proofing, removal/stabilization of landings, landslide stabilization, and other upslope erosion control projects, 2) riparian and instream fisheries habitat improvement projects, 3) invasive exotic species control and removal activities, and revegetation efforts in forest, meadow, dune and estuary ecosystems, 4) restoration of hydrologic flow regimes in stream and estuary ecosystems, and 5) fuels reduction efforts. These include both labor and heavy equipment intensive forms of work as well as the more technical engineering and scientific studies necessary for project planning, prioritization, and monitoring.

This definition of restoration captures the great majority of work being done in Humboldt County whose primary focus is to improve ecosystem condition and health. While the definition of restoration this study employs may appear to be expansive, it becomes less so when we consider what this definition excludes. For the purposes of this study, we are not considering restoration activities that are embedded within more traditional resource management and extraction regimes. Thus we are not including, for example, 1) the relatively recent work concerning the creation of dairy waste management systems designed to improve water quality in the lower Eel River watershed, 2) mitigation required for the approval of Timber Harvest Plans on industrial forestland ownerships, e.g. road system work such as stormproofing, crossing removal, and bridge installation done in conjunction with timber harvesting, 3) forest harvesting techniques and silvicultural practices that come under the rubric of "restoration forestry," and 4) municipal water supply and storm water drainage system infrastructure development and upgrades. Also excluded are the 20 years of studies and related efforts to understand and build the knowledge base necessary to restore the Trinity River and Klamath Rivers. Similarly, the $35 million to $40 million science and research driven "environmental restoration, assessment, and protection" industry, part of the "Education and Research Industry" cluster of the Humboldt County's Prosperity economic development strategy, is only included to the extent that it contributes directly to restoration implementation work in Humboldt County.[5] These various activities, many of which have immediate positive environmental effects, e.g., reduced rates of sediment delivery to fish-bearing streams, improved

[5] See www.northcoast prosperity.com for a copy of the recent Institute of the North Coast (a Humboldt Area Foundation Program) report on the "Environmental Restoration, Assessment, and Protection Industry," - part of the Education and Research Industry cluster.

water quality, and enhanced forest ecosystem health are excluded from this assessment because 1) for some, e.g. restoration forestry, it is nearly impossible to separate out the restoration component from the non-restoration component, or 2) some of these activities may be carried out to mitigate for the negative effects of other concurrent management actions and hence do not constitute a reinvestment designed to improve ecological conditions, or 3) some research efforts, such as the years of studies that culminated in the Trinity River Flow Evaluation Study, call for physical manipulations (e.g., gravel introduction and bank rehabilitation) and flow regimes to restore the Trinity River that are just beginning to be implemented, or that are on hold pending availability of water flows as required in the December 2000 U.S. Department of Interior Record of Decision. The focus here is on recent and current restoration work in Humboldt County and the system that has evolved to implement and accomplish restoration goals on the North Coast.[6]

Natural Resources Restoration: a Sector, Industry, or System?

As this report demonstrates, even within these relatively narrow sideboards, there exists a vigorous and growing natural resources restoration sector in Humboldt County. This sector is not a random assemblage of parts engaged in different aspects of restoration in an uncoordinated fashion. Rather, since the late 1970s, and especially during the last 10 years, an internally coherent restoration system has evolved in Humboldt County. This system incorporates the characteristics of an industry, but also embodies many attributes that extend beyond the definition of an industry. Webster's Dictionary defines industry as "the aggregate of manufacturing or technically productive enterprises in a particular field" and it defines system as "an assemblage or combination of things or parts forming a complex or unitary whole" and "a coordinated body of methods or a complex scheme or plan of procedure." For some purposes, the county's restoration sector certainly could be considered an industry, especially when the aggregate of the diverse "technically productive enterprises" that comprise this sector is considered, along with the millions of dollars it brings annually into the county and the approximately 300 jobs local restoration work generates.

However, while the restoration sector meets the definitional criteria associated with an "industry," several important characteristics of the restoration system in Humboldt County sharply distinguish it from most forms of industry and illustrate the unique ways in which restoration integrates ecosystem reinvestment, knowledge generation, place-based commitment to environmental stewardship, and community development. In significant ways restoration is rooted within an environmental stewardship ethic that prioritizes ecological health over revenue generation. For many within the restoration sector, this stewardship ethic is linked with a strong place-based identity joined with a commitment to restoring key ecosystem elements, whether they be salmon and steelhead runs or thriving native plant and forest communities. Furthermore, in recognition of the interdependence between sustainable livelihoods and ecosystems, a key guiding element within the restoration sector has been the search for ways to provide quality jobs within restoration while simultaneously reinvesting in ecosystem health and productivity. Thus, in powerful ways the natural resources restoration sector belies the increasingly discredited "jobs verses the environment" rhetoric. Instead, it demonstrates the extent to which socioeconomic well-being is not only consistent with enhanced ecological conditions, but also that the process of restoring ecological processes and functions itself contributes towards socioeconomic well-being.

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[6] Defining the scope of restoration activities examined in this study in this manner 1) tends to underestimate the amount of work, investment, and expertise going into practices that have outcomes consistent with restoration, and 2) draws attention away from relatively recent changes in traditional resource management, such as forestry and dairy management, that have the effect of integrating restoration goals and objectives into management planning and practice. These changes are encouraging. Their institutionalization will help improve the sustainability of present and future resource management and extraction activities, thereby minimizing the likelihood of creating future restoration challenges.

Furthermore, as this report demonstrates, the restoration sector in Humboldt County exhibits characteristics that conform closely to Webster's definition of a system. Restoration in Humboldt County is a tightly coordinated, internally coherent, well organized, and complex network of relationships that bind together extremely diverse groups and organizations around the common goal of reinvesting in ecosystem health. This "system" of relationships is comprised of 1) diverse entities linked together within a restoration network, united in their shared commitment to the goals of restoration, 2) explicit and formalized linkages between science and restoration practice and a commitment to an adaptive management learning process, 3) the development and codification of standardized restoration methodologies and the export of specialized restoration knowledge and expertise, and 4) a complex institutional infrastructure (including both "node" organizations, as well as higher level "network organizations") that facilitates collective learning and constitutes an effective vehicle for advancing restoration efforts.

The entities within the restoration system include federal, state, and local government agencies, tribes, public and private land owners and managers, restoration nonprofits and watershed groups, private contractors, consulting firms, businesses, and applied research scientists. A complex web of relationships has evolved that links these entities together in a coherent fashion to enable restoration work to take place. Standardized restoration methodologies have been developed out of the rich experience with restoration over the last three decades. These methodologies, although periodically refined through adaptive management, have been codified in manuals and have begun to be used to guide restoration work elsewhere. The continuing evolution of restoration knowledge reflects the productive engagement between scientific inquiry and restoration practice that characterizes the restoration system. The restoration system includes institutional infrastructure for transferring lessons learned from one part of the network to others, and even to other regions. Indeed, in recent years the knowledge generated through the rich restoration experience in Humboldt County has begun to be exported to other parts of the state and country. Consulting professional resource managers and scientists, based in Humboldt County, apply their restoration expertise (derived from local experience) to analogous situations in other regions, states, and countries; the manuals, conference presentations, and published papers and reports developed out of restoration work on the North Coast are guiding restoration efforts elsewhere. Some restoration nonprofits are directly engaged in the horizontal transfer of restoration knowledge. For example, the Ford Foundation recently supported the Redwood Community Action Agency to reflect on restoration lessons learned over the past 25 years and to prepare materials geared to their horizontal transfer to other community-based restoration agencies and nonprofit organizations. Within Humboldt County, the adaptive management philosophy of iterative learning continues to guide restoration practice. Ongoing training workshops and other forums provide opportunity to disseminate information and mobilize resources concerning a wide range of topics, from recent insights concerning specific restoration approaches, to strategies for meeting the challenges associated with permitting requirements, to state and national efforts to garner political and policy support for restoration work. Taken collectively, these elements illustrate the important ways in which the restoration sector comprises more than an "industry" and why it justifies the appellation "system."

Evolution of Restoration in Humboldt County – An Overview

This study did not include a comprehensive analysis of the historical evolution of restoration in Humboldt County. Few detailed studies of this topic, which is closely related to the social history of the area, have been done for the North Coast region.[7] This study also does not provide comprehensive information on the evolution and

[7] But see *Totem Salmon* (House 1999) for a wonderful account of the evolution of community-based restoration efforts and more within the Mattole River Watershed in southern Humboldt County.

accomplishments of the various nonprofit and other organizations that are involved in restoration on the North Coast.[8] Where specific organizations or programs are mentioned, the purpose in doing so is illustrative only. However, it is useful to discuss a few key points about the history of restoration as they help inform our understanding of the current restoration sector. These points concern the various social and tribal roots of restoration and the nature of the engagement of federal, state, and local governments in restoration.

Diverse Sociocultural and Tribal Roots

The first point concerns the diverse roots of restoration in Humboldt County. As the fieldwork for this assessment progressed, the diverse origins of the different groups of people involved in restoration became increasingly apparent. Despite the very different backgrounds of these groups, they all share a strong, and in many cases passionate, commitment, often rooted in a well developed sense of place, to help restore the natural environment and in particular, to bring back the salmon and steelhead runs. Furthermore, it is important to note that while the roots of restoration are diverse, many key individuals involved in restoration transcend the group boundaries that, for heuristic purposes, are sketched below.

First generation residents of the area comprise an important group of people who early on were involved in restoration. These are the people who moved here mostly during the 1960s and 70s, motivated by the ideals and ideas of the environmental movement, bioregionalism, and back-to-the-land self-sufficiency. Combining the skills and knowledge of higher education with a strong work ethic, some of these men and women started the early forest cooperatives that did a large part of the tree planting and other labor-intensive work related to forest and watershed restoration work in the 1970s and early 80s. These individuals were also some of the earliest advocates of restoration as well innovators in the development of the methods and practices associated with it. Many of these individuals remain involved in the restoration sector as leaders (locally and at state and national levels), contractors, policy analysts and planners, practitioners, and watershed association organizers.

Ex-commercial fishers and individuals who come from a commercial fishing background comprise a second key group. In the early 1980s, some of the men and women who were unable to continue fishing due to declining catches resulting from catch size limits and reduced fish abundance turned to restoration. Gradually, their efforts to restore the anadromous fisheries of the North Coast developed into a professional activity that paid the bills. Today, ex-commercial fishers work in the restoration sector in a variety of roles, including leading some of the area's restoration nonprofits, managing their own restoration businesses, working within agencies such as the California Department of Fish and Game, and doing independent restoration-related consulting.

A third group that became involved in restoration are people whose families have lived in the area for more than one generation, and who are or have been involved in land management and resource extraction, primarily logging and ranching. Over the last 20 years or so, a number of factors including declining employment in forestry, ranching and agriculture, a strong attachment to the area and outdoor lifestyle, and an environmental stewardship ethic have lead people from this background to become involved in restoration in a variety of ways. These include contracting and heavy equipment operation, school and community education and outreach work, involvement in restoration nonprofit organizations, and in some instances, implementing restoration projects on their property.

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[8] Some restoration nonprofits and public resource management agencies have prepared documents detailing the history of their involvement with restoration, lessons learned, etc. Many of these have been published. An example of a historical retrospective and lessons learned analysis is the Redwood Community Action Agency's recent (2002) Ford Foundation-funded report "Lessons Learned from the Natural Resources Services Organizational Model: 20 Years of Community-Based Resource Management."

A fourth group of people involved in restoration consists of professionals – geologists, fisheries biologists, hydrologists, foresters, ecologists, engineers, and others – who apply their skills and expertise to the problems and challenges associated with the planning, implementing, and monitoring of restoration efforts. Scientists and other resource professionals generally work in the private sector, alone or with a small group of other consulting professionals, with state or federal resource management agencies, or from within Humboldt State University. Some work in the nonprofit sector and others are part of large engineering firms. The involvement of this group of people dates as far back as 30 years. These individuals play important roles in activities such as the development, articulation, and application of the scientific and engineering principles that underlie restoration practice. Furthermore, through their interaction with other colleagues in professional forums and associations, they facilitate the horizontal transfer of knowledge and insight about restoration to other regions and bring back lessons learned from restoration experiences elsewhere.

This overview of the diverse roots and origins of restoration in Humboldt County would be entirely incomplete without mention of the area's tribes and their involvement in restoration. In particular, the Hoopa Valley Tribe and the Yurok Tribe have been extensively involved in restoration work in the watersheds of their ancestral territories. The Hoopa Valley Tribe's watershed restoration program, managed by the tribe's forestry division, gained tremendous momentum following the assumption of full management authority over tribal forest resources by the tribe, which took place soon after passage of the 1988 Hoopa-Yurok Settlement Act. Upon completion and approval of the forest management plan by the tribal council, the tribe, with partial support from the Bureau of Indian Affairs using Northwest Forest Plan funds, embarked on an ambitious trajectory that involved watershed assessment and restoration project implementation. In an analogous manner, the Yurok Tribe, whose ancestral territory along the lower Klamath River lies primarily under the ownership of Simpson Resource Company, has been extensively involved in watershed restoration efforts since the early 1990s. Because Simpson Resource Company owns most of the Yurok territory, the watershed restoration efforts of the tribe's Watershed Department take place on Simpson property under the authority of various cooperative agreements between the tribe and the corporation. These efforts are primarily funded by grants from federal and state agencies.

The Hoopa, Yurok, and Karuk Tribes have also been involved in a variety of efforts, focused on the mainstem Klamath and Trinity Rivers, related to restoring the salmon and steelhead fisheries of the Klamath-Trinity basin. These efforts have centered primarily on 1) scientific research to understand the ecology, status, and trends of the basin's fishery, and 2) developing hydrologic models to secure the flows necessary to guide the eventual restoration of the basin's salmon and steelhead. To date, these efforts have not resulted in large amounts of restoration work along the mainstem of these two rivers – although extensive upslope watershed restoration work has been undertaken.[9] The Hoopa and Yurok Tribes have played central roles in producing the knowledge and models that are necessary to guide restoration efforts along the mainstem of these rivers – once the flows are secured for doing so. For example, with respect to the Trinity River, the Hoopa Valley Tribe was a central player in the Trinity River Flow Evaluation Study, completed in 1999. This study, formally

[9] The various studies of the mainstem Trinity and Klamath Rivers conducted by the Hoopa Valley Tribe, Yurok Tribe, and agencies such as the Fish and Wildlife Service that culminated in the Trinity River Flow Evaluation Study are not included as part of the assessment of the amount of funding coming into Humboldt County for restoration purposes. Although this is admittedly a fuzzy issue, it was decided to exclude these efforts because of our focus on restoration project implementation and those evaluations such as road inventories and watershed assessments that prioritize and precede project implementation. This decision is consistent with our relatively narrow focus on on-the-ground restoration-related work that is, for the most part, not associated with mitigation efforts required by law as compensation for the environmental effects of other management activities such as timber harvesting or dam construction.

embraced by the 2000 Record of Decision, outlines a restoration plan that combines flow management, fine and coarse sediment management, and channel and watershed management to restore the natural production of salmon and steelhead on the Trinity River. Although plan implementation has been delayed due to court challenges from downstream purveyors of Trinity River water, notably Westlands Water District in the San Joaquin Valley, no one doubts the political and scientific momentum that the work of the Hoopa Valley and Yurok Tribes has generated for restoring the salmon and steelhead populations of the Trinity (and Klamath) Rivers. Indeed, a recent North Coast Times Standard editorial acknowledged the efforts of the Hoopa Valley Tribe to restore the river in the following manner: "In reality, the Hoopa Tribe has intervened for all of the North Coast. Without the tribe, we would have hardly a chance to bring back the [Trinity] river" (10.10.03).

Other Native American groups have also been actively involved in restoration efforts in the area. For example, although most of their lands lie outside of Humboldt County (and therefore fall outside the geographic scope of this study), the Karuk Tribe has also been involved in large restoration projects, primarily associated with various forms of road decommissioning on public lands under Forest Service management. To the south, in Mendocino County, the Sinkyone Wilderness State Park is a well known example of Native American environmental management with a large restoration component based on traditional ecological knowledge. In Humboldt County, another example of American Indian involvement in restoration is the efforts of the Wiyot Tribe to purchase and restore the northern portion of Indian Island in Humboldt Bay; the Wiyot Tribe was also extensively involved in restoration work on the South Spit of Humboldt Bay. The restoration efforts of the Yurok, Hoopa, and Karuk Tribes all include or have included a job training component.

The Federal Government Connection

The links between employment and restoration have been prominent throughout the evolution of restoration on the North Coast. Indeed, the employment generating capacity of restoration, especially within the context of declining timber industry jobs, partly accounts for the willingness of the federal government to support restoration programs. One of the first periods when this relationship was highlighted was immediately following the 1978 expansion of Redwood National Park. The legislation authorized the acquisition of 48,000 acres to expand the park boundaries and more effectively protect the old growth redwood groves, particularly the Tall Trees Grove, included in the original 28,000 acre Redwood National Park established in 1968. The legislation also authorized expenditures up to $33 million within 10 years for watershed restoration work on the cutover acquired lands, as well as funding for worker retraining and assistance programs to offset the job losses resulting from the harvest level reductions the acquisition caused (DeForest 1999). The acquisition of these cutover lands provided an unprecedented opportunity for experimenting with and developing effective methodologies for watershed restoration. And although restoration has had to compete with other National Park Service funding priorities (approximately $23 million of the initial amount authorized has actually been allocated for restoration to date [Spreiter, pers. comm.]), funding levels have been adequate to support an active restoration program. The years following the Redwood National Park expansion were a time of rapid innovation in restoration techniques on the heavily roaded, steep, and unstable slopes characteristic of the Redwood Creek watershed and much of Humboldt County. Much of this early restoration work consisted of labor-intensive check dam construction and tree planting. Monitoring studies conducted by park scientists during the late 1970s and early 1980s revealed that heavy-equipment intensive restoration techniques were more ecologically beneficial and cost-effective than labor intensive manual techniques (Spreiter 1992). This realization, in combination with other structural and implementation problems associated with the training and worker compensation programs established by the 1978 legislation (DeForest 1999), meant that restoration in Redwood National Park would not be able to provide long term employment for large numbers of out-of-work timber workers. It

did however, and still does today, provide jobs for both park employees as well as heavy equipment operators and other restoration practitioners in the region. Furthermore, while consensus exists within the restoration community about the need for heavy equipment for restoration project implementation, lively debates continue regarding the most effective mix of labor-intensive and heavy equipment-intensive restoration practices and techniques.

Two subsequent federal government programs were also based on the presumed relationship between employment and watershed restoration. The first was the Northwest Emergency Assistance Program, begun following President Clinton's declaration that the Pacific Northwest salmon industry was in a state of disaster. The Northwest Emergency Assistance Program, which lasted from 1994 through 1997 and was administered in Humboldt County through the county Resource Conservation District, provided funds to displaced salmon fisherfolk for training in watershed restoration and habitat assessment (Yoon 1998). In Humboldt County, approximately 15 displaced salmon fishermen and women were trained in restoration and habitat assessment techniques; 130 fishers were trained throughout northern California (Yoon 1998). Several individuals in Humboldt County continue to work in watershed restoration nonprofit and for profit organizations (Mitch Farro, pers. comm.). The relationships that were forged amongst those enrolled in the program and between them and landowners and resource management agencies, as well as the skills that the enrollees acquired during the Northwest Emergency Assistance Program, were crucial in enabling them to continue to work in watershed restoration.

The Northwest Forest Plan and the accompanying Northwest Economic Adjustment Initiative were the other federal policy initiatives, launched in 1994, that included programs to buffer the effects of declining timber harvests on displaced timber workers and rural communities. The Northwest Forest Plan made available more than $1.2 billion to mitigate the socioeconomic effects associated with the changes in federal forest policy contained in the Northwest Forest Plan. This money, to be allocated through the Northwest Economic Adjustment Initiative using a novel approach that sought to coordinate the actions and programs of a large number of state and federal agencies, was focused on the following assistance categories: ecosystem investment, communities and infrastructure, workers and families, and business and industry. Part of this assistance included funds for federal agencies such as the Forest Service, Bureau of Land Management, Bureau of Indian Affairs, and the Fish and Wildlife Service, to support watershed restoration and implement training programs known as Jobs-in-the-Woods for displaced timber workers.[10] Resource professionals working at Redwood National Park, as well as a group of talented innovators working throughout the region had developed, and to some extent formalized, the art and science of watershed restoration during the late 70s and early 80s. The Northwest Forest Plan and Economic Adjustment Initiative provided key opportunities to expand the application of that knowledge and to begin to institutionalize watershed restoration as an independent sector of economic activity.

Although the Northwest Economic Adjustment Initiative did not provide the jobs and relief promised for displaced timber workers and their families (Kusel et al. 2003) and the Northwest Forest Plan has not been implemented as envisioned (Blackwell et al. 2003), it is nevertheless hard to overestimate the importance of the plan and the initiative for the development of the North Coast restoration sector in the 1990s. Two key elements were the provision of financial support for ecosystem management and watershed restoration through Jobs-in-the-Woods and other programs, and the prioritization of interagency coordination and collaboration that was a hallmark of the Economic Adjustment Initiative. For some federal land management agencies such as the Bureau of Land Management, funding for watershed restoration had previously come from timber harvest revenues. The Northwest Forest Plan altered this arrangement by reducing timber harvest

[10] Many graduates of these training programs continue to work in the restoration field.

levels and providing an independent source of funding for restoration work. On the North Coast, Bureau managers responded to these changed circumstances by strengthening already emerging partnerships with local restoration nonprofit organizations, such as the Mattole Restoration Council, the Redwood Community Action Agency, and the Pacific Coast Fish, Wildlife, and Wetlands Restoration Association, to achieve their watershed restoration goals and objectives. These continuing partnerships constitute an important element of the current restoration system in Humboldt County, discussed further in the next section.

The Northwest Forest Plan also provided other agencies key opportunities to increase their involvement in watershed restoration. For example, the Bureau of Indian Affairs provided significant support, through Jobs-in-the-Woods funding, to the Hoopa and Yurok Tribes for watershed assessment and restoration work. This funding provided these two tribes opportunities to increase their internal capacity for watershed analysis and restoration planning and implementation, as well as train tribal contractors in restoration techniques. Some of these trainees have continued to work in restoration. Similarly, the Northwest Forest Plan Jobs-in-the-Woods program provided the Fish and Wildlife Service with resources to partner with the Yurok Tribe, other federal agencies such as the Bureau of Land Management and Redwood National Park, and private landowners (a relationship generally brokered by one of several restoration nonprofits including the Eel River Watershed Improvement Group, the Mattole Salmon Group, the Mattole Restoration Council, and the Redwood Community Action Agency), to conduct watershed assessments and implement restoration projects. The collaborative partnerships that evolved through this process are an important part of the existing restoration system.

State Involvement in Restoration

It is well beyond the scope of this study to provide a thorough review of the history of California's extensive engagement with fisheries and watershed restoration, which began soon after statehood. It is appropriate, however, to highlight some of the key aspects of the last quarter century of this history as it relates to the North Coast. While generalizations are inevitably proven by the exception, it is perhaps safe to say that the primary mode of state involve-

A CCC crew beginning to remove Ammophila (European Beachgrass) at the Lanphere Dunes Unit of the Humboldt Bay National Wildlife Refuge. CCC crews are often contracted for labor-intensive aspects of restoration work.
Photo credit: Andrea Pickart, USFWS.

CCC's burning piles of Ammophila after the "first dig," which removes Beachgrass biomass. Photo credit: Andrea Pickart, USFWS.

ment in fisheries restoration work has been through the Resources Agency, particularly the Department of Fish and Game. The Department of Fish and Game is one of the primary state agencies involved in efforts to halt declines in salmon and steelhead runs and to restore these fisheries and their habitat. The collective efforts of the Department of Fish and Game and other state agencies, with the committed engagement of entities such as the California Advisory Committee on Salmon and Steelhead Trout, the California Salmonid Restoration Federation, representatives of commercial and sportfishing associations, conservation groups, concerned individuals, and state political representatives, have produced an impressive array of legislation, propositions, and programs oriented towards salmon and steelhead habitat and watershed restoration. A dominant theme throughout these efforts is the goal of restoring naturally reproducing native fisheries in order that viable commercial and sport fishing industries may be restored and sustained, while maintaining the viability of other resource extraction industries and allowing for sustainable economic growth.

In the 1970s, documentation of declining salmon and steelhead runs was instrumental in generating the momentum to establish and fund fisheries restoration and related activities. Reports

Replacing a culvert on the north fork of Widow White Creek to enable anadromous fish to access spawning habitat upstream. This project was a collaborative effort involving the McKinleyville Community Services District and Redwood Community Action Agency. Funding was provided by grants from the Department of Water Resources – Urban Streams Restoration Program and NOAA Fisheries Community-based Restoration Program. Photo credit: Don Allan, Natural Resources Services, RCAA.

Part of a culvert modification project on the main stem of Widow White Creek. Shown is the installation of three rock weirs to create jump pools that reduce the overall jump height from one 3-foot jump at the culvert outlet to three 1-foot jumps. Funding was provided by grants from the Department of Water Resources – Urban Streams Restoration Program. Project partners included Loring Swanlund of Ocean West Senior Village and the McKinleyville Community Services District. Photo credit: Don Allan, Natural Resources Services, RCAA.

published in 1971, 1972, 1975, 1986, and 1988 by the Citizen's Advisory Committee on Salmon and Steelhead Trout (established in 1970 and re-authorized by the state legislature in 1983 as the California Committee on Salmon and Steelhead Trout) and the Department of Fish and Game Staff Working Committee, chronicled the declines in runs and suggested strategies for restoring and protecting fisheries resources. The later reports in particular, emphasized the economic contributions associated with healthy salmon and steelhead trout runs, stressed the need for both amelioration of degraded habitat and the prevention of further declines in habitat quality, and documented restoration opportunities.

These reports, along with the concerted efforts of conservation groups such as Cal Trout, advocacy and research groups such as the Pacific Coast Federation of Fisherman's Associations, the Pacific States Marine Fisheries Commission, and the Humboldt Fisherman's Marketing Association, responsive political leadership at the state level, diverse stakeholder groups such as the Fish, Farms, and Forest Communities Forum, and many other groups and organizations too numerous to list here, have generated several pieces of key legislation promoting fisheries and watershed restoration. These include 1) the 1981 Boscoe-Keene Assembly Bill 951, which allocated $1 million in cooperative fish restoration projects, 2) Senate Bill 2261 (introduced by Senator Barry Keene in 1988), which established and funded the Salmon, Steelhead Trout, and Anadromous Fisheries Program whose purpose was to increase the natural production of these species of fish through protection, conservation, and restoration measures, including those that engaged the public's participation, and 3) Senate Bill 271 (introduced by Senator Mike Thompson in 1997) that created the Salmon and Steelhead Restoration Account and provided $43 million for six years to be administered by the Department of Fish and Game for funding the implementation of restoration projects. In addition to these legislatively-authorized programs and funds, other state support for restoration (and fish hatcheries) has come from the Resources Agency's Renewable Resources Investment Fund. The Resources Agency has also prepared and published long-term plans for achieving restoration goals, the most recent of which is the agency's "California Coastal Salmon and Watersheds Program." Other important state-level sources of funding for restoration include Senate Bill 400, Assembly Bill 1705, Propositions 19, 70, and 99, the commercial salmon stamp program, and the Steelhead Report Card. More recent propositions that provide significant funding for restoration include 13, 204, 40, and 50.

State legislative and programmatic support has been central to the evolution of the restoration sector in Humboldt County. The Department of Fish and Game's Fisheries Restoration Grant Program has helped support the development of the institutional capacity and infrastructure necessary for achieving restoration goals and objectives. Collaborative partnerships between the Department of Fish and Game and watershed groups, non-profit organizations, landowners, and contractors are a dominant feature of the North Coast restoration network. More than one-third of the cumulative financial support for restoration that came into Humboldt County between 1995 and 2002 was administered by the Department of Fish and Game through its restoration grant program (see Table 1 on page 40). Apart from administering the restoration grant program, the Department of Fish and Game also plays a variety of other roles with respect to restoration. For example, the department has taken a lead role in the development and systematization of fisheries habitat restoration science and technique, as represented in the California Salmonid Stream Habitat Restoration Manual (1991, rev. 1994, rev. 1998) developed by department staff in conjunction with members of the restoration community, many of whom are based on the North Coast. The department is also currently developing systematic protocols to guide effectiveness and validation monitoring of restoration projects. The Department of Fish and Game's Wildlife Conservation Board, established in 1947 to support wildlife conservation and public recreation, plays key roles in land and conservation easement acquisition, public access enhancement, and habitat restoration. It has pursued all three of these objectives in Humboldt County.

One of the Department of Fish and Game's key partner organizations is the California Conservation

Corps. It is hard to overestimate the contribution of the California Conservation Corps (CCC) to restoration in Humboldt County as well as statewide. Since 1980, the Corps has collaborated with the Department of Fish and Game, other agencies and non-government organizations, and public and private landowners to restore salmon and steelhead habitat through the Salmon Restoration Program. With its roots in the social mission of the Civilian Conservation Corps of the New Deal era, the Corps combines employment and educational opportunities related to natural resource conservation and public service for young adults. In the north state, the Corp's Salmon Restoration Program has been nationally recognized as a leader in stream and watershed restoration. In Humboldt County Corps members reside at the Fortuna residential center.[11] The great majority of the work of these members and the center staff relates directly to restoration projects in Humboldt County. The Fortuna Center has an annual budget of between $6 million and $7 million (Michelle Rose, pers. comm.). As with other restoration-related investments, these investments ripple throughout the Fortuna and greater Humboldt County economy. Another nearby California Conservation Corp center that specializes in restoration work is the Requa Center in Del Norte County. The recent outpouring of community and political support from those knowledgeable about the Corps' work and mission, in opposition to the Requa Center's tentative closure due to budget cuts, illustrates the high esteem in which the Corps, its mission, and work are held.

Other state agencies also play important roles in supporting restoration efforts on the North Coast (although detailing each agency's history of engagement with restoration is beyond the scope of this study). The California Department of Parks and Recreation, North Coast Redwoods District, has a well developed restoration program in the county that focuses primarily on planning and implementing watershed restoration within Humboldt Redwoods State Park. The Parks Department annually lets contracts for restoration work worth several hundred thousand dollars within Humboldt County. The State Water Resources Control Board funds watershed restoration work, as authorized by the Clean Water Act (sections 319(h) and 205(j)). The Water Board also participates in community-based partnerships and training programs related to restoration project implementation. The involvement of the Water Board in funding restoration work on the North Coast will likely increase as a result of the passage of Proposition 50 and the Board's central role in administering Prop. 50 restoration funding. In addition to the California Coastal Conservancy's prior work supporting dune and coastal zone restoration efforts, in recent years the Conservancy has enlarged its scope of engagement with restoration to include significant support for restoration-oriented nonprofit organizations. The Department of Water Resources' Urban Streams Program is another effective state-level vehicle for funding restoration work. Interestingly, the Department of Water Resources' Urban Streams Program requires partnerships between non-government organizations and municipalities. This progammatic innovation improves on-going stewardship efforts, helps to leverage resources from multiple sources, and engages the participating municipality in the restoration solution (Sungnome Madrone, pers. comm.). And lastly, the Department of Forestry and Fire Protection supports restoration work through the various cost-share stewardship programs that it administers. In recent years, these have included the California Forest Improvement Program, the Stewardship Incentive Program, and the Vegetation Management Program. The Department of Forestry and Fire Protection has also provided support for the Five Counties Salmonid Conservation Program, which is the preeminent example of local government involvement in restoration activities.

Local Government Involvement in Restoration

One of the most substantive engagements with restoration at the county level has been Humboldt County's participation in the Five Counties Salmonid Conservation Program. The

[11] In addition to minimum wage (with graded salary increases) and benefits, Corps members receive subsidized room and board and, after one year of service, an educational award of $4,725 to be used to pay for further education or to repay student loans.

program was initiated in 1997 when the Boards of Supervisors of the five northern California counties (Del Norte, Humboldt, Mendocino, Trinity and Siskiyou) adopted resolutions in which they agreed to collaborate in developing a positive, proactive response to the federal listings of salmon as Threatened species by identifying opportunities whereby the counties can contribute to the long-term recovery of these species. The primary goal of the program is:

> To strive to protect the economic and social resources of Northwestern California by providing for the conservation and restoration of salmonid populations to healthy and sustainable levels and to base decisions on watershed rather than County boundaries.

The program, which is administered by the Trinity County Planning Department – Natural Resources Division, focuses on those elements over which county governments have jurisdiction that affect salmonid species and their habitat. These elements include the region's extensive network of county roads and county-managed levees and spoils, and the planning and zoning authorities related to land use. Not surprisingly, decisions regarding these elements have vast implications for salmonid species and habitat. The goal of the Five County Program is to enable these elements to become vehicles for achieving restoration goals and objectives and, in the process, preserve and enhance the social and economic resources of the region. To date, the Five County Program has generated and is administering more than $8.5 million, most of which is comprised of state and federal funds, to achieve its goal. The specifics of the program, its accomplishments, and its linkages with the Humboldt County Public Works Department, are discussed in a subsequent section. However, it is worth noting here that one of the primary underlying assumptions of the Five County Program is that restoration can be an important mechanism for conserving and enhancing the socioeconomic resources of northwestern California.

Although the initial county resolutions in support of the Five County Plan are six years old, and despite subsequent changes in the composition of the Boards of Supervisors, support for the program, and restoration in general, remains strong (Mark Lancaster, pers. comm.). For example, on October 21, 2003, the Humboldt County Board of Supervisors passed a resolution declaring that the third full week of October 2003 would be a week to honor "Watersheds and Fisheries Restoration Workers" and declaring furthermore that the Board is committed to supporting an "economy based on Conservation and Recovery of Watersheds and Fisheries" in which watershed and fisheries restoration workers receive living wages and benefits. The actual resolution is preceded by a series of statements describing the decline of salmonid and steelhead populations. It then briefly reviews the unstinting efforts of restoration workers and practitioners to restore the once-abundant runs of salmon and steelhead "that have and could still maintain life on California's North Coast." It notes that the "Restoration Industry" contributes significantly to the North Coast economy in a "just, equitable and sustainable fashion" and that the restoration effort should be based on "love of the resources, dedication to its recovery and living wages and benefits." It is hard to imagine a stronger embrace and expression of support for the continued growth of a socially and economically sustainable restoration sector.

Almost every municipality in Humboldt County has some degree of involvement in restoration-related activities; some cities have well-developed restoration programs. Eureka and Arcata are both engaged in restoration projects related to the creeks, sloughs, and marshes that feed into and ring Humboldt Bay. The City of Ferndale has been involved in flood control and restoration efforts within the city limits. Fortuna, McKinleyville and others also have varying levels of involvement in restoration work. The majority of these efforts are funded by the same array of state and federal funding sources that support restoration elsewhere in the county. Some cities have unique opportunities to fund restoration work. For example, the City of

Arcata Environmental Services Division reinvests a portion of the revenue derived from its management of the Arcata Community Forest into restoration projects. The sums generated and invested in restoration are significant. For example, in addition to Community Forest revenues, the City of Arcata has acquired and administered approximately $4.1 million for restoration work within the past nine years. Many of the restoration projects cities implement are multi-purpose projects that satisfy other purposes, such as flood control, in addition to achieving restoration goals and objectives. Many of these programs are also linked with community groups, neighborhood associations, and the public schools. Volunteer days are opportunities for city dwellers to participate in restoration work; in the process of restoring a marsh or creek, they develop community and a sense of place. School science classes have been intimately involved in the planning, implementation, and monitoring of some city restoration efforts – thereby providing students valuable opportunities to learn about the myriad connections between society and the environment and no doubt helping some to find their place in the world.

Current Restoration Models in Humboldt County

Restoration in Humboldt County is organized in complex ways that reflect the historical evolution of restoration work, the existing patterns of land ownership and settlement, the diverse array of federal and state public lands management agencies as well as regulatory agencies in the region with their respective agendas, interests, and capacities, and the robust civic culture of the North Coast that has given rise to a variety of nonprofit organizations, citizens' groups, and private enterprises involved in restoration. The web of connections and relationships that binds the people and organizations involved in restoration together is not arbitrary, on the contrary, its structure is identifiable and provides cohesiveness as well as flexibility to the restoration sector.

The key components of the restoration sector include: funding agencies and organizations, public and private landowners and managers, tribes, regulatory agencies, nonprofit organizations, for profit businesses, community-based organizations, restoration workers, and university-based scientists. These different components of the restoration sector are bound together in numerous and complex ways. In many cases the networks that link these components together are based on personal relationships between people who have been a part of the evolving restoration sector for several years. While the mandates of many of the agencies involved in restoration are obviously much broader than restoration, in many there are individuals for whom restoration-related activities constitutes the primary component, if not the entirety, of their workload. These restoration "nodes" are linked together through dense networks of relationships to similar nodes in other agencies, e.g., US Fish and Wildlife Service, the Bureau of Land Management, the CA Dept. of Fish and Game, and the CA Dept. of Parks and Recreation, and to the other nodes within the restoration network that are comprised of nonprofits, tribes, public and private landowners, businesses, and other community-based organizations. The strength and content of the relationship amongst these nodes varies across time and space. Financial resources, technical capacity, scientific expertise, heavy equipment, labor, regulatory oversight, coordination, and local environmen-

Two Native American men and Redwood Community Action Agency member Sungnome Madrone share thoughts on manual restoration techniques during a road decommission project at Humboldt Redwoods State Park. RCCA-managed restoration projects generally incorporate job training components. Photo credit: Mark Baker, Forest Community Research.

tal knowledge are some of the elements that flow through the restoration network.

Private Lands Models of Restoration

Among other factors, land ownership patterns strongly condition the specific configuration the restoration network assumes in a particular place. Almost half of the county's 2,272,000 acre land base (48 percent or 1,100,000 acres) is comprised of industrial and nonindustrial forest timberland.[12] Federal, state and tribal lands account for approximately 29 percent or 650,246 acres within the county (Reichard 1998). Key to the success of restoration efforts on private industrial and nonindustrial lands is developing enough rapport and trust between the landowner and the involved government agencies to enable the access necessary for project design and implementation to take place. Within the general climate of distrust of government and well-founded concerns about the economic impacts of regulation, this is not a trivial matter. Another key challenge for restoration work on private lands (and on public lands too, but to a lesser degree) concerns the permitting requirements for restoration projects. Almost invariably, an array of permits or consultations from a variety of different agencies must be obtained before a restoration project can be implemented. These can include, 1) permits from the Army Corps of Engineers required under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act, 2) consultations with the US Fish and Wildlife Service and National Marine Fisheries Service required under the Federal Endangered Species Act and the Marine Mammal Protection Act, respectively, 3) permits from the State Water Board required under Section 401 of the Clean Water Act, 4) permits from the CA Dept. of Fish and Game required by Section 1601 of the Fish and Game Code concerning stream alterations, 5) county coastal development permits, and 6) California Coastal Commission permits required under the California Coastal Act and the Coastal Zone Management Act. Other county and state permits are also sometimes required.

The time and effort required to prepare the necessary documentation the permitting process requires, not to mention the costs involved, constitutes a significant disincentive for private landowners to engage in restoration activities. The gravity of this issue is illustrated by the fact that a full day workshop, sponsored by the Collaborative Learning Circle, For the Sake of the Salmon, and UC Cooperative Extension, was held July 2003 that focused on understanding the permitting process and developing strategies for overcoming the hurdles that the permitting process represents. Attending the workshop were key members of the restoration sector, including people from almost all of the different nodes of the restoration network (e.g. federal, state, and county agencies, restoration nonprofit organizations, tribes, restoration practitioners, and watershed groups). Subsequent restoration-related workshops and training sessions have continued to include sessions on permitting.

How are the issues of trust, access to private property for restoration project design and implementation, and the challenges associated with permitting and regulatory compliance addressed on private property? In a minority of cases, often involving the Natural Resources Conservation Service and the County's Resource Conservation District, both of which have a long tradition of landowner outreach and extension, agency personnel themselves work directly with landowners to develop, plan, and implement a restoration project. However, in the great majority of cases involving restoration on private property using public funds, one of the area's restoration-oriented nonprofit organizations will play a key role in addressing these issues. These nonprofit organizations are a key component of the institutional infrastructure that has developed within the restoration sector. They often play crucial roles in addressing restoration issues on private lands. The trust they have cultivated with many landowners in the region enables

[12] There are approximately 608,000 acres of industrial forest timberland and 492,000 acres of nonindustrial timberland in the county (Reichard 1998).

them to function as bridging structures between the landowner and the regulatory and funding agencies. Area nonprofits also have developed the expertise required to navigate the regulatory shoals of the permitting process for landowners. They also have extensive knowledge concerning how to develop and submit proposals to funding agencies for restoration projects. Furthermore, many have the in-house expertise necessary for conducting the assessments and inventories that enable prioritization of restoration projects. Most also have the capacity to subcontract for restoration work and to work with contractors in a supervisory capacity throughout a restoration project's implementation. In short, they constitute extremely important nodes within the restoration network.

To a certain extent, the major nonprofits involved in restoration project design and implementation seem to have evolved a territory and landowner-based division of restoration activities on private lands. The Mattole Restoration Council and the Mattole Salmon Group, not surprisingly, concentrate their activities in the watershed and tributaries of the Mattole River in southern Humboldt County. The Eel River Watershed Improvement Group and the Eel River Salmon Restoration Project work mainly on restoration projects within the Eel River basin, including the Van Duzen riverbasin, and their tributaries. The Pacific Coast Fish, Wetland, and Wildlife Restoration Association works primarily on Simpson Resource Company lands in the northern part of the county (and on Bureau of Land Management [formerly Pacific Lumber] lands in the Humboldt Bay watershed). The Redwood Community Action Agency works on pivate lands scattered throughout the county, including in the Humboldt Bay watershed and elsewhere.[13]

The types of collaboration that almost invariably emerge on private lands restoration projects illustrate the complexity of the restoration sector, and the density of the restoration network. Restoration projects on private lands are often designed and proposed by one of the primary nonprofits (and based on a prior watershed assessment and/or inventory and sometimes on consultations with a regional expert) that has longstanding relations with the landowner, funded by a combination of state and federal funding sources (each with their own reporting requirements, billing and payment procedures, timelines, and grant lifespans), implemented by a local contractor under the guidance of the nonprofit during the very short restoration work season, often with in-kind and cash contributions from the landowner. It is not at all uncommon for more than two years to elapse between initial project proposal development and project completion.

While this is probably the most common scenario for the organization of restoration work on private lands, the restoration network does occasionally assume slightly different configurations. In some instances a private restoration business such as Coastal Stream Restoration Group, Restoration Forestry, or Monschke Watershed Management may perform many of the same functions as the nonprofit organization, and implement or subcontract the project themselves. There are, however, relatively few private businesses engaged in the lengthy and time consuming process of writing the grant proposals upon which most restoration work continues to depend. A further difference is that some nonprofit organizations, such as Redwood Community Action Agency, have an explicit commitment to community development and view restoration as a vehicle for achieving community development goals. Thus, Redwood Community Action Agency restoration proposals and projects often contain a training component that is designed to help prepare individuals for on-going work in restoration. Similarly, the Pacific Coast Fish, Wildlife and Wetland Restoration Association has trained (using Northwest Emergency Assistance Program funding) displaced fishers in watershed assessment methodologies, and continues to employ some of their prior trainees.

Other variations in the structure of restora-

[13] In addition to these relatively large nonprofit organizations, there are many other smaller organizations and watershed associations, some with 501(c)3 status others without, whose activities are focused on various aspects of watershed and fisheries restoration.

tion on private lands concern the extent to which consulting engineers, geologists, biologists and other professionals are contracted with to aid in the preparation of the documentation required for the permits, or for other aspects of the project such as the watershed assessments, road inventories, hydrologic analysis, or specifications for culverts or bridge installation.

Two points emerge from this discussion of restoration on private lands. First, although the nonprofit-landowner-agency collaboration is at the heart of this model of restoration, there are significant permutations and variations in the configurations the restoration network assumes on private lands. Secondly, regardless of the specific configuration, it is clear that a successful restoration project involves the correct alignment of a large number of different factors and the application of a diverse set of skills, expertise, and capacities. These skills, expertise, and capacities are distributed across multiple nodes within the restoration network. It is a significant coordination challenge and achievement to align these resources and the nodes where they are located, and to bring them to bear in an effective fashion on a particular patch of land or stream reach to accomplish a restoration objective, especially given the extremely narrow operating window of four months for most forms of restoration work.

Using heavy equipment to remove invasive plants from a Bureau of Land Management Endangered Plant Protection Area. This work was organized using a cooperative agreement between Redwood Community Action Agency and the BLM. RCAA contracted with a local private heavy equipment operator for project implementation. Photo credit: Andrea Pickart, USFWS.

Public Lands Models of Restoration

On public lands restoration work is organized slightly differently than on private lands, although in many cases restoration nonprofits are still involved. The two most common models of conducting restoration work on public lands are 1) for the public land management agency to be responsible for all of the tasks related to a restoration project except for project implementation, which may be contracted out to a private contractor and, 2) for the public agency to enter into a multi-year cooperative agreement with a nonprofit organization under which separate task orders are drawn up for each individual project. Although there are exceptions, restoration work in Redwood National Park, the Six Rivers National Forest, Fish and Wildlife Service units in Humboldt County, and Humboldt Redwoods State Park is generally carried out in the first manner. Within these jurisdictions agency personnel are responsible for conducting the various assessments, surveys, and inventories used to prioritize restoration sites, conducting the environmental analyses and preparing the environmental documentation required in order to obtain the necessary permits, obtaining permits, preparing and letting the contracts for implementing the project, supervising the restoration contractor during the implementation phase, documenting the project implementation and doing post-implementation monitoring. Clearly, this approach is extremely staff-intensive. This method of organizing restoration generally does not involve extensive collaboration with other nodes on the restoration network, except for the private contractors who are hired to implement the project. Some modifications of this model are the extensive engagement of the community-based Friends of the Dunes organization with restoration efforts at the Lanphere Dunes Unit of the Fish and Wildlife Service's Humboldt Bay National Wildlife Refuge, and collaborative restoration efforts at Redwood National Park involving the Yurok Tribe.[14] Both of these examples are dis-

cussed further below.

The Bureau of Land Management has embraced the other primary model for organizing restoration work on public lands—that of the cooperative agreement. Since the mid-1990s, the Bureau of Land Management has entered into multi-year cooperative agreements, under the authority of the Cooperative Assistance Agreement Act of 1977, with the Mattole Restoration Council, the Mattole Salmon Group, and the Redwood Community Action Agency. These cooperative agreements have constituted the foundation for building lasting community partnerships with these two area nonprofits. A core principle of the cooperative agreement, which requires matching funds from the agency partner as well as demonstrated community participation and involvement, is that local community partners should not only participate in the decision making process concerning public lands management, but that they should also participate in the actual planning process. This involves sharing in the development of land management plans, watershed analyses, and alternatives as required by the National Environmental Policy Act. Under the cooperative agreements, community-based partner organizations share the burden and the responsibility for performing some of these management functions. Project implementation is carried out as specified in individual task orders. Restoration project implementation (as distinct from the planning components of a restoration project) that often requires heavy equipment is contracted out. More recently, the Bureau of Land Management has begun partnering with the Pacific Coast Fish, Wildlife, and Wetlands Restoration Association (PCFWWRA) for restoration work in the Headwaters Forest acquired from Pacific Lumber as part of the 1999 Headwaters agreement brokered by the State of California. As Bureau of Land Management Assistant Field Manager Dan Averill described, working with PCFWWRA was an opportunity to partner with a nonprofit that had matching dollars and access to restoration talent and good contractors to begin work on the highest priority restoration sites in the Headwaters Forest. The partnerships that have been built through the use of the cooperative agreement approach have helped to develop the institutional capacity of these area nonprofits as well as the strength of the overall restoration network.

Tribal Models of Restoration

In Humboldt County, the Yurok Tribe and the Hoopa Valley Tribe have both been extensively involved in watershed restoration efforts.[15] Beginning in 1994, watershed assessments and restoration work on the Hoopa Valley Indian Reservation were funded to a large extent by the Jobs-in-the-Woods program associated with the Northwest Economic Adjustment Initiative and the Northwest Forest Plan. These funds were allocated through the Bureau of Indian Affairs. Other current funding sources include the Bureau of Reclamation, the National Marine Fisheries Service, and tribal timber harvest revenues. The initial watershed assessments and restoration projects that were funded through the Jobs-in-the-Woods program played an important role in building restoration capacity. During the 1980s and early 1990s, most of the watershed assessments and some of the restoration project implementation work were contracted out to outside professional geologists, hydrologists, and equipment contractors. However, by the mid-1990s, this work had begun to be shifted in-house using the growing skills and expertise of the tribe's own employees. For example, beginning during the period after the adoption of the Northwest Forest Plan, most watershed assessment work was being

14 The California Department of Parks and Recreation, North Coast Redwoods District, has also entered into an innovative agreement with Native American groups (the InterTribal Sinkyone Wilderness Council) regarding the management of the Sinkyone Wilderness State Park. However, this is located in Mendocino County and is therefore outside of the geographical scope of this study.

15 Just next door to Humboldt County, the Karuk Tribe has been and continues to be engaged with watershed restoration work on their ancestral territory located on Forest Service lands. This work, which tends to focus on road decommissioning with a strong job training component, is organized through cooperative agreements with the Forest Service and through partnerships with the Redwood Community Action Agency and other organizations.

done by staff within the Hoopa Tribal Forestry Division. The road decommissioning projects, which followed the watershed assessments and were funded through the Jobs-in-the-Woods program, included training workshops for independent tribal heavy equipment operators who then implemented the decommissioning project. A few of these individuals have gone on to develop successful businesses specializing in restoration contracting work. Currently, as with the watershed assessments, much of the roads-related restoration work is now done in-house by the Tribal Roads Department. As internal capacity and expertise have increased, the need to contract out assessment and restoration work has declined; these functions have been internalized within the Hoopa Valley Tribe and have created jobs for employees of the tribe.

Most of the Yurok Tribe's restoration efforts are organized through the Yurok Watershed Restoration Department. The department's planning, assessment, and project implementation work occurs primarily on land owned by the Simpson Resource Company, which controls the majority of the Yurok ancestral territory. Beginning in the early 1990s, a remarkable collaborative effort, facilitated by the California Coastal Conservancy, developed between the tribe and Simpson Timber Company (now Simpson Resource Company) that focuses on watershed restoration in the Lower Klamath basin. In 1996, this collaboration was formalized through the creation of the Lower Klamath Restoration Partnership. The partnership has three goals: improving the health of the Lower Klamath basin and its tributaries, restoring the basin's anadromous fishery, and training tribal members to be skilled workers in the field of watershed restoration (Gustaitis 1998). As with the Hoopa Valley Tribe, the early years of this partnership involved working with private sector restoration firms such as Pacific Watershed Associates and Terra Wave, Systems, Inc., in part to provide training in restoration science and heavy equipment operation for road decommissioning work to tribal members. The Northern California Indian Development Council, a nonprofit organization based in Eureka, with support from the Coastal Conservancy, contributed to this collaborative effort by helping the partners prepare a strategic watershed restoration plan and prioritize restoration needs. For the last several years, using grant funds from a variety of sources, the Yurok Watershed Restoration Department has continued to integrate restoration training with project planning and implementation, primarily on Simpson Resource Company lands. Monitoring efforts, especially concerning the anadromous fishery, are coordinated with the tribe's fisheries program (Bob Rohde, pers. comm.).

It should also be noted that the Yurok Tribe and Redwood National and State Parks have signed a Memorandum of Understanding for Government to Government Relations and the Yurok Tribe and the U.S. Department of Interior, National Park Service have signed Self-Governance Annual Funding Agreements. Both the MOU and the Annual Funding Agreements are designed to foster collaborative management of cultural and natural resources within Redwood National and State Parks. While the MOU and Annual Funding Agreement cover a wide variety of different issues ranging from the application of traditional ecological knowledge to the provision of employment opportunities, they also provide the basis for collaboration between these entities for the purposes of watershed restoration. In recent years, this has resulted in significant amounts of watershed restoration work contracted with the Yurok Watershed Restoration Department by Redwood National Park. Watershed and anadromous fisheries restoration are of particular importance to these Native American communities. In addition to being critical for the maintenance of safe and clean domestic water supply, arresting sedimentation, and maintaining adequate water flows, ensuring the viability and return to health of the basin's salmonid populations are of central importance to the continued integrity of the cultural lifeways and identity of these communities. Not incidentally, these goals are also central to the federal-tribal trust relationship.

The Five County Salmonid Conservation Program[16]

As noted briefly above, the Five County Salmonid Conservation Program was initiated in 1997 through resolutions passed by the Board of Supervisors for Del Norte, Humboldt, Mendocino, Siskiyou and Trinity Counties that sought to protect the region's social and economic resources through proactive efforts to restore salmonid populations and habitat. The focus of the Five Counties Program is on those areas over which the region's counties have jurisdiction. This includes county roads and facilities, and planning and zoning processes concerning land use. Since its inception, the Five Counties Program has pursued its overarching goal through a wide variety of strategies. One of the early initiatives was to commission the University of California Cooperative Extension to conduct a study of the effects of County land use regulations and management on salmonid species and their habitat. Completed in 1998, the report focuses on 1) county facilities management and practices and 2) land use regulations and environmental review. The former refers to county roads, levees, spoils disposal, etc., while the latter relates to land subdivisions, use permits, rezoning, and California Environmental Quality Act review (Five Counties Salmonid Conservation Program 2003). The Cooperative Extension study included a series of recommendations, to which the Five Counties Program has begun to respond. These recommendations include issues such as 1) county road and bridge maintenance, 2) an inventory of county roads with a focus on sediment delivery to streams, 3) further development of County policies and standards for protecting riparian and instream habitat, 4) institutionalizing mechanisms for consultation with hydrologists and biologists on projects that affect salmonids and their habitat, and 5) increasing opportunities for information and technology exchange throughout the five county region and with state and federal entities (Five Counties Salmonid Conservation Program 2003).

To date, the program has conducted systematic inventories of barriers to fish passage and potential erosion sources on county roads throughout the five county region. These efforts have advanced restoration science and knowledge. The methodology developed and refined for the fish passage barrier inventory (by Ross Taylor and Associates and Michael Love and Associates, both based in Humboldt County) is currently being incorporated into the Department of Fish and Game's California Salmonid Stream Habitat Restoration Manual. The county road erosion inventory adopted the roads inventory model developed by Pacific Watershed Associates for forest and ranch roads and then adapted it to reflect the specific differences between county roads and private roads. Pacific Watershed Associates conducted training sessions for field crews and was responsible for quality assurance and control throughout the inventory work. Information from both inventories has been shared with the Department of Fish and Game and other agencies to assist in restoration planning efforts.

In Humboldt County, these inventories have lead to the implementation of 13 fish barrier removal projects between 1999 and 2003. Most of these projects involved replacing culverts that blocked migrating fish with fish-friendly bridges. Humboldt County Department of Public Works, Roads Division was responsible for the design and implementation of these projects; most of the construction work was contracted out to local contractors. More than $2.7 million, more than half of which was provided by the Department of Fish and Game, has been spent on these efforts in Humboldt County. Other funding sources for these projects include the California Coastal Conservancy, Pacific States Marine Fisheries Commission, Proposition 319 (via the Redwood Community Action Agency), and contributions from Humboldt County.

In addition to these migration barrier removal

[16] In 2003, the Five County Salmonid Conservation Program received both federal and state government recognition for its accomplishments. It was a recipient of the Federal Environmental Protection Agency's "Clean Water Partners for the 21st Century Award" (selected from a pool of over 200 nominations from around the country), and in December, 2003, it received the Governor's Environmental and Economic Leadership Award for the Program's innovative public-private partnerships and environmental conservation efforts.

projects in Humboldt County, the Five County Program has achieved other environmental and economic objectives throughout the five county region. From the project implementation standpoint, program accomplishments include the implementation of 22 fish passage barrier removal projects in Del Norte, Trinity, and Siskiyou Counties and eight sediment reduction projects (seven in Trinity County, one in Mendocino County). All of these projects were identified and prioritized through the erosion and fish barrier inventories of county roads. The Five County Program has also worked to increase information and technology exchange throughout the region by sponsoring annual workshops and fieldtrips for County Public Works staff, policy makers, and county planners who are involved in the planning and implementation of restoration projects. These workshops have helped increase support for restoration among county staff and have facilitated the process of strengthening county policies and programs related to road maintenance as they relate to salmonid species and habitat.

Another significant accomplishment of the program is the preparation of a draft county roads manual, *A Water Quality and Stream Habitat Protection Manual for County Road Maintenance in Northwestern California Watersheds*. The manual was developed through a collaborative effort involving County Public Works Staff, watershed consultants, the National Marine Fisheries Service, the Department of Fish and Game, and State Water Board representatives. This manual encapsulates many of the insights and approaches that the program has developed, and distills them into a set of improved Best Management Practices (BMPs) for road maintenance that minimize negative effects on local streams. Part of the development and codification of practice-based restoration science and knowledge, this manual, once it is adopted by counties, will institutionalize county practices that contribute to the recovery of salmonids and salmonid habitat. The guarantees regarding management actions and practices the manual will provide once it is adopted will facilitate the permitting process for county restoration projects.

Clearly, the Five County Program contributes to the development of the region's restoration sector in many important ways. It has advanced restoration science and knowledge through the fish barrier and erosion inventories of county roads. Between 1998 and 2002, it generated more than $8.5 million for all aspects of the program, e.g., the inventor-ies, barrier removals, sediment reduction projects, county roads manual, training workshops and policy work. This constitutes a significant infusion of investment into the five county region. The Program has also played a key role in fostering local (county) participation in state and federal meetings, forums, and conferences concerning restoration-related topics. Through its efforts to build relationships within the region and between the five county region and state and federal entities, the Program helps build the mutual understanding among different nodes of the restoration network that is necessary to address some of the barriers and hurdles that restoration practitioners face. Perhaps most importantly, the Program has illustrated the central role that local governments can play in helping to achieve the goals and objectives of restoration. In particular, it demonstrates that conserving and restoring salmonid populations and habitat is not only consistent with, but actually helps, achieve the goal of sustaining the social and economic resources of the region.

Restoration and Community

Many restoration network nodes and linkages have a vibrant community element woven into them. This is because for many people involved in restoration, their commitment to it springs from a passionately held vision of healthy watersheds, reinvigorated salmon runs, and resource management practices grounded in stewardship principles. This vision often springs from a deeply rooted sense of place, of relationship to the natural environment that gives meaning, and of connections with other like-minded restoration practitioners and conservationists. This vision inspired those who pioneered many of the restoration practices and techniques that are commonplace today. Often working on shoe-string budgets or sometimes on a volunteer basis, these individuals were the early innovators of community-based fishbox hatcher-

ies, in-stream restoration techniques, and monitoring methods and technologies. For many, the idea of actually earning a living from restoration work came only as an afterthought. And, as described by one long-time restorationist, the approach of some early restorationists was tinged with a slight "guerilla" element that stemmed from a combination of shared commitment to helping the salmon runs return and a critique of the "system" that had lead to the salmon declines in the first place.

While restoration in Humboldt County has become institutionalized in the last 20 years, the early visions of communities and people, rooted in place, working towards a more harmonious integration of people, watersheds, and working landscapes, still provide a powerful ideological anchor for the restoration system. The community-based aspects of restoration manifest in both rural and urban forms of restoration. In both cases, community engagement with the restoration process serves to build community, as well as to build connections between people and the natural environment, while simultaneously achieving the ecological goals and objectives of restoration. In some contexts, restoration is as much a social process as it is a set of practices and methods designed to restore ecosystem health. In these situations there are strong linkages between restoration and civic engagement, community identity, and the development of a sense of place. Freeman House, writing about community, place and restoration in the Mattole River watershed in southern Humboldt, conveys this notion in the following manner, "Engaging the lives of wild salmon in a single watershed has created a situation wherein the peoples of our place have begun to experience themselves as functional parts of the place itself. Engaging the lives of any part of the wild in any self-defined natural area will lead to the same experience" (1999:198).

In Humboldt County, some of the many examples of contemporary community-based restoration are the work and activities of the Mattole Restoration Council, the public school education outreach programs funded by the Dept. of Fish and Game, the involvement of public school students in the planning, implementation, and monitoring of restoration projects, the community-based restoration efforts of the Friends of the Dunes, and the community-based fire planning efforts of the Lower Mattole Fire Safe Council and the Orleans Somes Bar Fire Safe Council. Additionally, there are a large number of other community-based watershed groups, some of which are actively engaged in different aspects of watershed restoration. A selective description of some of the activities of a few of these organizations serves to

Volunteers removing lupine as part of the Friends of the Dunes' 25th annual "Lupine Bash" at Lanphere Dunes. Photo credit: Emily Walter, Friends of the Dunes.

Removing iceplant as part of the Friends of the Dunes' annual alternative "Spring Breakaway". Photo credit: Emily Walter, Friends of the Dunes.

highlight various facets of the relationship between restoration and community.

The Friends of the Dunes, a nonprofit organization based in Arcata, typifies the positive ecological and social outcomes that can result from community-based approaches to restoration. For 20 years, Friends of the Dunes has been focused on community involvement in coastal dune conservation and restoration. The great majority of the members and supporters of the Friends of the Dunes live in the urban communities that ring Humboldt Bay. To fulfill their education and restoration goals, the "Friends" have partnered with numerous public agencies including the Manila Community Services District, Bureau of Land Management, County of Humboldt, and the U.S. Fish and Wildlife Service. The 500 acre Lanphere Dunes on the north spit of Humboldt Bay has been one area where Friends of the Dunes has focused its education, community outreach, and volunteer-based restoration efforts. Lanphere Dunes became a unit of the U.S. Fish and Wildlife Service's Humboldt Bay National Wildlife Refuge in 1998; previously The Nature Conservancy owned and managed this area. The Friends of the Dunes, which became an independent 501(c)3 nonprofit in 1996 and had been working in a collaborative manner with The Nature Conservancy, developed new collaborative relationships with the Fish and Wildlife Service following the transfer. In recent years, the nonprofit has gradually broadened its geographical range of activities to include the adjacent bay and dune environments. Fish and Wildlife Service staff (primarily dune ecologist Andrea Pickart) at the Lanphere Dunes Unit have helped Friends of the Dunes develop their community-based restoration program, acquire funding, and generally develop their current organizational capacity. As a community-based partner of the Fish and Wildlife Service, Friends of the Dunes plays several important roles. These include 1) contracting with the Fish and Wildlife Service to provide community outreach and interpretation at Lanphere Dunes and other units of the Humboldt Bay National Wildlife Refuge, 2) a volunteer program to help staff the newly opened Humboldt Bay National Wildlife Refuge Visitor Center, and 3) providing important in-kind contributions of labor and other resources through its community-based volunteer programs that constitute the matching contributions required by the National Fish and Wildlife Foundation and other organizations that fund restoration work at the refuge.

Some of the hallmark programs of the Friends of the Dunes are its community-based education and restoration program and its coastal areas land trust. While the latter was begun in 2000, the other two have been in existence since the mid-1990s. The Bay to Dunes educational program, supported by local foundations such as the Humboldt Area

Volunteers removing and piling European Beachgrass at Manila Dunes. Photo credit: Emily Walter, Friends of the Dunes.

Foundation and the McLean Foundation, consists of in-class and fieldtrip activities in area public grade schools.

Restoration work on the dunes consists primarily of labor-intensive removal of exotic plants—the type of work conducive to extensive community involvement.[17] This is accompanied by a rigorous regime of basic research and intensive ecological monitoring conducted by Fish and Wildlife Service staff. The Friends of the Dunes' community-based restoration program, known as the Dune Ecosystem Restoration Team (DERT), organizes volunteer restoration work days the first three Saturdays of every month at the Manila, Eureka, and Lanphere Dunes. It also organizes the annual spring "Lupine Bash," an alternative spring break in which college students spend a week doing manual restoration work and enjoying the local environs, a Humboldt State University orientation, and various other activities.

The community volunteer restoration work days demonstrate the integration of community involvement and restoration. The activities of the Ecosystem Restoration Team illustrate the ways in which building community and ecological restoration go hand in hand, by linking people to each other and developing relationships between people and the environment where they live. The organization of the volunteer work "parties" reflects an explicit effort to foster these relationships. Three different coffee shops in Arcata and Eureka sponsor one of each of the three dune areas. On restoration work days, community volunteers gather at the designated coffee shop to socialize and enjoy discounted or free beverages before heading out to work; social gatherings, sometimes including an evening meal and bonfire burning of the exotic plants, often follow the conclusion of the work day. Both the volunteer work days and the Bay to Dunes educational school programs serve to create connections between program participants and the bay and dune ecosystem; they foster a sense among participants that they are a part of the natural environment and related to it in meaningful ways. This approach is rooted in the understanding that environmental stewardship entails active engagement with ecosystems and landscapes. As Carol Vander Meer, Executive Director of Friends of the Dunes has written, "By participating in restoration I find a way to actually be a positive part of the ecology of the dunes….joining together with other community members who care about this place completes my sense of connection and belonging" (2001). This statement clearly invokes William Jordan's notion that restoration provides opportunities for both creating community and negotiating the relationship between community and nature (2000:27).

The ability of restoration to establish relationships between people and the natural environment and to serve as a vehicle for the development of a resource stewardship and conservation ethic is also apparent in the many public school restoration education programs in the county. Examples of this include the Bay to Dunes program of the Friends of the Dunes mentioned above, the extensive collaboration between Arcata High School and the City of Arcata around the planning and implementation of restoration projects, and the involvement of Humboldt State University students in various aspects of local restoration work. Some public school programs, funded by the Department of Fish and Game, area nonprofits, and other restoration organizations, involve taking fertilized salmon eggs into classrooms where children care for them and watch them develop into salmon fry and fingerlings. Such a program has existed in the Mattole watershed for almost 20 years (House 1999:215). A more recent one is the education program, supported by the Department of Fish and Game, Humboldt Area Foundation, and the Trees Foundation, that Jan Vaughn in southern Humboldt County has been involved with for the last five years. Drawing on the earlier work on developing small-scale community-based fish hatcheries

[17] Although it should be noted that other groups besides community volunteers, e.g., the Civilian Conservation Corps, prison crews, and California Department of Forestry crews, also do a significant amount of labor-intensive restoration work, and that occasionally some work is contracted out to heavy equipment operators.

and community outreach by the Humboldt Fish Action Council and other restoration groups, Ms. Vaughn began in 1998 to develop a school program that entails placing tanks in school classrooms and teaching the students (and teachers) how to care for salmon eggs and rear salmon fry. This exercise provides an effective vehicle for teaching about the life cycles of anadromous fisheries, their ecological requirements, and the need for watershed restoration. The project is integrated within the school system's science curriculum, and continuing efforts are being made to fit into the state standards for science teaching. Each year the effort culminates with the release of the fry into a local stream. In the beginning, tanks were placed in 33 classrooms; since then the number of classrooms with tanks has increased to 75, which means that approximately 4,000 children and parents are involved in the project. While the short and long term effects of this kind of project are hard to assess, it is clear that the project awakens a new awareness in many children (and in their parents) of our collective stewardship and land ethic obligations and, like the volunteer restoration work "parties," helps to build connections and relationships between people and the place where they live.

The Mattole Restoration Council, in its efforts

A sequence showing the "Cedar Ed" stream crossing road decommisioning project along Willow Creek, a tributary of the Trinity River, in the Six Rivers National Forest. The Redwood Community Action Agency and Forest Service jointly managed this project using a cooperative agreement. Photo credit: Don Allan, Natural Resources Services, RCAA.

to address the problem of sediment delivery to streams within sub-basins of the Mattole River, has developed and is implementing a community organizing approach to working with landowners throughout the Mattole watershed. Although quite different from the approach the Friends of the Dunes Ecosystem Restoration Team has developed, this model too, fosters community and is aimed at creating the conditions necessary for a sustainable community stewardship ethic to take root, thrive, and be institutionalized within the region's natural resource management regimes. Drawing on lessons and approaches from grassroots organizing in other contexts, Mattole Restoration Council staff have developed a set of outreach and organizing tools, initiated a program that employs those tools, and deployed a network of paid, part-time "landowner liaisons" throughout the riverbasin to implement the program. The goals of the program, called "Good Roads, Clear Creeks," are to arrest sedimentation coming from roads at the points of delivery – many of which are on private property, which thus raises the difficult challenge of gaining landowner trust, confidence, and access permission. Arresting sediment delivery requires conducting road inventories and implementing heavy equipment-intensive restoration work. Gaining landowner confidence and access to the road networks on private lands is difficult and challenging under the best of circumstances. Mattole Restoration Council staff are attempting to do this through their network of community-based landowner liaisons—the centerpiece of the organization's community outreach strategy. The methods the liaisons employ are the tried and true approaches of convening small gatherings of adjacent landowners and neighbors, phone calls, and house visits. The idea is to gradually be able to convince landowners to participate in a sub-basin level road inventory and then support the development and implementation of treatments to address sedimentation sources. Eventually, the range of activities under consideration will hopefully expand to include fuels reduction efforts. As landowner confidence in the integrity of the Mattole Restoration Council's role as a service provider grows, the need for continued outreach is expected

A sequence showing the excavation of an old abandoned railroad crossing with a 80-year old 36-inch redwood box culvert that was threatening to fail. Two excavators removed over 10,000 cubic yards of unstable soil materials and loaded them into dump trucks. Channel side slopes were excavated back to a stable, low gradient angle and protected with mulch, jute netting, and plantings. The channel bottom was rock armored. This restoration project and the one pictured on page 32 were implemented on Simpson Resource Company property in the Little River watershed. In both cases, Pacific Watershed Associates worked with the nonprofit organization Pacific Coast Fish, Wildlife, and Wetlands Restoration Association on project planning, management, and reporting; local heavy equipment operators were employed for project implementation. The projects were funded by the California Department of Fish and Game, with additional partial match funding from Simpson Resource Company. Photo credit: Pacific Watershed Associates and the California Department of Fish and Game.

to diminish. This will occur as the relations of trust between the Mattole Restoration Council and landowners in the river basin expand and the manifestations of those social relations on the landscape in the form of "good roads, clear creeks" become increasingly evident. As we saw with the Friends of the Dunes, restoration in the Mattole is as much a social process as it is an ecological one.

Restoration Science (and Art)

There has always been a lively interaction between natural resources restoration and natural science in Humboldt County (the social sciences, although essential to successful restoration efforts, have been less well integrated into the restoration system). Adaptive management, the process through which learning mechanisms and opportunities for experimentation are integrated into management plans and actions, has been a hallmark of the restoration field—in many cases, because in the early days restorationists where navigating uncharted waters and therefore had to rely almost entirely on their own "home grown" knowledge base. Because restoration is itself a multidisciplinary phenomena, scientists and engineers from a wide variety of disciplines have contributed their expertise to the restoration endeavor. The long-standing interest in restoration and restoration-related issues and research questions among faculty from the natural sciences at Humboldt State University has greatly contributed to the productive synergy between restoration practice and science in the region. Faculty from several different departments and programs, including environmental systems, engineering, fisheries biology, geology, and natural resources and watershed management have contributed their knowledge and expertise to help advance various aspects of the restoration system. They have often also facilitated the engagement of their students in restoration-related activities, from applied research projects to volunteering for community restoration work days. A significant number of these students, upon graduation, have remained in the area to apply their skills within the restoration sector.

The site-specific nature of restoration efforts, combined with the challenges of designing restoration projects that must contribute to restoration goals and withstand stochastic and extreme environmental perturbations, requires that a good deal of "art" be mixed with the science. Thus restoration practice is not only informed by science, but also by the practical wisdom gained through years of experience by restoration practitioners, whether they be community-based streamside salmon hatchbox operators or heavy equipment operators skilled in road decommissioning. Restoration knowledge is therefore an interdisciplinary amalgam that combines the insights of science with the art of experienced practitioners.

The dynamic interplay between art and science integrated within an adaptive management framework is apparent in the evolution, development, and formalization of restoration knowledge in the county. This evolution includes several sea changes. One of the earliest and perhaps most significant sea change related to upslope watershed restoration was the realization, based on study and experimentation that, by themselves and without being integrated with a heavy equipment component, labor-intensive restoration techniques borrowed from agriculture, such as willow plantings and check dams, were not effective ways to control sediment input to streams from logging and road construction on the steep, erosive slopes of the North Coast. These insights were initially derived from experiences with watershed restoration at Redwood National Park soon after the 1978 park expansion. They quickly spread throughout the region and beyond as restorationists realized that stabilizing steep, heavily roaded slopes required the same types of equipment, especially large excavators and bulldozers, that had been used to construct the road and logging networks in the first place. The realization that watershed restoration would be comprised of a mix of heavy equipment-intensive and labor-intensive efforts, and that the appropriate mix would vary with site-specific ecological, social, and political conditions, moderated the expectations regarding the labor-absorbing potential of watershed restoration. It also firmly established that restoration would be an art as well as a science because of the challenges associated with removing road crossings

A sequence showing the decommissioning of a stream crossing. The original Humboldt crossing (logs laid lengthwise in stream and then covered with soil) had been overlain with a culvert. The entire crossing was excavated and approaching road segments decommissioned. Unstable fill on the road has been removed and the road was outsloped using the excavated spoil material. Mulching by hand prevents further erosion. Photo credit: Pacific Watershed Associates and the California Department of Fish and Game.

or landings and discovering and uncovering the original, natural contours of the stream and slope before the road was pushed across it. This understanding of restoration as a process that combines technical skills with experience-based understanding and expertise resonated with the experiences of restoration practitioners who focus on in-stream and near-stream restoration projects.

Over the last 15 years there has been a trend towards the standardization of restoration approaches and practices. This has occurred both with regard to upslope watershed restoration as well as in-stream fisheries habitat improvement work. In both cases, standard reference texts and restoration manuals have been developed and written, based almost entirely on restoration experiences on the North Coast. Two central texts are the Department of Fish and Game's California Salmonid Stream Habitat Restoration Manual (Flosi et al. 1998) and the Handbook for Forest and Ranch Roads (Pacific Watershed Associates 1994). These and other documents, which now guide restoration work in many regions beyond the North Coast, speak to the wealth of expertise that has evolved in the region, and to the productive integration of scientific knowledge and method with field experience-based expertise that characterizes watershed restoration.

The frameworks that guide both up-slope and in-stream restoration work are designed to provide restoration practitioners the information necessary to prioritize restoration work in a manner that maximizes ecological benefit (measured for example, in cubic yards of sediment saved from entering a stream or amount of fish habitat restored or opened up) and meets cost-effective criteria. The model of upslope watershed restoration developed by local watershed scientists and practitioners is based on the understanding that sediment deliveries from road systems constitute one of the largest sources of anthropogenic sediment production and that watershed restoration work can effectively minimize those types of sediment deliveries. Effective prioritization of restoration work requires detailed site-specific information regarding sediment delivery sources and erosion potential within a watershed. Multi-stage watershed assessment methodologies have been developed to provide this information. These assessments include, 1) compiling and mapping the road construction history of the watershed, often using historical aerial photo analysis, 2) conducting a field inventory and analysis of sites that have the potential to deliver sediment into fish-bearing stream systems, and 3)

Humboldt State University students monitor post-restoration vegetation recovery at Lanphere Dunes as part of a class project. Photo credit: Andrea Pickart, USFWS.

A research project investigating the habitat parameters and invasion ecology of Parentucellia viscosa (sometimes called yellow glandweed) - part of the science-based restoration program at Lanphere Dunes. Photo credit: Andrea Pickart, USFWS.

developing detailed prescriptions for treating each sediment delivery site. This watershed assessment approach for prioritizing and guiding upslope restoration work is commonly used by many organizations within the restoration sector.[18]

Restoration practitioners working downslope on in-stream and near-stream fish habitat restoration programs generally rely on the California Salmonid Stream Habitat Restoration Manual. This extensive manual (first edition 1991) was prepared by the Department of Fish and Game with extensive help from local restoration consultants and contractors, HSU faculty, and staff and researchers from other agencies (e.g., US Forest Service and the California Conservation Corps).[19] The manual, which was subsequently revised in 1994 and 1998, defines and explains the department's approach to fisheries restoration; it is part of an effort to help provide restoration practitioners with proven standard procedures and techniques for in and near-stream restoration. The manual provides detailed guidance concerning watershed assessments, fisheries habitat inventory and distribution analysis, fish habitat restoration project planning and implementation, and monitoring. The manual also offers a standardized approach for downslope restoration work. Proposals submitted to the Department for funding under its Fisheries Restoration Grant Program must meet the design specifications contained in the manual.

The implementation phase of any restoration project, whether an upslope effort to hydrologically decommission a road network or an

[18] Pacific Watershed Associates, a local consulting firm, has played an important role in developing and formalizing this methodology, which is based on earlier restoration approaches and techniques developed at Redwood National Park. The level of detail involved in developing an assessment that can effectively guide implementation work is impressive. For example, PWA's 2001 watershed assessment and erosion prevention planning project in Jacoby Creek, Washington Gulch, and Rocky Gulch watersheds involved inventorying 69 miles of roads to assess future sediment sources. The assessment identified 454 potential sediment delivery sites, of which 304 were stream crossings, 89 were potential landslides, and 61 were ditch relief culverts and gullies. Detailed information was provided regarding each of these sites. This information is used to prioritize each site or group of sites according to erosion potential, the severity and urgency of treating the threat of sediment delivery, and cost-effectiveness (costs range from $5 to $15 per cubic yard sediment prevented from entering a fish bearing stream system – although this figure can vary widely depending on the purpose of the restoration project and whether or not the project is single-species focused). Based on this assessment, specific treatments and cost estimates for equipment and labor are prescribed for each site. Watershed assessments that provide this level of information are important tools that help in the acquisition of funding for restoration implementation and that function as a set of plans to guide the restoration work itself.

[19] The principle consultants who contributed to the manual were Aldaron Laird, Keith Barnard, Matt Smith, and Don Allan. Professor Terry Roelofs of HSU was the primary university faculty involved in the manual's preparation.

instream fish passage barrier removal project, always requires considerable expertise and ability to make mid-stream corrections and modifications to the original project blueprint, regardless of the blueprint's quality and sophistication. This is due to the unexpected vagaries and natural variations in circumstances that invariably arise in such complex situations. This also speaks to the importance of experience-based insight and knowledge of restoration practitioners, whether heavy equipment operators or workers installing stream habitat enhancement structures. In this field, experience matters a lot. Furthermore, the specialized expertise required for this work suggests that restoration manuals alone are a necessary but insufficient way to impart the requisite knowledge to restoration workers; on-the-job training, technical assistance, and experienced supervision are necessary to assure quality control.

Monitoring also plays an important role in the restoration sector; it is key to the long-term success of restoration. Monitoring provides baseline information that establishes the need for restoration projects. For example, United States Geological Service studies of erosion and sedimentation rates in Redwood Creek were instrumental in helping to gain support for the 1978 park expansion and funding for restoration of park resources. Monitoring of restoration projects themselves is the hallmark of an adaptive management approach. It is only by monitoring the effects of restoration projects that lessons can be learned and incorporated into the subsequent restoration efforts. However, many restoration practitioners readily acknowledge that developing effective monitoring protocols and securing the funding and other resources to implement them is an on-going challenge

There are several types of monitoring. These include trend, implementation, effectiveness, and validation monitoring. The monitoring program of the Mattole Restoration Council illustrates some of the varieties. The Council's monitoring program emphasizes trend monitoring; this includes monitoring of parameters such as water temperature at approximately 110 locations in the Mattole watershed, surveys of salmonids at different life cycle stages, cross-sectional stream channel surveys, and seedling survival and forest growth monitoring. Chris Larson, Executive Director of the Mattole Restoration Council, notes that much of the learning necessary for adaptive management can come from trend monitoring and observational monitoring.

Implementation, effectiveness, and validation monitoring become increasingly more challenging. Implementation monitoring entails an evaluation of the degree to which a project was implemented as planned. Implementation monitoring sometimes includes evaluation of the immediate, short term effects of a restoration project. Implementation monitoring protocols have been used to monitor recent road decommissioning projects in sensitive areas of the Mattole River watershed. Effectiveness and validation monitoring quickly become fairly complex endeavors that challenge even the scientific "experts." The aim of the former is to relate restoration project implementation to changes in watershed function and species abundance and diversity—to basically answer the question "to what extent are restoration projects improving water quality and facilitating the return of once-abundant salmon and steelhead?" The aim of validation monitoring is no less challenging – to assess the validity of the presumed causal relationships between restoration activities and ecological structure and function. While a number of resource professionals and scientists, many of them supported by the Department of Fish and Game, are currently conducting research on some of the issues related to effectiveness and validation monitoring, the complexity of the modeling challenges and the limits of human understanding of these complex ecological systems challenge our ability to draw conclusive, causal linkages between fish populations, watershed health, and restoration.

As can be seen from this discussion, monitoring issues can quickly develop into science research questions. There are many examples of the productive synergy that has developed between research and restoration on the North Coast—several have already been noted. A brief review of one such example—the research-based restoration program at the Lanphere Dunes Unit of the Humboldt

Bay National Wildlife Refuge—exemplifies the complementarity between research and restoration. At the Lanphere Dunes Unit, monitoring for restoration is integrated with basic research concerning different aspects of the dune ecosystem, much of which is conducted through collaborative efforts involving faculty and graduate students at Humboldt State University, as well as by Fish and Wildlife Service staff. Formal monitoring protocols have been developed and are followed to determine the effectiveness of diverse techniques for removing exotic invasive species such as iceplant, English ivy, and annual grasses. In addition to monitoring activities, basic research is conducted at the dunes. The research results guide and inform the active restoration agenda of the unit's managers. Research projects have examined the effects of invasive plants on the distribution and structure of biotic soil crusts, developed baseline information on the common pollinators of dune species to aid in future trend and effectiveness monitoring, and determined the effects of invasive exotic plant species on native pollinators (Pickart 2001, 2003).

The productive integration of research and restoration at the dunes is yielding a model and techniques for restoring such ecosystems that restorationists in other regions are finding useful. Closer to home, the "tried and true" restoration techniques that have been developed at Lanphere Dunes through collaborative efforts between Friends of the Dunes and dunes managers are beginning to be applied to restoration of other dune ecosystem areas in Humboldt Bay and on the North Coast, as well as to the adjacent estuarine systems of the bay. The recently formed Humboldt Bay Scientific Advisory Committee for Estuary Restoration (SACER), comprised of scientists and restorationists from both the private and public sector, is a key institutional forum through which Humboldt Bay ecosystem science and restoration efforts can be coordinated. SACER recently (October 28, 2003) sponsored a one day symposium, "Advancing the Science of Estuary Restoration in Humboldt Bay," that drew a large group of restoration practitioners and scientists to discuss current and future restoration efforts, the role of science in those efforts, and the challenges of developing a conceptual model of the estuary to guide future restoration efforts. At the symposium it was evident that estuary restoration efforts are gradually becoming linked with upstream watershed restoration programs and are beginning to evince the qualities of a regional ecosystem approach to ecological restoration—as Mitch Farro of the Pacific Coast Fish, Wildlife and Wetlands Restoration Association put it, "a headwaters to tidewaters" approach is emerging.

Restoration—a Coherent System

The various nodes and relationships that comprise the area's restoration network collectively create a pattern that exhibits enough cohesiveness and integrity to be thought of as a system. Webster's Dictionary defines system as "an assemblage or combination of things or parts forming a complex or unitary whole" and "a coordinated body of methods or a complex scheme or plan of procedure." The restoration sector in Humboldt County conforms to Webster's definition of system as "an assemblage or combination of things or parts forming a complex or unitary whole" and "a coordinated body of methods or a complex scheme or plan of procedure" in many respects. It is comprised of a diverse assemblage of different "parts" (agencies, organizations, and people) bound together by the common enterprise of restoring ecosystem health. Taken together, these diverse entities comprise the restoration community and its well developed institutional infrastructure.

Let's consider some of the evidence for thinking of the restoration sector as a system and the benefits that might derive from this perspective. While it is clear that a variety of "models" for organizing restoration work on different types of land ownerships have evolved, it is also apparent that rather than comprising disparate and unrelated actions and endeavors, these different models draw on common sets of relationships, skills, expertise, resources, and people that are all loosely linked together within the restoration network. Thus, a comprehensive understanding of any one component of restoration, say for example the flows of dollars into the restoration sector, or road decom-

missioning on Forest Service lands, is incomplete without also taking into consideration how it relates to the other components of the restoration network.

Attempts to address a bottleneck or barrier within restoration, such as the increasing time, resources, and money required for the permitting process, or securing on-going financial support for restoration, will only be effective if restoration is understood as a set of interdependent parts that together comprise a system. This "system perspective" speaks to the importance of acknowledging the implications of networks of relations for the design of an effective strategy to address the permitting issue, or for engaging in the collective action and coalition building necessary for securing future streams of restoration funding.

Employing a "system" perspective highlights the importance of the existing institutional infrastructure that enables restoration to take place, as well as the need to invest in and maintain that infrastructure. Part of the restoration infrastructure derives from the fact that a self-identified restoration community exists. This community is comprised of an extremely diverse assemblage of individuals who occupy very different positions within the restoration system. Diversely positioned members of the restoration community know each other and understand that only through their concerted actions and mutual cooperation will restoration work be sustained. The strength and importance of the personal relationships that bind members of the restoration community together are hard to overestimate. As Paula Golightly of the U.S. Fish and Wildlife Service noted, "It's the trust, the ability to communicate, work one-on-one with people that trust and like you—these relationships are what make all of this (restoration work) go." Similarly, Gary Flosi, of the California Department of Fish and Game and co-author of the *California Salmonid Stream Habitat Restoration Manual*, emphasizes the importance of stable personnel within the restoration system because of the importance of the social relationships and shared understanding of restoration within the restoration community. When new staff join his agency, Flosi noted that "the hardest part in training new staff is (helping them understand) the web of the restoration system."

The restoration community has developed a standardized and codified body of methods and techniques for achieving the goals of restoration—these methods and techniques are encoded in the various restoration manuals and publications that have emerged from the restoration experience in northwestern California. Examples of these manuals (standardized texts) include the Department of Fish and Game's *California Salmonid Stream Restoration Manual* (3rd edition), the *Handbook for Forest and Ranch Roads* developed by Pacific Watershed Associates, and the *Water Quality and Stream Habitat Protection Manual for County Road Maintenance in Northwestern California Watersheds* developed by the Five County Salmonid Conservation Program. Other publications, such as the aforementioned Redwood Community Action Agency 20 year retrospective on its Natural Resources Services' engagement with restoration on the North Coast, also distill lessons learned, promulgate standardized methods for different aspects of restoration, and facilitate horizontal technical assistance and information transfer. The wealth of knowledge, experience, and expertise that is embodied within the restoration system is an extremely valuable asset that could inform the many restoration initiatives and efforts of other regions of the country.

Many of the agencies, organizations, and individuals that comprise the restoration system also participate in one or more formalized or quasi-formalized network organizations. Founded almost without exception on principles of collaboration, cooperation, and mutual exchange, these organizations include the Collaborative Learning Circle, the Humboldt Bay Watershed Advisory Committee, the Redwood Regional Watershed Center, the Humboldt Bay Scientific Advisory Committee for Estuary Restoration, and the newly emerging Humboldt Bay Stewards, among others. These network organizations often are comprised of multiple nodes within the restoration network and they themselves serve to coordinate activi-

ties among adjacent network nodes. Some, like the Collaborative Learning Circle, extend beyond Humboldt County to encompass western northern California and southern Oregon. These network organizations exist at a larger scale than individual network nodes; they play extremely important roles within the overall restoration network—although they generally do not actually implement restoration projects themselves. For example, network organizations facilitate information exchange, promote resource sharing and partnering, enable collective prioritization of restoration needs and priorities, provide opportunities for coordination of restoration activities, and facilitate technology transfer between adjacent nodes within the restoration network. These important functions, which would be greatly diminished without these network organizations, help to institutionalize the links between extremely diverse entities, such as nonprofit organizations, state and federal resource management agencies, environmental groups, scientists, and public and private land managers. These network organizations therefore comprise an important part of the institutional infrastructure of the restoration system.

A good example of a network organization is the Humboldt Bay Watershed Advisory Committee (HBWAC). HBWAC emerged out of a 1996 Humboldt Bay Symposium in which participants agreed that a coordinating group for the Humboldt Bay Watershed was needed to help facilitate and guide salmon and steelhead restoration efforts. The initial group that formed was a technical advisory committee that met regularly to discuss common issues and challenges related to salmonid restoration efforts within the bay. A year or two later, with support from For the Sake of the Salmon, an Oregon-based organization that supports fisheries restoration in the Pacific Northwest, a watershed coordinator position was created and housed with the Humboldt Fish Action Council. Later, the advisory committee transformed itself into the Humboldt Bay Watershed Advisory Committee, and it and the watershed coordinator position shifted institutional affiliation to the Redwood Community Action Agency. Since then HBWAC, under the guidance of Ruth Blyther, has continued to pursue its goals and objectives with financial support from the Department of Fish and Game and the California Coastal Commission. HBWAC is somewhat unusual in that its members are exceedingly diverse; they represent the full spectrum of stakeholder groups with an interest in restoration of the bay watershed, including industrial timberland owners and environmental groups, in addition to restoration practitioners, agricultural interests, municipalities, and agencies. The diverse composition of the committee reflects HBWAC's explicit commitment to develop the trust and communication necessary to build a common middle ground around the goals and practices of restoration that would be acceptable to as diverse a group as possible. This multi-stakeholder approach facilitates the acquisition of support for restoration from public agencies, which increasingly are looking for evidence of such broad-based, collaborative efforts. Thus, HBWAC was an important player in obtaining the first 319(h) Grant from the California State Water Resources Control Board for Humboldt Bay Watershed. Furthermore, once the Humboldt Bay Watershed Salmon and Steelhead Plan is completed, such broad-based support will give the plan much more credibility than if it was developed by only a subset of stakeholders. In addition to developing the watershed plan, HBWAC has two other primary goals: to engage in education and outreach for the purpose of promoting restoration activities within the watershed, and to provide a regular forum in which members of HBWAC members can discuss restoration-related issues and gradually identify areas of common ground.

Like other network organizations within the restoration system, HBWAC plays an important function as a bridging mechanism that links diverse nodes within the restoration system. Through its on-going sponsorship of restoration-related workshops and forums, HBWAC contributes to the advancement of restoration knowledge and the sharing of that knowledge among diverse network nodes. HBWAC also provides a forum for one segment of the restoration network (that pertaining to the bay watershed) to interact with county, state,

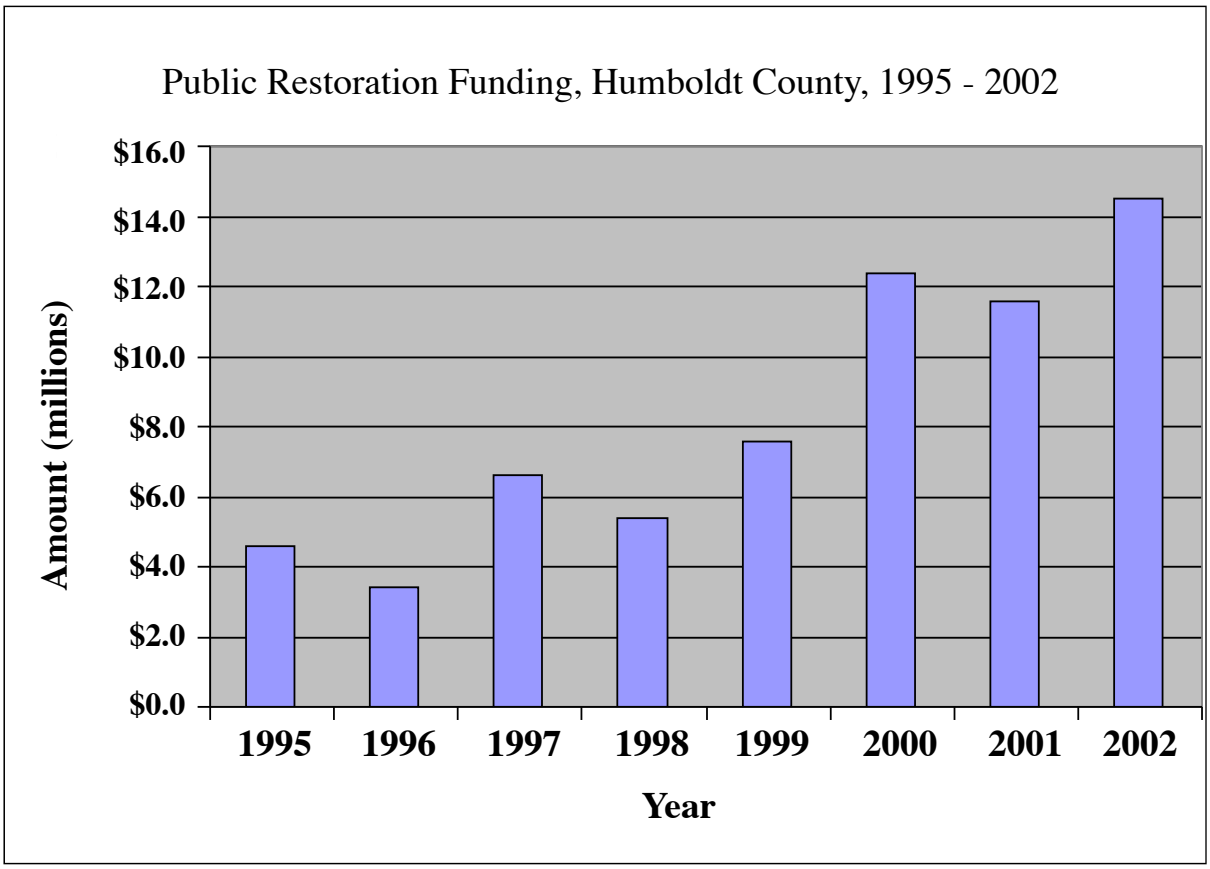
and federal entities. For example, the watershed plan, although still in draft form, is already tied to the state and federal coho recovery plans and HBWAC is involved in the Regional Water Quality Control Board's deliberations concerning TMDL issues on Elk and Freshwater Creeks. HBWAC also facilitates interaction between Humboldt State University researchers and restoration nodes to help ensure that university-based research is relevant for and meets the needs of restoration practitioners. Lastly, the attempt to build common ground among diverse stakeholder groups has yielded positive results; it has begun the process of breaking down barriers between otherwise polarized groups as ranchers, farmers, forest managers, environmentalists, and restorationists, learn to communicate with one another within a context of mutual respect that allows the common middle ground, where it exists, to grow more firm.

HBWAC is but one example of a restoration system network organization. As noted above, there are several others within the restoration system—all of which have institutionalized mechanisms for collective learning and crystallizing and transferring, through practitioner to practitioner relationships and the dissemination of codified knowledge, some of the lessons learned from the area's rich experience with restoration. For the Sake of the Salmon's California Regional Watershed Coordinator Program, funded in part by the California Water Resources Agency, supports three regional watershed coordinators in three regions of coastal California to provide technical assistance to local watershed groups working on restoration efforts. Watershed coordinators (Sungnome Madrone of the Redwood Community Action Agency is the North Coast Regional Watershed Coordinator) sponsor funding workshops, networking forums, and capacity-building activities for watershed groups in their region, in addition to providing direct assistance to individual groups. This program is another example of a regional-level effort to advance restoration through building the necessary institutional infrastructure to promote organizational development within restoration network nodes, in this case with a particular focus on building the capacity within watershed organizations to develop proposals for watershed assessment, planning, and restoration projects. HBWAC and other network organizations sponsor numerous workshops, training sessions, and field trips each year to address different aspects of restoration. These forums include training programs for heavy equipment operators, planners, and policy makers, watershed restoration techniques, business management techniques, and ways of sorting out the permitting challenges restorationists face. The University of California Cooperative Extension, the Five Counties Salmonid Conservation Program, the Collaborative Learning Circle, the Redwood Community Action Agency, the Eel River Watershed Improvement Group, the Institute for Sustainable Forestry, and Humboldt County Resource Conservation District are just some of the regional entities that have sponsored workshops in the last year alone.

Like HBWAC, other network organizations also constitute effective vehicles for interacting with state and federal entities. For example, the Redwood Regional Watershed Center (whose primary mission concerns education, research, and interpretation related to watershed-based management and restoration) coordinates directly with the California Watershed Council and the California Watershed Network, and communicates to these state entities restoration-related priorities, concerns, and support needs. Another important state level forum is the annual Salmonid Restoration Federation Conference which, like local network organizations, constitutes an extremely important arena for diversely positioned members of the state-wide restoration community to come together annually to share lessons learned and generally advance restoration goals and objectives.

Humboldt County's restoration system also includes forums and arenas that integrate restoration research with restoration practice. This component of the restoration system involves the efforts of research scientists to understand ecological structure, function, and dynamics and to then relate that understanding to the design and implementation of restoration projects. A prime example of this integration is the recently formed Humboldt Bay Scientific Advisory Committee for Estuary

Graph 1: Public Restoration Funding for Humboldt County, 1995-2002



Restoration (SACER), whose mission is to "contribute to an interdisciplinary approach for guiding restoration efforts in Humboldt Bay…."

Clearly, restoration on the North Coast is not comprised of a set of discrete, atomistic individuals working on their own restoration projects in an uncoordinated fashion; rather, it is a tightly articulated system, a community of people occupying extremely diverse positions within the restoration network, bound together by their common commitment to work towards improving ecological conditions in their neighborhood. Paula Golightly noted the role of fish in bringing people together through restoration: "fish have connected a lot of people; everybody can relate to fish, everybody wants fish."

How Much Money Does Restoration Bring Into Humboldt County?

While restoration exists as a system—a coordinated network of people, agencies, and organizations—it does not lend itself to easy quantification in terms of its size. In this respect it differs significantly from other sectors of the North Coast economy, such as agriculture, forestry, commercial fishing, or tourism. The difficulty of describing the scope and scale of the restoration system in Humboldt County has challenged the ability of people within the restoration sector to convey to others outside the sector a clear picture of the sector's size. Indeed, coming up with some quantitative parameters of the size of the restoration sector was one of the primary reasons for initiating this study. This section reports on the flow of investment dollars into restoration.

Natural resources restoration work in Humboldt

Table 1. Public Funding for Restoration, by Source, Humboldt County, 1995-2002

	Bureau of Indian Affairs	Bureau of Land Management	National Fish and Wildlife Foundation	National Park Service	U.S. Fish and Wildlife Service	U.S. Forest Service	Department of Water Resources
1995	$311,329	$943,500	$40,000	$527,197	$280,490	$191,410	$63,624
1996	$275,666	$539,924	$0	$167,870	$158,820	$323,700	$0
1997	$293,708	$837,308	$20,000	$621,130	$211,297	$236,517	$0
1998	$510,934	$366,000	$380,876	$1,120,057	$109,849	$318,155	$0
1999	$235,774	$421,746	$46,210	$1,793,258	$199,155	$465,507	$0
2000	$248,149	$1,435,762	$128,992	$2,443,216	$370,214	$189,951	$158,826
2001	$363,795	$1,284,340	$157,350	$1,345,986	$108,254	$217,512	$1,918,402
2002	$346,010	$1,976,183	$20,000	$1,383,050	$262,533	$51,020	$502,209
Agency Total	$2,585,365	$7,804,763	$793,428	$9,401,763	$1,700,612	$1,993,772	$2,643,061

	Coastal Conservancy	California Conservation Corps[1]	State Water Resources Control Board	California Department of Parks and Recreation	Department of Fish and Game	Wildlife Conservation Board	Humboldt County Public Works[2]	Year Total All Sources
1995	$450,000	$1,000,000	$0	$68,000	$472,170	$288,197	NA	$4,635,917
1996	$0	$1,000,000	$0	$146,849	$570,628	$234,581	NA	$3,418,038
1997	$0	$1,000,000	$402,504	$540,806	$2,320,444	$93,650	NA	$6,577,364
1998	$0	$1,000,000	$419,315	$99,990	$1,039,850	$0	NA	$5,365,026
1999	$75,000	$1,305,646	$248,751	$705,186	$1,980,911	$159,388	NA	$7,636,532
2000	$185,000	$1,301,120	$158,826	$848,856	$4,818,131	$99,700	NA	$12,386,743
2001	$680,000	$2,115,109	$330,534	$317,148	$2,295,063	$24,090	$464,833	$11,622,416
2002	$1,036,000	$1,685,591	$52,209	$329,785	$6,652,388	$0	$199,775	$14,496,753
Agency Total	$2,426,000	$10,407,466	$1,612,139	$3,056,620	$20,149,585	$899,606	$664,608	$66,138,789

[1.] The figures for the Californian Conservation Corps refer only to the State Budget General Fund Allocation the Fortuna CCC Center received. Figures for 1995-1998 are place holder estimates; the actual figures, while higher, were not obtained. The total annual budget of the Fortuna Center is approximately $6.5 million to $7 million. Much of this is comprised of grants and fee for service contracts paid for by other sources listed in this table and hence not included under the CCC column to avoid "double counting."

[2.] These figures only represent the amount Humboldt County contributed for the implementation of fish barrier removal projects associated with the Five County Salmonid Conservation Program. Other county contributions for restoration have not been determined.

County is funded primarily by 13 different state and federal government agencies using a much larger number of programs, initiatives, ballot measures and legislation. The level of funding has increased dramatically in recent years. The great majority of funding for restoration that this study tracked comes in the form of grants to local nonprofit organizations, businesses, landowners, tribes, municipalities, and in some cases to public land management agencies. Graph 1 shows the total annual levels of public funding for restoration in Humboldt County for 1995 through 2002. Table 1 shows by source the annual flows of investment into Humboldt County for restoration for the same period.

Betweeen 1995 and 2000, the restoration system generated more than $65 million for restoration work in Humboldt County. For the last three years, restoration pumped more than $11 million annually into the local economy; in 2002, it brought more than $14 million into the county. The great majority of this amount is spent in Humboldt County; there is extremely little "leakage" of this investment outside of the county. From any perspective, this represents a significant, and growing, contribution to the region's economy. And this is not even counting the present net worth of the future value of restored watersheds, fisheries, estuaries and dune ecosystems, which increases with every incremental restoration investment. As Table 1 demonstrates, by any account, the restoration community in Humboldt County has been very successful at securing consistent, high, and increasing levels of funding.

Table 1 includes only those projects and activities that are directly related to ecological restoration. We purposively adopted a conservative definition of what to include as restoration investments for the purpose of this study. Thus, Table 1 consists of grants and contracts for restoration project implementation and the watershed assessments and sediment inventories that are directly related to project prioritization and implementation. It also includes grants for the school aquatic education programs and public outreach efforts, and grants intended to support watershed organizations. It does not include the internal costs associated with the salaries, benefits, etc. of those public agencies that are part of the restoration system (see below for an estimate of public sector restoration-related FTE's). Nor does it include the costs of on-going studies that are indirectly related to restoration project implementation such as salmon and steelhead and other monitoring efforts on the lower Klamath and Trinity Rivers.

Table 1 and Graph 1 provide conservative estimates of restoration investments in Humboldt County. Other investments fit the criteria for inclusion but for various reasons are not included in the table. For example, the direct investments in restoration that industrial and nonindustrial timberland owners themselves make are not presented in this table. Some of these investments are made independently of other restoration grants, many constitute an in-kind or cash match required for a restoration grant. In-kind contributions include items such as materials and supplies, the use of heavy equipment, and in some instances, labor contributions. For this study we considered, but later rejected, the idea of collecting comprehensive information on in-kind restoration contributions due to the difficulty of tracking this information with any degree of certainty and comprehensiveness. Researchers did track matching contributions for the Dept. of Fish and Game's restoration grants program by reviewing the prior three years of funded proposals stored at the DF&G's Fortuna office. This information is not entirely reliable because the matching contributions were anticipated, not retroactively determined, and the portion of the matching amounts from other grant sources already counted could not be easily separated. Including them again as matching amounts for the DF&G grant program would have "double counted" those amounts.

We did, however, acquire some information from Simpson Resource Company and Pacific Lumber Company regarding their restoration-related investments. For example, between 1995 and 2002, these two corporations together invested approximately $630,000, primarily through collaborative partnerships with other restoration organizations, in restoration planning and implementation work. Most of this work focused on in-stream projects such as riparian corridor enhancement projects, bridge replacements or improvements, and

fish habitat enhancement projects. While most road improvement work on industrial timberland ownerships is related to the implementation of Timber Harvest Plans, some is not. For example, Pacific Lumber Company spent the following amounts on non-THP related road improvements between 1995 and 2002: 1995 to1999–$300,000; 2000–$1,800,000; 2001–$600,000; 2002–$400,000. Most of this work was contracted out. The large increase in expenditures after 1999 reflects Pacific Lumber Company's efforts to comply with the Habitat Conservation Plan and the terms of the 1999 Headwaters Forest agreement. Clearly, private landowners are making significant investments in restoration that Table 1 does not capture. These investments constitute additional contributions to the restoration sector.

There are additional reasons why Table 1 constitutes a conservative estimate of restoration investments. Several types of activities that have a restoration component but that are integrated into other resource management and extraction regimes are not included in this table. Thus, for example, the innovative cost-share programs of the Natural Resources Conservation Service that are fostering the development of dairy waste management systems on many of the dairy farms in the Eel River delta are not included in this database, even though such systems have direct and immediate positive effects on water quality and sediment delivery on the Eel River. Similarly, a large amount of the upslope restoration work related to road systems on industrial forestland ownerships is not included in this database. This work, which is almost entirely associated with Timber Harvest Plan implementation, includes stormproofing road systems and decommissioning spurs and skid trails using the standard restoration techniques that restoration practitioners have developed in Humboldt County. Often using watershed assessments conducted for restoration purposes, timber corporations upgrade sub-basin road systems simultaneously with timber harvesting operations. These "restoration" investments are made for a variety of reasons, including as necessary mitigation required by approved Timber Harvest Plans, to comply with a Habitat Conservation Plan, or to demonstrate commitment to land stewardship goals and objectives. Whatever the motivation, these activities also result in thousands of cubic yards of sediment saved from entering fish bearing streams. Yet, they are excluded from Table 1 because of the near impossibility of parsing restoration-related investments from the larger resource management regime in which they are embedded.

A third example of restoration investments that are excluded from this database concerns restoration forestry. An important sub-discipline of forestry, restoration forestry focuses on the development and implementation of silvicultural treatments and forest management techniques that restore a degraded forest's species composition, structure, and function. Restoration forestry is often distinguished from "industrial forestry" in which short term profit generation objectives may override long term, natural capital-enhancing management prescriptions. In Humboldt County there is a strong restoration forestry movement and one of the leading proponents of it is the Institute of Sustainable Forestry. As with dairy waste management and timber corporation road improvement projects, investments and projects associated with restoration forestry are not included in this database—this is primarily due to the difficulty of distinguishing between restoration forestry and other models of forestry, both conceptually and in terms of investment levels. As a result of these exclusions, the flow of money, expertise, and other resources into natural resources restoration in the county is significantly larger than the amounts shown in Table 1.[20]

Comparing the Value of the Restoration Sector With Other Resource and Agricultural Products

The restoration system constitutes a significant economic engine that has the capacity to attract more

[20] Table 1 also does not include the significant investments that some of these agencies and organizations have made for the acquisition of areas that are subsequently integrated within a restoration regime. For example, the Coastal Conservancy and the California State Wildlife Conservation Board have historically spent significantly more on land acquisition than they have on actual restoration efforts. These acquisition-related expenditures are not shown.

Table 2: Gross Value of Selected Agricultural Production, Humboldt County, 2001 (Source: Summary of County Agricultural Commissioners' Reports, 2001, p.12)

Product	Value
Nursery, Flowers, and Foliage	$33,952,000
Milk, Market	$27,572,000
Cattle and Calves	$18,547,000
Milk, Manufacturing	$15,290,000
Pasture, Range	$4,700,000
Livestock	$3,450,000
Pasture, Irrigated	$2,828,000
Vegetable Crops	$952,000
Silage	$871,000
Hay, Other	$600,000

Source: Summary of County Agricultural Commissioners' Reports, 2001, p.12

than $10 million from outside Humboldt County for investing in restoration in the county each year. How does the size of this sector measure up against other sectors within Humboldt County? Not surprisingly, it pales when examined in light of the value of the county's timber harvest; the 374,041 MBF (thousand board feet) harvested in 2002 was valued at $130,554,325 (California State Board of Equalization 2003). While a tiny fraction of this value was reinvested in restoration-related activities, it should be noted that that reinvestment is NOT included in Table 1. However, the $14.5 million that restoration brought into the county in 2002 does compare favorably with the value of some of the county's other resource-dependent sectors. Consider the gross value of some of Humboldt County's leading agricultural products that Table 2 shows for 2001. While the commodity values of several products are significantly larger than the amount of money restoration brings into the county, it is interesting to note that the differences are not huge and that in fact restoration generates more revenue than the value of several agricultural commodities. Lastly, it is of interest to compare restoration with commercial fishing. In 2001 the total value of the commercial landings (fish) in Humboldt County was $6,302,270 (California Department of Fish and Game 2002). This is slightly more than half the amount of money that was brought into Humboldt County for restoration that same year. The point of these comparisons is to demonstrate that even when restoration investments are accounted for in a conservative manner, they are comparable to other resource extraction and agricultural sectors of the county's economy. Thus the fact that restoration brings into the county almost twice the revenue that commercial fishing does, indicates both the importance of the current restoration sector and the need to continue and expand restoration investments to enable the value of other sectors, such as commercial fishing, to also increase.

How much value do the restoration investments in Table 1 generate? Using earnings multipliers from related industries, we can calculate the approximate value of the money brought into Humboldt County by restoration as it ripples through the economy. The Regional Input-Output Modeling System (RIMS II), developed and used by the United States Department of Commerce, Bureau of Economic Analysis, provides these multipliers for 38 indus-

tries in California. The earnings multiplier for "farm products and agricultural, forestry, and fishing services" is 2.05, and for "forestry and fishing products" it is 2.56. Using these two multipliers leads us to conclude that the $14,496,753 brought into Humboldt County for restoration in 2002 generated between $29,718,343 and $37,111,687 in earnings for households employed in industries related to the restoration sector.

Clearly, restoration constitutes a significant component of the Humboldt County economic landscape. Furthermore, restoration interacts both directly and indirectly with other resource-based sectors of the economy in an entirely synergistic manner. Thus, for example, fisheries habitat and upslope restoration efforts will result in increasing numbers of anadromous fish that successfully spawn and develop in Humboldt County's fish bearing streams. Over the long run, this will increase the poundage and value of commercial and sport fishing landings on the North Coast. In the near term, restoration efforts contribute in a variety of ways to the sustainability of dairy farming, timber management, and other resource-based sectors. Furthermore, such efforts are an important part of restoring and conserving the environmental qualities of Humboldt County, whose amenity values are becoming increasingly recognized as one of the primary reasons why people want to live on the North Coast.

Private, Public, and Tribal Employment in Restoration

How many people work in restoration in Humboldt County? The answer to this question is also difficult to descern. Neither the Standard Industrial Classification (SIC) code nor the North American Industry Classification System (NAICS) that replaced the SIC system in 2000 include restoration as a category of employment. Additionally, consistent with the focus of this report, we were interested in determining how many jobs restoration work in Humboldt County generates. This meant that we would not be estimating those jobs in Humboldt County that out-of-county restoration-related projects and work generate. Our primary focus was to assess the employment creation of within-county restoration efforts.

To estimate the employment that restoration work in Humboldt County generates, we first began with the private sector. We set a base year (2002) and drew up as complete as list as we could of all the private sector nonprofit organizations, businesses, firms, and contractors that have paid employees who do restoration work in the county. This list includes 35 contractors (mostly heavy equipment), 16 consulting firms (mostly providing professional, science-based services), and 10 nonprofit organizations. Through phone interviews we asked these businesses and organizations several short questions about their organization, including questions concerning how much time employees (permanent full and part-time and seasonal full and part-time) spent on restoration-related work in Humboldt County in 2002 (see Appendix 1 for the survey form). This information was used to develop an estimate of the number of restoration jobs in Humboldt County. Based on this employment information, we then determined how many Full Time Equivalents (FTE's) were devoted to restoration-related work in 2002. In this context, an FTE is the amount of work (in hours) that represents full-time employment for one person for one year. For consulting firms and nonprofit organizations we assumed that one FTE is the equivalent of 48 40-hour weeks (52 weeks minus two weeks paid leave and two weeks holidays), or 1,920 hours. Definitions of full time work (the amount required in order to qualify for an annual pension credit and health benefits) in construction and trades varies from 1,200 hours per year for the Carpenters Union to 1,320 hours per year for the Operating Engineers Union. Due to the seasonality of heavy equipment work in this region, most operators consider 1,300 hours of work to be a good year (Brian Bishop, pers. comm.). Accordingly, we converted the estimates of time spent on restoration work by equipment contractors into FTE's at the rate of 1,300 hours per FTE.

The results of our phone surveys with more than 60 organizations and businesses show that restoration work in Humboldt County generated

approximately 240 jobs in the private sector in 2002. It should be noted that this does not include the California Conservation Corps members who reside at the Fortuna Center and whose work almost entirely consists of restoration-related efforts. Of these 240 jobs, approximately 70 are in consulting firms and businesses, 105 in contracting businesses, and 65 within area nonprofits.

Clearly, these jobs are not all permanent, full-time jobs; a significant number are part-time and seasonal jobs. Converting these jobs into FTE's as per the above discussion, yields approximately 160 FTE's generated in private sector Humboldt County restoration work in 2002. Of this total, 86 FTE's are distributed across restoration contractors, mostly heavy equipment; 44 FTE's are in consulting firms and businesses that do restoration work; and 30 FTE's are within nonprofit organizations in the restoration system.[21] This is a conservative, rough estimate of restoration employment. The actual number of jobs and FTE's in restoration work in Humboldt County is almost certainly somewhat higher as we were unable to reach some (less then five) of the organizations and businesses on our list, and there may be some firms and businesses involved in restoration work that we inadvertently did not include on the list in the first place. Additionally, it must be kept in mind that California Conservation Corps members do much of the manual labor involved in restoration project implementation and that the above job and FTE estimates do not include the corps members who reside at the Fortuna CCC Center.

Several factors account for the fact that there are significantly more jobs than FTE's in restoration. One primary factor is the seasonality of restoration work itself. Due to a variety of constraints, especially those designed to minimize the negative short term environmental effects of restoration project implementation, the great majority of restoration project implementation work is restricted to a four month window from July through October.[22] The constraints that restrict operations to this time period are based on environmental considerations having to do with protecting federally listed endangered and threatened species and prohibitions against soil disturbing activities during the wet season. Because of the relatively narrow window of restoration work for heavy equipment operators, many find other jobs during the "off" season, even if they have specialized in restoration work. A second factor that accounts for the difference between the number of restoration-related jobs and the FTE's in the restoration sector is the fact that many of the resource professionals involved in restoration, such as consulting engineers, geologists, hydrologists, biologists etc. who participate in restoration projects, also work on non-restoration-related jobs during the course of the year.

What are the secondary job creation effects of the restoration sector FTE's? In order to assess the number of jobs created through the multiplier effect of the number of jobs in the restoration sector, we can again turn to the RIMS II model—this time to the employment multiplier. The employment multiplier indicates the number of jobs that are gained or lost within the economy for every job gained or lost in the sector of interest. For "farm products and agricultural, forestry, and fishing services" the employment multiplier is 1.69, and for "forestry and fishing products" it is 3.01. Using these two multipliers and taking the most conservative route of using only the number of private sector FTE's in restoration, not the number of private sector jobs, we can conclude that restoration jobs in Humboldt County in 2002 created between 270 and 480 jobs in the industries related to restoration.[23] While these are only rough and conservative estimates, they do

[21] For comparative purposes, it is interesting to note that there are 571 employees in the logging industry (North American Industrial Classification System Code 1133) as reported in the 2001 "County Business Patterns for Humboldt, CA" (U.S. Census 2001).

[22] However, it should be noted that while this is certainly true for heavy equipment operators, other types of restoration work are not restricted to such a short season. Some tasks related to dune restoration, for example, can be done during the winter months using California Conservation Corps and California Department of Forestry crews (Andrea Pickart, pers. comm.). This suggests that perhaps the more labor-intensive forms of restoration work can be distributed throughout the year.

[23] If we use the most conservative method of calculating the employment multiplier effect by using Full Time Equivalents instead of number of actual jobs, the number of jobs created by the 123.5 FTE within restoration turns out to be between 209 and 370.

convey a clear sense of the extent to which the level of investment generated for restoration purposes ripples through the local economy, both in terms of dollars and jobs generated in other, related sectors.

There are also a wide variety of public sector restoration jobs in Humboldt County. Public sector restoration jobs include jobs in state and federal government agencies, and local government. We asked each public sector organization and municipality with restoration jobs to estimate their restoration employment. We used this to develop an estimate of the total number of public sector restoration FTE's and jobs. In Humboldt County there are at least 37 FTE's and 45 restoration jobs in the public sector. These restoration jobs are distributed across the following organizations: U.S. Bureau of Land Management, U.S. Fish and Wildlife Service, U.S. National Park Service (Redwood National Park), California Department of Parks and Recreation (North Coast Redwoods District), California Department of Fish and Game, City of Arcata, and Humboldt County. The majority of these public sector jobs concern almost everything related to accomplishing restoration objectives except actual project implementation, which in most (but not all) cases is contracted out to private sector entities.[24] Thus, they include managing restoration grants programs, conducting the environmental analyses and inventories necessary to prioritize, plan, and obtain permits for restoration projects, contracting, supervising, and working with other partners in the restoration system during the actual implementation of a restoration project, monitoring and report preparation, etc.

The Yurok Tribe is the primary tribal entity that generates full-time employment in watershed restoration work as defined in this study. The tribe's Watershed Restoration Department has 11 full-time employees. The department's activities include everything related to watershed restoration, from securing funding to project implementation and subsequent monitoring.

Both the Yurok and Hoopa Tribes also focus significant resources, both human and financial, on efforts to restore the salmon and steelhead populations in the Klamath and Trinity Rivers. These efforts include participating actively in 20 years of research and monitoring to determine how best to restore the mainstem Klamath and Trinity Rivers, participation in countless forums, meetings, and planning sessions on this topic, litigation, etc. These efforts, and the associated employment figures associated with them, are not included in our estimate of restoration employment because in this assessment we are focusing on direct restoration employment, by which we mean activities that encompass or are closely related to restoration project implementation. We also are not including watershed restoration employment figures for the Hoopa Valley Indian Reservation because the current upslope restoration program is almost entirely integrated within the tribe's timber harvesting program. It is therefore difficult to separate restoration employment from timber management employment; furthermore in this study we have decided to focus on restoration as an independent activity as it exists separately from resource management and extraction regimes.

To summarize, this information indicates that natural resources restoration work in Humboldt County in 2002 generated approximately 300 jobs (equivalent to 210 FTE's) in the private and public sectors and within tribal government.

Restoration Constraints

The challenges and uncertainty associated with building a restoration system based almost entirely on government support through grants are daunting. Unlike other resource-based sectors of the North Coast economy, in which revenue is generated through the application of labor, skills, and expertise to manage and extract a portion of the region's natural capital, restoration practitioners must manifest their funding "out of thin air,"

[24] The California Department of Parks and Recreation is an exception to this generalization. In-house crews and equipment operators do approximately one-third of the department's restoration project implementation work (Don Beers, pers. comm.). The jobs and FTE's associated with this in-house project implementation work are not included in the estimates this section discusses; this constitutes yet another reason for assuming that the job and FTE estimates err on the conservative side.

as it were.[25] Their whole aim and purpose is to replenish, not diminish, our stocks of natural capital, and at least to date, their efforts have not been significantly funded by resource extraction activities. In the long run the presumed sustainability of both restoration and resource extraction-related industries will depend on the institutionalization of restoration practices within the dominant resource management regimes, through the development of the appropriate mix of economic incentives and regulatory constraints, in a manner that a portion of the financial capital created by those regimes is reinvested in restoring and maintaining the productive capacity of the natural capital base. This, however, is not how restoration is currently organized, nor is it feasible to saddle the current resource extraction industries with the costs associated with restoring the region's inheritance of restoration challenges. As a result, restoration practitioners have had to be, and will continue to be, creative and diligent in securing the funding, developing the expertise, and growing the infrastructure necessary to sustain restoration.

Not surprisingly, a wide variety of constraints have made restoration efforts all the more challenging and difficult. These constraints are well known to those who are part of the restoration system, but they are less well known to those outside it. Some of the key constraints that surfaced during this study are briefly discussed below. It should be noted that this is neither a comprehensive discussion, nor do all segments of the restoration system experience these constraints to the same degree – this latter point is not surprising given the heterogeneity of the restoration sector. Furthermore, the reader interested in this topic is directed to the report of the Task Force to Remove Barriers to Restoration released by the California Resources Agency, January 2003. The report, *Removing Barriers to Restoration*, is the result of a collaborative effort involving diverse stakeholders from a variety of state and federal agencies, rural counties, private landowners, and restoration organizations. The report (available at http://resources.ca.gov/) under "Reports and Publications") discusses barriers to restoration on private lands and then presents a series of 10 recommendations and next steps for addressing them. Most of the issues discussed below (except that pertaining to permitting challenges) are not discussed in the task force's report.

- Inequity in application of regulatory authority governing the heavy equipment work season. Some restoration practitioners have observed that there are several-week periods when timber corporations are able to implement Timber Harvest Plans but restorationists are enjoined from implementing watershed restoration projects due to concerns about the negative environmental effects of implementing the restoration project. These practitioners suggest that the heavy equipment work season for restoration project implementation should be at least as long as the logging season. This is especially important because the short work season of approximately four months is perhaps the primary obstacle to sustaining a decent living and a successful business for restoration contractors. The invaluable knowledge and expertise of equipment operators experienced in restoration work will be lost if they are unable to sustain themselves by doing restoration-related project implementation work. Maintaining and sustaining a trained restoration workforce is of paramount importance. Terry Spreiter of Redwood National Park emphasized the importance of retaining a skilled workforce by commenting that "nature cannot afford to have every restorationist re-invent the wheel at her expense."

[25] However, it is worth noting that economic sectors based on extracting natural capital and restoration reinvestments based on mobilizing social, political, and legal capital are both subject to significant levels of risk and uncertainty. While fiscal uncertainty, i.e., fluctuating funding levels, may challenge restoration efforts, witness the precipitous decline of the commercial fishery due to regulation and declining stocks and the high level of uncertainty and flux in the current regulatory and policy framework that governs the state's timber industry.

Recommendation: Remove the inequities between restoration and timber harvesting in the application of regulatory authority governing the heavy equipment work season.

- Cash flow challenges. Many restoration contractors and nonprofits face enormous cash flow constraints due to a combination of the short work season and delays in receiving payment resulting from the grant-based funding structure of restoration.[26] While the severity of the issue often varies depending on the funding source for the specific project, it is not uncommon for contractors to have to wait 60 days after completing a job before receiving payment. This means that some contractors receive their last payment in December for a work season that ended in October, and have to wait until August of the following year for their next payment. In order to pay their expenses, some contractors and nonprofits have obtained credit lines from local banks. This remedy is not ideal because of the expenses incurred by the contractor or nonprofit and the barriers it represents for smaller businesses unable to qualify for a credit line. Revolving loan funds have been suggested to remedy this situation, but such a fund has yet to be established.
  Recommendation: Provide loans and financial "bridgers" to help restoration nonprofits and contractors avoid the cash flow challenges that they regularly face and that limit their ability to do restoration work.

- Relatively short or non-complementary grant lifespans and lack of fit between agency operating procedures and grantee organizations. Many restoration projects are funded by combining grants from a variety of different funding sources with different sunset dates by which the money must be used or forfeited. It is extremely important that grants have a lifespan that takes into consideration the lengthy and time consuming environmental analyses and permitting processes that must be completed before actual project implementation may take place; it is not unusual for this planning and permitting process to take more than two years and to consume significant financial and human resources. If grants that are combined to implement a restoration project have different sunset dates or relatively short validity periods, the complex juggling act associated with grant management gets even more complex; extensions must be applied for and in some cases funding has been forfeited. Additionally, there are a variety of bureaucratic challenges that themselves constitute significant hurdles. Two concrete examples are that some restoration grant recipient organizations need to charge overhead to meet organizational expenses while some grantors refuse to pay for overhead and some grant recipient agencies require payment up front while some grantors only pay after the project has been completed.
  Recommendation: Improve coordination among agencies that provide restoration grants in order to improve the complementarity of different grant programs, for example, in terms of grant porposes, terms, conditions, lifespans, and other restrictions.

- Permitting hurdles. Depending on the nature of the restoration project, restoration projects require permits from and consultations with the U.S. Fish and Wildlife

[26] The electronic payment methods used by the National Oceanic and Atmospheric Administration (NOAA) to reimburse restoration grantees is a welcome exception to this trend. As described by Sungnome Madrone of the Redwood Community Action Agency, NOAA restoration program grant funds are retained in an easy-to-access account. When the restoration project grantee requests reimbursement for costs associated with implementing a restoration project, NOAA immediately processes the request and the funds become available within only three days.

Service, National Marine Fisheries Service, Army Corps of Engineers, the California Department of Fish and Game, Regional Water Quality Control Board, California Coastal Commission, and County Planning Departments. The primary purpose of the permitting process is to ensure compliance with relevant environmental legislation. In this regard, a grant-funded restoration project is treated by regulatory agencies in much the same way as a "development" project such as a highway, shopping mall, or harbor expansion, despite its avowed positive overall and long term environmental impact. The rising costs and time delays associated with the environmental review and permit processing procedures is emerging as a significant and costly hurdle that restorationists are struggling to overcome. An increasing percentage of grant funds are, of necessity, being devoted to the environmental analyses and consultations associated with the permit process. Due to the increasing severity of the issue, it has recently been receiving more attention within the restoration community. Some agencies have proactively addressed the permitting challenges. For example the Department of Fish and Game has worked to get what are called general review permits from permitting agencies such as the Army Corps of Engineers. These are essentially umbrella permits that cover those restoration practices and procedures described in the department's restoration manual. In other cases, e.g., the Fish and Wildlife Service's Jobs in the Woods Watershed Restoration and Partners for Fish and Wildlife Programs, the lead agency for a restoration project will contribute expertise and staff time to meet the necessary federal requirements and assist as time allows with applications for permits from other agencies. Another successful model for addressing this issue is the Partners In Restoration program that has evolved in Monterey County through partnerships between the Natural Resource Conservation Service, the Resource Conservation District, and a nonprofit, Sustainable Conservation. The one-stop regulatory shopping approach that this effort has produced will likely be of benefit and relevance to other regions in the state. With the sunset of SB 271 funding through the Department of Fish and Game in 2003, it is quite likely that other agencies will increasingly take the role of being lead agency for restoration projects. This suggests that the permitting process will likely get more complex, especially because some of the other agencies that fund restoration do not have general review permits for restoration work.
Recommendation: Permitting agencies need to continue to ensure compliance with permit and consultation requirements but work in earnest to identify ways to reduce the costly and time-consuming efforts necessary to prove compliance.

- Multiplicity and complexity of restoration funding sources. The plethora of different sources of funding for restoration is astonishing. Each funding source and grant program has its own application process, guidelines, conditions, payment policies, deadlines, and reporting requirements. They often also have slightly different objectives and purposes, and varied willingness to support organizational overhead and institutional development. Restoration nonprofits often find it difficult to obtain grant money for organizational maintenance and development. The extent to which they do so influences the degree to which they must self-subsidize their restoration efforts; as one restoration practitioner phrased it, "the more grants we get (to do restoration work) the poorer we become." The complexity of the funding process for restoration presents serious challenges to restoration organizations that must navigate through diverse

funding mechanisms, simultaneously maintaining cash flow, meeting monthly payroll, and planning for future restoration work. The strategic thinking and organizational savvy required to successfully do this is hard to overestimate. The development of a more coordinated restoration funding mechanism, perhaps along the lines of the multi-agency Regional Community Economic Revitalization Team (CERT) process associated with the Northwest Forest Plan and the implementation of the Northwest Economic Adjustment Initiative could help address this issue. One of the successes of the Northwest Economic Adjustment Initiative was the way in which the CERT process institutionalized interagency and intergovernmental partnerships and improved service delivery to communities (Kusel et al. 2003). Adopting the successful elements of this initiative to improve interagency coordination for restoration purposes could be one way to address this hurdle. This is likely to become a more pressing issue as ballot proposition-supported funding flows for restoration begin to move through funding channels and agencies that have not developed programmatic permitting agreements with regulatory agencies for restoration purposes.

Bringing coherence and consistency to the funding process would improve the current situation. That said however, some of the differences between the organization of restoration funding across different funding entities can prove to be useful to restoration organizations and nonprofits if, as some do, they strategically combine sources of restoration funding in a manner that effectively utilizes the comparative advantages of each funding source. For example, the fact that the Department of Fish and Game currently has programmatic permits makes them an excellent choice for lead agency in a restoration project, with other agencies providing supplemental financial support. Working with the State Coastal Conservancy is desirable from a contracting standpoint because of their prompt payment guidelines, but the agency requires landowners to agree to a deed restriction before funding actual restoration work; not surprisingly, this is unacceptable to most landowners. As a result some nonprofits find Coastal Conservancy support very useful for watershed planning, inventory, and assessment efforts, and rely on other sources, such as the State Water Board, to help fund actual implementation projects. As Chris Larson, Executive Director of the Mattole Restoration Council described it, "having a good understanding of the comparative advantages and disadvantages of different funding agencies is absolutely key to success."

Recommendation: Develop more coordinated and stable funding mechanisms to finance restoration work.

- Difficulty of providing quality jobs in restoration. A variety of factors conspire against efforts to provide a living wage and benefits to some segments of the restoration system, particularly for the contractors that implement restoration projects and in some cases for nonprofit and for profit restoration organizations and businesses. The fact that most restoration work is grant funded exerts significant downward pressure on wages, especially if the nonprofit or for profit entity managing the contract is forced to choose between maximizing the removal of cubic yards of potential sediment and paying workers benefits and a higher wage, or between preparing a competitive proposal or paying their employees and contractors a living wage. When funding for restoration becomes tighter, this downward pressure increases. This situation tends to be less extreme when federal

funds are used for a restoration project and wage rates are governed by the prevailing wage codes under the Davis-Bacon Act.

A second factor that makes it difficult for some to earn a living from restoration work is the dramatic seasonality of the project implementation component of restoration. Most restoration work, and especially most ground disturbing work, is restricted to approximately four months, from July through October, each year. During the other eight months of the year heavy equipment operators scramble for other jobs, work less, and/or rely on income and benefits from their spouse's job. Related to the short work window for restoration implementation is the uncertainty regarding the availability of future work. This insecurity challenges efforts at long range planning

For example, the National Park Service, the California Wildlife Conservation Board, the State Coastal Conservancy, the Department of Fish and Game, the City of Arcata and other public entities have all either supported the acquisition of private lands for conservation purposes or have acquired such lands themselves. Acquisition, in many cases, is only the first step in what is often a set of expensive and ongoing restoration and resource management challenges and obligations—some of which will go unmet without adequate financial support. Securing the necessary funding for the effective integration of these three activities (acquisition, restoration, and management) remains an on-going organizational challenge, especially when much of this work is supported by grants. Some agencies, such as the Department of Fish and Game, encounter the double organizational challenge of supporting extensive private lands restoration programs as well as restoring and managing the areas under their own control.

Recommendation: Continue to develop and improve the funding and policy mechanisms necessary for integrating acquisition, restoration, and management activities on public lands, and restoration and management activities on private lands.

Conclusion

A dynamic restoration system has evolved in Humboldt County. The complex and coordinated institutional infrastructure of this system includes government agencies, public and private lands managers, tribes, nonprofit and for profit restoration organizations, private contractors and consulting firms. This infrastructure is linked through a dense network of relationships. Its internal coherence stems in part from common commitment to the goals of restoration—to conserve and restore the habitat and aquatic and terrestrial species native to our place that once sustained and may once again sustain the human communities on the North Coast.

The restoration system of Humboldt County is large. It generates significant employment and has the potential to generate much more. The revenue it currently generates rivals and in some instances exceeds the value of other resource-based sectors of the regional economy. The restoration system demonstrates that employment generation and investment are indeed compatible with, and in this case are mutually supportive of, the enhancement of resource condition.

The restoration system of Humboldt County is socially important. It provides opportunities for communities to come together to identify common ground for collective action, while at the same time engendering a sense of place rooted in environmental stewardship. For tribal communities in particular, restoration is intimately linked with cultural integrity and the sustenance of lifeways.

The restoration system of Humboldt County has been at the forefront of developing the knowledge base necessary to ameliorate the current environmental effects of past land use and management practices on the North Coast. The standardization and codification of this knowledge base constitutes an immediate and direct inheritance that is available to be passed on to other regions engaged in restoration as well as to succeeding restoration practitioners in northwestern California. North Coast restoration-oriented nonprofit organizations have already begun the process of passing on this knowledge throughout the region and the country. On-going interaction between researchers and practitioners of restoration promises to continue the productive interaction between restoration practice, scientific inquiry, and knowledge production.

The legacy of restoration challenges that we have inherited due to past management actions ensures that the restoration system of Humboldt County will be hard at work for many years. It is true that public funding levels for restoration may fluctuate, and may even drop during periods of fiscal crisis. However, it is clear that the general trajectory of support for restoration is upwards. This is especially evident when we observe the various ways in which restoration-related activities are gradually becoming institutionalized within cur-

rent resource management and extraction regimes in a manner that will eventually ensure that current management practices will not create future restoration needs. As economic incentives are developed that help integrate restoration-related practices into dominant resource management regimes, then the uncertainty regarding public funding levels for restoration work and associated volatility of financial support will correspondingly diminish. However, even when we view restoration as an independent sector, as this study has done, it is clear that restoration is here to stay. Consider some recent estimates of the magnitude of the challenge. Addressing the barriers to fish passage and potential sediment delivery problems associated with just the county roads of the five northwestern California counties will require an investment of $150 million (Trinity County Planning Department 2002). The recent National Academy of Sciences report on the Klamath River recommends an immediate investment of $25-30 million for restoring coho salmon and sucker populations. And a recent study by the Center for Environmental Economic Development concerning road decommissioning on Forest Service lands estimates that a nation-wide program to decommission 186,000 miles of unneeded Forest Service roads would cost $93 million per year for 20 years and would generate more than 3,000 jobs annually (Ihara, Hackett, and Manning 2003). This ever-increasing awareness of the magnitude of the challenge, when combined with the increasing levels of public and political support for ecological restoration, legal mandates associated with the Endangered Species Act and other federal and state environmental protection laws, and the increasing appreciation for the short term socioeconomic benefits of restoration lead us to conclude that, despite fluctuating fiscal conditions, the restoration system is not only here to stay but that in the foreseeable future it is likely to continue to grow.

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Appendix 1

Survey Form Used for Phone Interviews of Private Sector Restoration Organizations

(This was used to generate the private sector employment profile for 2002. Other survey forms were developed to guide in-depth interviews with contractors, non-profit organizations, consulting firms and businesses, and public agencies. They are available upon request.)

Contractor/Consulting Firm Phone Survey[28]

Name of contractor/firm: _____
Name of contact person: _____
Address: _____
_____
Phone: _____
Email: _____
Date of interview: _____

1. What kinds of work does this business do? _____
_____
_____

2. How long have you been in business? _____

3. How many PERMANENT employees were in this business in 2002?

Number of **full-time** employees (32 hrs/week or more)	% time involved in restoration-related work

Part-time employees		% time involved in restoration-related work
number	hrs/week	

4. How many SEASONAL employees were employed in 2002?

Employee	Number of hours	Number of weeks	% time involved in restoration-related work
Employee #1			
Employee #2			
Employee #3			

[28] The survey form that was used to guide the phone interviews with restoration nonprofit organizations was essentially the same as this one.

5. Can you give us a rough estimate, to the nearest $50,000, of your business' gross revenue in 2002 from restoration work in Humboldt County?

< 25K___ 25K-50K___ 50K-100K___ 100K-150K____ 150K-200K___ 200K-250K___ 250K-300K___ 300K-350K___ 350K-400K___400K-450K___ 450K-500K___ 500K-550K___ 550K-600K___ 600K-650K___> 650K (but if greater than 650K, try to specify which 50K interval it is between)

6. Over the last five years has your business a) remained the same size, b) grown, c) gotten smaller? (Note: if possible, ask for more specific information, e.g., estimate of highest and lowest annual gross revenue.)

7. What are the largest roadblocks or hurdles, if any, that stand in the way of your company obtaining restoration work? _____

_____

_____

8. Would you be willing to participate in a face-to-face interview to more fully discuss the challenges, barriers, and opportunities your organization faces? (Note: be sure to mention that agreeing to this does not guarantee we'll be able to meet with them. We will, time and other resources permitting.)

9. Would you like us to send you a copy of the report from this study?

Yes No

Appendix II

People Interviewed
(these in-depth interviews were in person unless otherwise noted)

Dan Averill, US Bureau of Land Management
Corrine Black, US Forest Service, Six Rivers National Forest
Ruth Blyther, Redwood Community Action Agency
Jean-Louis Carmona, Restorationist
Mitch Farro, Pacific Coast Fish, Wildlife, and Wetlands Restoration Association
Gary Flosi, CA Dept. of Fish and Game
Paula Golightly, US Fish and Wildlife Service
Tom Hedt, US Natural Resource Conservation Service
Matt House, Simpson Resource Company
David Kahn, Full Circle Forestry
Mark Lancaster, Trinity County Planning Department
Chris Larson, Mattole Restoration Council
Tyler Ledwith, Ledwith and Associates
Sungnome Madrone, Redwood Community Action Agency
Tim Metz, Restoration Forestry
Jack Monschke, Monschke Watershed Management
Ted Oldenburg, Hoopa Tribal Forestry (phone)
Andrea Pickart, US Fish and Wildlife Service (phone)
Bob Rohde, Yurok Watershed Restoration Department
Michelle Rose, California Conservation Corps, Fortuna Center
John Schwabe, CA Dept. of Fish and Game
Matt Smith, Environmental Restoration Services
Terry Spreiter, US National Park Service (Redwood National Park)
Bill Trush, McBain and Trush
Harry Vaughn, Eel River Salmon Restoration Project
Jan Vaughn, Restoration Educator
Mark Wheetley, CA Dept. of Fish and Game
Carol Vander Meer, Friends of the Dunes
Jude Wait, Collaborative Learning Circle
Bill Weaver, Pacific Watershed Associates
Tom Weseloh, Cal Trout
Chris Whitworth, Humboldt County Public Works Department
Paula Yoon, Fisheries Focus

People Contacted Regarding Restoration Investment Information

Mark Andre, City of Arcata Dept. of Environmental Services
Dan Averill, Jennifer Wheeler US Bureau of Land Management
Jeff Barrett, Rich Bettis, Robert Darby, Pacific Lumber Company
Chris Beresford, CA Dept. of Parks and Recreation, North Coast Redwoods District
Corrine Black, US Forest Service, Six Rivers National Forest

Janet Blake, State Water Resources Control Board
Ruth Blyther, Redwood Community Action Agency
Ruthanne Cecil, Center for Environmental Economic Development
Scott Clemons, Wildlife Conservation Board
Beth DeCarolis, National Fish and Wildlife Foundation
Rick Elliot, CA Dept. of Forestry
Karyn Gear, Nadine Hitchcock, Jamie Schmidt Coastal Conservancy
Paula Golightly, US Fish and Wildlife Service
Tom Hedt, US Natural Resource Conservation Service
Nicole Hileman, Yurok Watershed Restoration Department
Matt House, Simpson Resource Company
Curtis Ihle, Humboldt County Resource Conservation District
Kim Karcher, Robin Carlson, CA Dept. of Fish and Game
Katherine Luscher, River Network
Tom Mattson, Humboldt County Public Works Department
Dennis Orthomeyer, CA Waterfowl Association
Michelle Rankin, California Conservation Corps
Ron Rekker, US Bureau of Indian Affairs
Terry Spreiter, US National Park Service (Redwood National Park)
Chris Whitworth, Humboldt County Public Works Department