The Headwaters Forest Stewardship Plan

A Citizens' Alternative to Maxxam Management of Headwaters Forest

DRAFT FOR PUBLIC COMMENT

Coordinated by the Trees Foundation
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D e d i c a t i o n

The Headwaters Forest Stewardship Plan is dedicated to the life, work, commitment, and inspiration of Judi Bari. Judi would never let us forget that justice in the forest will only come with justice for the people who work in the forest. This project is a direct result of her tireless effort to protect Headwaters Forest.

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I. Overview

The Headwaters Forest Stewardship Plan (HFSP), born from a deep concern for the integrity of the redwood ecosystem and the viability of timber-related jobs and revenue, offers an alternative for management and land use of the 60,000-acre Headwaters Forest. It is presented to the community of Humboldt County and concerned persons elsewhere, including the timber workers, conservation community, and government agencies.

Based on accepted scientific principles of conservation biology, the Headwaters Forest Stewardship Plan puts forth a three-pronged proposal for preserving the existing ancient redwood forest. This is achieved by setting aside pristine core reserves, restoring cutover lands to suitable mature-forest habitat, and carrying out responsible, long-term forestry in appropriate areas of second-growth forest. Economic analysis clearly reveals that significant levels of employment and revenue will still be generated from Headwaters Forest, through implementing forestry prescriptions and restoration activities.

All Species Grove. Photo: Doug Thron

Most emphatically, this Stewardship Plan refutes the erroneous assumption by some sectors of the public that conservationists want to "lock up" the entire 60,000 acres as a nature preserve. Throughout the decade-long campaign to save Headwaters from destruction, it has been recognized by many – most notably by the late Judi Bari – that true resolution of this debate can only come by addressing the needs of timber workers employed by the Pacific Lumber Company (PL), which owns Headwaters Forest. Furthermore, the role of this forest in Humboldt County's regional economy must be taken into account, though as this study shows, that role need not (and should not) be limited to wholesale liquidation of the existing old-growth resource, which is what current owner Maxxam/PL has proposed.

The Headwaters Forest Stewardship Plan aims to present a thorough and scientifically credible plan. We have included both in-text definitions of terms italicized as well as a complete glossary. Because this document is only a draft, it will be modified in upcoming weeks by public comments and critiques. It is our hope that significant public input, especially from beyond the conservation and scientific communities, will contribute to making this an all-inclusive and workable blueprint for the future of Headwaters Forest and all of Humboldt County. (See Section XIII: Request for Input.)

We respectfully request that timber workers and all residents of Humboldt County concerned about our collective environment and economy read this plan and think about how your needs can best be addressed.

This document does not fully engage issues of property ownership or acquisition. In fact, Headwaters Forest could theoretically be owned by PL and managed according to the conservation biology principles presented herein.

Much of the debate around Headwaters Forest concerns the overarching issue of "stewardship" of the land, that is, using the land in a responsible manner consistent with a healthy ecosystem and long-term resource base. It directly contrasts with the practice of "exploiting" the land in a short-term drive for quick profits.

Prior to its acquisition by Maxxam corporation, the old Pacific Lumber Company more closely approached a definition of "steward." Maxxam, however, exemplifies a "cut and run" corporate mentality that views environmental concerns contemptuously, as an impediment to business. Over the past decade of Maxxam ownership, citizens have loudly protested the rapid depletion of rare old-growth redwood and Douglas-fir forests on PL property, and the serious adverse consequences to the region, both ecological and economic.

We hope the ideas presented here will move the dialogue around Headwaters Forest beyond the tired and false dichotomy of "jobs vs. the environment." Contrary to current corporate management practices in Headwaters Forest, our Stewardship Plan shows that jobs can co-exist with effective environmental stewardship. It is an attempt to portray the type of land use we believe would most benefit the Headwaters Forest while attaining the goal of ecosystem maintenance and restoration, as well as forest productivity.

This plan provides an empowering "citizens' alternative" to the common inaccessibility of information, demonstrating the means by which other options to the status quo can be explored and implemented. The information needed for decision-making, if it exists at all, is rarely shared among all the parties involved. Important environmental-impact decisions made by state and federal agencies such as the California Department of Forestry and the US Fish and Wildlife Service are often based on little more than data made available to them by the corporate landowner. A closed loop is thereby created in which the industry feeds the regulators the data most favorable to itself. Public access to this information is difficult, at best, often requiring citizens to use the Freedom of Information Act to obtain important information and data, or else generate their own.

Development of the HFSP has resulted in some of the best available maps and data on Headwaters Forest today. We thank all the individuals and organizations who assisted us with gathering this data and note that much more needs to be done to promote a cooperative atmosphere regarding the sharing and review of important data by industry and other sources.

This Stewardship Plan also goes beyond the status quo by prioritizing recovery of endangered species to the point where federal protection is no longer necessary, (as the Endangered Species Act mandates). The degraded state of Headwaters' 60,000 acres a classic case in point of a severe shortcoming in current regulatory practice: the lack of coordinated monitoring of the cumulative impacts of multiple projects across a landscape. Only ecologically-sound, broad-based regulation of resource extraction and a commitment to good stewardship will prevent the serious environmental depredations that result when irresponsible forest practices are approved and carried out piecemeal. This has long been a major complaint of those concerned about the continued decline of the redwood ecosystem.

The Headwaters Forest Stewardship Plan opens with a discussion of the forest's natural history and key features, as well as the goals and objectives of the Plan. Next it presents the principles and practices of conservation biology, which it then applies to Headwaters Forest through actual forestry and restoration prescriptions. Economic analysis of forestry and restoration costs and benefits follows, showing how when profits gained from ecologically certified forestry operations are reinvested in Headwaters restoration activities, a substantial share of the restoration costs is covered. The document concludes with discussion of how a conservation-based land-use plan that favors ecosystem maintenance and recovery of jeopardized species will enable the Headwaters Forest to remain a productive part of the Humboldt County economy for generations to come.

II. Introduction

The 60,000-acre Headwaters Forest is located in Humboldt County, California – a *bioregion* known for its tall, pristine forests, cool running streams, abundant fish and wildlife, and tranquility. One hundred and fifty years ago, two million acres of ancient redwood forest ecosystem blanketed the California and southern Oregon coast. Today less than four percent of these ancient redwoods remain, with a significant number located within the Headwaters Forest. Headwaters contains the six largest unprotected groves of ancient redwoods left on Earth. Many of the species found within the Headwaters Forest are federally and/or state listed as endangered or threatened, and other species are candidates for listing. Species such as the northern spotted owl, marbled murrelet, and coho salmon are indicators of the decline in *biodiversity,* alerting us, as stewards of this planet, that we need to uphold the responsibilities that we assume as active members of the *biotic* community.

bioregion – a geographic area defined by natural boundaries such as watersheds or plant communities.

biodiversity – the variety of life and its processes; it includes the variety of living organisms, the genetic differences among them, the communities in which they occur, and the ecological and evolutionary processes that keep them functioning, yet ever-changing and adapting.

biotic – pertaining to any aspect of life, especially to characteristics of entire populations or communities.

fragmentation – the process of reducing the size and connectivity of stands that compose a forest.

siltation (silted) – a process whereby fine particles from upstream erosion affect instream habitat.

ecosystem – all the living organisms interacting with their non-living, physical environment, considered as a unit.

symbiotic relationship – the relationship of two or more organisms living is close association, usually with benefits for each and often obligatory.

The Headwaters Forest, like other remnant ancient forests around the globe, is in a region known for high timber production. Over the past century, such areas have been heavily utilized for timber extraction, with the ultimate cost being the loss of biodiversity and disruption of social fabric. Degradation and *fragmentation* of these ancient forests results in islands of lower-quality habitat, *silted* streams, and disruptions in vital ecological processes. A loss of diversity spans the entire *ecosystem*. Over thousands of years, in an area as ecologically rich as the Headwaters Forest, numerous organisms have developed unique relationships with one another, the ecological processes that drive this system, and certainly the ancient redwoods. The *symbiotic relationships* that weave this complex ancient forest community into one vast organism are only vaguely understood, yet they are truly being compromised at current production levels. There is much to be learned scientifically, culturally, and socially from pristine areas such as the ancient groves of Headwaters Forest. There are means by which to implement ecologically-sound timber production while maintaining the appropriate levels of biodiversity necessary to support all beings within the forest community.

The Headwaters Forest Stewardship Plan (HFSP) is a visionary plan for the permanent protection of Headwaters Forest and the people who depend on it for their livelihood. It is an ecologically-based forest land management plan that emphasizes the principles of conservation biology, ecosystem restoration, and ecologically responsible forestry. One of the primary objectives of the HFSP is to maintain and/or restore the levels of biodiversity within this ecosystem in order to appropriately represent the native flora and fauna native to this bioregion. This plan serves as an outline for the management actions needed to ensure the proper degree of habitat protection for species that depend on the ancient forest for their continued survival, including the recovery of additional habitat for impacted species. Equally critical, the HFSP also identifies long-term stable employment options to positively

contribute to the economic well-being of Humboldt County.

In our role as plan coordinators, the Trees Foundation is building on the expertise of the decade-long grassroots effort to protect Headwaters Forest and the resulting contributions of scientific, agency, and university personnel toward achieving this goal. The Trees Foundation does not assume ownership of this plan; rather we are bringing together information from many arenas and facilitating community dialogue regarding development of this model for our future. Through this project, we are actively seeking a wide range of community input to develop broad-based ownership and support of the Headwaters Forest Stewardship Plan. The basic principles we are putting forward – habitat recovery, maintenance of public trust values, and long-term, stable, forest-based employment – are principles our rural community embraces.

(For information on how to contribute to this process, please see Section XIII.)

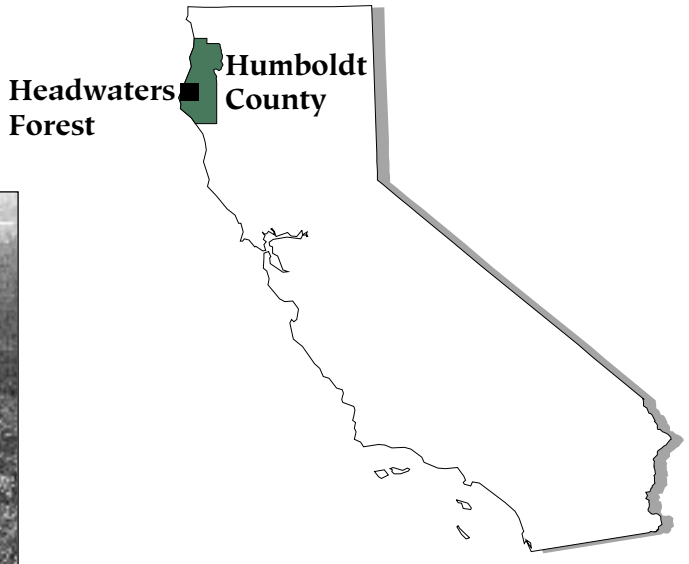
III. What Exactly is Headwaters Forest?

As mentioned above, Headwaters Forest contains the largest unprotected groves of ancient redwood forest left on Earth. These forests have existed here for thousands of years. The six principal groves of Headwaters Forest are: Headwaters Grove, Elk Head Springs Grove, All Species Grove, Shaw Creek Grove, Owl Creek Grove, and Allen Creek Grove. *(See Map 2: Headwaters Forest Ancient Groves.)*

Headwaters Forest is located approximately 10 miles southeast of Eureka and 250 miles north of San Francisco. The elevation of the forest ranges from approx. 400 to more than 3,000 feet. Nearby biologically significant areas east of Headwaters include Iaqua Buttes (part of the Bureau of Land Management Old-Growth Reserve System) and Six Rivers National Forest (6 miles east of Iaqua Buttes). Headwaters Forest is the last substantial ancient redwood forest remaining between Redwood National Park to the north and Humboldt Redwoods State Park to the south, providing a critical ecological link.

Federal vegetation maps identify 5,462 km^2 of redwood forests (both old growth and second growth) in Northern California. Of these, 4,659.6 km^2, or 85%, are on private lands. The intact old-growth stands of Headwaters cover 18.55 km^2, or 0.339% of all redwoods in Northern California (Thorne 1997).

Map 1: Headwaters Forest, Humboldt County, and California Location



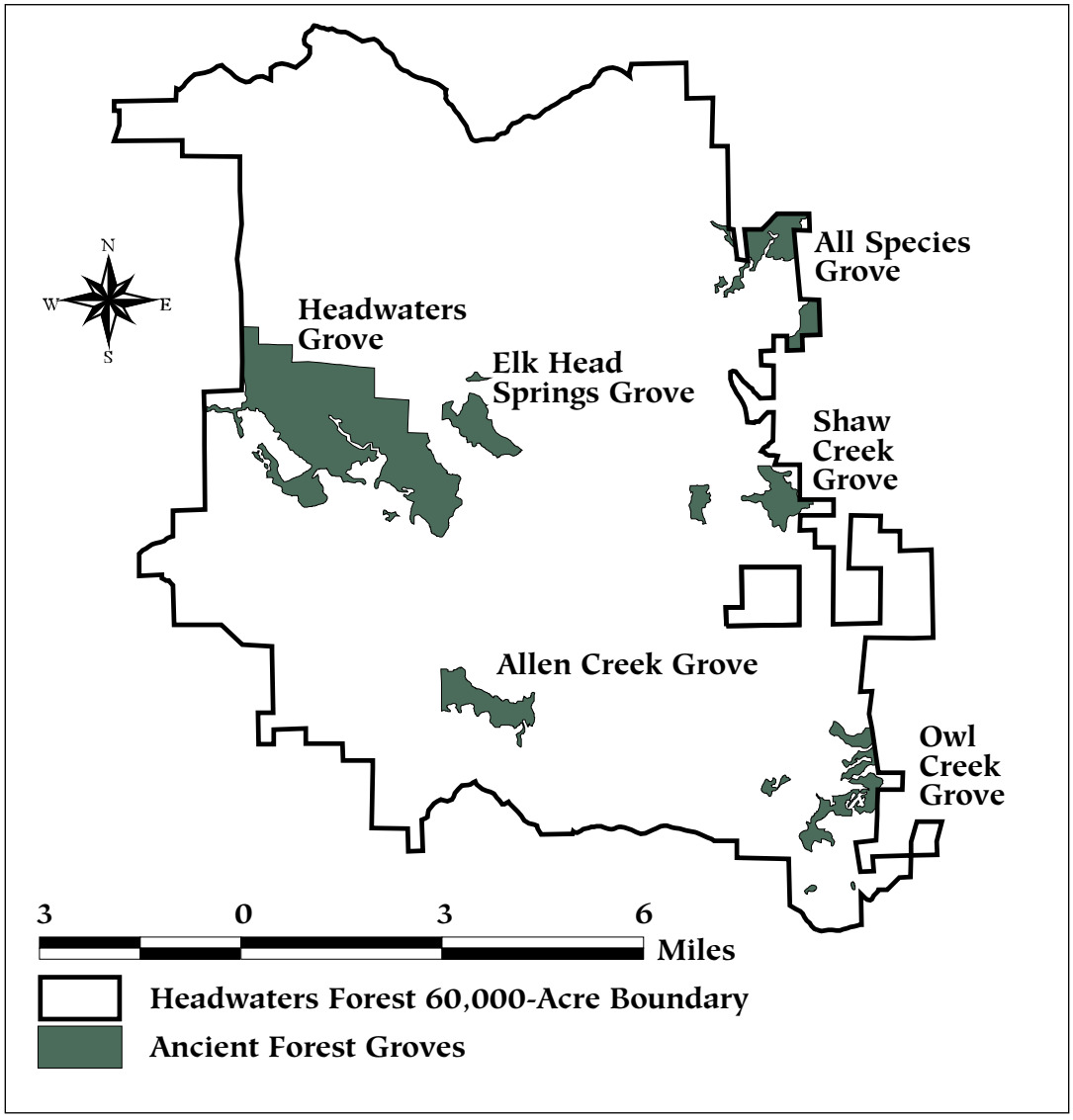
Headwaters Grove to Humboldt Bay,
Photo: Doug Thron/Light Hawk

Headwaters Forest has been defined by a roughly 60,000-acre area. The actual acreage is approximately 59,558. It includes the 44,000 acres identified in 1993 as the area to be acquired under the proposed Headwaters Forest Act (HR 2866), plus the ~13,000-acre North Fork Elk River *watershed,* included in the Act as a study area because of its importance to salmon. The US Fish and Wildlife Service upheld the biological significance of the 44,000-acre figure in August 1995 by designating it as critical habitat for the threatened marbled murrelet *(Brachyramphus marmoratus)*.

watershed – the drainage basin contributing water, organic matter, dissolved nutrients, and sediments to a particular river, stream, lake, or other body of water.

The northern boundary of the 60,000 acres is defined by the watershed boundary of the North Fork of the Elk River watershed. The southern boundary is defined by the Yager Creek watershed. Eastern and western boundaries are defined by Pacific Lumber and Elk River Timber property ownership lines. The eastern border is also the inland boundary of the redwood forest ecosystem. Only Pacific Lumber and Elk River Timber company are included in the designation; no neighboring small landowners are included. The six ancient groves are primarily located around the edges of Headwaters Forest, making its interior a biologically significant management unit.

MAP 2: HEADWATERS FOREST ANCIENT GROVES



Headwaters Forest contains parts or all of the following watersheds: Yager Creek, Lawrence Creek, Elk River, Cooper Mill Creek, Blanton Creek, Corner Creek, Shaw Creek, Fish Creek, Booths Run, Bell Creek, Salmon Creek, Strawberry Creek, Strongs Creek.

IV. Headwaters Forest Stewardship Plan Goal and Objectives

The goal of the Headwaters Forest Stewardship Plan is to design a blueprint for an ecologically functioning reserve based on principles and accepted theories of conservation biology which also addresses local employment needs and long-term economic sustainability.

This plan evaluates the ecological status of the forest and inhabitant species and prescribes needed treatment to restore impacted areas. It aims to protect critically important waterways and wild fish populations. From ecologically-based forestry and restoration prescriptions, it projects the economic impacts of protecting the area, with the aim of maintaining or improving local economic health and well-being.

The objectives of the HFSP are to:

- Design a recovery-based landscape management scenario and land use plan that will protect all species and their current and future habitat using the concepts of conservation biology.
- Determine the nature and magnitude of work required to restore Headwaters Forest ecosystem health and eventually its ancient forest characteristics throughout the landscape.
- Determine the volume and rate of timber extraction consistent with maintaining biodiversity and the Institute for Sustainable Forestry's Ten Elements of Sustainability.
- Analyze and forecast the social and economic effects of varying rates of production of wood products and other commodities.

V. History of the Headwaters Forest Stewardship Plan

As stated above, this project was spawned in the conservation community. Throughout the campaign, and certainly with the influence of Judi Bari, we have attempted to advocate justice for both the forests and the people of the redwood region. However, the general public never seemed to be aware of this twin commitment to conservation and social justice.

In 1993, then-congressman Dan Hamburg introduced the Headwaters Forest Act. The Act proposed public acquisition of 44,000 acres of Headwaters Forest, with an additional study area in the 13,000-acre North Fork Elk River watershed. A critical component of the Act was the Jobs and Rehabilitation Plan package. *(See Appendix 6: But What About Jobs?)* The proposal was developed by a "Worker-Earth First!" committee convened by Judi Bari, consisting of displaced and then-employed workers of Pacific Lumber/Maxxam, Simpson, and Louisiana-Pacific, with several Earth First!ers. One of the outcomes of that package was the call for a more in-depth study of possible employment in long-term restoration and "sustainable" forestry of Headwaters Forest. As history had it, the Act passed the House of Representatives, but died in the Senate before it could even come to a vote.

In the ensuing years, the call for justice continued as the campaign heated up and gained more national significance. However, the media continued to portray the issue of environmentalists wanting to "lock up" 60,000 acres of forest versus the timber workers who just wanted to keep their jobs. Very few media actually documented the environmental position calling for protection for the ancient groves and other areas of critical habitat, while

implementing restoration and long-term responsible forestry on the remaining areas within the 60,000 acres. *(See Appendix 11: This is Our Stand.)*

After announcement of the inadequate Clinton/Feinstein/Hurwitz "Headwaters Agreement" in September 1996, the Headwaters Forest Coordinating Committee – the body representing all the collective members of the campaign to protect Headwaters – decided to dedicate resources towards the "Jobs and Restoration" study Judi Bari had called for years before. The initial project team included Seth Zuckerman as project facilitator, with Judi Bari developing the worker component and Richard Gienger developing the restoration component. However, shortly thereafter, Judi was diagnosed with her fatal cancer and had to drop out of the project. At the same time, it was realized that a much more thorough study was necessary than originally conceived, and the Trees Foundation offered to facilitate the project. The Headwaters Forest Stewardship Plan project was born in January of 1997. In the ensuing months, scientific data was collected, the *geographic information system* (GIS) was designed, forestry prescriptions were developed and analyzed, restoration efforts were projected, an economic analysis was made of the entire effort, and community outreach was sought to ensure the plan represented the needs of the people of Humboldt County. Following is what we have learned in this nine-month process, based on the work of many for years before us. We do not yet view this as a finished product or exhaustive analysis.

geographic information system (GIS) – a compilation of data sets and other information relating to various geographic entities and the people who process this information, using computer software and hardware to provide decision support to project planners.

VI. Natural History

The Headwaters Forest is situated in the northern coastal region of California. The dominant species within this forest is the coast redwood *(Sequoia sempervirens)*. When first described by Europeans, pristine coastal redwood forests covered about two million acres (Veirs 1996). At that time redwood stands extended along the California coast from present-day Monterey County northward to the Chetco River watershed, some fifteen miles into southern Oregon (Griffen and Critchfield 1972). Today, the coast redwood occurs exclusively within a narrow belt, six to thirty miles wide, in southwestern Oregon and northwestern California (Fox 1996). The largest, most continuous, and most impressive stands are found in the north, where winter rainfall is highest and summer fog moderates the effect of the rainless California summer (Veirs 1996).

This ability to thrive in a bioregion that is often in drought conditions is characteristic of the redwood forest. Fog plays a key role in the ecology of the coast redwood. The fog supplements the annual water supply by condensing onto the millions of needles of the redwoods and associated shrub foliage, creating a "fog drip" that ultimately ends up back in the soil and available for absorption by the redwood and other understory vegetation. This high precipitation allows for the massive heights of the many redwoods that blanket this region; as the range moves south, however, the precipitation falls off, the fog influence lessens, and so does the abundance of the trees. In the northern range of the coast redwood the presence of frost becomes the limiting factor in the abundance of the species.

Redwoods grow best in deep, well-drained soils with a favorable moisture balance (Roy 1966). The coast redwood grows in pure stands and with associated tree species, primarily Douglas-fir (*Pseudotsuga menziesii*), grand fir (*Abies grandis*), red alder (*Alnus rubra*), and tanoak (*Lithocarpus densiflora*) (Fox 1996). Sword fern, oxalis, and evergreen shrubs dominate the forest understory (Veirs 1996). The coast redwood forests provide a variety of

diverse habitats for many species that rely on the cool temperatures and lush foliage for their continued existence.

Tree species include western hemlock, California bay laurel, and the rare vine maple. Rhododendron, huckleberry, western azalea, a wide variety of ferns, violets, trilliums, Douglas iris, leopard lily, skunk cabbage, red firecracker, and the calypso orchid are among the many shrubs and flowering plants that paint the forest floor. The giant Pacific salamander and fifteen other salamander species (including the rare southern torrent salamander), as well as tailed frogs, truffle-eating red tree voles and flying squirrels, Pacific fishers, pileated woodpeckers, spotted owls, marbled murrelets, northern goshawks, black bears, martens, mountain lions, coyotes, steelhead trout, and salmon comprise only a few of this forest's native species.

One species of special concern is the marbled murrelet. The endangered marbled murrelet is a small diving seabird that breeds along the coast from the Aleutian archipelago and southern Alaska to central California. In the Pacific Northwest, it forages almost exclusively in the near-shore marine environment (mainly within a few kilometers of shore) but flies inland to nest on the mossy limbs of mature conifers as far as 80 km (50 miles) from the coastline (USFWS 1995).

The three separate areas where marbled murrelets currently are found in California correspond to the three largest remaining blocks of *old-growth* coastal conifer forests (Carter and Erickson 1992). The average age of forest stands for a sample of 16 nests in the Pacific Northwest has been calculated at 522 years (Hamer and Nelson 1995). To date, all tree nests found in North America have been found in stands described as old-growth or mature forests (Hamer and Nelson 1995).

In at least some areas, evidence has begun to accumulate that the marbled murrelet population has declined in recent years. This decline has been attributed to reduction and fragmentation of old-growth forests, increased predation, and mortality from fishing nets (Ralph et al. 1995). In 1991, the State of California listed the species as endangered because of the loss of older forests (Ralph et al. 1995).

old-growth – an older forest stand that exhibits the structure and function of a forest that has not had a drastic disturbance in many years.

mature – an older stand of trees that are not yet old growth.

anadromous - fish that hatch and rear in freshwater, migrate to the ocean where they grow mature, and return to fresh water to reproduce.

residual forests – contain mature trees left after a timber harvest; in the case of Headwaters Forest, this refers to second-growth forests with large, old redwood trees that were part of the old growth prior to harvesting many years ago. These residual forests of Headwaters provide endangered species habitat that closely approximates the core reserves.

One of the goals of the HFSP is to provide habitat for species such as the murrelet in the hope of revitalizing the populations to historic numbers. According to murrelet expert Kim Nelson, "The location and habitat characteristics of the Headwaters Forest, coupled with the fact that little suitable habitat remains in the historic range of the species in California, make the acquisition and preservation of the Headwaters Forest key to the survival and recovery of the murrelet in California." (Oral testimony, *Marbled Murrelet v. Pacific Lumber,* 1994.)

Another species of concern is the coho salmon. Coho or silver salmon *(Oncorhynchus kisutch)* are *anadromous* fish that are born and live in fresh water as juveniles and then migrate to the ocean as adults before returning to their birth streams to spawn. The historical range of coho salmon on the west coast includes the coastal rivers and streams of Washington, Oregon, and California. In California, the naturally-spawned adult coho salmon population has been reduced to approximately 1% of

its historic size, which was between 200,000 and 500,000 in the 1940s (Brown et al. 1994).

Optimal habitat for juvenile salmon is known to be deep pools containing logs, root wads, or boulders in heavily shaded sections of stream. These habitat characteristics are typical of streams in old-growth forests, and for that reason, the decline of coho stocks in California can be tied to the widespread elimination of old-growth forests on the California North Coast (Brown et al. 1994). The reasons for the decline of coho salmon in California include: stream alterations brought about by poor land-use practices (especially those related to logging and urbanization), the effects of periodic floods and drought, the breakdown of genetic integrity of native stocks, introduced diseases, overharvest, and climatic change (Brown et al. 1994).

One of California's best coho salmon runs faces extinction from the overharvesting of the ancient trees in the Headwaters Forest. The Elk River originates within the 3,000-acre Headwaters Grove, supporting California's best remaining natural, wild run of coho spawning on private land. According to Dr. Peter Moyle of the University of California at Davis, "Streams in the Headwaters Forest area are important habitat for anadromous fishes, especially the coho salmon." (Expert testimony, Headwaters Forest Act Congressional hearings, 1993.) The HFSP recognizes the importance of the coho to the ecosystem as a whole. Preservation of the old-growth and residual old-growth within the Headwaters Forest will ultimately contribute to the restoration of healthy coho salmon stocks in California.

VII. The Landscape Context: The Health of the Redwood Ecosystem

In less than 150 years, European settlement and development has led to the removal of over 96% of the original forest of the redwood region. That primeval forest contained a diversity of ages and types of forest, with a majority of the forests displaying old-growth characteristics. Scientists generally agree that our coastal forests need to be approximately 200 years old before they can begin to be defined as ancient forest. In addition to their age, the diversity of the forest in structure and function adds to its old-growth character. In fact, in defining old growth, there is often recognition that the diversity of these forests is directly related to their apparent ecological stability (Maser 1988).

resiliency – the ability of a natural system to return to its original condition after disturbance.

interior species – area-sensitive wildlife species that require interior forest conditions for optimal survival, e.g., those found in the center of an ancient forest.

seral stage – a step in the process of succession that progresses from bare land, to shrub,to immature forest, to mature forest, to ancient forest.

landscape ecology – the study of how the heterogeneity within a landscape affects that landscape, especially as it relates to disturbances.

This diversity is critical in allowing for *resiliency* across a landscape. Franklin and Forman (1987) stressed the need to "identify and reserve large patches of primeval forest in the landscape for maintenance of *interior species* and amenity values." It is common knowledge that several old-growth-dependent, or interior, wildlife species are diminishing in numbers consistent with the decline of the ancient forest.

What now survives in the aftermath of just over one century of our management is a severely changed landscape. Where once the forests had a wide range of diversity – a healthy mix of all *seral stages* – we now find a landscape of primarily young forests, or in many cases, no forest.

The redwood and Douglas-fir trees of North Coastal California can live for 1,000, even 2,000, years. Today forests of fifty years or less cover a vast majority of our hillsides.

The current redwood region landscape is comprised of expanses of forests of the same

age, and in many cases the same species. Industrial forestry often replaces a forest of many species with trees of only one or two species, those which have the highest economic value as timber. What results is a limitation of our options for the future. If a disturbance of any kind happens in these forests, such as fire or floods or pest infestation, the lack of diversity both in the forest and across the landscape means the potential is high for disaster. The discipline of *landscape ecology* teaches us that a diverse landscape has the inherent ability to deter such disturbances from spreading and becoming all-consuming. For instance, an ancient forest, with its thick-barked large trees and cool, moist climate, is less favorable for fire spread (Maser 1988, Franklin and Forman 1987, Redwood National and State Parks 1996). In contrast to younger, second-growth forests, fires in old-growth forests usually do not spread into the crowns (or tops) of the trees, meaning the forest survives the fire, often with positive benefits resulting (Redwood National and State Parks 1996). Similarly with pest outbreaks, ancient forests with their diversity of species tend to confine the outbreaks to a few places, kept in balance by other species in the forest. The uniformity of young forest across our landscape means that the threat of massive wildfires or other catastrophic disturbances is great. Diversifying the landscape – managing for forests with differing characteristics – reduces the chance of catastrophic disturbance, and increases our options in many ways. Given that the North Coast economy is dependent on our natural resource base, a diverse landscape will also enhance our ability for a diverse and resilient economy.

"Even with major natural disturbances, redwood forests retain the multiple age classes, structure, composition and appearance of old growth (Veirs 1982). The large areas of logged redwood forest have no know natural precedent."
– Redwood National and State Parks 1996, p.9

VIII. Conservation Strategy: Protecting and Recovering Biodiversity

CONSERVATION BIOLOGY: HISTORY, RESERVE DESIGN, APPROACHES TO LAND CONSERVATION

HISTORY

In approximately 1986, a new discipline emerged that was stimulated by the limitations of traditional conservation - conservation biology.

Conservation biology addresses the basic issue of eroding biodiversity. It derives its theoretical basis from the pure sciences such as population genetics, *demography, biogeography,* and community ecology. Conservation biology is not a typical science. Although it is fundamentally ecological and relies on the principles of ecology, it is cross-disciplinary and depends on the interaction of many different fields. Geography, geology, sociology, education, philosophy, law, economics, and political science are just as important to the successful practice of conservation biology as are wildlife biology, forestry, ecology, zoology, botany, genetics, and other biological sciences (Noss and Cooperrider 1994).

demography – the quantitative analysis of population structure and trends.

biogeography – the study of the geographical distribution of living organisms.

Conservation biology studies biodiversity and the dynamics of extinction. Much of this work focuses on how genes, species, *ecosystems,* and landscapes interact, and how human activities affect changes in ecosystem components, patterns, and processes (Grumbine 1992).

Conservation biology is an applied science. It differs from other natural-resource fields such as wildlife management, fisheries, and forestry by accenting ecology over economics. Most traditional resource management is reductionist, mainly concerned with species of direct utilitarian interest: How can humans have deer to hunt, trees to harvest, salmon to catch? Conservation biologists, in contrast, consider the entire biodiversity hierarchy at diverse scales of space and time and generally "attach less weight to aesthetics, maximum yields, and profitability, and more to the long-range viability of whole systems and species" (Grumbine 1992) Of course, the long-range viability of our natural resource base is directly tied to the long-range stability of our regional economies.

RESERVE DESIGN

In order to maintain and eventually enhance the current level of native biodiversity within the Headwaters Forest, a set of ecological goals must guide the conservation strategy. These goals, along with a set of objectives that prioritize restoration of the existing landscape to late-seral forest and recovery of *critical habitat,* are essential in order to maximize biodiversity and maintain an economy for a region that has relied on the timber industry for many years. The HFSP recognizes the economic importance of the forest to the local communities of the redwood region. It also acknowledges the many values – economic and otherwise – of the intact ancient forest habitat. Undisturbed areas within the Headwaters Forest will be left alone, while the areas that have suffered from overharvesting in the past will require extensive restoration to return the forest to its former healthy state. These second-growth forests will then continue to be managed in an ecologically sound manner for the long-term viability of the forest and the regional economy.

critical habitat – areas occupied by a federally listed Endangered Species that is essential for the conservation of that species.

In order to implement a conservation strategy that emphasizes an ecologically responsible approach to restoration and recovery, some basic parameters must be considered. According to Noss (1991) there are four fundamental objectives consistent with the overarching goal of maintaining the native biodiversity of a region in perpetuity. These four objectives are discussed below.

1. Represent, in a system of protected areas, all native ecosystem types and seral stages across their natural range of variation.

Representation is an integral part of any conservation strategy. A prerequisite for preserving maximum biodiversity in a given biological domain is to identify a reserve network that includes every possible species (Margules et al. 1988). In a region such as Headwaters Forest, the diversity of the system as a whole relies on the representation of many species. The concept of representation is one of many that justifies the need for a large reserve size in order to appropriately capture the biodiversity of the Headwaters Forest.

community types – a group of one or more populations of plants and/or animals using a common area; an ecological term used in a broad sense to include groups of plants and animals of various sizes and degrees of integration.

taxa – classification system for organisms that indicates natural relationships.

viable population – a population of species that contains an adequate number of reproductive individuals appropriately distributed to ensure the long-term existence of the species.

Representing *community types* rather than just species would do more to capture *taxa* not currently well inventoried such as invertebrates (Noss and Cooperrider 1994). Perhaps the best way to represent all ecosystems is to maintain the full array of physical habitats and environmental gradients in reserves, from the highest to lowest elevations, the driest to wettest sites, and across all types of soils, substrates, and topoclimates (Hunter et al. 1988).

2. Maintain viable populations of all native species in natural patterns of abundance and distribution.

Maintenance of *viable populations* of particular species is directly correlated to the concept of species representation within an ecosystem. Without the viable populations, a species' survival becomes questionable. Conservation should not treat all species as equal, but must focus on species and habitats threatened by human activity (Diamond 1976). In the Headwaters Forest this would include the marbled murrelet, northern spotted owl, and scores of other organisms whose populations do not currently meet the probability criteria for continued existence within that system. Population viability is extremely species-specific, but Thomas et al. (1990) in their "Conservation Strategy for the Northern Spotted Owl" list five reserve design concepts "widely accepted among specialists in the field of ecology and conservation biology." A sixth reserve design concept was added by Reed Noss (1992).

1. Species well distributed across their native range are less susceptible to extinction than species confined to small portions of their range.
2. Large blocks of habitat, containing large populations of target species, are superior to small blocks of habitat containing small populations.
3. Blocks of habitat close together are better than blocks far apart.
4. Habitat in contiguous blocks of habitat is better than fragmented habitat.
5. Interconnected blocks of habitat are better than isolated blocks; corridors or linkages function better when habitat within them resembles that preferred by target species.
6. Blocks of habitat that are roadless or otherwise inaccessible to humans are better than roaded and accessible habitat blocks.

3. Maintain ecological and evolutionary processes, such as disturbance regimes, hydrological processes, nutrient cycles, and biotic interactions, including predation.

These two concepts are often overlooked when attempting to implement conservation strategies. Most strategies target individual organisms, but without considering the functions of an ecosystem as a whole any conservation attempt becomes futile. The processes fundamental to ecosystem function include the cycling of nutrients, flow of energy, hydrological cycles, erosion, decomposition, predation,pollination, seed dispersal, and many more (Noss 1992). Evolutionary processes such as mutation, gene flow, and differentiation of populations must also be maintained if the *biota* is to adapt to changing conditions (Noss 1992). Maintaining and ensuring that these processes are allowed to proceed without unnatural disturbance is vital to the biodiversity of a system. The conservation strategy of maintaining all physical habitats (soil types, slope aspects, etc.) and intact environmental gradients, with corridors or other forms of connectivity linking habitats across the landscape, is perhaps the best way to accommodate change without losing biodiversity (Noss 1992).

biota – the living organisms of an area.

4. Design and manage the system to be responsive to short-term and long-term environmental change and to maintain the evolutionary potential lineages.

Change is inevitable. Ecosystems are continuously changing, habitats are always being modified, and organisms are adapting to these changes on a daily basis. Any conservation strategy must allow for these changes to occur naturally on short-term and long-term scales. However, the strategy must realize that change needs to occur without a loss of biodiversity.

In order to accomplish this task, we must monitor biodiversity closely since we humans seem to have little concept of the impacts we are placing on natural systems and their ability to function. *Adaptive management* considers human activities with a degree of humility and recognizes how unaware we are about biodiversity and how to maintain it. The

adaptive management – the process of adjusting the management techniques of an area to new scientific information and changing environmental realities.

underlying assumptions of adaptive management as applied to biodiversity can be summarized as follows (after Noss and Cooperrider 1994):

1. Ecosystems should be maintained with optimal function of all their components, i.e., biodiversity, as an overriding goal.
2. Ecosystems are extremely complex, and human understanding of them is rudimentary.
3. Human activities may have severe and largely unpredictable effects on ecosystems, and these effects can be irreversible or require centuries for restoration.
4. Management should therefore be conservative, erring on the side of minimal risk to ecosystems.
5. Careful, systematic monitoring of ecosystems and how we affect them can help us learn to avoid causing further harm to them.

Implementation of these ecological goals is an integral aspect of a successful conservation strategy. The HFSP intends to integrate these guidelines across the landscape of the Headwaters Forest in order to enhance and maintain the biodiversity of this region. Utilizing these concepts will enable the community to responsibly restore the areas that have been heavily damaged in the past while at the same time providing a higher degree of protection for the pristine ancient redwood groves.

Approaches to Land Conservation

To achieve the goals outlined above, Noss (1992) describes four approaches that a land conservation and multiple-use program like the HFSP should implement to meet the objectives of representing all ecosystems, maintaining viable populations, maintaining natural processes, and allowing for change. They are:

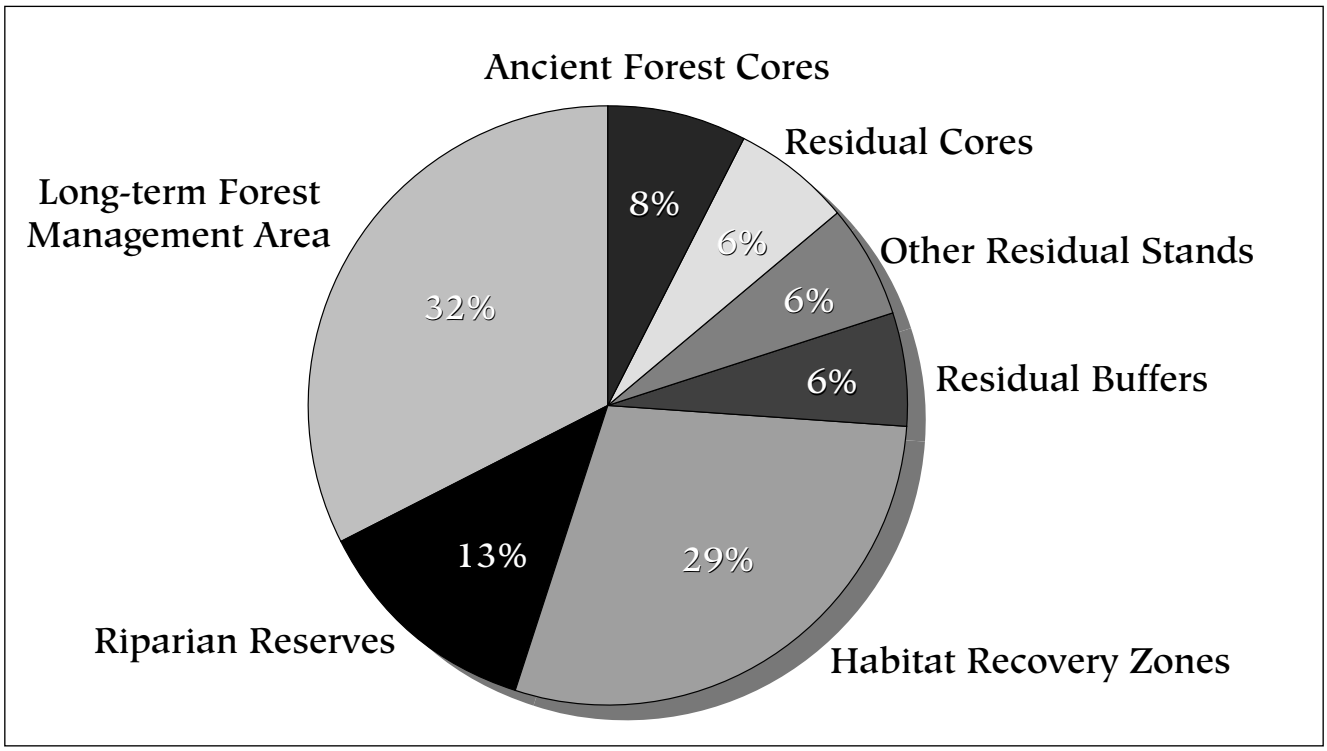
1. Identify and protect populations of rare and endangered species.
2. Maintain healthy populations of species that play especially critical roles in their ecosystems *(keystone species)*.
3. Protect high-quality examples of all communities.
4. Identify and manage greater ecosystem landscapes both for biodiversity and sustainable human use.

keystone species – a species whose presence indicates the overall health of an ecosystem.

These approaches to land conservation would exhibit positive results in an area large enough to express its potential for biodiversity. In practice, the familiar strategy of protecting sites that harbor rare species or natural communities has worked quite well for plants and animals with small area requirements, but it has been less successful in protecting wide-ranging animals and has been unable to capture landscape mosaics and other higher-order expressions of biodiversity (Noss 1987). Thus, in order to implement the reserve design concepts outlined in the previous section, large reserve areas would be necessary for the Headwaters Forest Stewardship Plan. Empirical evidence has demonstrated that the small reserves selected through the site-by-site approach are heavily assaulted by external influences and often fail to retain the natural qualities for which they were set aside.
To meet the ecological requirements of maintaining biodiversity described above, the HFSP has designed a reserve network comprised of old growth and residual old-growth cores, habitat recovery zones (HRZs), buffer zones, and riparian reserves. *(See Map 3: HFSP Management Areas.)*

FIGURE 1: MANAGEMENT AREAS BY ACREAGE

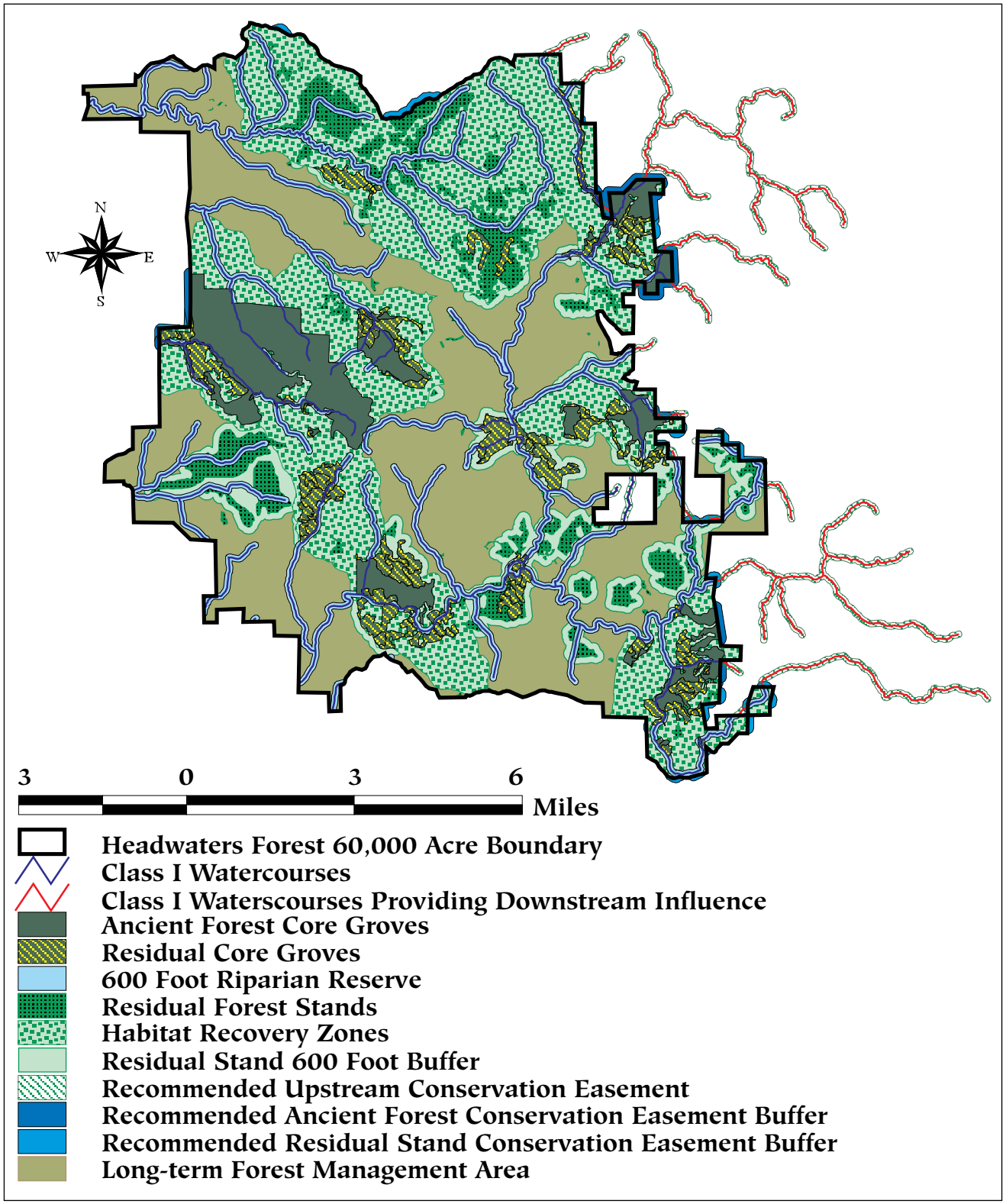
This pie chart shows the proportion of total acreage occupied by various forest types.



Total Acres = 60,000

Shaw Creek Grove and adjacent Maxxam clearcuts. Photo: Doug Thron/LightHawk

Map 3: HFSP Management Areas



See color map on cover for reference.

This reserve system was designed to maintain the natural processes of the pristine core areas, while allowing for variable levels of human use on the outer edges of the reserve. The HFSP is attempting to strike a balance that discourages outright *fragmentation,* but at the same time encourages intelligent stewardship of the land. As Noss and Cooperrider (1994) emphasize, "Sites outside reserves and of lesser conservation value can afford greater management experimentation, such as innovative forestry techniques designed to provide commodities for people as well as to maintain most elements of biodiversity."

fragmentation – process by which habitats are increasingly subdivided into smaller units, resulting in their increased insularity as well as losses of total habitat area.

data sets – a compilation of information on a particular feature of the landscape, such as vegetation, including spatial and non-spatial data.

ArcInfo® – advanced GIS software for the creation and manipulation of geographic data.

coverage – a type of geographic data representing a particular landscape feature, such as streams or vegetation type. Coverages are the spatial data that exist within a data set.

Components of the reserve proposed by the Headwaters Forest Stewardship Plan have been created and analyzed through utilization of the project's geographic information system (GIS). Elements of various *data sets* have been combined through numerous processes to accomplish the structuring of the five reserve categories and to allow for the spatial identification of their locations. **Current designations are to be considered as a draft only at this time, and further analysis may warrant the addition or deletion of areas to the various categories.**

HFSP MANAGEMENT AREA DESIGN

GEOGRAPHIC INFORMATION SYSTEM

The utilization of a geographic information system (GIS) for the Stewardship Plan has been integral in all phases of project planning. The HFSP research staff has integrated the best available data on current conditions within the Headwaters Forest with industry-standard GIS technology. This process has allowed for meeting our goals of informed and accurate analysis, decision support, and reserve design.

The Klamath Bioregional Assessment Project of the Spatial Analysis Lab at Humboldt State University, and the US Fish and Wildlife Service, Klamath Basin Ecosystem Restoration Office have provided considerable support in advising Trees Foundation during initial development of the GIS.

Trees Foundation has developed and maintained a GIS database in *ArcInfo*® for the Headwaters Forest. Throughout the course of early 1997, data was acquired from a variety of sources, either as existing GIS *coverage* or as hard copy. All data created by Trees Foundation from hard-copy sources has been produced to meet current industry geographic information standards. Results of reserve area analysis in acres and the sources of data used are shown in the Appendix 3: GIS Methodology and Results, and Appendix 4: GIS Data Sources.

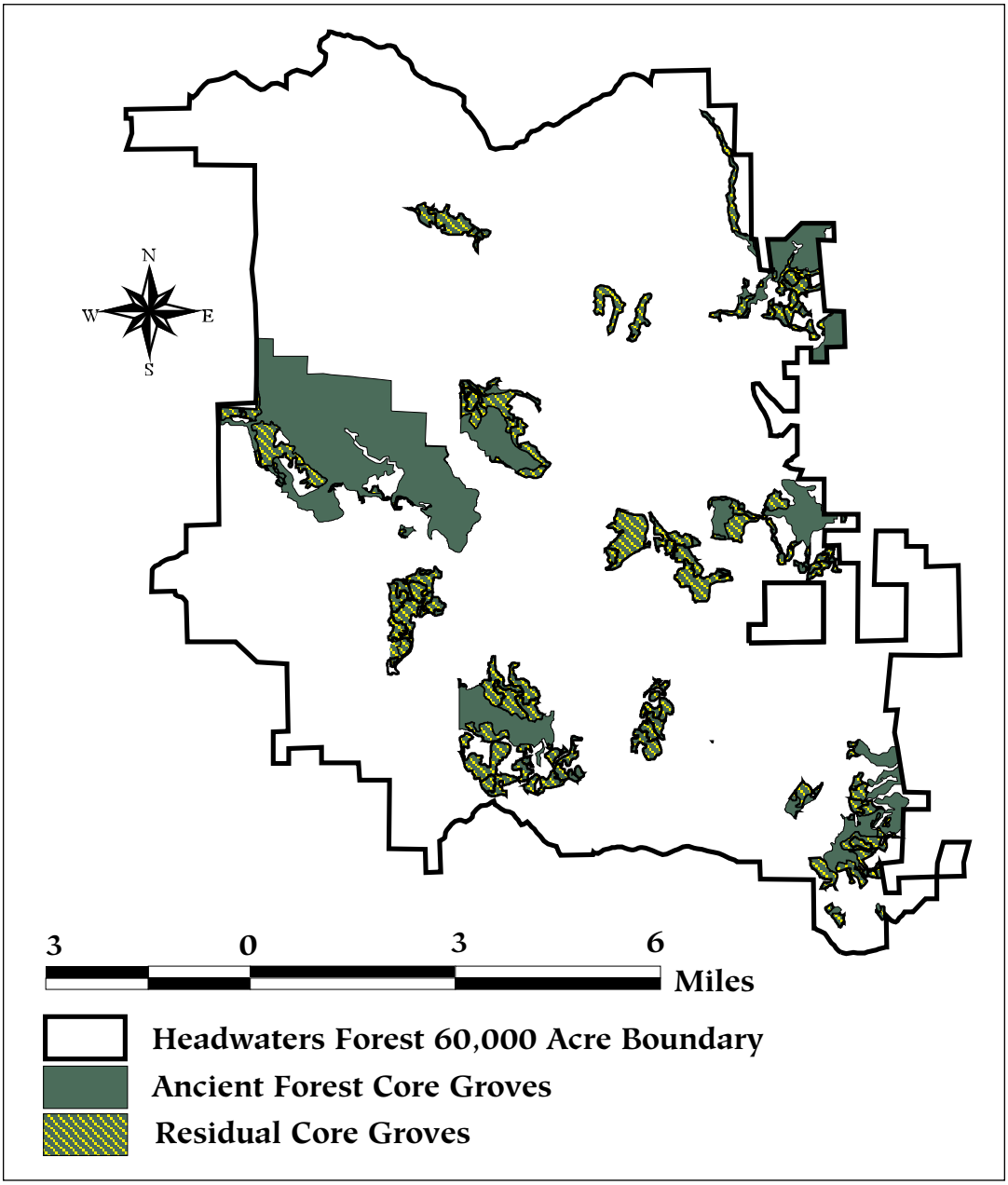
CORES: ANCIENT AND RESIDUAL FOREST

Cores are defined as unentered, pristine ancient forest areas that maintain the late-seral qualities. The eventual goal of this plan is to restore core characteristics across the landscape. These areas will be off limits to logging and other serious impacts. Core reserves should collectively encompass the full range of communities, ecosystems, physical habitats, environmental gradients, and natural seral stages in each region (Noss 1992). In addition to the pristine core reserves, the HFSP recognizes as core areas residual forest stands that are adjacent to ancient forest cores and those that have been publicly documented as marbled murrelet habitat at the time of analysis, or display the characteristics of suitable habitat for

the murrelet. The valuable contribution of the residual old-growth forest in the preservation of murrelet habitat, regeneration of ancient forest characteristics, and connectivity among adjacent core areas cannot be underestimated. The core areas would be considered "no entry" zones with the few roads in virgin stands promptly removed. Restoration forestry will be prescribed in recently logged residual stands.

The total acreage of ancient forest in core reserves is 4,583 acres. There are 3,819 acres of residual forest in cores, bringing the total core reserve acreage to 8,402. The following core reserves were identified through this process.

MAP 4: HFSP FOREST CORES



The Core Reserves of Headwaters Forest

Headwaters Grove and Residuals *(approximately 3,140 acres)*

Photo: Doug Thron

One of the largest groves of intact ancient redwoods in the world, the Headwaters Grove is the origin of the South Fork of the Elk River and Salmon Creek. Both of these waterways flow into Humboldt Bay. Headwaters Grove ranges from 1,000 to 2,000 feet in elevation and consists of nearly three square miles of largely contiguous unentered virgin redwood forest. The old growth lies along the southern-facing slopes of upper Salmon Creek and, except for one road, wraps the entire headwaters of two tributaries to the Little South Fork of the Elk River. One north-facing watershed in Salmon Creek and the intricate web of micro drainages in the headwaters of Salmon Creek remain in an unentered condition.

Nearly all of the edges of the grove have been made distinct by clear-cutting, and there are only a few places where the old-growth canopy does not transition abruptly to mineral soil. The contiguous second-growth forests in the South Fork of the Elk River to the north have developed sufficiently over the past 80 years to augment and expand late-seral forest structure in the area, and significant areas of residual old-growth forest exist in the riparian areas of Salmon Creek.

Elk Head Springs Grove and Residuals *(approximately 612 acres)*

Photo: Doug Thron

This virgin redwood grove is one-half mile due east of the Headwaters Grove and ranges from 800 to 1,400 feet in elevation. Elk Head Springs straddles the eastern and western banks of the upper South Fork of the Elk River, making this grove a crucial element for salmon habitat in this watershed The stand is a contiguous block of forest and is not fragmented by roads or unnatural disturbance within the core. Elk Head Springs Grove is surrounded by residual old-growth forest, the highest density of which lies to the north of the grove along the river.

Allen Creek Grove and Residuals, including Lower Road 24 *(approximately 1,061 acres)*

Photo: Doug Thron

Visible from Highway 36 near Hydesville Allen Creek's untouched ancient forest lies between 400 and 1,891 feet in elevation and anchors the southwest corner of the 60,000 acres. The grove straddles the ridge between Yager and Blanton Creeks but is mainly south-facing. The Allen Creek watershed drains the western part of the grove and drops precipitously through a series of cascades into Yager Creek. This is the most significant stand of old growth on the main fork of Yager Creek. Residual stands surround Allen Creek Grove and significant residual is found across Yager Creek to the south. Rare Pacific fishers, a large member of the weasel family, have been detected within the Allen Creek area.

Owl Creek Grove and Residuals *(approximately 748 acres)*

Owl Creek & Bootjack Prairie. Photo: Doug Thron

Ranging from 750 to 3,172 feet in elevation, Owl Creek constitutes an *ecotone* transition from lowland redwood forest to upland prairie and butte. Residual stands stem from the South Fork Yager Creek and main Yager Creek drainages up to the intact grove/prairie/butte core habitat. Giant redwoods and Douglas-fir provide habitat for federally listed threatened marbled murrelets and spotted owls. Black Butte, the highest point within the 60,000-acre Headwaters Forest, constitutes prime breeding and roosting habitat for sensitive raptor populations such as bald and golden eagles, northern goshawk, and peregrine falcon. Owl Creek has a profusion of small streams feeding into its deep ravines and rushing waters. Owl Creek Grove retains great beauty and habitat value, and its rugged and varied terrain harbors some of the most diverse vegetative and wildlife compositions within the Headwaters Forest area.

ecotone - a habitat created by the juxtaposition of distinctly different habitats.

Shaw Creek Grove and Residuals, including Right Side Road 9 *(approximately 590 acres)*

Photo: Doug Thron

This substantially intact tract of old-growth redwoods and Douglas-fir, ranging from 1,250 to 1,800 feet, remains at its core unentered and pristine. It straddles Shaw Creek, providing important shade to keep water temperatures low. This drainage is some of the best coho salmon spawning habitat in the Yager/Lawrence creek system. Incremental clearcutting has taken place all around the perimeter of the core stand. The gently sloping topography has helped to create the environment for numerous gigantic redwoods and Douglas-firs. Many small cascading streams flow through the thick undergrowth. Incursions into the upper watershed have resulted in a need for restoration and revegetation.

All Species Grove and Residuals, including Booths Run and Road 12 Lawrence Creek *(approximately 832 acres)*

Photo: Doug Thron

This area encompasses Lawrence, Bell, and Booths Run Creeks and ranges between 1,250 and 2,000 feet in elevation. It is composed of two main areas. The first and largest intact element of the grove lies along Lawrence Creek, to the east, and up the Bell Creek watershed. A significant stand of Douglas-fir old growth is found on the north-facing slopes of Booths Run. All of these areas are either contiguous or connected through residual corridors.

The area within the Bell Creek drainage is currently threatened by a proposed Timber Harvest Plan, THP 1-97-188 HUM. All Species Grove is located in a migration corridor from the Headwaters Forest to the old-growth forests and rock outcroppings of the BLM's Iaqua Buttes, which rim the greater Lawrence-Yager Creek watershed. The stream side and upland vegetation is also unique in this area, including Western red cedar, hemlock, California bay laurel, and madrone along with the ancient redwood and Douglas-fir..

Unnamed Groves and Residuals *(approximately 112 acres)*

Photo: Greg King

Pre-Maxxam Pacific Lumber left many scattered stands of old growth ranging from 2 to 100 acres that contribute to the genetic and habitat diversity of the Headwaters area. The remaining stands of this forest type occur throughout the landscape, with the highest density found in the upper Yager and upper South Fork Yager drainages. These pockets lend structural diversity to the forest and provide sources for the recolonization of soil micro-organisms, small mammals, and amphibians. The retention of these areas is essential for recovery of old growth characteristics throughout the landscape. These scattered tracts provide islands of diversity in a watershed where very little ancient forest remains. PL's former policy of 30-70% selection logging in its old-growth redwood stands left a legacy of entered ancient forests that retain much habitat value. Key areas for ancient forest rehabilitation, they retain the multi-story canopy which moderates stream temperatures – essential for anadromous and resident fish populations.

Cooper Mill Residuals *(approximately 369 acres)*

This area is a significant pocket of residual old-growth forest with a developed intermediate codominant component. In other words, it is one of the few places remaining on the landscape where pre-Maxxam Pacific Lumber's silvicultural prescription of selective logging and a well-established second-growth forest have combined to form a unique stand condition.

Lower North Fork Elk River and Road 11 Boulder Creek Residuals *(approximately 308 acres)*

The Boulder Creek drainage is an important tributary to the salmon-bearing North Fork of the Elk River. Because of its large residual component, it is an important biological stepping stone between the Headwaters Forest Grove to the west and All Species Grove and Iaqua Buttes to the east. With up to 30% of its canopy cover remaining, it provides a large area to recruit future habitat and recover late-seral characteristics.

Road 3 Residuals *(approximately 168 acres)*

Photo: Doug Thron

This area lies to the south of Yager Creek at its confluence with Lawrence Creek and is the only remaining example of the forest type that carpeted the drainage prior to the Maxxam takeover. There is a significant component of overstory residual redwood old growth with an undisturbed second-growth coniferous codominant strata. This area (including Cooper Mill Creek, Below Road 7, and Below Road 9) is one of the most important locations for the study of habitat recovery and will be among the earliest areas developing late-seral-stage characteristics.

Below Road 7 and Below Road 9 Residuals *(approximately 459 acres)*

These are the only significant patches of residual old-growth forest with a well-developed second-growth codominant strata remaining in Lawrence Creek drainage. The stand below

road 7 lies to the east of Lawrence Creek, north of its confluence with Yager Creek, and appears to be one of the only forested areas remaining on the eastern side of the main watercourse. This area is critical to the maintenance of cool water temperatures in Lawrence Creek and as a repository of genetic material for a recovering watershed. The stand below road 9 lies southwest of the confluence of Corner Creek and Lawrence Creek and is similar in composition except for the fact that it contains a slightly larger hardwood component. It is the only late-seral habitat area remaining within the Corner Creek watershed.

Habitat Recovery Zones

Habitat Recovery Zones (HRZ) are areas surrounding core reserves where management will emphasize restoration of the primary area next to the pristine core to one that also displays old-growth characteristics. HRZs initially function as *buffer* zones; however, after sufficient recovery and restoration, an HRZ could be evaluated for integration into the associated core reserve. Other functions of an HRZ include the ability to provide for intact watersheds, connectivity, and to act as migration corridors between core areas. HRZs are given the same recognition as core reserves in that they are limited-entry areas that allow only restoration (including restoration forestry), wildlife surveys, and road removal. The role of the HRZ, and its difference from a multiple-use buffer zone, is that it will eventually become part of the adjacent core reserve. In the event of a natural disturbance regime within the core, the HRZ will provide additional habitat for sensitive species. *(See "Restore to Late Seral" prescription in Section X.)*

The HRZ is a vital segment of the conservation strategy that initiates the processes of recovery and restoration, while providing immediate protection for the core reserves. Especially in the case of small reserves, HRZs may ameliorate *edge effects* that would otherwise be intense near reserve boundaries. Wind, extreme sun, exotic weeds, agricultural chemicals, noise, and opportunistic predators could all be largely filtered out by well-managed buffer zones (Noss and Cooperrider 1994). With buffer areas such as HRZs, the cores will be further insulated against these threats to the integrity of the ecosystem, while adding valued habitat to the reserve as a whole.

buffer - a designated protective area around a core grove, body of water, or other sensitive site (such as a nest tree) that is left uncut or otherwise undisturbed during a timber harvest.

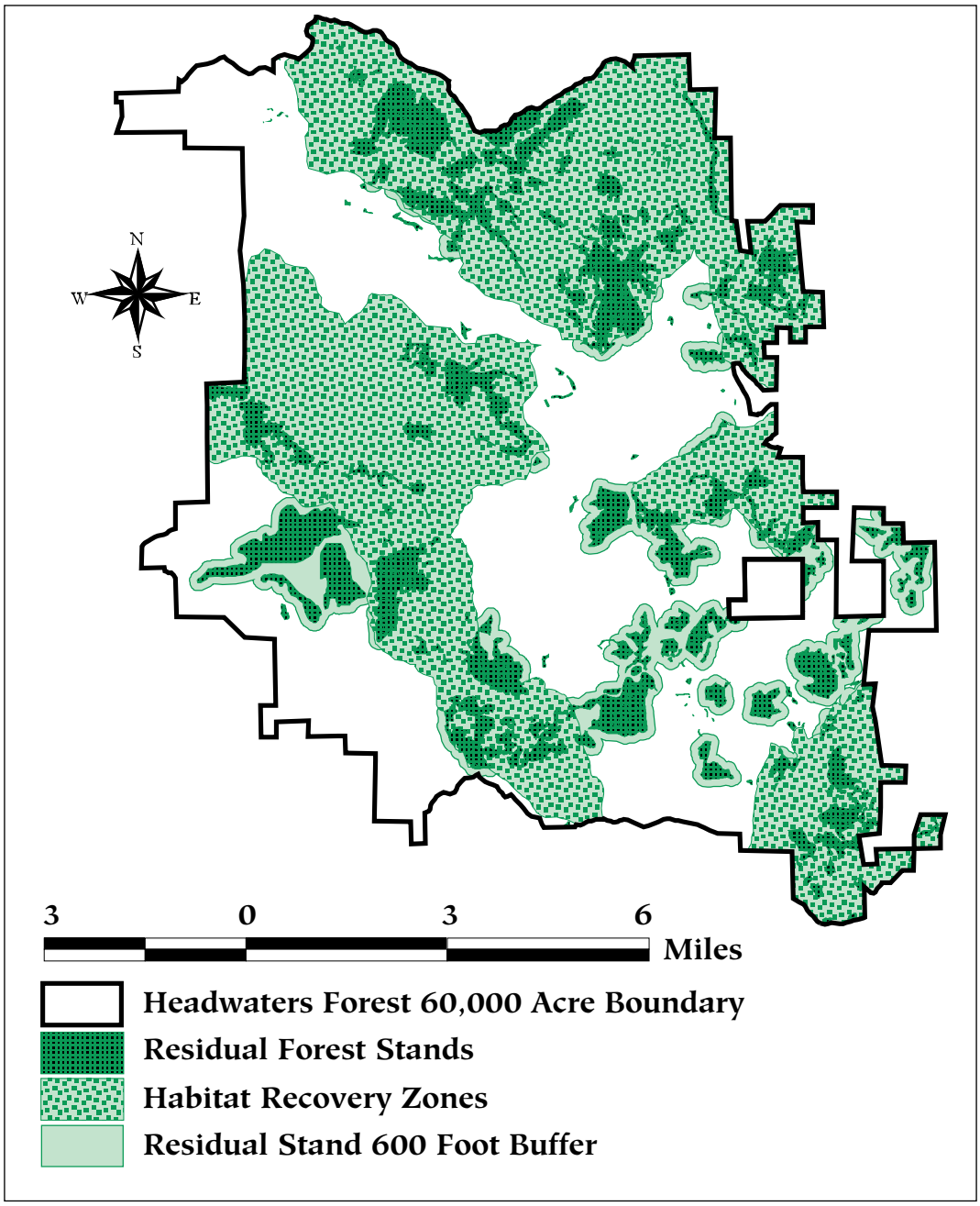
edge effect - accelerated degradation along the margins of forest patches surrounded partially or entirely by cutover lands. Only forested areas at substantial distances from the edge provide unmodified interior forest conditions.

sub-watershed - a drainage basin that feeds into a larger one (see watershed).

The HRZs designated within the Stewardship Plan were implemented utilizing *sub-watershed* boundaries in which core reserves are located, with other natural boundaries utilized in the absence of a nearby, clearly defined watershed. The boundary lines for the HRZ ensure that the watersheds surrounding the core areas remain intact to preserve hydrologic systems and maintain the characteristics necessary to provide connectivity between these areas. Watersheds providing significant influence to aquatic habitat and water quality or potential contribution to habitat recovery, such as the North Fork Elk River, were also designated as HRZs. This latter area was so designated due to its importance to the survival of the coho salmon and marbled murrelet, as well as the presence of large contiguous stands of high-quality residual and second-growth forest.

In instances where the core reserve was not buffered by the HRZ to a minimum of 600 feet, the boundary was extended through a buffering process within the GIS. The total acreage of HRZs within the Headwaters Forest is 17,246, not including the cores and categories within.

Map 5: HFSP Habitat Recovery Zones, Residual Stands, and Residual Buffers



Components of each designated HRZ:

Headwaters Grove, Elk Head Springs Grove, and Residuals
Salmon Creek and Upper Salmon Creek CWPUs (California Watershed Planning Units, developed by the California Dept. of Forestry), Little South Fork Elk River, and South Fork Elk River below their confluence with unnamed creek to the north. If acquired publically, this HRZ should be evaluated for eventual federal wilderness designation.

Allen Creek Grove, Yager Creek Residuals, and Cooper Mill Residuals
Portions of the Camp CWPU containing the watersheds of Cooper Mill Creek beginning 600 feet below the southern extent of residuals, Allen Creek, and drainages containing residuals

along Yager Creek, including Lower Road 24.

Owl Creek Grove, Nearby Detached Old Growth, and Residuals

Bald Lessie and Humphrey CWPUs, and drainages containing old growth south and east of Yager Creek in the Yager Creek CWPU.

Shaw Creek Grove (including Right Side Road 9) and Residuals

Southern section of Shaw Creek CWPU and drainages containing old growth in the Side 8 CWPU.

All Species Grove (including Booths Run and Road 12 Lawrence Creek) and Residuals

Lawrence Creek and Bell Creek CWPUs, watershed of Booths Run Creek upstream from its confluence with Lawrence Creek.

North Fork Elk River Residuals(including Road 11, Boulder Creek, and Lower North Fork Elk River)

Turkeyfoot CWPU and Scout Camp CWPU upstream from the confluence of the North Fork Elk River and Lake Creek.

Residual Forests

Photo: Doug Thron

Prior to Maxxam Inc.'s takeover of Pacific Lumber *(see Appendix 10: About Maxxam/Pacific Lumber),* forest management practices left more of the forest behind. *Selection forestry* meant that PL only harvested some of the big trees, leaving some to remain as wildlife habitat and a seed source for the regenerating forest below. However, Maxxam recognized the economic value of the standing forests and the new Pacific Lumber began to harvest them as fast as possible, sometimes even breaking the law to do so.

Residual forests are the most logical forests to restore to ancient forest characteristics since they contain the one component that restoration cannot easily replicate – ancient trees. Therefore all stands of residual forests within Headwaters Forest have been identified and proposed for permanent protection under the Stewardship Plan.

All known residual forests that support marbled murrelets exhibiting "occupied behavior" (meaning they have been seen using the forest for nesting, breeding, etc.) and residual forests adjacent to forest cores have been given core status. Wherever possible, these residual cores have been included in Habitat Recovery Zones. The residual cores within Habitat Recovery Zones total 3,012 acres. Those residual forests without documented marbled murrelet occupation are called residual stands, and within the HRZs total 2,286 acres. Therefore the total acreage of residual forest in HRZs is 5,298 acres.

selection forestry – an uneven-aged harvest method in which individual trees or small groups of trees are removed from an intact forest.

When residual forest stands do not lie within the HRZs, a buffer zone of 600 feet will be implemented to insulate the habitat from detrimental external influences. The reasoning behind this buffer zone is primarily based on the fact that wildlife survey data is incomplete or inconclusive in these residuals and the utmost protection is necessary until their role in habitat recovery can be better analyzed and understood. As additional survey data is disclosed, many of these stands may be designated as core areas. In addition to an increased level of protection for the residual stands, these buffer zones will also provide necessary corridors between habitats for the ease of movement for many species of concern.

Riparian Reserves

Conservation of *riparian areas,* or the forest bordering watercourses, is a vital aspect of the HFSP. Intact, healthy riparian areas not only protect *spawning* grounds for the anadromous *salmonids* of the Pacific Northwest, but also act as corridors between various types of habitat for many species. Current forest management practices are actively encroaching on these areas, with detrimental effects on the riparian habitat. Land-use practices, including forestry, grazing, agriculture, urbanization, and mining, can substantially alter watershed processes, resulting in degradation of streams, lakes, and estuaries (Spence et al. 1996). Many riparian areas in the Headwaters Forest suffer from the effects of current forest practices, including increased siltation, mass wasting, surface erosion, and increased stream temperatures.

riparian area – an ecological zone along watercourses with distinctive plant communities. Riparian zones play an important role in shading salmonid habitat.

spawning – the act of salmon or other species depositing eggs.

salmonid – belonging to, or characteristic of, the fish family Salmonidae, which includes the salmon, trout, and whitefish. Species in Headwaters Forest include chinook and coho salmon and steelhead trout.

The HFSP recognizes the importance of riparian areas to the system as a whole. In order to restore native biodiversity to riparian areas, a conservation strategy must emphasize revitalizing the natural processes that once flourished in these watersheds and sub-watersheds. If ecosystems are allowed to function in a natural manner, habitat characteristics favorable to salmonids will result, and fish will be able to reinvade and populate historical habitats, to recover from earlier stressors, and to continue to survive without influence or management (Spence et al. 1996).

The establishment and maintenance of riparian buffer zones is generally accepted as the most effective way of protecting aquatic and riparian habitats (Cummins et al. 1994). Riparian buffers should be established for all land-use types and designed to maintain the full array of ecological processes (i.e., shading, organic debris inputs, bank stability, sediment control, and nutrient regulation) needed to create and maintain favorable conditions through time (Spence et al. 1996).

Riparian Reserve Widths for Each Category of Stream

(from FEMAT 1993)

Fish-bearing streams *(Class I)* Riparian reserves consist of the stream and the area on each side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year flood plain, or to the outer edges of riparian vegetation, or to a distance equal to the height of two *site-potential trees,* or 300 feet slope distance (600 feet total, including both sides of the stream channel), whichever is greatest.

site-potential tree – the average maximum height of the tallest dominant trees, two hundred years or older for a given site class.

dominant tree – a tree with a well-developed crown extending above the general level of the forest canopy and receiving full light from above and partial light from the sides.

intermittent streams – any non-permanent flowing draining feature having a definable channel and evidence of annual scour or deposition. This definition includes what are sometimes referred to as ephemeral streams if they meet these two physical criteria.

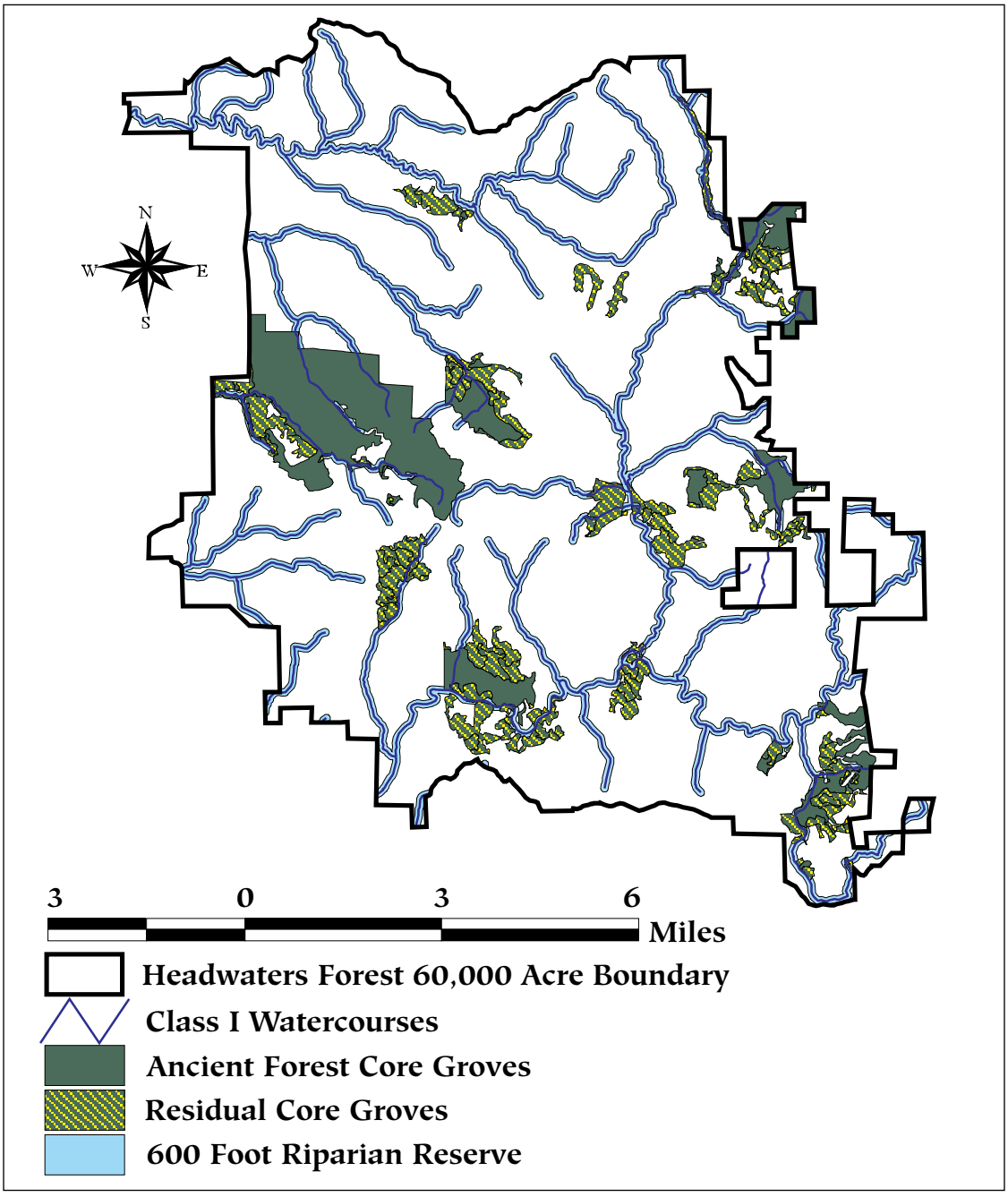
Permanently flowing non-fish-bearing streams *(Class II)* Riparian reserves consist of the stream and the area on each side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year flood plain, or to the outer

edges of riparian vegetation, or a distance equal to the height of one site-potential tree, or 150 feet slope distance (300 feet total, including both sides of the stream channel), whichever is greatest.

Seasonally flowing or *intermittent streams*, wetlands less than one acre, and unstable and potentially unstable areas *(Class III)* This category applies to features with high variability in size and site-specific characteristics. At a minimum, the riparian reserves must include the extent of unstable and potentially unstable areas (including earth flows) from stream channel to the top of the inner gorge; the stream channel or wetland and the area from the edges of the stream channel or wetland to the outer edges of the riparian vegetation; and from the edges of the stream channel to a distance equal to the height of one site-potential tree, or 100 feet slope distance, whichever is greatest.

Class I riparian reserves in Headwaters Forest are approximately 7,561 acres. This includes 852 acres of residual forest that is also counted in the acreage numbers for residual forest.

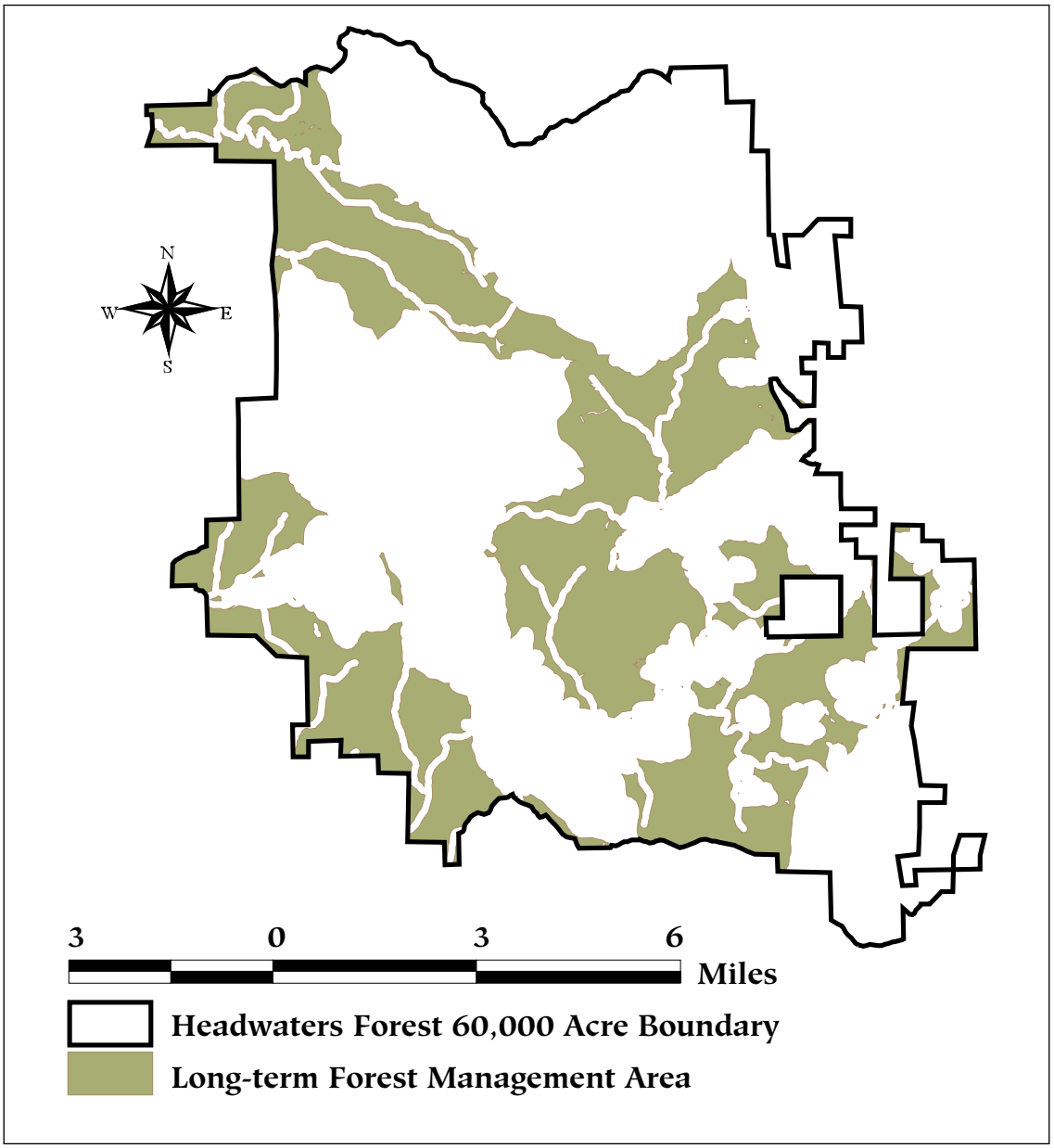
MAP 6: HFSP FOREST CORES AND RIPARIAN RESERVES



Long-Term Forest Management Area

All remaining forest lands falling outside of cores, Habitat Recovery Zones, residual buffers, and riparian reserves are designated as Long-Term Forest Management Areas. These areas will be managed using certified ecological forest practices to produce high-quality timber products indefinitely. This area is 19,224 acres.

Map 7: HFSP Long-Term Forest Management Area



Suggested Conservation Easements

There are several locations either upstream from the Headwaters Forest, or directly adjacent, where management practices could have a significant influence on natural systems and processes that occur within the Headwaters Forest. In such areas, conservation easements may act as an ecologically sound way for private landowners to protect environmentally significant land while at the same time retaining their ownership.

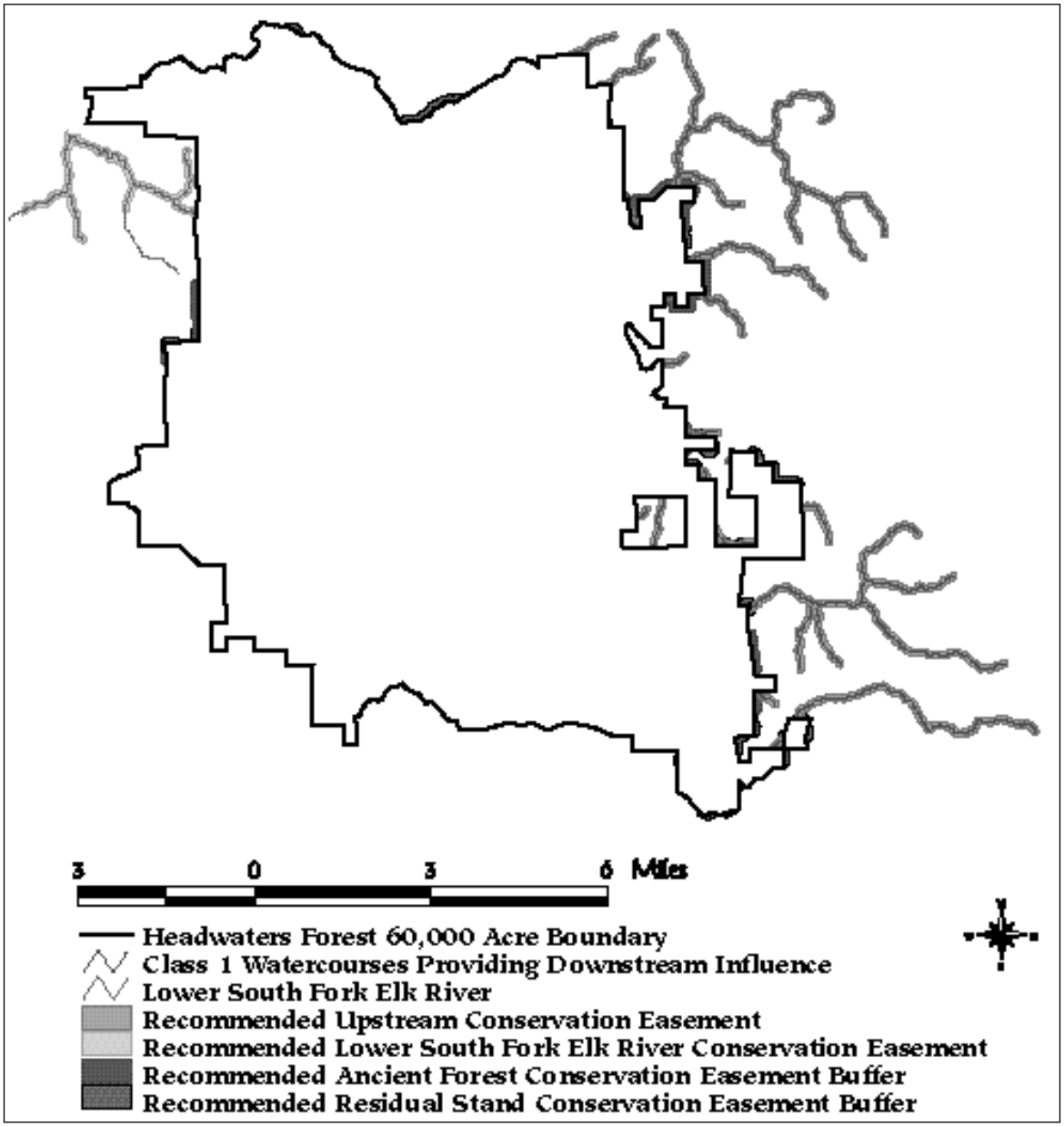
Conservation easements are positive voluntary means that a landowner can employ to permanently protect their land for its ecological value, wildlife habitat, watershed quality, silviculture, etc. In doing so, the landowner may receive tax incentives and other considerations from the government for protecting these ecologically important areas.

A conservation easement is a legal restriction that a landowner places on his or her property to define and limit the type of development that may take place there. Typically, with conservation easements certain development rights such as construction, subdivision, timber harvesting, or mining are restricted to some degree so as to limit impacts on the land that may harm the conservation values identified for protection.

The Headwaters Forest Stewardship Plan is a community-based approach to land conservation that invites all levels of involvement for the good of the forests. The HFSP encourages the conservation of all significant lands surrounding the Headwaters Forest for the continued benefit of all the natural systems and organisms that may be detrimentally affected by irresponsible land practices.

Acreages for suggested conservation easements are: South Fork Elk River System (within Elk River Timber property, including South Fork Elk River, McCloud Creek, Tom Gulch Creek, and its unnamed tributary) – approx. 494 acres; Upstream – approx. 2,799 acres; Adjacent to old-growth forest – approx. 415 acres; Adjacent to residual forest – approx. 421 acres. Suggested conservation easements total 4,129 acres.

MAP 8: HFSP SUGGESTED CONSERVATION EASEMENTS



IX. Vegetation Analysis

The Headwaters Forest Stewardship Plan utilized several types of data in the process of developing its conservation strategy. Reserve design for the HFSP was developed with a variety of GIS data sources covering major landscape and wildlife features. This approach is similar to that of Noss (1992), which allowed our staff to identify, as accurately as possible, concentrations of the marbled murrelets, significant areas of old growth and residual old-growth forest, and landscapes that can serve as linkages between biologically significant landscapes.

Vegetation data was initially analyzed by the Institute for Sustainable Forestry (ISF). Utilizing existing GIS vegetation coverages from Pacific Lumber, aerial photo interpretation, and *Landsat* imagery, our forestry staff identified *species composition, size class,* and density (based on California *Wildlife Habitat Relationship system [WHR]* classification) of stands within the Headwaters Forest. This data was then integrated into our GIS.

Landsat – a satellite that provides imagery used in remote sensing of forests. Analysis of this imagery produces maps of vegetation conditions.

species composition – the make-up of various plant and wildlife species in an ecosystem.

size class – average diameter at breast height (dbh) of the dominant tree canopy

WHR – the California Wildlife Habitat Relationship model, a system used to identify habitat types for wildlife species in California..

Analysis of data by our GIS technicians provided decision support to project staff, assisting in visualization and identification of the areas necessary for the highest priority of protection (core areas, Habitat Recovery Zones, and riparian reserves). From this, utilizing the most recent scientific literature, we were able to establish boundaries surrounding these areas that provide the acreage necessary for proper protection of sensitive species while allowing for buffer areas that in the future will become suitable habitat as well as responsibly managed forest lands.

The primary sources used in classifying current vegetation in Headwaters Forest were 1996 1:24,000 WAC Corporation black and white aerial photos, 1994 Landsat imagery (both raw and classified), Pacific Lumber Company stand coverages, and active Timber Harvest Plan maps. *(See Appendix 4: GIS Data Sources, for information on specific data sets and GIS coverages.)*

The classification system is based on the California Wildlife Habitat Relationship system as modified by Dr. Lawrence Fox of Humboldt State University (Fox and Carlson, 1996). *(See Appendix 5.)* Further modifications were required to account for uneven-aged *stand structure*. In addition, we divided size class 4 (11"-24" dbh) into two classes: 4a (11"-18") and 4b (18"-24").

ArcView® – a GIS software system used to view, process, and analyze geographic data and other information.

ERDAS Imagine® – a GIS software system for the viewing and analysis of remotely sensed imagery, i.e. satellite imagery.stand structure – the physical structure of a community of trees with certain common characteristics that form a management unit.

minimum mapping unit – the smallest area considered in GIS analysis for a given feature.

crown density – the forestry measurement of biomass in the canopy of a tree.

Interpretation of aerial photography and classified Landsat imagery was used to delineate distinct polygons of homogenous vegetation on mylar using a 20-acre *minimum mapping unit*. Polygons were then created digitally in ArcView® and ERDAS Imagine® based on these original mylar overlays using both raw and classified Landsat base imagery as references. These polygons were based on species composition, average diameter, and *crown density* – characteristics resulting primarily from different silvicultural systems. The aerial photo

interpretation was used to increase the accuracy of this translation and subsequent analysis, as well as to confirm the accuracy of the classified Landsat imagery. Each polygon was classified according to the modified WHR system and further modified based on known timber harvest activity subsequent to 1996.

An aerial survey of the Headwaters Forest conducted on August 14, 1997, was used to further refine the species and size class attributes of the polygons.

The resulting vegetation coverage was combined with coverages for each respective reserve category in an overlay analysis in ArcInfo® to calculate total acreage per vegetation type in each reserve category. This data was utilized in the development of forestry and economic analysis for the HFSP. A separate analysis was conducted to determine the current extent of ancient forest groves and residual forest stands.

Wildlife Habitat Relationship System

The Wildlife Habitat Relationship System (WHR) was developed by the California Department of Fish and Game to describe forest stand structure while also correlating the potential presence of wildlife species. The modified WHR system chosen for this plan uses three basic indicators to describe forest structure – species composition, size class, and density. Species composition was broken into two classes: MCN (mixed conifer) is less than 20% hardwood, and MCH (mixed conifer/hardwood) is 20-50% hardwood. Size class is defined in the table below and describes the average diameter of the stand being discussed.

Size Class	Dominant Canopy DBH Range in Inches
1	Recently clearcut
2	1 - 6”
3	6 - 11”
4	11-24”
4a	11-18”
4b	18- 24”
5	> 24” even-aged
6	> 24” multi-story

Finally, a density class is designated based on canopy closure. Sparse (S) is less than 15% canopy closure, Open (O) is 15-30% canopy closure, Medium (M) is 30-60% canopy closure, and Dense (D) is greater than 60% canopy closure. Additionally, a two-tiered system was used to describe a residual tree component. For example, MCH1D-5S would describe a stand that is 20-50% hardwood less than 1” in diameter with a canopy closure of greater than 60%. The 5S denotes a residual tree component of the smaller stand that is greater than 24” trees with less than 15% canopy closure.

X. Economic Development Strategy: Building a Stable Forest-Based Community

LONG-TERM RESPONSIBLE FORESTRY

Contrary to what we see in the headlines, it is possible to have jobs while still protecting the environment. This is certainly true in the realm of forestry. Since 1991 the Institute for Sustainable Forestry (ISF), located in Humboldt County, has been at the forefront of developing responsible forestry standards and economic development strategies that improve the long-term ecological and economic well-being of forest-based communities. The Headwaters Forest Stewardship Plan (HFSP) draws on the knowledge and experience of those who have worked for years to balance these two facets of forestry. Their concerns and conclusions are the basis for the forestry recommendations put forth by the HFSP team. ISF research associates developed the forestry prescriptions and yield figures for the Stewardship Plan with the goal of protecting and restoring *late-seral* stand structure and wildlife habitat, while providing long-term employment.

late seral – functional characteristics of this forest type include large trees, snags, and large downed logs. Approaching the definition of ancient forest, late-seral forests have multiple canopy layers and other features.

value-added – processing of a raw material, such as timber, by skilled labor to make finished items with more economic value, such as cabinets and furniture.

Central to a strategy that effectively combines both ecological and economic concerns is third-party certification. Similar to labeling of organic food, forest certification labels products harvested in a manner that maintains a healthy ecosystem and natural resource. It has been demonstrated that consumers are willing to pay a premium for forest products that are certified as ecologically sound. Certifiers are independent bodies (with no financial ties to the timber industry) and follow guidelines set regionally and internationally by the Forest Stewardship Council, an accreditation body. Locally, ISF's certification program is part of the SmartWood® Network, a program of the Rainforest Alliance.

A key component of ISF's economic development efforts is a local hardwood forest products industry. Providing for both the diversification of forestry practiced locally (long based on old-growth Douglas-fir and redwood extraction) and the utilization of hardwoods that proliferate in many second-growth forests, development of a hardwood industry provides both ecological and economic benefits. Hardwoods are an important wildlife resource and component of forest diversity, and the existence of an industry utilizing these hardwoods provides further economic justification for maintaining them in forest stands. Currently most native hardwoods on the West Coast are "chipped" for paper production, providing few jobs, low economic returns, and little reason to maintain them for wildlife habitat or future sawlogs. This local industry will take the hardwood products of certified restoration forestry – tanoak, madrone, and other native hardwoods – and process them locally into finished products, supporting stable, *value-added* employment in the community. In this way hardwood processing from the Long-Term Forest Management Area of Headwaters Forest (in addition to harvesting of the desirable conifers) will aid the objectives of the Stewardship Plan.

CURRENT HEADWATERS FOREST STAND DESCRIPTION

The Headwaters Forest currently supports a dramatically fragmented ecosystem of virgin old-growth islands surrounded by a patchy landscape of clearcuts, residual old-growth stands, and second-growth stands. This mosaic of different stand types belies the fact that Headwaters Forest has been heavily cut in the past decade. For example, more than 60% of the Lawrence Creek watershed has been clearcut during this time.

These young stands support a significant component of hardwoods, especially red

alder on moister sites and tanoak on drier sites. The stands are often so extremely dense that they are difficult to walk through. On hotter, drier, south- and west-facing slopes, significant competition from a brush component of primarily blue-blossom ceanothus *(Ceanothus thyrsiflorus)* has forced Pacific Lumber to resort to heavy herbicide applications in order to regenerate the forest. This herbicide use is unprecedented in the company's long history and coincides with its shift to large-scale clearcutting. The presence of alder and ceanothus, both nitrogen-fixing species, denotes the heavily disturbed nature of the soil ecosystem on these sites. In many cases, up to eighty percent of the soil surface in a given area has been highly impacted by tractor logging and *layout* construction.

In most older second-growth stands, primarily in the Elk River watershed, the hardwood component has been reduced from competition by the faster-growing conifers – redwood and Douglas-fir. Redwood regeneration from stump sprouts dominates the forest. A closed, single-layer canopy allows little understory vegetation to grow and contribute to the forest's natural structural complexity. This is detrimental to native wildlife, reducing the availability of food and shelter. *Suppressed trees* are slowly dying out of the stands, creating heavy fuel loads that increase the risk of catastrophic fire. Soil compaction is high due to extreme skid road densities.

layout – a prepared area into which trees are felled in a timber harvest plan.

suppressed tree – one whose growth is limited by the surrounding competing vegetation, e.g. trees that are shaded out or crowded.

snags – standing dead trees. These make great wildlife habitat, especially for cavity-nesting birds.

silviculture – the art, science, theory, and practice of establishing, tending, and reproducing forest stands of desired characteristics based on knowledge of the environmental requirements and characteristics of tree species.

Second-growth stands up to 100 years of age with varying residual old-growth redwood components are scattered throughout Headwaters Forest, with trees up to 160 feet tall and 3-5 feet in diameter. Some of these stands are beginning to exhibit more mature forest characteristics, including *snags* and large downed logs, adding structural diversity and important wildlife habitat to the understory. In addition to the more intact residual old-growth stands, these older second-growth stands offer the best potential for recovery of ancient forest structural characteristics and habitat quality. When adjacent to ancient forest islands, they provide buffers and developing habitat with a high potential for recolonization by old-growth-dependent species. Significant second-growth stands occur in the watersheds of the South and Little South Forks of the Elk River, Lower Salmon Creek, and the North Fork of the Elk River, as well as other areas throughout Headwaters.

All second-growth forests will be managed using restoration forestry principles for a minimum of several decades in order to improve habitat quality. The Long-Term Forest Management Areas will then continue to be managed using selection *silviculture* to provide ongoing employment for the local community after active management has stopped in the restoration areas.

The remaining stands – those not in core reserves or among the second-growth stands described above – are residual forests. Some of the residual areas will be restored using the forestry prescriptions described below. As stated previously, the unentered old-growth forest areas are off limits to logging, and residual old-growth trees in all logging units will be maintained as habitat components.

"The goal of second-growth management* ... is to recover a fully functioning, self-sustaining, old-growth redwood forest ecosystem. The strategy for recovery is to treat second-growth stands to speed return of old-growth characteristics. It is assumed, for the purposes of this plan, that the more closely conditions resemble those found in old growth, the sooner the second-growth forest will begin to function as old growth. Some specific old-growth forest characteristics that the plan calls for restoring include: appropriate tree density; species balance; diversity of tree spacings; healthy understory; multiple age distribution; a multi-storied canopy; few large trees; snags; down logs; natural fuel loading and arrangement. A few old-growth characteristics, such as a healthy understory, are expected to recover after several years. Some old-growth characteristics, such as large trees and multi-storied canopies, are expected to take decades or centuries to recover, but at least the process toward recovery will have been initiated. The plan recognizes that recovery of old-growth forest characteristics is a continuous process and that no specific time period is appropriate to identify when the process is complete."

Redwood National and State Parks 1996, p. 4.

** In the HFSP this applies to Habitat Recovery Zones, buffers, and scattered residual stands.*

Forestry Prescriptions and Methodologies

Without access to site-specific inventory information (which could have been obtained only from PL or by trespassing), developing detailed silvicultural prescriptions was not possible. However, for the purpose of general long-term planning, two generic prescriptions with numerous timing choices were utilized to estimate the average volume that could be harvested now and in the future. These estimates were based on assumed growth rate, and the harvest of only a portion of that growth, in order to rebuild forest structure over time. Harvests will always remain less than growth across the long-term forest management areas.

The first prescription developed was a light-touch restoration harvest with the single goal of recreating late-seral stand structure in the shortest time frame possible. The second prescription utilizes single-tree selection across the *diameter classes,* leaving *legacy trees*. This prescription will be applied in the areas where forest management is to continue for the long term. There will be variation in actual on-the-ground silviculture from stand to stand based on site-specific needs, and some areas will yield more volume than others. However, for planning purposes we assumed an average potential growth and yield for large areas based on current and future forest growth and development. Every stand also has a no-management option. This analysis is logical because of the relative homogeneity of the potential natural vegetation and *site class* across the 60,000 acres, as well as the landscape-wide goal of recovering late-seral characteristics. Timber yields were produced using a fifteen-year cutting cycle, five-year planning periods, and an eighty-year *planning horizon*. The

diameter class – classification of trees based on their diameter size.

legacy trees – a mature tree permanently protected from harvest to provide forest structure and eventually become a snag and large downed log.

planning horizon – time frame in which management prescriptions are implemented.

site class – a class placed upon a forest site via the site index process. The site index is a system of classifying forest land by its ability to grow timber based on the size or height of a tree at a target age. Site index is also used to project tree growth. For example, a 50-year-old redwood tree that is 160 feet tall can be predicted to reach 220 feet at 100 years of age using a site index curve. Site I is the most productive and Site V is the least.

yields were based on cutting a percentage of the assumed board-foot volume growth over the previous fifteen-year period.

Rx 1: Restore to Late Seral

Suppressed and intermediate trees will be thinned with the goal of opening up the stand and encouraging the most growth on the healthiest dominant and *codominant* trees. The aim is to recreate late-seral habitat as soon as possible. This will be applied to HRZs, buffers, and sparse residual stands. Harvesting will end in these areas as late-seral conditions are attained. Lower harvest volumes and higher logging costs are associated with this prescription. Concurrent with these entries, other restoration activities will be performed, such as permanently abandoning and revegetating no longer needed roads and *skid trails*.

codominant – a tree with medium-sized crown forming part of the general level of the forest canopy, receiving full light from above but comparatively little light from the sides.

skid trail – a trail for skidding (dragging) timber to a loading area.

Rx 2: Selection with Legacy Tree Retention

This prescription is applied exclusively to the Long-Term Forest Management Area. The goal is still to return late-seral conditions by opening up the stand and encouraging growth on the healthiest dominant and codominant trees; however, once this structure is attained, these areas will continue to be managed for wood products through selection harvesting into the future. Harvest volumes will be only slightly higher in the near term than the restoration prescription, and 5-10 legacy trees per acre will be maintained in perpetuity to provide for the continued recruitment of snags and downed woody debris. Harvests will always remain less than growth due in part to the accumulated growth on legacy trees that will never be cut.

Seral-Stage Development

The seral-stage development of each vegetation type under each management prescription was modeled for the entire planning horizon. *(See Figure 3 – Projected Size and Density Class Development.)* Potential yields per acre and acres by vegetation type under each prescription were then entered into a spreadsheet that tracks harvest by period, revenue, costs, net revenue, person-days of employment, and present net value. The spreadsheet also tracks WHR development over time in order to link with the GIS to produce forest seral-stage development maps over the 80-year planning horizon. Numerous assumptions regarding current and future forest conditions were made in order to allow planning in the absence of site-specific inventory information. All assumptions were conservative in nature.

Murrelet Grove, clearcut by Maxxam in 1990. This former forest will be restored under Rx 1 as part of an HRZ. Photo: Doug Thron

Figure 2 – Headwaters Forest Habitat Development

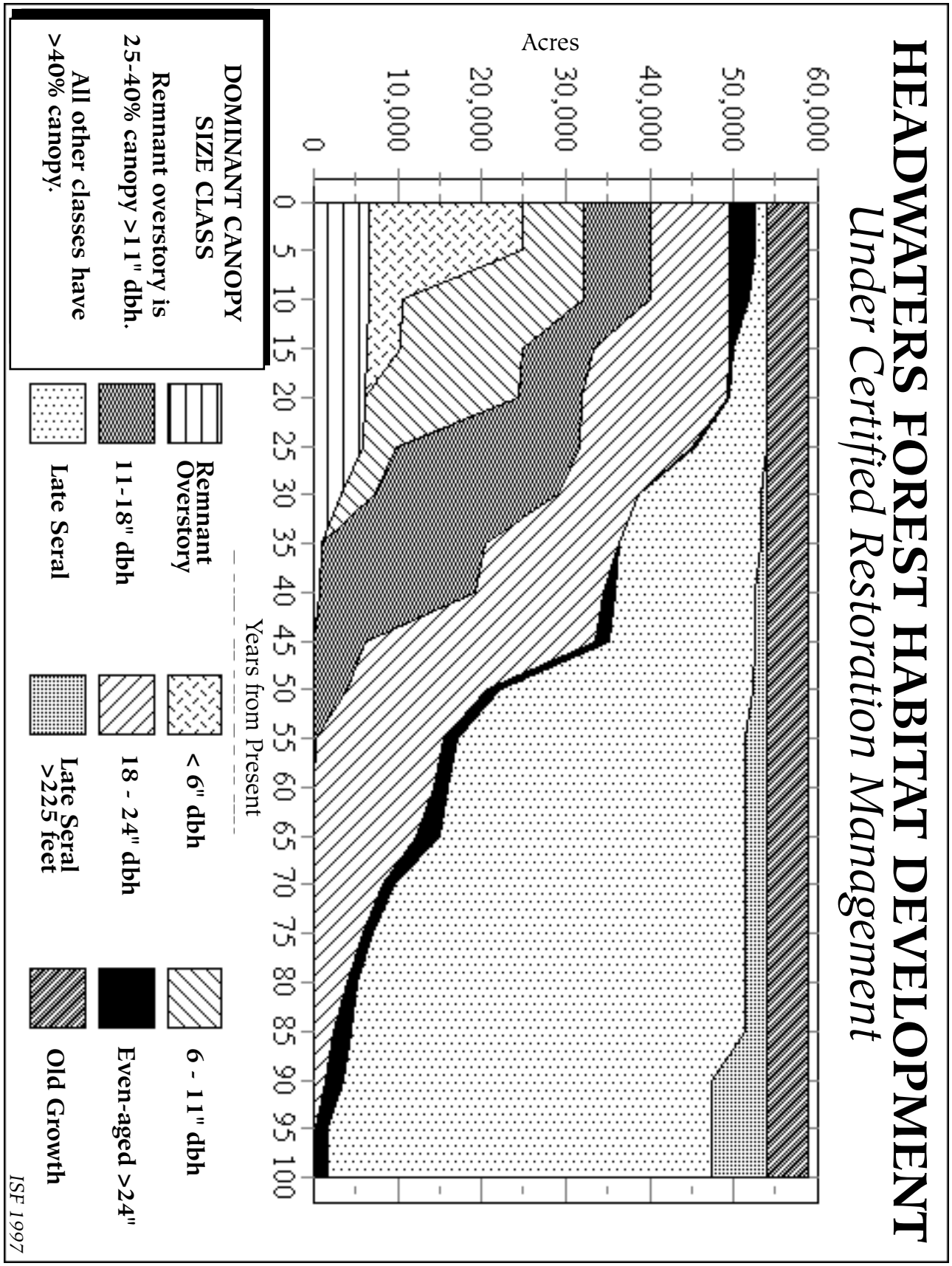


FIGURE 3

PROJECTED SIZE AND DENSITY CLASS DEVELOPMENT

Site II Coastal Redwood Lands After Industrial Logging

Stand Age	Restoration Prescription			Selection Prescription			Let Grow with pre-commercial thinning		
	Current Canopy Remaining			*Current Canopy Remaining*			*Current Canopy Remaining*		
years	*NONE*	*25-40%*	*<25%*	*NONE*	*25-40%*	*<25%*	*NONE*	*25-40%*	*<25%*
0	1D	4P	1D	1D	4P	1D	1D	4P	1D
5	1D	4P	1D	1D	4P	1D	1D	4P	1D
10	2D	4P	2D	2D	4P	2D	2D	4P	2D
15	2D	4P	2D	2D	4P	2D	2D	4P	2D
20	3D	4P	3D	3D	4P	3D	3D	4P	3D
25	3D	4P	3D	3D	4P	3D	3D	4P	3D
30	3D	5P	3D	3D	5P	3D	3D	5P	3D
35	4aD	5P	4aD	4aD	5P	4aD	4aD	5P	4aD
40	4aD	6D	4aD	4aM	5P	4aM	4aD	6D	4aD
45	4aD	6D	4aD	4aD	6D	4aD	4aD	6D	4aD
50	4aD	6D	4aD	4aD	6D	4aD	4aD	6D	4aD
55	4bM	6D	4bM	4bM	6D	4bM	4aD	6D	4aD
60	4bD	6D	6M	4bM	6D	4bM	4bD	6D	6M
65	4bD	6D	6M	4bD	6D	6M	4bD	6D	6M
70	4bM	6D	6M	4bM	6D	6M	4bD	6D	6M
75	4bD	6D	6M	4bM	6D	6M	4bD	6D	6M
80	4bD	6D	6M	4bD	6D	6M	4bD	6D	6M
85	4bD	6D	6M	4bM	6D	6M	4bD	6D	6M
90	6D	6D	6D	4bD	6D	6M	4bD	6D	6M
95	6D	6D	6D	6D	6D	6D	4bD	6D	6D
100	6D	6D	6D	6D	6D	6D	4bD	6D	6D
105	6D	6D	6D	6D	6D	6D	5D	6D	6D
110	6D	6D	6D	6D	6D	6D	5D	6D	6D
115	6D	6D	6D	6D	6D	6D	5D	6D	6D
120	6D	6D	6D	6D	6D	6D	5D	6D	6D
125	6D	6D	6D	6D	6D	6D	6D	6D	6D
130	6D	6D	6D	6D	6D	6D	6D	6D	6D
135	6D	7D	6D	6D	6D	6D	6D	6D	6D
140	6D	7D	6D	6D	6D	6D	6D	6D	6D
145	6D	7D	6D	6D	6D	6D	6D	7D	6D
150	6D	7D	6D	6D	6D	6D	6D	7D	6D
155	7D	7D	7D	6D	6D	6D	6D	7D	6D
160	7D	7D	7D	6D	6D	6D	6D	7D	6D
165	7D	7D	7D	6D	6D	6D	6D	7D	6D
170	7D	7D	7D	6D	6D	6D	7D	7D	7D
175	7D	7D	7D	6D	6D	6D	7D	7D	7D
180	7D	7D	7D	6D	6D	6D	7D	7D	7D

Note: *See Section IX: Vegetation Analysis for WHR 1-6 definitions. Sparse (S) is less than 15% canopy closure, Open (O) is 15-30% canopy closure, Medium (M) is 30-60% canopy closure, and Dense (D) is greater than 60% canopy closure. Seral stage 7 was created during the modeling process in order to track stands that have become at least 3/4 of the height of an adjacent residual or unentered old-growth stand. This height was chosen because it is thought that after this time, nest predation of adjoining marbled murrelet nest areas would decline as the canopies overlap. A height of 225 feet was chosen based on a site-potential tree height of 300 feet.*

Additional notes on Figure 3:

• Seral-stage development on Site II redwood land after industrial harvesting is predictable and follows the general development path outlined in the table above.

• Brush control and/or pre-commercial thinning is applied to all stands while in size class 2 (2-6").

• Habitat is tracked by the seral stage of dominant trees, which must be a "P" or denser (>25% canopy).

• Stands with a "5S" overstory become a "6M" when the understory becomes a "4bD."

• Stands with a "5P" overstory become a "6D" when the understory becomes a "4aD."

FIGURE 4

PROJECTED RESTORATION FORESTRY HARVEST VOLUMES

			Prescriptions:	**Restore to Late Seral**		**Selection w/ Legacy Tree Retention**					
Current Modified WHR	**1st Entry Period**	**Assumed Growth bf/ac/yr***	**Harvest by entry (mbf/acre)****			**Harvest by entry (mbf/acre)****					
			1st entry	2nd entry	3rd entry	1st entry	2nd entry	3rd entry	4th entry	5th entry	6th entry
MCN5D	1	2000	10	12		12	15	20	20	20	20
MCN5M	1	1500	8	10		10	13	17	20	20	20
MCN4bD	1	1500	10	12		10	15	17	20	20	20
MCH4bD	1	1200	8	10		8	12	15	15	17	17
MCN4bM	1	1300	7	9		8	10	12	15	17	20
MCH4bM	1	1000	6	8		6	9	12	14	14	17
MCN4aD	2	1000	6	8	10	8	10	15	15	18	20
MCH4aD	2	900	5	7	9	6	9	12	12	15	15
MCN4aM	2	900	5	7	8	5	8	10	13	15	17
MCH4aM	2	800	4	6	8	4	7	9	12	12	15
MCH3D	3	900	5	7	9	6	9	12	12	15	
MCH3M	3	800	4	6	8	4	7	9	12	12	
MCH2D	5	0	5	7	9	6	9	12	12	15	
MCH2M	6	0	4	6	8	4	7	9	12		
MCH1D	7	0	5	7	9	6	9	12	12		
MCH1M	7	0	4	6	8	4	7	9	12		

Note: *A period is five years. The first period is therefore years 0-4, the second is years 5-9, etc. Each entry is fifteen years apart. See Appendix 5 for description of WHR types.*

** **bf/ac/yr** = board feet per acre per year, ** **mbf/acre** = thousands of board feet per acre Each entry is fifteen years apart.*

ASSUMPTIONS FOR FIGURE 4

• An average site index of 160 (using a 100-year base) is assumed over the entire 60,000 acres.

• Hardwoods are a significant portion of the regenerating forest (20%-50%) until the stand reaches size class 4a, when conifers begin to dominate to the point where hardwoods are less than 20% of the stand.

• Harvests from MCH types are 25% hardwood.

• Approximately 1/2 of the assumed periodic board-foot volume growth is harvested in each restoration entry.

• Approximately 2/3 of the assumed periodic board-foot volume growth is harvested in each selection entry.
• In areas with less than 40% overstory currently remaining (S or P density), the younger portion of the stand will be managed and the overstory trees left to create habitat diversity.
• The presence of an unmanaged overstory does not delay the timing of harvest entries, due to the predominantly clumpy nature of this overstory, but it does reduce harvest yields from those shown in the table below by the percentage of canopy closure – 15% for "S" and 30% for "P" densities.

FIGURE 5
FORESTRY ANALYSIS RESULTS

Yrs from Present	MBF* Harvested by Period	Person Days of Employment**	Revenue	Total Costs	Net Revenue
0 - 4	46,846	55,432	$24,926,050	$13,682,890	$10,905,865
5 - 9	54,827	54,330	$29,315,450	$14,238,615	$14,624,530
10 - 14	46,964	50,340	$22,838,096	$12,715,835	$9,818,593
15 - 19	77,693	49,799	$41,640,903	$16,379,258	$24,503,795
20 - 24	109,740	71,179	$57,610,845	$22,952,898	$33,618,208
25 - 29	99,938	66,086	$48,179,476	$21,074,560	$26,291,768
30 - 34	85,506	55,591	$43,453,910	$17,639,208	$25,040,261
35 - 39	115,626	74,087	$59,657,041	$24,011,760	$34,575,923
40 - 44	134,608	86,889	$70,808,383	$28,358,080	$41,176,794
45 - 49	110,257	70,442	$57,657,601	$22,780,104	$33,831,172
50 - 54	127,192	80,735	$69,934,865	$26,378,081	$42,250,080
55 - 59	102,691	65,488	$56,480,094	$21,064,572	$34,353,056
60 - 64	106,330	67,350	$58,481,588	$21,762,437	$35,617,576
65 - 69	81,647	51,109	$44,906,092	$16,329,488	$27,719,306
70 - 74	81,802	51,654	$44,990,979	$16,360,356	$27,771,704
75 - 79	88,123	55,232	$48,467,870	$17,624,680	$29,917,894
80 - 84	89,233	55,660	$49,078,095	$17,846,580	$30,294,570

Numbers shown are for each 5-year period.

**MBF = thousand board feet*
*** See Figure 10 for actual full-time jobs created by timber management.*

Present Net Value of Headwaters Forest
Based on Forestry Prescriptions Modeled = $130,542,332

Logging Costs: $160 - $180 per thousand board feet (depends on prescription)
Timber Prices: $550/mbf for conifers and $250/mbf for hardwoods (delivered to mill)
Hauling Cost: $40/mbf
Interest Rate: 4%
Thinning/Brush Treatments: $450/acre and 3 person-days per acre
Labor includes pre-commercial treatments, harvest layout, falling, yarding, and loading.

Truly sustainable forestry provides for the long-term economic health of forest-based communities. This concept includes an even flow of wood products over time in order to maintain stable employment levels. Actual harvest flows would be smoother with access to real inventory figures for use in planning. The drop in periodic harvest volume after year 40 (indicated in Figures 5, 6, and 7) is caused by the cessation of management in most areas under restoration prescriptions.

FIGURE 6
HEADWATERS FOREST HARVEST VOLUME UNDER CERTIFIED FOREST MANAGEMENT

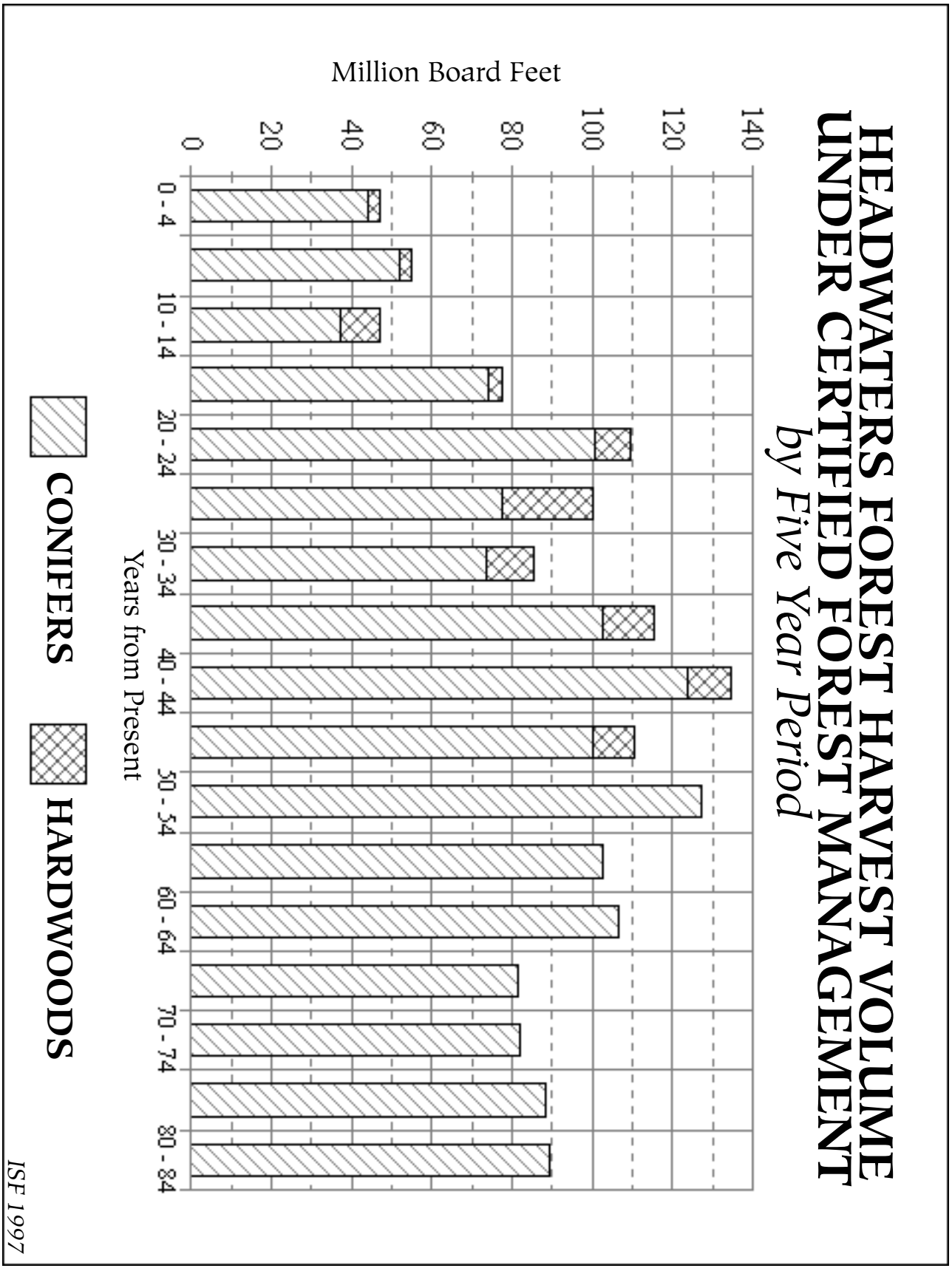
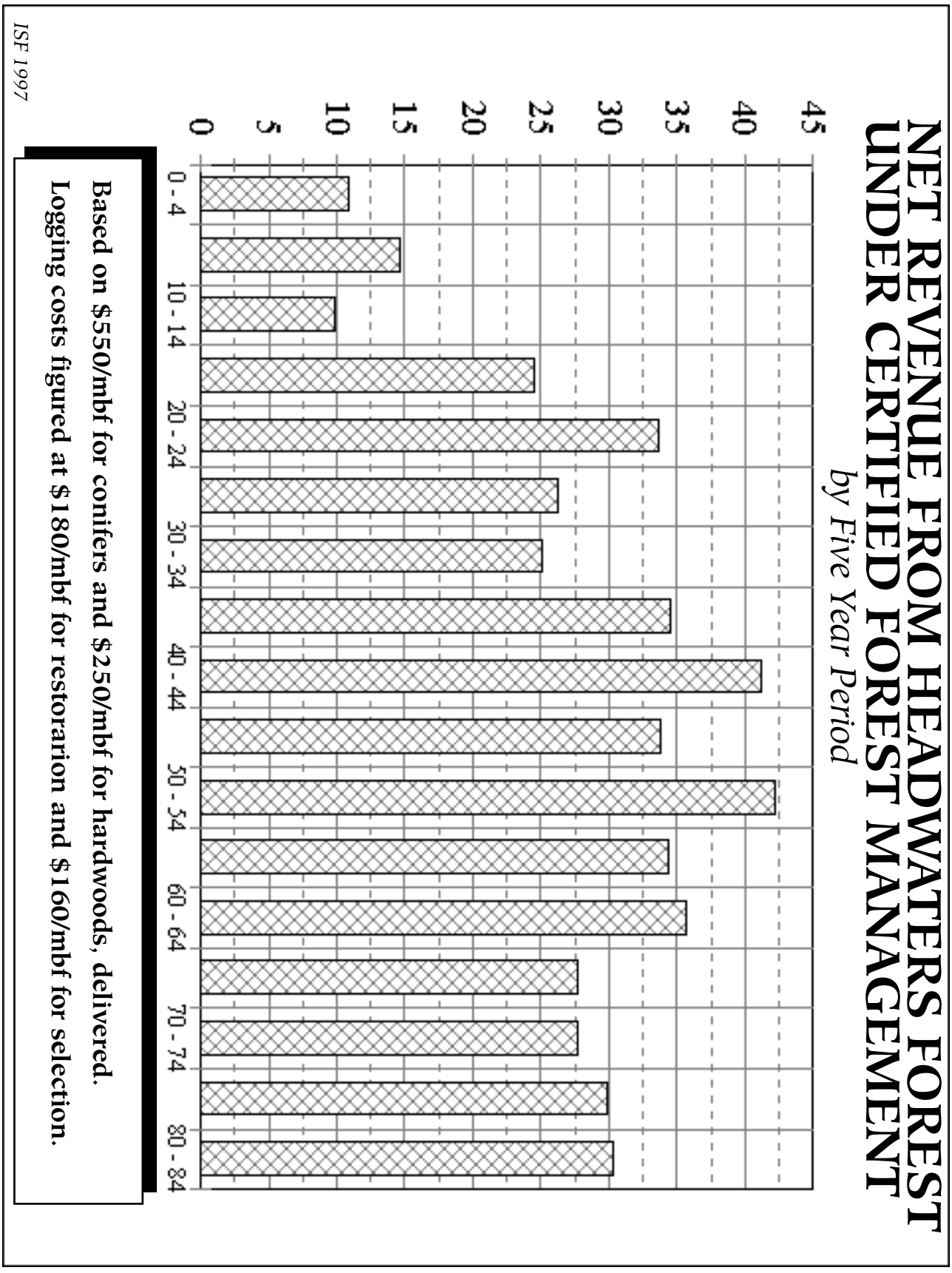


FIGURE 7
NET REVENUE FROM HEADWATERS FOREST UNDER CERTIFIED FOREST MANAGEMENT



Beyond the Planning Horizon

All stands treated using the restoration prescription will have dropped out of forest management by the end of the 80-year planning horizon. These areas, including HRZs, buffers, and sparse residual stands, will begin to exhibit mature forest characteristics and associated wildlife habitat values including a multi-layered canopy, large snags, downed woody debris, and diverse understory vegetation. Future "management" in these areas will likely involve only the natural reintroduction of fire into the ecosystem. As the stands continue to develop, we should begin to see migration of old-growth-dependent species from the ancient forest islands into these areas. Over time, perhaps within 250 years, we hope these areas will again provide nesting habitat for the marbled murrelet.

Eighty years was chosen for the draft analysis because only the Long-Term Forest Management Area will remain in production after this time. The lack of site-specific inventory information for more thorough site planning and forest stand growth and yield projections was a major limiting factor to a longer planning horizon. At any rate, flexibility is an important element of adaptive management planning.

The Long-Term Forest Management Area will continue indefinitely to support the human communities that rely on the resources these forests can supply based on certified forest practices. After 80 years, these areas will be the only forests continuing to produce wood products. The stands will exhibit late-seral structural complexity with snags and downed logs and a multi-layered canopy. Maintenance of this forest structure is compatible with producing high-quality forest products for value-added manufacture – providing long-term stable employment in the woods and in the mill. The structure of these stands will provide habitat for a number of old-growth-dependent species such as the northern spotted owl, while providing protection for core areas and connectivity between the unentered groves, restored HRZs, and residual stands. A conservative estimate of the long-term sustained yield from the Long-Term Management Areas is approximately 20 million board feet per year. This is an approximate estimate of what could be harvested on an annual basis 100 years from now, as defined by long-term sustained yield *(See Figure 6)*.

Restoration: Fisheries and Watershed Recovery

This summary is based upon and seeks to combine the intent of two of the primary documents in the 1993 Headwaters Forest Act legislative package submitted to then-Congressman Dan Hamburg by the Headwaters Forest Coalition. The first is the "Headwaters Redwood Forest Rehabilitation Jobs Program" (retitled "But What About Jobs?" in 1996) written by Judi Bari *(see Appendix 6)*, and the second is the "Watershed Restoration Plan for Proposed Headwaters Redwood Forest Complex" by Pacific Watershed Associates *(see Appendix 9)*. The basic restoration outline is contained in these two documents.

Each of the creeks in Headwaters Forest has its own set of unique circumstances as regards watershed conditions and steps for recovery. They all are, in one degree or another, impacted by past and present human management activities. All of them, or some part of them, have supported or may be capable of supporting chinook, coho salmon, and/or steelhead. Some of the major impacts on these creeks are increased *sediment loads;* instabilities and erosion affecting both riparian and upslope areas; and decrease in the quality and quantity of riparian forest, which affects stream temperatures and the quality of instream habitat, both current and future.

In order to adequately evaluate conditions and prescribe recovery procedures for each of the affected watersheds, a full-bore watershed assessment is necessary. Because of constraints against trespass, as well as the constraints of time and resources, the examples and

estimates used for this summary have been based on aerial photographs and publicly available documents. These documents include but are not limited to: present and past timber harvest plans (THPs), agency reports, and Department of Fish and Game (DFG) and California Conservation Corps (CCC) stream surveys.

Watershed assessments are the beginning phase of human involvement in the fisheries and watersheds recovery process. Watershed assessment, in one form or another, plays a basic role throughout the process – from planning, to implementation, to monitoring – for documentation of each step and for future adaptive measures.

There are several levels of approach to watershed assessment and recovery. One predominant model stresses the assessment, selection, and correction of high-impact, high-volume sediment delivery to streams from erosion and mass wasting related to the existing road network. Corrective work under this approach is almost entirely based on heavy equipment access and on cost effectiveness (measured in cost per cubic yard of soil removed from active or potential delivery to streams). This model is part of the Headwaters Stewardship model. What distinguishes this Stewardship Plan is the incorporation of an often labor-intensive approach that addresses the whole spectrum of fishery and watershed recovery, independent of equipment accessibility and selection of actions based strictly on the cost per cubic yard of soil moved to a stable location. Another distinguishing feature is a training component for people in the arts and sciences of watershed restoration, for application in the Headwaters area as well as the rest of the North Coast.

For example: Watershed assessments will include watercourse-by-watercourse, skid-trail-by-skid-trail evaluations that will document both existing features and possible corrective measures. Another distinguishing feature will be an emphasis on the recovery of the stability and quality of riparian habitat for all watercourses. There will be a strong focus on sediment reduction *per se;* the California Department of Fish and Game/California Conservation Corps recommendations for most of the listed creeks include mapping, inventory, and correcting of bank and upslope erosion sources. But the re-establishment of watercourse riparian quality and correction of significant problems independent of heavy equipment accessibility will have a high priority. Instream habitat improvements will be undertaken only when upslope stability has been adequately addressed and/or when it is clear that an instream project or bank stabilization is truly warranted in light of upslope and stream reach conditions.

sediment loads - the amount of suspended material in a watercourse at a particular time.

watershed assessment -a systematic procedure for characterizing watershed and ecological processes to meet specific management and social objectives.

Overall, the Fisheries and Watersheds Recovery Program will generally follow the eleven steps outlined in the Pacific Watershed Associates (PWA) portion of the original Headwaters Forest Act. As stated above, there will be a greater emphasis on labor-intensive efforts such as riparian forest improvement, significant recovery measures not related to heavy equipment use, and training of personnel in the arts and sciences of watershed restoration.

Ten-Year Recovery Program

The 60,000-acre Headwaters Forest is approximately 94 square miles. The rough estimates that follow are based on work for that general area. The following outline is for a ten-year Recovery Program taken from Pacific Watershed Associates, *Watershed Restoration Plan for Proposed Headwaters Forest Complex*. [Brackets enclose comments or changes to the original Pacific Watershed Associates text.]

1) "Assemble restoration team: Needed to conduct and coordinate a detailed ecosystem-based watershed restoration program."

Hydrologist (per year)	$ 50,000	
Geologist	50,000	
Fisheries Biologist	50,000	
Wildlife Biologist	50,000	
Mapping/photo expert	50,000	
Administrative staff	50,000	
Administrative staff	40,000	
Administrative staff	30,000	[Trainee]
	$370,000	
Office rental, supplies, phone, copying, etc.	70,000	
YEAR ONE TOTAL	$440,000	
Total for Ten Years:	**$3,500,000**	

After first year the time commitment by the resource professionals (except for the mapping/photo expert) will go to one-half time.

2) "Conduct reconnaissance assessment: Aerial photograph interpretation and cursory field surveys and investigations . . . compile existing data reports and literature to determine the current status and disturbance levels in stream channels, on hillslopes and to the biological community."

Aerial Photos, Interpretation, fieldwork *[per PWA]	$15,000
Two Trainees @ $15/hour	60,000
YEAR ONE TOTAL	$75,000
Level for training for each of the succeeding nine years:	$30,000
Total for Ten Years:	**$345,000**

3) "Prepare environmental documents: Prepare mandated environmental compliance assessments and documents for the conduct of restoration activities covering the remainder of the program (years 1 through 2)."

Expert	$50,000
Assistant	30,000
YEAR ONE TOTAL	$80,000
Total for Ten Years:	**$160,000**

4) "Develop mapping and database capabilities: Concurrently develop computerized mapping capabilities to ensure physical and biological watershed data is collected and stored in a usable, readily reproducible digital and spatial format." [Much of this work of data compilation has been completed by Trees Foundation. However, we believe that priority should be given to establishment of a centralized data clearinghouse for this information. The compilation of more complete data must be a priority.]

Expert	$50,000
Assistant [can be trainee]	30,000
YEAR ONE TOTAL	$80,000

Total for Ten Years: **$800,000**

5) "Develop resource base maps: Based on the reconnaissance level assessment . . . develop base maps . . . to eventually direct the prioritization of rehabilitation needs (year 1)."

Technician	$40,000
Two Trainees	60,000
YEAR ONE TOTAL	$100,000
Total for Ten years:	**$100,000**

6) "Establish criteria to prioritize work sites: Develop site-specific selection criteria to be used to prioritize the immediacy of both physical and biological restoration needs throughout Headwaters Forest."

[Done by Restoration Team – see item 1 above]

7) "Prioritize watersheds for detailed inventories: – Apply selection criteria to reconnaissance level inventory data to determine the sequence at which detailed watershed inventories will be conducted on the total land base (i.e., a detailed listing of the most critical to the least critical areas in need of physical and biological restoration)."

[Done by Restoration Team – see item 1 above]

8) "Conduct watershed inventories: Healthy watersheds will be inventoried for potential problems and treated first so that biological and physical conditions of these comparatively intact systems can be maintained and protected. Within more impacted sub-watersheds or areas (those exhibiting relatively degraded biological integrity and reduced complexity), professionals [and Trainees and Others] will begin [and continue] conducting detailed watershed inventories. The purpose of each inventory will be to identify [the conditions of Headwaters resources], specific potential and existing threats to resources, and to prescribe appropriate corrective or preventative measures needed to reverse resource damage (years 2 through 10)."

[Part of responsibility of Restoration Team described in item 1 above.]

20 Trainees	$600,000
YEAR TWO TOTAL	$600,000
Total for Ten Years:	**$3,000,000**

After the first year the number of Trainees will be reduced to ten.

9) "Estimate cost-effectiveness [and resource recovery effectiveness] of proposed work: Based on the results of the detailed watershed inventories, recommended treatments will be carefully and systematically reviewed and analyzed by the restoration team. [Resource recovery] effectiveness and cost-effectiveness analyses of proposed treatments will be performed to ensure they efficiently and effectively accomplish restoration goals. This analysis will result in a prioritized listing of all proposed restoration work within each sub-watershed of Headwaters Forest (years 2 through 10)."

[Part of responsibility of Restoration Team described in item 1 above.]

Effectiveness Expert	$50,000
Trainee	30,000
YEAR TWO TOTAL	$80,000
Total for Ten Years:	**$400,000**

After the first year *both* will be one-half time.
10) "Implement restoration work: Based on the recommendations and priorities established by the watershed assessments [resource recovery effectiveness] and cost-effectiveness evaluations, a local heavy equipment and labor-intensive work force will be hired or contacted to implement on-the-ground erosion control, revegetation, fisheries and wildlife improvement, and stream channel restoration activities. The bulk of the expenditures for the Headwaters restoration work will occur during this phase of the program. Most of the funds [much of the time] will [probably] be directed to local heavy equipment operators for use in erosion prevention and restoration work on logging roads and in stream channels [as appropriate] (years 2 through 10).

A wide variety of activities will take place, examples:"

(a) Removal of haul road stream crossings and landing fills with associated tasks related to correction of "deranged hillslope hydrology" — hypothetical cost estimate from typical 2,000 feet of haul road in clearcut/overstory removal area of former old-growth forest (taken from overhead examination of actual area).

Excavator & "Cat" work removing and stabilizing three crossings and three landings (18,435 cubic yards):	$28,100
Eight-person crew correcting associated gully system & bank failures for two days @ $15/hour:	1,920
TOTAL FOR PROJECT	**$30,020**

(b) Replanting native conifers and riparian tree species along 1,000' of stream, 100' on either side @ 5' centers (8,000 trees)

Eight-person crew @ $15/hour, 5 days:	$4,800
Trees and expenses:	2,000
TOTAL FOR PROJECT	**$6,800**

(c) Stabilizing inaccessible eroding skid trail crossing, unstable headwall area, and bank failures —

Eight person crew @ $15/hour, 5 days:	$4,800
Materials, supplies, & expenses:	1,100
TOTAL FOR PROJECT	**$5,900**

[Nine Years of Restoration Work — Employing from 100 to 200 people/year]	
EACH YEAR (starting at year two):	$3,000,000
Total for Ten Years:	**$27,000,000**

11) "Monitor, document and evaluate restoration work: Develop and implement a qualitative and quantitative monitoring plan designed to determine the effectiveness of individual rehabilitation measures and the overall rehabilitation effort, as well as measure recovery of the ecosystem as a whole and in part. Results and findings from monitoring and evaluation data will be used to modify and improve restoration activities throughout the remainder of the program (years 2 through 10)."

[Part of responsibility of Restoration Team described in item 1 above.]

Monitoring Expert	$50,000
Two Trainees	60,000
YEAR TWO TOTAL	$110,000
Total for Ten Years:	**$990,000**

12) Coordinate Education, Outreach, Business Creation, and Trainee Programs
The trainee program needs to be well coordinated throughout the ten-year restoration project, coupling the needs of the program with the needs of individual trainees. Part of this responsibility is to enable trainees and others to create viable businesses involving the arts and sciences of watershed restoration — for both the assessment and implementation skills essential for a conservation-based economy. An extension of this general task is the periodic and regular offering of seminars and conferences open to the public as regards the specific efforts and findings in the Headwaters Restoration Project that apply to local and regional interests and needs (years 2 through 10).

Education/Business Expert	$50,000
Administrative staff person	40,000
Trainee	30,000
YEAR TWO TOTAL	$120,000
Total for Ten Years:	**$1,080,000**

FIGURE 8
COSTS AND PERSON-YEARS OF PROPOSED RESTORATION WORK

Category #	Year One $	Year One Person-years	Year Two $	Year Two Person-years	Ten-Year Total $	Ten-Year Total Person-years
1)	440,00	8	340,000	6	3,500,000	62
2)	75,000	3	45,000	2	345,000	21
3)	80,000	2	80,000	2	80,000	2
4)	80,000	2	80,000	2	80,000	20
5)	100,000	3	0	0	100,000	3
6)	(covered by #1)	-	-	-	-	-
7)	(covered by #1)	-	-	-	-	-
8)	(covered in part by #1)		600,000	20	3,000,000	100
9)	(covered in part by #1)		80,000	2	400,000	10
10)	0	0	3,000,000	150	27,000,000	1350
11)	(covered in part by #1)		110,000	3	990,000	27
12)	0	0	120,000	3	1,080,000	27
First Year Total	**$775,000**	**18**				
Second Year Total			**$4,461,000**	**190**		
Grand Total					**$37,295,000**	**1622**

RECREATION

In order to fully assess the effects of the Headwaters Forest Stewardship Plan on regional economic and environmental conditions, it is essential to consider the value of recreational resources and potential environmental impacts of recreational use in Headwaters.

Current economic trends in Humboldt County have tended in the direction of a flourishing service sector. There is a great need for long-term "soft industry" alternatives to sup-

plement a natural resource-based economy no longer capable of providing adequate employment for the burgeoning population. In fact, many of the successful soft industries in the Humboldt Bay area in recent decades are related to recreation. County revenue generated from tourism now rivals that produced by timber, and tourism may soon be the largest industry in the county (Dean Runyan Associates 1997). While it would be premature to project actual jobs and income from recreation (ecotourism) in Headwaters Forest, it is unarguable that this ancient forest would generate significant tourist interest and revenue, as well as publicity for the local area. To claim that such revenue can approach that of timber harvesting would be absurd on a short-term comparative basis, but on the scale of decades, the intact forest will mean more to Humboldt County.

Headwaters Forest lies a mere ten miles from the largest population center in the county, Eureka. Various businesses in this urban area could benefit from the development of appropriate public access into some of the cathedral forests of Headwaters. But appropriate access is an issue on which people devoted to the preservation of Headwaters Forest are likely to disagree vehemently. This Stewardship Plan invites debate on the topic of recreation in Headwaters Forest, given that people around the world will be interested in seeing Headwaters if it is acquired from the current owner. However, it is essential that wilderness qualities and habitat value be preserved from adverse impacts of human visitation.

Although it would be ideal (from a pure conservation standpoint) to devote the ancient groves of Headwaters to inaccessible wilderness and maximum recovery of endangered species, it seems unavoidable that members of the public will want controlled access to this much-publicized and seldom-seen natural wonder. Even among wilderness advocates who want total protection for Headwaters Forest, people will have a need and desire to come and relate to this place they have worked so hard to protect. Treading the thin line between wilderness experience and wilderness impacts will be a challenge to all who love the ancient redwoods.

At almost 3,000 acres in size, the Headwaters Grove is perhaps the only large old-growth redwood stand not yet impacted by the effects of mass human traffic. There are no freeways, no RVs, no parking lots carved out of the wilderness, no domesticated animals of any sort. Relatively few people have ever even traversed this delicate web of streams and ridges. It is valuable endangered species habitat. The Headwaters Grove should therefore be designated as wilderness and access strictly controlled. In fact, one of the smaller groves may be more appropriate for tourism.

The watersheds of the upper South Fork of the Elk River and Salmon Creek including potential conservation easements on surrounding buffer areas to the west constitute an appropriate acreage for the wilderness/recreation planning process, but the Headwaters Grove alone – without the other five ancient groves – is probably not large enough to accommodate the demand for recreational activity without adverse impacts. Thus any future discussion of recreation potential will be based on the actual acreage eventually acquired.

While this document cannot detail the possibilities and ramifications of the recreation projects identified below, we acknowledge the need for careful planning in the following areas:

- **Circulation strategies:** Considering the proximity of the forest to Eureka, a shuttle bus could be used to convey visitors to the Headwaters area, minimizing traffic and pollution.
- **Vehicular exclusion within buffer areas:** In order to protect the habitat and wilderness values of the main Headwaters Grove, the South Fork of the Elk River watershed and Salmon Creek can serve as the boundaries of the roadless area.
- **Visitor center location:** An appropriately scaled interpretive visitor center, if estab-

lished, would be the termination of vehicular access to Headwaters Forest. Its displays would emphasize education about critical habitat and how to protect it.

- **Trail system design**: To minimize negative effects upon natural vegetation and water quality, trails should be designed along decommissioned roads when possible.
- **Camping and day use**: Such areas should be designed to provide facilities compatible with the primitive character of the area, including sufficient safeguards against resource degradation. It is important to regulate what areas of the forest have visitors and how many in a particular area. Permits should be required.
- **Interpretive and educational programs**: Visitors will need to be oriented to the special conditions of Headwaters Forest, including principles of conservation biology and rules for "no trace" camping and day use. Natural history and perhaps a history of the struggle to protect Headwaters would be of interest to visitors.

(See also "The Relevance and Role of Recreation and Regional Quality of Life" in the next Section.)

NON-TIMBER FOREST PRODUCTS

Another largely untapped area is the potential harvesting of non-timber forest products (NTFPs) within Headwaters Forest. The field of NTFPs is a rapidly growing complement to tree-based forest harvesting. With increasing concerns regarding the cumulative effects of rigorous logging practices, numerous markets are emerging for forest products that do not require the harvesting of trees. These markets range from a rapidly increasing demand for natural medicinal herbs to supplies for the floral industry. While it would be unrealistic to expect large-scale returns on non-timber forest products, their marketing offers substantial opportunities for creative cottage industries to benefit economically from Headwaters Forest. Of course, core areas of the ancient forest could not support intensive utilization of NTFPs.

Plants within the redwood forest ecosystem that could be potentially harvested are:

- food: huckleberry, blackberry, raspberry, salmon berry, mushrooms
- basketry: hazelnut, ferns
- floral: huckleberry, ferns, moss, lichens, and pearly everlasting.

Many of the available NTFPs in the Headwaters region have traditionally been harvested by Native Americans as a means of maintaining their cultural art forms and medicinal methods. This facet of the HFSP would be implemented with input from both the Native American community and local NTFP researchers.

XI. Economic Development Findings: The Long-Term Economic Impact to Humboldt County

INTRODUCTION

Contrary to depictions commonly offered by those engaged in non-sustainable natural resource exploitation, responsible stewardship of forestlands such as the Headwaters Forest is not a black hole from which no economic activity is generated to benefit the local and regional economies. Rather, stewardship entails the active protection, management, and restoration of a natural resource land base according to defensible ecological principles and with the intent of achieving desired objectives that include long-term regional socio-economic well-being.

In the case of the Headwaters Forest Stewardship Plan, our vision for how the 60,000-acre land base should be managed includes all three elements: protection, restoration, and resource management (e.g. timber harvesting and non-timber forest products). The focus of

this section is on the last two elements, for both restoration and resource management require expenditures of capital and labor in order to achieve desired end-states. In the case of resource management and timber harvesting, a marketable commodity will be produced that generates regional income.

In clear contrast to the standard industrial model of resource exploitation, forest stewardship is explicitly oriented towards long-term natural resource use that does not sacrifice ecological and economic well-being. Normally it is conceded that resource stewardship necessarily entails reduced short-term economic activity – relative to full-scale industrial exploitation – in exchange for long-term sustainability and ecological integrity. But this trade-off may exist only if resource extraction (i.e., timber harvesting) is the sole basis of comparison between the industrial and stewardship models. When the economic activity generated by resource restoration is included in the calculus, the expected "cost" of reduced short-term economic benefit under the stewardship model may, in fact, be substantially and perhaps completely eliminated. As detailed below, resource restoration of a land base as badly degraded as the Headwaters Forest entails a very substantial effort that will generate significant economic activity, in terms of both employment and expenditures.

Furthermore, the economic (and other) benefits of a healthy ecosystem far exceed that attained by the industrial model; such a detailed analysis of relevant human (and other) health costs or benefits is, however, beyond the scope of this plan.

The intent of this portion of the Stewardship Plan is to present and discuss the economic dimensions or implications of the plan; that is, to focus on the employment and income that would be generated within the local and regional economy were the Stewardship Plan to be implemented. We will first address the economic implications of the stewardship-driven timber harvesting and then address the economics of resource restoration.

HFSP Timber Harvesting

As presented in detail previously in this planning document, the Headwaters Forest stewardship vision is decidedly not one of merely locking up and "preserving" the entirety of Headwaters Forest. While the remaining ancient forest groves and necessary buffers will be exempted from timber harvesting, the stewardship planning team recognizes and incorporates the principle that ecologically sensitive timber harvesting can be used as a tool to achieve desirable outcomes for the forest as well as to address regional economic concerns. The general intent of these timber harvesting prescriptions is to accelerate the progression of forest stands into late-seral states while providing a flow of marketable wood.

Selection silviculture is used exclusively in our Stewardship Plan as, for the next several decades, there is certainly no shortage of early successional forest stands within the area, due to Pacific Lumber's elevated rates of clearcutting over the past decade. Our harvesting prescriptions are intended to remove between 50% and 66% of periodic increment (growth), focusing removals on suppressed and phenotypically inferior trees within the mid- and lower canopy layers. The harvesting prescriptions are designed to be fully compatible with requirements for certification under both the SmartWood criteria and the Forest Stewardship Council (an international non-governmental organization that oversees independent, third-party forest management certification). While our proposed harvesting regimes are decidedly "light touch" relative to industrial norms, the high stocking levels of qualified stands within Headwaters Forest mean that a substantial harvest removal will still take place.

Based upon GIS-based land capability and land use zoning analyses, the stewardship planning team determined that approximately 46,000 acres of the 60,000-acre area could be

available for scheduled timber harvesting. Of this total, approximately 26,000 acres are available for the lightest harvest entries, referred to as "restoration" cuts that take approximately 50% of periodic increment. The acres allocated to the restoration harvest prescription are generally associated with designated Habitat Recovery Zones and other buffers where forest management will conclude as desired conditions are met, e.g. late-seral forest. Nineteen thousand acres are allocated to a slightly more intensive selection cut that is intended to remove approximately 66% of periodic increment. Lands termed the Long-Term Forest Management Area are available for the selection prescription. For both types of harvesting, a 15-year re-entry cycle is prescribed. The remaining 13,000 acres of Headwaters Forest are reserved from timber harvest. These areas are associated with either the remaining ancient forest groves (core reserves) or Class 1 watercourse zones (riparian reserves).

As described in more detail elsewhere in this plan *(see Section X: Long-Term Responsible Forestry),* the proposed harvest levels by five-year periods for the next 25 years are as follows:

FIGURE 9 – PROPOSED HARVEST LEVELS

Years from Present	Total Harvest for Period (MMBF)*	Average Annual Harvest (MMBF)*
0-4	46.8	9.4
5-9	54.8	11.0
10-14	47.0	9.4
15-19	77.7	15.5
20-24	109.7	21.9
25 Yr. Total	336.0	13.4

** Million Board Feet*

While not as high as old-growth-depletionary and ecologically-damaging industrial harvesting regimes,[1] these projected stewardship harvest levels nonetheless constitute a significant economic activity within the regional economy of Humboldt County. Most clearly, our stewardship vision for the Headwaters Forest cannot be depicted as economically non-productive. Following are our estimates of the employment and income likely to be generated by the proposed stewardship harvest levels for Headwaters Forest.

Stewardship management of the 45,000-acre portion of Headwaters Forest entails the following activities:[2]

- pre-commercial treatments (brush control and thinning)
- harvest layouts (e.g. THP preparation)
- timber falling, yarding, and loading
- truck hauling

Each activity entails employment of labor and, in some cases, machinery. Using coefficients generated in a prior study (ISF 1995)[3] we used the following unit labor requirements for timber-related activities:

- brush control and thinning: 3 person-days per acre
- harvest layout: 0.375 person-days per acre
- timber falling, yarding, and loading: 0.6 person-days per Million Board Feet
- timber hauling: 0.125 person-days per Million Board Feet

For field labor activities such as brush control and logging, a person-year of employment is assumed to be equal to 195 person-days. A person-year of professional forestry

activities (such as harvest planning and layout) is assumed to be the equivalent of 238 person-days. Using these labor coefficients, the estimated direct employment levels associated with the timber management element of the Headwaters Forest Stewardship Plan are listed below.

FIGURE 10 – TIMBER MANAGEMENT DIRECT EMPLOYMENT BY FIVE-YEAR PERIOD

Years from Present	Total Person-Days of Employment	Average Annual Person-Days	Total Person-Years of Employment	Average Annual Person-Years
0-4	55,400	11,100	272	54
5-9	54,300	10,900	266	53
10-14	50,300	10,100	247	49
15-19	49,800	10,000	244	49
20-24	71,200	14,200	349	70
25-Yr. Total	281,000	11,200	1,377	55

As the table reveals, proposed stewardship timber harvesting on the Headwaters Forest is projected to generate almost 1,400 person-years of direct woods-based employment levels over the next 25 years. This translates to a sustained level of approximately 55 full-time jobs per year. An additional 8 full-time jobs in timber hauling (truckers) will also be generated, on average, bringing the total to approximately 63 full-time jobs supported by the stewardship harvesting and stand management. Of this total, approximately 50% are estimated to be related to timber falling, yarding, loading, and trucking; approximately 45% related to silvicultural treatments (brush control and thinning); and approximately 5% related to harvest layout and administration. And equally important (but not displayed here), the employment levels are truly sustainable over the long run, as the timber resource base (either in total standing volume or average tree sizes) is not being depleted. *(See Section XII: Summary for a comparison with Pacific Lumber and Maxxam employment levels.)*

PROCESSING-RELATED EMPLOYMENT

The above employment figures relate only to the management, harvesting, and transport of logs to a mill. Subsequent processing of this harvested volume will generate additional employment. Using employment coefficients developed in a prior study (ISF 1995), the projected harvest levels under the Headwaters Forest Stewardship Plan are likely to generate the following primary processing employment.

FIGURE 11 – PRIMARY PROCESSING EMPLOYMENT

Years from Present	Total Person-Years of Mill Employment	Average Annual Person-Years of Mill Employment
0-4	188	37
5-9	219	44
10-14	188	37
15-19	311	62
20-24	439	88
25 Yr. Total	1,344	54

That is, projected timber harvesting under the HFSP could support more than 50 full-time jobs in primary processing within the local economy.

While we offer no quantitative estimates, it is relevant to note that the stewardship model of resource use also favors localized value-added processing of wood products, which historically has not been part of the industrial exploitation model, which largely focuses on high-volume commodity production. So if the HFSP were to be adopted and implemented, there is a heightened possibility that value-added secondary processing capacity – and associated employment – would be developed within the regional economy.

Indirect Timber-Related Employment

The employment of workers, especially if from within the regional workforce, generates additional regional economic activity and benefit as wages are expended on goods and services, a percentage of which is supplied by regionally-based vendors. This wage-induced respending effect is described by "employment multipliers." Generally, the magnitude of the multipliers is a function of the extent to which employment wages are respent within the regional economy as opposed to leaking out to be spent elsewhere. This is a function of the wage spending patterns of those employed as a result of the project in question (i.e., developing and implementing the HFSP), which in turn is largely a function of the extent to which local workers, not those outside the region, are employed. As a general rule, the employment multiplier is approximately 2, meaning that for every direct job generated by a project or activity, one additional job within the region is created through the respending of wages.

Regarding the regional economic benefits generated by project wages, there are clear differences between the industrial and stewardship models. Generally, the industrial model is driven by cost minimization and/or profit maximization, which tends to reduce employees to factors of production rather than social and economic objectives in their own right. In this framework, workers (e.g. contract loggers, truckers, and silviculture workers) are often brought in from outside the region of the forest if there is a cost advantage, which reduces the local/regional benefits generated by the natural resource base since wages seem to be spent elsewhere. In fairness, however, PL does largely employ woods and mill workers from within the regional workforce. In the case of Maxxam/PL, the issue is more one of retaining profits locally than needing a greater proportion of local workers.

At any rate, the stewardship approach to resource management – with its emphasis on local ownership, local employment, and local processing – is clearly oriented towards retaining a greater proportion of the economic benefits within the region when compared to the industrial exploitation model *(see Appendix 10 for more on local ownership)*. Reflecting this fact and in the absence of readily available empirical multipliers we suggest that the stewardship multiplier is at least 10% greater than the standard multipliers. Using a multiplier of 2.2, we estimate that the Headwaters Forest Stewardship Plan will generate at least 3,200 person-years of total (direct and indirect) employment within the Humboldt County regional economy over the next 25 years.

Timber-Related Regional Income

Another measure of regional economic activity/benefit is the market transaction value of producing and selling a commodity such as timber. In the case of the proposed Headwaters Forest Stewardship Plan, the projected harvest schedule, if implemented, would generate approximately $131 million of total net present value (4% discount rate) over the next 85 years. For the first 25 years:

Figure 12 – Timber-Related Revenues by Five-Year Period

Years from Present	Periodic Gross Revenue $Million	Periodic Total Cost $Million	Net Revenue $Million
0-4	24.9	13.7	10.9
5-9	29.3	14.2	14.6
10-14	22.8	12.7	9.8
15-19	41.6	16.4	24.5
20-24	57.6	22.9	33.6
0-24	176.2	79.9	93.4

Figure 12 clearly shows that stewardship management can be both ecologically responsible and financially viable. While the ecological health of Headwaters Forest will be improved over time, the timber harvesting that is one tool within the suite of tools for achieving better forest health will more than pay for itself, generating an average of $3.7 million in profits for the regional economy each year. Whereas corporate profits under the industrial model (notably represented by Maxxam/PL), generally accrue to investors far removed from where the resource base is located, the profits generated by timber harvesting under the HFSP will accrue and likely be reinvested locally.

Like expenditure of wages, the geographical pattern of reinvestment of the returns on capital (profit) determines the total (direct, indirect, induced) economic benefit to the local region of resource extraction and/or management. In regard to local economic benefits derived from management of Headwaters Forest, the stewardship model is clearly superior to the industrial exploitation model.

Industrial ownership and public lands concessions[4] patterns of forest land in North America are increasingly marked by capital concentration in fewer and fewer large, oftentimes multinational corporations. The benefits to the regional economies in which the forests are located are increasingly diminished as return on capital accrues to investors far removed from the forest. The present ownership of PL and the Headwaters Forest is a classic case of local ownership being displaced by a global financier located in another region of the country. Whereas local employment still occurs, albeit at rapidly decreasing rates due to the industrial model's emphasis on labor reduction, a dramatically lower proportion of corporate profits is retained as local wealth and subsequent capital reinvestment.

In contrast, the stewardship model is oriented towards local ownership, wherever feasible. In the case of Headwaters Forest, the question of future ownership is largely political, as the capital required to purchase the resource base likely far exceeds the capacity of any private entity willing to manage the forest under a stewardship framework. So the question turns to the ultimate disposition of the property were the federal/state government coalition to purchase it from the present owner. One real possibility would be to turn management and ownership over to a regionally-owned not-for-profit corporation, with below-market financing arrangements. It comes down to the social and political priorities of the government agencies that would acquire Headwaters from the present owner.

Restoration-Related Expenditures and Employment

It is the arena of investments in restoring the ecological health of a resource base that most starkly differentiates the stewardship and industrial exploitation models. In virtually every

case of industrial exploitation of forest resources throughout the world, ecological attributes[5] are sacrificed (including ecologically mature forest structure and composition, pre-disturbance levels of biodiversity, and gene pool composition) for short-term economic gain, whereas forest stewardship entails reversal of ecological degradation patterns through active investments in resource restoration. Such investments or actions include:

- silvicultural prescriptions designed to accelerate the re-attainment of late successional forest attributes such as multi-layered stands
- obliteration of unneeded roads and return to native vegetative cover
- correction of faulty or failed drainage structures on roads
- elimination of backlog of failed regeneration in clearcut areas
- treatment of sediment transport corridors and elimination of sediment sources
- in-stream aquatic habitat and stream channel restoration
- re-introduction of native riparian vegetation
- stabilization of watercourse banks
- elimination or stabilization of stream crossings

But to be of maximum effectiveness, these types of actions cannot be *ad hoc* or piecemeal. Rather, field-level restoration actions should evolve as the implementation phase of a comprehensive stewardship management plan that includes a resource restoration component. What is often overlooked is the fact that such planning efforts are an important economic activity in their own right – generating local/regional economic benefits. The components of stewardship, and to a lesser extent any management planning that generates economic activity, include:

- multi-resource data collection and reconnaissance assessments
- development of mapping and database capabilities
- assessment/inventory of resource conditions and restoration needs
- conduction of watershed inventories
- development of management and resource recovery priorities
- elaboration of multi-tiered management planning and resource recovery plans

Each of these management planning activities, and the field-level implementation projects they generate, are very labor-intensive, requiring both blue-collar workers (laborers) as well as a substantial component of technically trained workers such as planners, ecologists, hydrologists, foresters, and restoration specialists and practitioners.

Preliminary estimates of the total magnitude of the stewardship planning effort for Headwaters Forest have been prepared by members of the HFSP team. Being quite preliminary, they are subject to future modification.

As displayed in Figure 13, the average annual expenditures for the first decade on stewardship planning and resource recovery work could approach $4 million.

Figure 13 – Stewardship Planning and Resource Recovery Expenditures

Activity	Years 1 & 2 Estimated Expenditure	First Decade Estimated Expenditure
Professional and administrative staff: plan development	$770,000	$3,500,000
Conduct reconnaissance assessments	$120,000	$345,000
Prepare environmental documents (EIR, EIS, etc.)	$160,000	$250,000
Develop mapping and database capabilities	$160,000	$800,000
Develop resource base maps	$100,000	$100,000
Conduct watershed inventories	$600,000	$3,000,000
Assessment effectiveness and efficacy of investments	$80,000	$400,000
Implement restoration work	$3,000,000	$27,000,000
Monitor, document, and evaluate restoration work	$110,000	$990,000
Education and outreach	$120,00	$1,080,000
TOTAL	**$5,300,000**	**$37,500,000**

As mentioned, stewardship management planning and resource restoration is highly labor-intensive; a very high proportion of these estimated expenditures will go to wages, with the largest component (field implementation of restoration projects) going to workers from within the local workforce. Field implementation projects present logical and substantial opportunities to re-employ former timber workers.

Total employment supported by the estimated expenditures presented in Table 5 is projected to be between 1,600 and 1,700 total person-years over the first decade of stewardship management of Headwaters Forest, or approximately 165 person-years annually. Employment levels would ramp up after the first few years; employment for the first two years is estimated at 210 person-years, or 105 person-years annually. This is because the labor-intensive field restoration work would not commence until after a substantial portion of the data collection and analysis work is completed.

In summary, stewardship planning and resource restoration constitute a very important engine for economic activity and recovery. While employment associated with resource extraction is lower under the stewardship model as compared to the industrial exploitation model, such job "losses"[6] can be largely offset by the business of restoring the resource base to ecological health. In the long run – and even in the short run, as this overview indicates – ecological and economic health are compatible, not conflicting goals.

How Will Stewardship Planning and Resource Restoration Be Financed?

An important question regarding any proposed plan of management for a forest area is its financial feasibility – i.e., how it will be financed. In the absence of adequate financing from reasonably-assured sources, the plan runs a strong risk of not being implemented. In the case of the proposed HFSP, the first and most important source of funds is the net revenues derived from the stewardship harvests within the Long-Term Forest Management Area. As presented in Figure 12, above, the planned harvests will produce net revenues (timber receipts in excess of costs) of approximately $25 million in the first 10 years. It is quite consistent with the thrust and tenor of the HFSP to re-invest these revenues into the forest. So, upwards of two-thirds of the total projected cost of the restoration program are coverable by

net receipts from stewardship harvesting.

The sources and extent of additional outside funds to cover the costs of restoration depend in large part on the structure of the entity that is given control of Headwaters Forest, were it to be acquired politically. If it is managed by federal or state governmental agencies, appropriated funds could be applied to the uncovered restoration cost. Forest restoration is certainly an activity compatible with the mandates of agencies such as the USDA Forest Service or the California Department of Forestry and Fire Protection. (We assume that agencies such as the USDI Park Service would not be logical entities to implement the HFSP because of the proposed long-term forest management for timber production.)

Perhaps the most attractive management scenario would be to create a not-for-profit corporation to take management control – and perhaps ownership – of the Headwaters Forest. This corporation would ideally be structured around strong local representation on the Board of Directors and/or Executive Committee (including Native Americans, former PL workers/owners, current PL workers, people living in affected watersheds, and others with a proven commitment toward long-term stewardship management). If structured as not-for-profit, the corporation would be eligible to compete for grant funds from a multitude of foundations and granting agencies, both domestic and international. Even if structured as for-profit, the corporation would be eligible for numerous sources of funds such as those recently created by passage of State Senator Thompson's Salmon and Steelhead Restoration Account (SB 271) in the California State Legislature.

If modeled after similar private or quasi-private corporations that have been set up in other countries to manage forest lands formerly owned and managed by governmental agencies (e.g., New Zealand, Sweden), a Headwaters Forest not-for-profit corporation could either be gifted the deed or be allowed to purchase the land under long-term, favorable financing arrangements. At this very preliminary point in time, the options are numerous. But between the receipts generated internally and the ability to tap into the considerable funds that already exist for forest restoration activities, we are confident that the HFSP restoration program can be adequately financed.

The Regional Economics of Externality Avoidance

While the foregoing discussion has focused exclusively on market-based activities and issues, there are substantial non-market considerations that favor the stewardship model of resource management over the industrial exploitation model. Not only is the future health of the forest compromised by industrial exploitation,[7] but past, current, and future logging of Headwaters Forest under the industrial regime creates or compounds other resource damages. Such damages that are <u>not</u> recognized in the marketplace, and the responsibility for which is not borne by the perpetrators, are known to economists as "externalities." In the case of Headwaters Forest and surrounding industrial timberlands, past and current management has significantly contributed to degradation of commercial fisheries such as the coho and other anadromous species. In the case of commercial fisheries, the externalities generated by industrial logging do have a market-based effect, albeit indirect and borne by non-responsible parties, commercial fishermen. In the case of other habitat externalities such as to the marbled murrelet or the even more difficult-to-comprehend losses in biological diversity, no such market-based indicators are conveniently available. But they are real and substantial, nonetheless. In a full and proper comparative social benefit accounting of the industrial and stewardship models, the advantages of management directions such as those embodied by the HFSP are, we believe, paramount and ultimately persuasive. From a public policy standpoint, it is clearly appropriate to consider the HFSP relative to industrial "busi-

ness as usual" in this broader and more revealing light.

The Relevance and Role of Recreation and Regional Quality of Life: Economic Dimensions

A discussion of the economic dimensions of the proposed Stewardship Plan would not be complete without consideration of non-consumptive human use of Headwaters Forest and, more broadly, tourism within the region.

It is beyond the scope of this analysis to quantify the potential economic activity that could be associated with visitation to the Headwaters Forest. However, some cautionary points deserve mentioning. First, the inability of the Redwoods National Park to generate the level of visitation that was originally forecast cannot be ignored. Humboldt County is relatively remote, so there is clearly a need to be realistic as to how much visitation from outside the region can be generated for any type of attraction. It is most prudent in light of the Redwood Park experience to expect only modest levels of visitation to Headwaters Forest, were it to become publicly accessible.

Second, visitation to Headwaters, if not adequately controlled and directed, could compromise the main management objectives for the forest as mentioned previously. (See Recreation in Section X). Certainly the most compatible type of visitation would be environmental and cultural interpretation.

The issue of regional tourism and the general quality of life is, in fact, another externality issue. At risk of belaboring the obvious, people recreate in and visit areas that are attractive. People don't visit Humboldt County to see clearcuts and silted streams, they come to see the ancient redwoods. Visitors spend money. As with most every other region of the United States, tourism in Humboldt County is an increasingly important component of the regional economy. Like virtually every other region, tourism and general visitation is a growth sector, and traditional commodity extraction is on the decline.

It is important to understand that the travel and visitation industry involves much more than entry-level hotel and fast food restaurant work. Visitation generates employment throughout all sectors of the regional economy from service jobs (accommodations, food) to retail sales to finance to government.

In Humboldt County, visitation is a big business and it is growing. In 1995, according to statistics released by the California Trade and Commerce Agency (CA Trade and Commerce Agency 1997), more than $300 million was spent in 1995 by visitors to Humboldt County. This spending generated almost 4,500 jobs with a combined payroll exceeding $55 million. Visitation spending generated over $4.2 million in local taxes and $14.5 million in state taxes. Between 1992 and 1995, all of these economic indices increased by approximately 15% to 25%.

Will the absence of old-growth forests and viable anadromous fisheries destroy this economic engine? Perhaps not. But it will certainly not enhance the ability of the business reliant on visitation to maintain recent growth rates or even current levels. In the long run and in a climate of increasing inter-regional competition for the visitation dollar, environmental amenities will be a key competitive advantage.

To the extent that industrial logging damages the environmental amenities of the region, the long-term economic prospects for the region are compromised. From a public policy standpoint, the citizens of the North Coast have an important strategic choice to make: To myopicly ride the floundering ship of industrial resource exploitation as far it will take them, with knowledge that future quality of life and long-term regional economic viability are being compromised. Or to take steps now to adopt a new paradigm of resource management,

one built upon managing the land for economic benefit to the entire regional economy, rather than for one shrinking sector of the economy, and in a manner that is in harmony with ecological sustainability.

NOTES

[1] The likely future harvest levels on the Headwaters Forest were it to remain under the control of Pacific Lumber/Maxxam are not easily estimated as available data is for their entire holding of approximately 200,000 acres. Over the entire holding, average annual harvest levels are currently at least 300 mmbf and could be as high as 450 mmbf. Harvest levels were approximately 150 mmbf per year prior to take-over by Maxxam. Another element of uncertainty is associated with the regulatory and legal constraints on harvesting within the ancient forest groves.

[2] Since only selection silviculture is employed and the overstory is left largely intact, it is assumed that natural regeneration will maintain adequate stocking.

[3] On a per Million Board Feet basis, mill employment under the stewardship model is likely to substantially exceed mill employment under the industrial model. This is because the stewardship model, emphasizes local processing utilizing more mobile and labor intensive machinery. In contrast, industrial milling has undergone profound decreases in employment per unit output for the past 25 years.

[4] Whereas long-term private harvesting concessions on public forest lands are a dominant element of Canadian forestry, the equivalent focus in the U.S. is on the pattern and structure of ownership of private companies that are awarded timber sale contracts on federal forest lands.

[5] For instance: ecologically mature forest structure and composition, pre-disturbance levels of biodiversity, and gene pool composition.

[6] Losses of this nature are oftentimes illusory or short term, in that the industrial model entails drastic employment reductions over time as the resource base is depleted and as automation is continually emphasized. Assurances (found in Pacific Lumber planning documents) to the contrary notwithstanding, the nearly three-fold increase in harvest rates on the PL landholding since acquisition by Maxxam is, in all likelihood, simply not sustainable at some point, perhaps in the not-so-distant future. The illusory nature of regional economic reliance on industrial exploitation will be amply evident in Humboldt County, unless the stewardship model becomes the dominant paradigm.

[7] If not for the failure of the market to internalize these costs, the $37 million in forest resource damage that is the focus of the restoration program would be borne by the entity responsible for their creation; in this case, Pacific Lumber/Maxxam.

XII. Conclusions and Recommendations for Long-Term Management

More than simply a prescription for the 60,000 acres, the Headwaters Forest Stewardship Plan proposes a true alternative for forest management and conservation in Humboldt County and beyond. The current liquidation of old-growth forests to serve corporate profit-making spells the demise of the ancient redwood ecosystem as well as a way of life that has spanned generations in this area.

The Headwaters Forest Stewardship Plan could well be considered a true Habitat Conservation Plan (HCP) if one takes the meaning of those words seriously. The HCPs being offered up by industries like Maxxam/Pacific Lumber fall dangerously short of true habitat conservation; they are often little more than a contract between industry and government agencies to do business as usual with the sanction of the Endangered Species Act. The self-serving nature of most business practices and the fact that understaffed federal and state regulatory agencies lack a process for operating on a landscape-wide scale means that citizens concerned about long-term ecological and economic stability must take an active role. The stewardship model asks that a broad cross-section of the community become independent and responsible resource managers, discussing long-range goals and plans. With broad-based participation we can change the current paradigm to one that works for the environment and all the people in Humboldt County.

Conclusions

The type of forest management described in this Stewardship Plan can be implemented successfully and costs/returns will at least break even while maintaining employment levels that closely approach that of pre-Maxxam Pacific Lumber Co.

• After 55 years of stewardship management, the majority of the forest will be in late-seral condition. Approximately 3.4 million board feet (mmbf) will be harvested annually in the first 25 years. The volume peaks at 24 mmbf, then stabilizes at approximately 20 mmbf after restoration forestry is completed in areas outside of the Long-Term Forest Management Area. This harvest is significantly less than growth for the 20,000 acres proposed for Long-Term Forest Management. It is an approximate estimate of what could be harvested on an annual basis 100 years from now, as defined by long-term sustained yield.

• If these numbers are compared with pre-Maxxam Pacific Lumber, long-term volume numbers are roughly equivalent. Pre-Maxxam Pacific Lumber harvested 118 mmbf in 1984 from 180,000 acres, of which 50 mmbf was old-growth redwood. A simplistic analysis shows that roughly one-third of this (60,000 acres of 180,000) is about 39 mmbf or, without the old-growth redwood harvest component, 22.6 mmbf (118mmbf - 50 mmbf divided by 3). The 20 mmbf per year currently proposed for cutting in the Headwaters Forest Stewardship Plan is comparable to 22.6 mmbf.

It is important to recognize here that although second-growth redwood grows quickly, the old-growth redwood forest grows very little after a certain point. Thus, when considering forest growth and yield for sustained yield calculations, not only is the old-growth component of PL's former harvest no longer available, but past harvest figures cannot be used to predict future yields under the industrial model. This is because such figures were based on liquidation of the original ancient forest which took thousands of years to develop.

Maxxam is currently harvesting between 290 and 450 mmbf per year across the 200,000-acre ownership. These figures tell us nothing regarding projected future yields from Headwaters Forest other than the fact that the forest is rapidly being depleted. It would be difficult to demonstrate that these figures in any way could approach a sustained yield of timber, let alone the maintenance or restoration of a healthy forest.

• The proposed HFSP harvest will generate an estimated $3.7 million annual profit for the regional economy after logging and milling costs are covered. This profit is an average over a 25-year period, with the first decade generating $25 million, or an average of $2.5 million annually. Under this Stewardship Plan, this profit will be reinvested in Headwaters Forest to offset restoration expenses incurred by a decade of Maxxam mismanagement. Local investment of this profit, as opposed to its siphoning-off by a remote corporate entity, will generate more revenue for the regional economy while also enhancing local environmental quality.

• In addition, stewardship planning and resource recovery/restoration expenditures are predicted to be approximately $3.7 million annually for the rest of the decade and will diminish or cease to exist in the years to follow. This will be spread throughout the local area through respending of wages and associated expenditures. Thus the profits generated by timber harvest will pay the salaries and expenses of restoration, with the bulk of this money circulating locally.

• The projected harvest level would generate approximately $131 million total "present net value" (i.e. the present worth of the entire 60,000 acres) over the next 85 years. This figure stands in sharp contrast to the $380 million Maxxam has demanded for the public acquisition of only 7,500 acres under the "Headwaters Agreement."

Current PL employment levels are inflated as a result of the company's drive to harvest timberlands at double the historic rate. A more realistic comparison of job potentials in Headwaters Forest is gained by comparing these pre-Maxxam figures with those derived by the HFSP team.

• There will be approximately 63 full-time stable forestry jobs in logging and hauling under stewardship management. Primary processing (milling) will contribute over 50 full-time stable jobs. Stewardship planning and resource recovery, i.e., the working of restoration, will create approximately 165 jobs in the first decade and for several decades to follow. Together, these total approximately 278 long-term jobs.

• There will be additional employment in value-added secondary manufacturing of selected wood products harvested from the area, such as in woodworking, cabinet-making, and hardwood flooring production.

• The number of restoration jobs will likely decline over time as the forest is returned to a healthy condition. However, those working in Headwaters restoration will then constitute a skilled workforce, available for employment on other industrial lands throughout the North Coast. Additionally, the ongoing restoration training program will continue to employ several people. Also, as the 165 restoration jobs diminish in Headwaters Forest over time, we expect the fisheries will begin to recover. Therefore, additional employment in fishing could offset these other job losses over time.

• It is generally assumed in economic theory that for every direct job, one additional job within the region is created through the respending of wages.

• In comparing stewardship employment to that under the Pacific Lumber Co., we need to again reference pre-Maxxam figures. In 1984, PL employed 900 people locally. Comparing this number simplistically, at 1/3 (60,000 of 180,000 acres) we arrive at 300 employees. This is close to the approximately 278 jobs created by the HFSP.

• It is important to note that roughly 80% of PL's former employment was based on old-growth harvesting, which is highly skilled work. Through the management scenario defined here, we propose to return the forest to high-quality sawlog production over time. Although this is not the equivalent of old-growth lumber, high-quality redwood lumber is unique in the international market, and requires highly-skilled employees.

• Maxxam/Pacific Lumber employed 1,300 people in 1988. They now (1997) claim to employ 1,600. In fact, they have been bringing people from all over the state to help in the apparent rush to remove as much of the resource base as possible. Maxxam, in an obvious change from Pacific Lumber management, instituted a "graveyard" shift to keep the mill operating around the clock to help pay off the enormous debt incurred in the takeover of PL. We argue that this high rate of employment is a false "boom" that is sure to "bust" in the coming years as Maxxam simply cuts itself out of a timber base.

• Resource stewardship only entails reduced short-term economic activity (relative to full-scale industrial exploitation) when resource extraction (timber harvest) is the sole basis of comparison between the two models.

The long-term benefits of a local stewardship-based model far out weigh the repercussions of a short-term, profit-driven approach. Aspects of our quality of life here on the North Coast can greatly benefit from the peace of mind that accompanies long-term solutions to the utilization of our resources in Humboldt County.

In attempting to gauge the economic returns of ecologically-sound timber harvest and restoration activities in Headwaters Forest under this Stewardship Plan, we note that it is impossible to factor in the incalculable long-range value of this priceless ancient redwood ecosystem a century from now. The economic benefit to this region in terms of quality of life as well as tourism and forestry opportunities will undoubtedly be great.

RECOMMENDATIONS

• The 60,000-acre Headwaters Forest should be dedicated to the experimental implementation of a new model of conservation-based forestry as outlined in the Headwaters Forest Stewardship Plan. Only by demonstration can we prove the compatibility of jobs and a thriving ecosystem. Eventually this model could be applied to the entirety of PL land and other industrial forestlands on California's North Coast.

• This plan should be considered a flexible one, with the ability to adapt as new information becomes available. Such adaptability is an essential feature of the stewardship model.

• Because of the severely limited amount of old-growth habitat remaining for endangered species such as the marbled murrelet and coho salmon, the ancient groves of Headwaters Forest are critical to these species' continued survival. Any management plan for this area must not only protect the existing old growth but should strive to enhance and enlarge this habitat to aid in recovery of listed species to the point where federal protections are no longer necessary. In fact, strict interpretation of the Endangered Species Act requires this.

• Because high-quality redwood lumber is a unique commodity in the global marketplace, commanding a premium price tag, its ongoing production should be ensured. This is counter to current industrial trends to "fiber farm" our forests, with rotations of less than 80 years, producing fiber (e.g. chips, pulp, low-grade lumber) that is not competitive in the global economy.

• Long-term forestry will involve all-age, all-species management of both hardwoods and conifers. Hardwoods are an often overlooked component of economic return that are abundant in second-growth forests. Their utilization in a developing hardwood industry will create value-added wood products from a component of the forest long considered undesirable.

• Long-term forestry will involve all-age, all-species management of both hardwoods and conifers. Hardwoods are an often overlooked component of economic return that are abundant in second-growth forests. Their utilization in a developing hardwood industry will create value-added wood products from a component of the forest long considered undesirable.

• Use of herbicides is absolutely unacceptable in Headwaters Forest.

• Long-term monitoring of the effects of this Stewardship Plan should be undertaken to determine the following:

Effectiveness of restoration work in the forest: Has habitat quality and stand structure improved? Have species migrated from core reserves into Habitat Recovery Zones over time?

Effectiveness of restoration work on the quality of aquatic habitat: Have salmon returned in greater numbers?

Advances in development of conservation biology: If successful in Headwaters Forest, has the science been accepted and integrated into public policy and widespread applications? How can conservation biology and the stewardship model be promoted?

• Independent forest and wildlife surveys such as the ones undertaken in the HFSP should be encouraged to supplement data from the usual sources, such as industry and landowners.

In the case of environmental assessment, a public review system for landowner-provided information should be instituted as a "checks and balances" system to avoid bias.

• For the marriage between ecology and economy, it is critical that profits be kept within the local area. We recommend that all monies made off the bounty of the resource base in Headwaters Forest be reinvested back into the forest. Any material produced from Headwaters should not leave Humboldt County until it is a finished product, employing the maximum number of people and attaining the highest value for the product possible.

• Various options for long-term ownership and management should be considered for implementation of this plan. One option is a Debt for Nature swap, trading Maxxam's debt to the US taxpayers of $1.6 billion for title to the 60,000 acres. Another is Maxxam's forced disgorgement (relinquishing) of Pacific Lumber because of the allegedly fraudulent takeover that is now being challenged in the legal system. With either of these options, or even straight-out public acquisition, we believe the most just resolution of the Maxxam debacle and most effective implementation of a stewardship plan would be achieved by giving the land title to a not-for-profit corporation of local stakeholders. This corporation would undertake management responsibility of the Headwaters Forest according to parameters defined in the Final Headwaters Forest Stewardship Plan. Deed restrictions would be instated to ensure management direction maintained a stewardship philosophy and that the organization would not be victim to hostile takeover or other selfish motives. The new company would include current and former employees and families of Pacific Lumber, the people living in the affected watersheds (e.g. downstream from PL land), local Native Americans, and others who have a proven commitment to stewardship.

XIII. Request for Input

We are actively seeking community input on this draft document. By integrating the ideas, concerns, and vision of many individuals, we hope to make this a plan that we can all support. After all, the concept of land stewardship depends on the active input of the local community. When people value their natural resources and public trust values like wildlife, water quality, and magnificent forests, they take responsibility for their surroundings and their future. This is the alternative to assuming that government agencies or large industries will take care of environmental concerns and long-range planning.

The process of public review of the Headwaters Forest Stewardship Plan presents an excellent opportunity to engage in hospitable discussions right here within our own community about regaining control of our local economy and ecosystem. Let's begin by gathering and openly discussing how to make this happen. We encourage comments of all kinds – whether formal or informal – as a means of promoting such dialogue.

We need to receive comments on this draft by November 7, 1997, in order to incorporate them into the final document. We anticipate making the final available in December.

We will be conducting outreach by holding house-parties to give a short HFSP presentation, followed by open discussion and sharing of ideas. If you are interested in ordering copies of the plan, or in hosting a house-party or other presentation, please call the Trees Foundation. Only through active community interest and involvement will we be able to fully integrate a vision for the future of Humboldt County and its diverse population.

Please contact us at: **Trees Foundation, P.O. Box 2202, Redway, CA, 95560**
phone: (707) 923–4377 fax: (707) 923–4427
email: trees@igc.org (add subject: HFSP comments)

Thank you for your interest and input!

Appendix 1: Glossary

adaptive management - the process of adjusting the management techniques of an area to new scientific information and changing environmental realities.
anadromous - fish that hatch and rear in freshwater, migrate to the ocean where they grow mature, and return to fresh water to reproduce.
ancient forest - relatively undisturbed native forest containing trees over 200-250 years old and fully evolved structural complexity, including a multi-level canopy, downed logs, and standing dead trees (snags).
aquatic - growing, or living in or upon water.
ArcInfo® - advanced GIS software for the creation and manipulation of geographic data.
ArcView® - geographic information systems (GIS) software that allows information to be stored, combined, analyzed, and displayed.
biodiversity - the variety of life and its processes; it includes the variety of living organisms, the genetic differences among them, the communities and ecosystems in which they occur, and the ecological and evolutionary processes that keep them functioning, ever changing, and adapting.
biogeography - the study of the geographical distribution of living organisms.
bioregion - a geographic area defined by natural boundaries such as watersheds or plant communities, as opposed to political boundaries.
biota - the living organisms of an area, both flora and fauna.
biotic - pertaining to any aspect of life, especially to characteristics of entire populations or communities.
board foot - (or board feet) a unit of measurement of the volume or growth rate of a tree, if it were sawn into timber. Equivalent to a board one inch thick by one foot wide by one foot long. The board-foot volume of a tree is generally 5–7 times the cubic foot volume of the tree.
buffer - a designated protective area around a core grove, body of water, or other sensitive site (such as a nest tree) that is left uncut or otherwise undisturbed during a timber harvest.
canopy - the uppermost layers of foliage or branches in a tree or stand.
class I, II, III watercourses - CDF classifications of streams based on several factors, including presence of fish (Class I) and permanence of flow. See the discussion of "Riparian Reserves" for details.
clipped - where a particular feature in a geographic information system is limited to a selected area, such as applying a cookie cutter.
codominant tree - a tree with medium-sized crown forming part of the general level of the forest canopy, receiving full light from above but comparatively little light from the sides.
community type - a group of one or more populations of plants and/or animals using a common area; an ecological term used in a broad sense to include groups of plants and animals of various sizes and degrees of integration.
connectivity - the state of being functionally connected by movement of organisms, materials or energy
core - the central and largest area designated for conservation; in this stewardship plan, the intact old-growth and residual groves.
corridor - a connecting pathway for plant and animal life to migrate from one core area to another.
coverage - a type of geographic data representing a particular landscape feature, such as streams or vegetation type. Coverages are the spatial data that exist within a data set.
critical habitat - areas occupied by a threatened or endangered species, and which are

essential for the conservation of that species.
crown density - forestry measurement of biomass in the canopy of a tree.
data set - compilation of several types of information regarding a particular subject.
DBH / dbh - diameter at breast height, a common measurement used in forestry practices to judge the size of a tree, taken approximately 4.5 feet from the ground.
diameter class - classification of trees based on their diameter size.
demography - the quantitative analysis of population structure and trends.
density - the quantity of something per unit measure, especially per unit length, area, or volume.
diameter class - classification of trees based on their diameter size.
disturbance - an event that alters an area in a manner other than the progressive successional changes. Examples include landslides, fires, and severe storms.
dominant tree - a tree with a well-developed crown extending above the general level of the forest canopy and receiving full light from above and partial light from the sides.
ecosystem - all the living organisms interacting with their non living, physical environment, considered as a unit.
ecotone - a habitat created by the juxtaposition of distinctly different habitats.
edge - the place where two plant communities or successional stages come together.
edge effect - accelerated degradation along the margins of forest patches surrounded partially or entirely by cutover lands. Only forested areas at substantial distances from the edge provide unmodified interior forest conditions.
ERDAS Imagine® - a GIS software system for the viewing and analysis of remotely sensed imagery, i.e., satellite imagery.
exemption, or salvage, logging - cutting of "dead dying or diseased" trees from the forest. Instituted to address emergency situations but routinely abused by timber companies. The exemption means there is no requirement for environmental or public review.
fragmentation - the process of reducing the size and connectivity of stands that compose a forest.
fuel load- a term used to describe the amount of fire fuel (dead wood, combustible brush, etc.) in a forest.
geographic information system (GIS) - a compilation of data sets and other information relating to various geographic entities and the people who process this information, using computer software and hardware to provide decision support to project planners.
gradient - a way of referring to a range of representative conditions, such as a series of progressively increasing or decreasing differences.
habitat - the physical surroundings in which an organism lives.
Habitat Conservation Plan (HCP) - a permit that allows a land owner to take (see definition) an endangered species if this happens incidental to an otherwise legal activity.
habitat recovery zone (HRZ) - this term refers to natural areas that have been disturbed but not severely disrupted and are thus available for restoration actions that improve suitability as wildlife habitat. In this Stewardship Plan, HRZs abut existing core reserves.
interior species - area sensitive species that require interior forest conditions for optimum survival, eg. those found in the center of an ancient forest.
intermittent stream - a watercourse that flows only during the wettest times of year.
keystone species - a species whose presence indicates the overall health of an ecosystem.
Landsat - a satellite that provides imagery used in remote sensing of forests. Analysis of this imagery produces maps of vegetation condition.
landscape ecology - the study of how the heterogeneity with in a landscape effects that

landscape, especially as it relates to disturbances.
late seral - functional characteristics of late-seral stands include large trees, snags, and large downed logs. These are stands of dominant and codominant trees that meet the criteria of WHR class 5M, 5D, or 6 with an open, moderate, or dense canopy closure classification, often with multiple canopy layers. Refer to WHR description in the text.
layout - a prepared area into which trees are felled in a timber harvest plan. A layout is intended to reduce breakage that occurs during the felling of trees.
legacy tree - a mature tree permanently protected from harvest to provide forest structure and eventually become a snag and large downed log.
mass wasting - a landslide event in which large amounts of material are transported downslope.
mature forest - an older stand of trees that are not yet old growth.
minimum mapping unit (MMU) - the smallest area considered in GIS analysis for a given feature.
nutrient cycles - the path of an element through the ecosystem, including its assimilation by organisms and its release in a reusable inorganic form.
occupied behavior - term to describe when a particular old-growth-dependent species has been seen using the ancient forest or adjacent residual forest.
old growth - an older forest stand that exhibits the structure and function of a forest that has not had a drastic disturbance in many years.
old-growth-dependent species - one that relies upon old-growth forests for all or part of its life cycle.
periodic increment - cycles of growth or enlargement.
phenotypical - traits resulting from the interaction of genetic material with the environment, rather than being purely genetic.
planning horizon - time frame in which management prescriptions are implemented.
reserve - an area designated with legal status to retain general or specific biological elements.
resiliency - the ability of a natural system to return to its original condition after disturbance.
residual forest - contains mature trees left after a timber harvest; in the case of Headwaters, this refers to second-growth forests with large, old redwood trees that were part of the old growth prior to harvesting many years ago. These residual forest of Headwaters provide endangered species habitat that most closely resembles the core reserves.
riparian area - an ecological zone along watercourses with distinctive plant communities. Riparian areas play an important role in shading Headwaters Forest salmon habitat.
salmonid - belonging to or characteristic of the fish family Salmonidae, which includes the salmon, trout and whitefish. Species in Headwaters Forest include chinook and coho salmon and steelhead trout.
sediment delivery - the placement of silt and mud in a watercourse, greatly accelerated by severe erosion.
sediment load - the amount of suspended material in a watercourse at a particular time.
selection forestry - an uneven-aged harvest method in which individual trees or small groups of trees are removed from an intact forest.
seral stage - a step in the process of succession that goes from bare land, to shrub, immature forest, mature forest, ancient forest
silviculture – the art, science, theory, and practice of establishing, tending, and reproducing forest stands of desired characteristics based on knowledge of the environmental require-

ments and characteristics of tree species.
siltation - a process whereby fine particles from upstream erosion affect instream habitat.
site class - a class placed upon a forest site via the site index process. The site index is a system of classifying forest land by its ability to grow timber based on the size or height of a tree at a target age. **Site index** is also used to project tree growth. For example, a 50-year-old redwood tree that is 160 ft tall can be predicted to be 220 ft. tall at 100 years of age using a site index curve. Site I is the most productive and Site V the least.
site-potential tree - the average maximum height of the tallest dominant trees, two hundred years or older for a given site class.
size class - average diameter at breast height (dbh) of the dominant tree canopy.
skid trail - a trail for skidding (dragging) timber to a loading area.
snags – standing dead trees. These make excellent wildlife habitat, especially for cavity-nesting birds.
spawning - the act of salmon or other species depositing eggs.
spawning ground - specific locale where eggs are deposited.
species composition - the make-up of various plant species in an ecosystem.
stand structure - the physical structure of a community of trees with certain common characteristics that form a management unit.
sub-watershed - a drainage basin that feeds into a larger one (see *watershed*).
succession - a series of dynamic changes by which one group of organisms succeeds another through stages leading from bare ground to climax.
suppressed tree – one whose growth is limited by the surrounding competing vegetation, i.e., trees that are shaded out or crowded.
Sustained Yield Plan (SYP) - document that projects corporate timber production into the distant future.
symbiotic - a relationship of two or more organisms living in close association, usually with benefits for each and often obligatory.
take - in the Endangered Species Act, language meaning to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect an endangered or threatened species, or to attempt to engage in any of these activities.
taxa - classification system for species that indicates natural relationships.
upslope - an area above a chosen location relative to that location.
value-added - processing of a raw material, such as timber, by skilled labor to make finished items with more economic value, such as cabinets, musical instruments, or furniture.
viable population - a population of species that contains an adequate number of reproductive individuals appropriately distributed to ensure the long-term existence of the species.
volume growth - the amount of volume a forest stand increases over a given period.
watercourse - any well-defined channel with distinguishable bed and bank showing evidence of having contained flowing water.
watershed - the drainage basin contributing water, organic matter, dissolved nutrients, and sediments to a particular river, stream, lake, or other body of water.
watershed assessment - a systematic procedure for characterizing watershed and ecological processes to meet specific management and social objectives.
wildlife habitat relationship (WHR) model – a system used to identify habitat types for wildlife species in California (developed by California Dept. of Fish and Game).

ACRONYM AID

CDF . . . . . .California Department of Forestry
CWPU . . . . . .California Watershed Planning Unit
DBH or dbh . . . . . diameter at breast height
EIS . . . . . .Environmental Impact Statement
ESA . . . . . .Endangered Species Act
FEMAT . . . . . .Forest Ecosystem Management Assessment Team
GIS . . . . . .Geographic Information System
HCP . . . . . .Habitat Conservation Plan
HFSP . . . . . .Headwaters Forest Stewardship Plan
HRZ . . . . . .Habitat Recovery Zone
MBF or mbf . . . . . thousand board feet
MMBF or mmbf . . million board feet
MMU . . . . . .Minimum Measurement Unit
NTFP . . . . . .Non-Timber Forest Products
THP . . . . . .Timber Harvest Plan
WHR . . . . . .Wildlife Habitat Relationship system

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Appendix 3: GIS Methodology and Results

Management area design was conducted with the most accurate publicly available data at the time of analysis in early August, 1997. It has come to our attention, however, that the Pacific Lumber Company submitted several conflicting data sets, maps, and bodies of information during the Habitat Conservation Plan (HCP) and Sustained Yield Plan (SYP) processes. (HCP: Pacific Lumber Company et al. 1997; SYP: Pacific Lumber Company et al. 1996.) Some elements of the Headwaters Forest Stewardship Plan are based on this data. This problem is of particular concern when considering decisions regarding current wildlife habitat based on this information.

Because of these discrepancies and the evolving nature of spatial and survey data, Trees Foundation is committed to revising elements of this plan as new information becomes available. In order to facilitate this process it is imperative that new data be shared honestly and freely among management agencies, private industry, and the public.

Core Reserves

Core reserves were identified as un-entered old-growth redwood and Douglas-fir stands, including all contiguous residuals adjacent to these stands, through analysis of Pacific Lumber Company stand coverages (*see Appendix 4: GIS Data Sources for information on specific data sets and GIS coverages*) and Landsat imagery. Additionally, marbled murrelet-occupied residual stands were identified through spatial overlay analysis in ArcView® and the referencing of Pacific Lumber Company hard copy maps. These areas were also designated as core reserves. The following core reserves were identified through this process:

Ancient Forest Cores

Headwaters Grove
Elk Head Springs Grove
Allen Creek Grove
Owl Creek Grove
Shaw Creek Grove (including Right Side Road 9)
All Species Grove (including Booths Run and Road 12 Lawrence Creek)
Unnamed groves in the vicinity of Owl Creek

Residual Cores

All contiguous residuals adjacent to ancient forest cores (including Lower Road 24)
Cooper Mill Residuals
Lower North Fork Elk River and Road 11 Boulder Creek Residuals
Road 3 Residuals
Below Road 7 Residuals
Below Road 9 Residuals

Habitat Recovery Zones

The spatial extent of Habitat Recovery Zones (HRZ) is primarily based on the boundaries of sub-watersheds. Sub-watershed units were identified primarily by the boundaries of California Department of Forestry (CDF) California Water Planning Units (CWPU). Secondary identification was accomplished through hydrologic analysis in ArcView® Spatial Analyst of United States Geographic Survey (USGS) 30-meter Digital Elevation Model data. HRZs were designated by defining a sub-watershed unit in which a core reserve is located. Watersheds providing significant influence to aquatic habitat and water quality or potential contribution to habitat recovery, such as the North Fork Elk River, were also designated as HRZs. The North Fork Elk River was so designated because of its importance to survival of the coho salmon and marbled murrelet. In instances where the core reserve was not buffered by the HRZ to a minimum of 600 feet the boundary was extended through a buffering process in ArcInfo®. HRZ boundaries were then clipped in ArcInfo® to fall within the Headwaters Forest boundary.

Residual Buffers

Road 3, Below Road 7, and Below Road 9 core reserves were buffered in ArcInfo to a distance of 600 feet. HRZs were not created for the above-mentioned cores due to their location outside of reasonably definable sub-watersheds or drainages. However, the buffering structure has provided connectivity between these cores and nearby HRZs in addition to habitat protection.

Since wildlife survey data is incomplete or inconclusive in other residuals not falling within HRZs, all residual stands over 5 acres Minimum Mapping Unit (MMU) were buffered to the same criteria. These buffers were clipped to the Headwaters Forest boundary in ArcInfo®.

Riparian Reserves

Class 1 watercourses were buffered in ArcInfo® to a horizontal distance of 600 feet. Because of the limitations of the project's GIS and available data, slope distance could not be calculated. All analysis and graphic representation of riparian reserves should therefore be considered approximate. Additionally, because of the inability to conduct ground truthing and the unavailability of detailed hydrologic data, Class II and III streams could not be accurately identified and were therefore not included in the analysis. These buffers were clipped outside of ancient forest groves, residual cores, and inside the Headwaters Forest boundary in ArcInfo®.

Long-term Forest Management Area

Spatial overlay analysis was conducted in ArcInfo® utilizing coverages created for each reserve category to identify remaining areas to be designated as Long-Term Forest Management Area.

Suggested Conservation Easements

Upslope Class I watercourses flowing into Headwaters Forest and influencing aquatic conditions within were identified through spatial overlay analysis in ArcView®. These watercourses were then buffered to an extent of 600 feet horizontal distance in ArcInfo®.

Ancient forest groves and residual stands were also buffered to this extent and clipped outside of the Headwaters Forest boundary to create a distinctly designated conservation easement buffer.

A conservation easement was created for the South Fork Elk River and tributaries within the federal proposed Elk River Timber (ERT) acquisition area. The coverage for this watercourse was buffered to an extent of 600 feet horizontal distance and clipped inside the ERT acquisition area in ArcInfo®. The HFSP Team felt that a larger easement may be necessary in order to maintain the biological integrity of the Elk River watershed.

Results of Reserve Area Analysis (in acres)

Based on 4255.319149 square meters = 1 acre.
Headwaters Forest - 59,558
Headwaters Grove and residuals - 3,140
Elk Head Springs Grove and residuals - 612
Allen Creek Grove and residuals (including Lower Road 24) - 1,061
Owl Creek Grove and residuals - 748
Shaw Creek Grove (including Right Side Road 9) and residuals - 590
All Species Grove (including Bell Lawrence, Booths Run, and Road 12 Lawrence Creek) and residuals - 832
Unnamed groves and residuals - 112
Cooper Mill Residuals - 369
Lower North Fork Elk River and Road 11 Boulder Creek Residuals - 308
Road 3 Residuals - 168
Below Road 7 and Below Road 9 Residuals - 459
Total Ancient Forest In Cores - 4,583
Residual Cores Within HRZs - 3,012
Residual Cores Outside HRZs - 807
Total Residual In Cores - 3,819
Total Core Reserves - 8,402
Habitat Recovery Zones (not including other categories within) - 17,246
Habitat Recovery Zones (including all categories within) - 29,991
Total Residual Stands Within HRZs (not including residual cores or residuals within Riparian Reserves) - 1,799 (487 acres within Riparian Reserves)
Total Residual Stands Outside HRZs (not including residual cores or residuals within Riparian Reserves) - 1,796 (370 acres within Riparian Reserves)
Residual Stands Within Riparian Reserves - 860
Residual Buffers - 3,575
Class 1 Riparian Reserves - 7,561
Forest Management Matrix - 19,224
Suggested Conservation Easements - 3,934
0.075% (45-acre) error attributed to rounding to nearest whole number in calculations.

Appendix 4: GIS Data Sources

Trees Foundation has developed and maintained a GIS database in ArcInfo® for the Headwaters Forest. Throughout the course of early 1997 data was acquired from a variety of sources, either as existing GIS coverages or as hard copy. All data created by Trees Foundation from hard copy sources has been produced to meet current industry geographic information standards.

Headwaters Forest Boundary: Trees Foundation. Based on original hard copy maps produced by the Headwaters Forest Coordinating Committee/Environmental Protection Information Center (EPIC); created from ownership and California Department of Forestry California Water Planning Unit coverages.

Headwaters Agreement Boundary: Trees Foundation. From Pacific Lumber Company hard copy.

1:100,000 Hydrography: Klamath Bioregional Assessment Project, Spatial Analysis Lab, Humboldt State University, USFWS-Klamath Basin Ecosystem Restoration Office.

1:100,000 Roads: Klamath Bioregional Assessment Project, Spatial Analysis Lab, Humboldt State University, USFWS-Klamath Basin Ecosystem Restoration Office.

Public Land Survey System: Klamath Bioregional Assessment Project, Spatial Analysis Lab, Humboldt State University, USFWS-Klamath Basin Ecosystem Restoration Office.

California Department of Forestry California Water Planning Units: Klamath Bioregional Assessment Project, Spatial Analysis Lab, Humboldt State University, USFWS-Klamath Basin Ecosystem Restoration Office.

USGS 30-Meter Digital Elevation Model: United States Geographic Survey. Courtesy of California State University, Northridge.

Base Imagery

1:24,000 USGS Topographic Quadrangle Digital Raster Graphics: Sure! Maps Corporation.

1996 1:24,000 Digital Aerial Survey Photographs: WAC Corporation

1994 Landsat Thematic Mapper: EOSAT Corporation, courtesy of Klamath Bioregional Assessment Project, Spatial Analysis Lab, Humboldt State University, USFWS-Klamath Basin Ecosystem Restoration Office.

Vegetation Data

Forest Stand Types: Trees Foundation. Created from aerial photo interpretation by the Institute for Sustainable Forestry, old-growth and residual redwood and Douglas-fir stand data, and classified vegetation imagery.

Old-Growth and Residual Redwood and Douglas-Fir Stands: The Pacific Lumber Company.

Classified Vegetation Imagery: Klamath Bioregional Assessment Project, Spatial Analysis Lab, Humboldt State University, USFWS-Klamath Basin Ecosystem Restoration Office (Fox and Carlson 1996).

Timber Harvest Plans: Trees Foundation. From California Department of Forestry hard copy compiled by Environmental Protection Information Center (EPIC).

Reserve Design Data

All data created by Trees Foundation.

Wildlife Data

Pacific Lumber Company Marbled Murrelet Surveys: Trees Foundation. From Pacific Lumber Company data mapped by Environmental Protection Information Center (EPIC).

California Department of Fish and Game Marbled Murrelet Surveys: California Department of Fish and Game, Wildlife Management Division.

California Salmonid Habitat Inventory: California Department of Fish and Game.
California Natural Diversity Database: California Department of Fish and Game, Natural Heritage

Hard Copy Data

Pacific Lumber Company Sustained Yield Plan, Maps 1-23. The Pacific Lumber Company. 1996.

Appendix 5: Existing Vegetation Classification and Mapping from Landsat Imagery

KLAMATH BIOREGIONAL ASSESSMENT PROJECT OF THE SPATIAL ANALYSIS LAB AT HUMBOLDT STATE UNIVERSITY AND THE US FISH & WILDLIFE SERVICE, KLAMATH BASIN ECOSYSTEM RESTORATION OFFICE

The National Aeronautics and Space Administration (NASA) provided Landsat Thematic Mapper imagery to the ERO-HSU GIS Facility through their Mission to Planet Earth Program. The Thematic Mapper sensor produces raster, digital images with a nominal picture element (pixel) size of 30 meters by 30 meters (0.09 hectares) on the ground. Each image covers an area of 12,000 square miles with 33 percent overlap between near-polar orbit paths at 40 degrees north latitude.

Nine images were acquired by the Landsat satellite between June 22, 1994, and August 9, 1994, with five of the images acquired between July 8 and 17, 1994. The close proximity of the acquisition dates provided seamless coverage of the Klamath Economic Zone during one, early-summer season of plant phenology, in a time frame surrounding the summer solstice, thereby minimizing the effects of terrain shadowing in the imagery.

We produced an existing vegetation map using hybrid image classification techniques (Fox et al. 1992) within ecological regions. We developed separate spectral signatures for each Landsat Scene except for scenes acquired on the same day, for which signatures were developed across multiple scenes. It was necessary to develop unique signatures for each day of image acquisition due to the slightly different spectral properties of the atmosphere on different days. The final, grid cell, raster map was not smoothed into polygons, thereby creating a minimum mapping unit of one pixel (0.22 acres, 0.09 hectares).

Our spectral classification system was patterned after California's Wildlife Habitat Relationships (WHR) Classification System (Mayer and Laudenslayer 1988). We could not match the WHR classification system exactly because spectral signatures from the Landsat Thematic Mapper Sensor sometimes failed to discriminate specific WHR habitat types and sometimes discriminated more detail than is required by WHR. Therefore, we modified the WHR Classification System, as follows, to match the spectral capabilities and limitations of Landsat satellite imagery.

The vegetation classification system that we developed from spectral data and used to map existing vegetation in 1994 is shown in the following table. The Landsat-derived Habitat Type and its Symbol are on the left side of the table. Our classification was developed to be as similar as possible to California's Wildlife Habitat Relationships (WHR) Classification System (Mayer and Laudenslayer 1988). WHR classes that were included in the Landsat Type are listed in parentheses in the middle column. All discriminated stages of WHR size and canopy closure or zone and substrate class are listed in the right column. A typical map symbol was: SHGD (Greenleaf Shrub, closure class D) or MCP5M (Mixed Pine, size class 5, closure class M).

Spectral signatures from the Landsat Thematic Mapper sometimes failed to discriminate a specific WHR habitat type. Such an information loss occurred when the WHR label

contained a geographic reference that did not necessarily indicate a different spectral signature or even a different vegetation composition. For example, valley oak woodland and coastal oak woodland were aggregated to form a mixed oak woodland class.

Generalization of the classification was also required when two or more vegetation types and/or stages had very similar spectral signatures. This occurred extensively in the tree types. For example, the WHR Types - Sub Alpine Conifer, Red Fir, White Fir, Sierra Mixed Conifer, Klamath Mixed Conifer, Douglas Fir and Redwood (when not containing hardwood) - were all combined to form the Landsat Type, Mixed Conifer.

In some cases, the spectral signatures provided more information than the WHR type. This occurred when the WHR type contained multiple-canopy types that had very different spectral signatures (e.g. needle-leaf and broad-leaf mixtures). When a spectral difference allowed for finer discrimination than the WHR system, we discriminated those specific classes. For example, the WHR Type, Montane Hardwood Conifer (MCH), was divided into conifer dominated mixtures (MCH) or hardwood-dominated mixtures (MHC). Likewise, Coast Redwood (RDW) was divided into pure conifer (MCN) or various mixtures of conifer and hardwood, depending on the dominance of the hardwood component (MHC or MCH).

We did not label any spectral class with a symbol implying land-use, such as: agriculture, crops, cropland, orchard, vineyard, residential, urban, roads, fallow, pasture, etc. We labeled these areas according to their vegetation cover (or lack thereof) as defined by the classes we used. We did not label any spectral class with a reference to geographic location or geographic shape, such as: river, marsh, lake, bay, ocean, coastal..., valley..., etc. We labeled these areas according to their land cover condition. This is because spectral signatures recognize surface features of individual pixels as a spectral pattern without regard to where that feature is located, or to what landscape feature that pixel belongs. For example, water in a lake looks like water in a river, to a spectral signature classifier operating with satellite imagery.

Table 1: The Habitat Type Classification System used to map existing vegetation from 1994 Landsat Imagery. Equivalent California Wildlife Habitat Relationships (WHR) Types are shown in parentheses (Mayer and Laudenslayer, 1988, A Guide to Wildlife Habitats of California, California Department of Fish and Game, Sacramento, California, 166p).

GENERAL TREE TYPES HABITAT TYPE	Symbol	Included WHR Types	Identified Stages (WHR tree size & closure1)
(1) Mixed Conifer (Needle-leaf, <20% broad-leaf)	MCN	(SCN, RFR, SMC, WFR, KMC, RDW, DFR, JPN, PPN, EPN, CPC, LPN)	2S 2P 2M 2D 3S 3P 3M 3D 4S 4P 4M 4D 5S 5P 5M 5D The above classes repeat for all tree types.
1A. Mixed Fir (Mapped when possible)	MCF	(SCN, RFR, SMC, WFR, KMC, RDW, DFR)	
1B. Mixed Pine (Mapped when possible)	MCP	(JPN, PPN, EPN, CPC, LPN)	
(2) Mixed Conifer-Hardwood (Mixed needle-leaf & broad-leaf, >50 % Needle-leaf)	MCH	(MHC, KMC, DFR, JPN, PPN, EPN, RDW, CPC)	
(3) Mixed Hardwood-Conifer (Mixed broad-leaf & needle-leaf, >50 % broad-leaf)	MHC	(MHC, MHW, BOP)	
(4) Mixed Hardwood (Broad-leaf, <20% needle-leaf)	MHW	(MHW, MHC, MRI, VRI, EUC, ASP)	
(5) Mixed Oak Woodland (Oak-dominated broad-leaf)	MOW	(VOW, COW, BOW)	
(6) Mixed Juniper/ Pinyon	MJN	(PJN, JUN)	

WHR tree size classes are:

Size Class	DBH (inches)
2	1 - 6
3	6 - 11
4	11 - 24
5	>24

WHR canopy closure classes:

Closure Class	Closure (%)
S	10 - 24
P	25 - 39
M	40 - 59
D	60 -100

NOTE 1: We did not discriminate WHR size class 1 for trees since areas containing seedlings < 1 inch in diameter are normally spectrally dominated by the companion vegetation.

GENERAL SHRUB TYPES HABITAT TYPE	Symbol	Included WHR Types	Identified Stages (WHR shrub closure2)
Greenleaf Shrub (dominated by green leaves)	SHG	(ADS, MCP, MCH, CSC)	S P M D (10-24) (25-39) (40-59) (60-100) Percent crown closure
Deadstick Shrub (dominated by woody sticks)	SHD	(ASC, MCH, CRC, BBR)	S P M D
Soft Shrub (lacking stiff woody stems)	SHS	(LSG, SGB)	S P M D

NOTE 2: We did not discriminate WHR “size” (actually maturity) classes for shrubs.

GENERAL HERBACEOUS TYPES

HABITAT TYPE	Symbol	Included WHR Types	Identified Stages (WHR herb. closure3)			
Dead Grass/Forb (dominated by dead leaves)	GSD	(PGS, AGS, CRP, PAS)	S (2- 9)	P (10-39)	M (40-59)	D (60-100)
			Percentage of herbaceous cover			
Green Grass/Forb (dominated by live leaves)	GSG	(WTM, PGS, AGS, OVN, CRP, PAS)	S	P	M	D
Wet Meadow/Marsh	GSW	(WTM, FEW, SEW)	S	P	M	D

NOTE 3: We did not discriminate WHR height classes for herbaceous types.

GENERAL BARREN TYPES

HABITAT TYPE	Symbol	Included WHR Types	Identified WHR Zones4
Snow & Ice	BSI	(none defined)	(none defined)
Soil	BSL	(RIV, MAR, EST, LAC, URB)	2
Gravel/Rock/Talus (includes concrete and asphalt)	BGR	(RIV, MAR, EST, LAC, URB)	2

NOTE 4: We combined WHR Zones 3 & 4 to form a new Zone 2 (exposed during satellite overpass). We did not discriminate WHR substrates. BGR and BSL types occurring in or near rivers and lakes are spectrally identical to BGR and BSL types occurring on upland sites.

GENERAL AQUATIC TYPE

HABITAT TYPE	Symbol	Included WHR Types	Identified Zone5
Water	WTR	(RIV, MAR, EST, LAC)	1

NOTE 5: We combined WHR Zones 1, 2 & 3 to form a new Zone 1 (submerged during satellite overpass). We did not discriminate WHR substrates.

Appendix 6: But What About Jobs?

by Judi Bari, 1993, revised 1996.
Presented here verbatim, with minor edits for clarity and consistency.

When Redwood National Park was created in the 1970's, the loggers and millworkers in this region still had unions to represent them. Those unions negotiated an agreement in which displaced timber workers were paid two-thirds of their wages for the next six years, to give them a chance to retrain or relocate and find a new job.

Since then, the unions have been busted, and the only ones pretending to speak for the workers are Maxxam management and their captive congressman Frank Riggs. For all their talk about jobs, none of their proposals have included one iota of compensation for displaced workers, although all of their proposals have included oodles of compensation for corporate criminal Charles Hurwitz.

Back in 1993, when Democrat Dan Hamburg had just been elected to Congress and environmentalists were drafting the Headwaters Acquisition Bill, I got a chance to look at this problem in detail. I was in charge of the committee assigned to write a worker's clause for the bill.

In order to do this, I convened a group of displaced and currently employed loggers and millworkers from Maxxam, Simpson and L-P, who met with a small group of hand-picked Earth First!ers. We asked the timber workers what to do about the loss of jobs that would come from saving Headwaters. Printed below is the proposal we came up with. This proposal should be part of any plan to save Headwaters.

Forest Rehabilitation Jobs Program

Introduction

The basic principle of this proposal is that the employees of Pacific Lumber are not responsible for the crimes of Charles Hurwitz, and they should not have to bear the brunt of them. Displaced workers are entitled to a severance package that gives them an opportunity for equivalent jobs at equivalent pay to those lost through the creation of the Headwaters Forest public reserve. This plan calls for providing those jobs in restoration work, using the existing skills of the displaced timber workers, as part of a forest rehabilitation plan for the devastated lands surrounding the Headwaters Forest ancient groves.

In addition to providing jobs, this plan has two other advantages. First, it serves the needs of the timber workers for jobs in the community. Second, it serves the needs of the forest itself. The 44,000-acre Headwaters Forest[this was the acreage being considered in 1993] consists of six fragmented groves of old growth, connected by damaged cutover lands. The rehabilitation of these damaged connecting lands is essential to the long-term survival of the old growth. This is no make-work program – it is an integral part of ecosystem management, and an investment in the future productivity of the forest.

Number of Jobs

Without an in-depth study, we cannot predict the exact number of jobs that would be lost through the public acquisition of Headwaters Forest. But based on the recent history of Pacific Lumber employment and cutting rates, an educated guess can be made. In the first six years of the Maxxam takeover, Pacific Lumber employed 1,200-1,300 people. About 80 percent of these jobs (or about 1040 workers) have been in cutting and milling old growth. During this time Maxxam cut 8,000 acres of old growth. That translates to 650 jobs for six years. Adjusting for the fact that current environmental practices would not allow as much

cutting as was done in the past, these figures can be rounded downward to about 400 jobs for six years (at Hurwitz cutting rates), or 200 jobs for twelve years (at pre-Hurwitz rates). [These employment projections were Judi's estimates; the figures contained in the body of this Stewardship Plan are probably more accurate at this point.]

Severance Package

The rehabilitation of the Headwaters Forest lands, however, will only create about 100 jobs, based on the estimates of people currently engaged in restoration work. Therefore, we need to offer a way for displaced workers to opt out of the timber job market. We propose a voluntary option plan for Pacific Lumber workers that includes the following choices:

- Priority hiring for Headwaters restoration jobs, at logger wages.
- Incentives for early retirement.
- Monetary assistance for relocation and job search.
- Scholarships and monetary support for school or retraining.
- Low-interest loans for starting small businesses.
- Or, if none of the other options are exercised, a lump-sum severance plan.

These options would be offered by seniority, with more value placed on those options that provide re-employment opportunities and less on the lump-sum payment. By offering this option package, the number of people competing for the restoration jobs will be reduced to something in the neighborhood of the 100 jobs available. Although displaced Pacific Lumber workers will have priority for hiring, some non-Pacific Lumber workers with special skills in restoration work may also be hired if necessary.

Land Management

The cutover lands in the Headwaters Forest will be managed for the restoration of old-growth characteristics, and for the general health of the ecosystem, including forests, soils, waterways, fisheries, and wildlife. Since this type of restoration work is in its infancy, the Headwaters project can serve as a laboratory to learn the skills of ecosystem and habitat restoration.

Although the 5,000 acres of ancient forest in the Headwaters Forest must remain undisturbed, this plan does not call for the permanent lock-up of all 39,000 acres of connecting cutover lands. [Again, these figures are geared to the 44,000-acre acquisition plan.] After these lands are rehabilitated – and stream protection, wildlife corridors, and other ecological considerations are provided for – the cutover lands could be gradually brought back into sawlog production. Forestry methods would not resemble those of Maxxam, however, and any form of depletion logging would be banned. Rather, the lands would be used to implement sustainable methods such as the Plenterung system of all-age all-species management, and/or the 150-year rotation system proposed by the Pacific Lumber Takeback Committee. In this way, the forest rehabilitation program will be an investment in the future, providing both jobs and forests for our grandchildren and great grandchildren.

Project Management

One of the most important elements of a successful land rehabilitation program is that it be controlled by local people with a long-term interest in and knowledge of the community. For this reason, we propose that the Headwaters restoration project be set up as a locally controlled operation, and subcontracted only to locally controlled companies.

We also propose that, before Charles Hurwitz can receive any monetary benefit from the sale of Headwaters, he must be required to pay back the Pacific Lumber pension fund. This fund was looted of $90 [60] million during the Maxxam junk bond takeover of Pacific

Lumber, and replaced with unsecured annuities from the now-bankrupt Executive Life Insurance Company. Pacific Lumber workers, both past and present, must be assured a guaranteed pension plan.

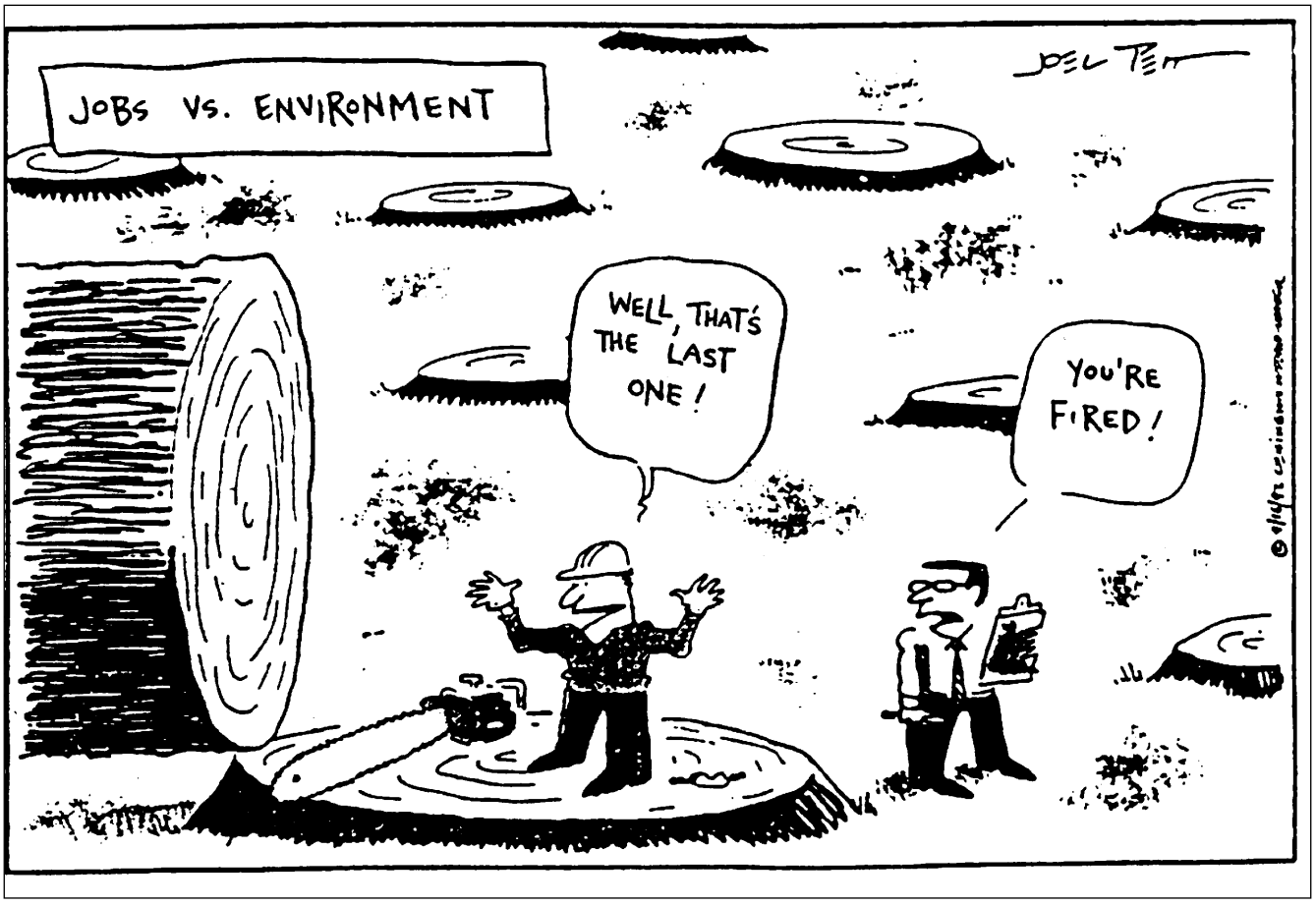
Costs

The cost of provisioning 100 jobs at $30,000 a year (including wages and benefits) is only $3 million a year. In addition, the worker severance plan would cost about $10 million to implement, on a one-time basis. These amounts are minuscule compared to the hundreds of millions that are to be paid to Charles Hurwitz. They are also minuscule compared to the annual subsidy given by the Forest Service to the timber corporations in the form of below-cost sales for logging rights on National Forest lands. This subsidy reached $400 million a year during the Reagan/Bush era.

These small costs could also be offset by marketing the products of restoration. These include salvaged logs, overgrown tanoak, crowded young conifers that need thinning, and even mushrooms and floral greens. A value-added local industry using these products can be developed as part of the restoration project.

Conclusion

The Forest Rehabilitation Jobs Program offers a viable plan to unite the needs of displaced timber workers for stable jobs in the community with the needs of the forest for restoration. The cost in monetary terms is insignificant, but the long-term benefit to the community and the forest is great. This is a perfect opportunity to implement President Clinton's ideas of ecosystem management, and of putting America to work building our future. By implementing this plan, we can serve at once the goals of social and ecological justice.



Appendix 7: Institute for Sustainable Forestry Ten Elements of Sustainability©

1 Forest practices will protect, maintain and/or restore the aesthetics, vitality, structure, and functioning of the natural processes, including fire, of the forest ecosystem and its components at all landscape and time scales.

2 Forest practices will protect, maintain and/or restore surface and groundwater quality and quantity, including aquatic and riparian habitat.

3 Forest practices will protect, maintain and/or restore natural processes of soil fertility, productivity and stability.

4 Forest practices will protect, maintain and/or restore a natural balance and diversity of native species of the area, including flora, fauna, fungi and microbes, for purposes of the long-term health of ecosystems.

5 Forest practices will encourage a natural regeneration of native species to protect valuable native gene pools.

6 Forest practices will not include the use of artificial chemical fertilizers or synthetic chemical pesticides.

7 Forest practitioners will address the need for local employment and community well-being and will respect workers' rights, including occupational safety, fair compensation, and the right of workers to collectively bargain, and will promote worker-owned and -operated organizations.

8 Sites of archaeological, cultural and historical significance will be protected and will receive special consideration.

9 Forest practices executed under a certified Forest Management Plan will be of the appropriate size, scale, time frame, and technology for the parcel, and adopt the appropriate monitoring program, not only in order to avoid negative cumulative impacts, but also to promote beneficial cumulative effects on the forest.

10 Ancient forests will be subject to a moratorium on commercial logging during which time the Institute will participate in research on the ramifications of management in these areas.

Appendix 8: Executive Summary: The Economic Benefits of Small-Scale Sustainable Forestry

by The Institute for Sustainable Forestry

PHASE 1: DETERMINING THE POSSIBLE SUPPLY OF CERTIFIED TIMBER

The purpose of the Phase 1 study was to generate estimates of the possible supply of small landowner "certified" timber that may be produced from within the Southern Humboldt/Northern Mendocino Counties study region. Certified timber comes from trees that are managed and harvested in a manner consistent with standards of exemplary forest management. For purposes of this study, exemplary forest management is defined as small landowner forest planning, management and harvesting practices consistent with the PCEFP (Pacific Certified Ecological Forest Products) Elements of Sustainability and the field Evaluation Checklist. The likely supply of certified timber from within the study region is a function of:

- actual inventories of merchantable timber, both now and over time.

- the periodic "recoverable yield" from the regional inventory that would comply with PCEFP certification standards.

- the propensity of small landowners to harvest timber consistent with PCEFP certification standards.

While the Forest Service issues periodic estimates of the standing inventory of merchantable trees on California's north coast, including the study region, these measurement efforts have paid inadequate attention to the extent and value potential of the region's vast supplies of hardwood trees (e.g., tanoak, pacific madrone, black oak). Because hardwoods are a prominent element of many small land ownerships and because the Institute for Sustainable Forestry has long recognized the key role that hardwoods can play in the biological and economical restoration/recovery of this rural region, hardwoods have received added attention in this study.

To develop an estimate of the possible supply of certified timber within the study region, we pursued the following analytical approach:

- develop and distribute a written questionnaire to a systematic sample of small tim berland owners in northern Mendocino and southern Humboldt Counties in order to gauge the propensity of small landowners to engage in certifiable management (i.e., harvesting) of the timber resource.

- from a subset of owners who respond in the affirmative to the questionnaire, con duct field-level inventories of forest resource conditions in order to determine likely per acre period recoverable yields, stratified by broad timber/productivity types.

- using published timber type data for the study region, extrapolate per acre periodic yields derived in step 2 to the broader area in order to estimate possible regional sup ply levels. The survey was sent to approximately 1,300 forest landowners, constituting approximately a 10% sample of all small landowners within the study region.

Approximately 5% of the surveys were completed and returned. There were no follow-up efforts to increase the response rate. Of the respondents, some 60 different landowners accounting for over 25,000 acres expressed a definite interest in commercial harvesting consistent with certification guidelines. Another 36 owners accounting for an additional 12,500 acres expressed a moderate or tentative interest in commercial, certifiable timber harvesting.

From the positive respondents, a sub-sample of 10 landowners was selected for conducting yield inventories of their timber resource. These 10 owners collectively account for approximately 1,800 acres and represent a range of forest types, parcel sizes, and likely management objectives. The inventories, conducted by ISF staff and consultants, were designed to estimate standing volume and future growth and yield by broad timber types roughly analogous to the Wildlife Habitat Relations (WHR) typing system and using silvicultural prescriptions that deemed compatible with certification guidelines. Field evaluations of the 10 ownerships revealed that approximately: 25% of the aggregate land area was excluded from possible timber management due to sensitive resource issues, 15% of the land area was excluded due to low timber values and site productivity. Of the 60% of the gross land area deemed to be available for commercial timber management, one-sixth was not analyzed from growth and yield because it was either inadequately sampled or too dissimilar to be lumped with the main forest type categories. Mixed hardwood/ conifer was found to be the dominant timber type, and small diameter tanoak-dominated stands comprised the second most common type.

The type-specific per acre stocking levels found on the 10 ownerships within the subsample were extrapolated to the 25,000 acres of "definite interest in harvesting" within the study region. This limited extrapolation constituted a notably conservative analytical approach as there is a high but unknown likelihood that many other landowners (both non-respondents and the 90% of landowners not sent a survey) would also be inclined to engage in certifiable timber harvesting. We chose not to make the usual expansion from a 10% sample because of the low rate of survey response. Accordingly, the actual but unknown acreage of forestland within the study region that would likely contribute certified timber is somewhere between 25,000 acres (actual positive respondents) and 250,000 (10-factor expansion for the 10% sample.)

For the 25,000 acres of known interest in certifiable harvesting, the inventory analysis revealed that for all timber types except the redwood type, the tanoak component within the species mix accounts for the greatest volume per acre. This is consistent with the harvesting history of most private forestland within the study region which was primarily industrial high-grading of the conifer stocking. Conifer volume per acre ranges from as low as one thousand board feet on hardwood-dominated types to 16 thousand bard feet for the Douglas-fir type. All-species volume per acre ranges from 7 thousand board feet per acre for young tanoak stands to 26 thousand board feet per acre for redwood-dominated stands. Growth and yield computer analysis revealed that the 25,000 acre land base could support a total average annual certifiable harvest of approximately 2.8 million board feet for the next 25 years with higher levels thereafter.

Appendix 9: Watershed Restoration Plan for Proposed Headwaters Redwood Forest Complex

by Pacific Watershed Associates, 1993

Appendix 10. About Maxxam/Pacific Lumber - The Larger Issues of Local Control and Corporate Accountability

The Headwaters Forest Stewardship Plan has made every effort to address straightforward biological and economic concerns in the 60,000-acre target area and to avoid contentious political or idealistic positions. However, the circumstances surrounding the corporate takeover of the Pacific Lumber Company by Houston-based Maxxam Inc. and consequences of its control by an out-of-state entity have undeniably contributed to the need for this Stewardship Plan to come forth as an option for proper long-term management of an important resource. Although the factors that drive a corporation to prioritize resource extraction and profits above all other considerations are at the root of the crisis surrounding Headwaters Forest, we limit this brief discussion to an Appendix so the main elements of the Stewardship Plan can take center stage in this document. However, as touched upon in the Economic Analysis sections, the Stewardship Plan exists in the larger context of an alternative to the industrial exploitation model. In fact, one of the purposes of this project is to explore avenues by which alternatives to the prevailing model can be designed and implemented.

A major tenet of the stewardship model is local control of resources such as forests, for the obvious reason that inhabitants of the local community depend upon long-term utilization of the forest as well as a healthy ecosystem and thus have a stake in maintaining ecological and economic balance. By contrast, an out-of-state corporation like Maxxam is primarily concerned with liquidating resources and extracting the short-term value from a region, with profits accruing to the far-away corporation and its executives. Such a corporation typically denies responsibility for widespread ecological impacts to a region or devastating "boom and bust" economies created by their style of business. At any rate, it's easy for them to pick up and leave when the profit margin shrinks or a resource is exhausted.

The historic (pre-takeover) Pacific Lumber Company (PL) was a local, family-run operation that eschewed liquidation logging practices and clearcuts in favor of selectively logging its forestlands, leaving relatively healthy forests for future generations of both human and non-human residents. That's why PL still had old-growth forests long after other private timber companies logged all theirs – and why PL, with its abundant standing timber "assets," was ripe for takeover by a greedy outside corporation. In 1985-86, CEO Charles Hurwitz and his Houston-based Maxxam Corporation floated $700 million in high-interest, high-risk junk bonds and acquired the entire Pacific Lumber Company for $900 million – by all counts, a steal.

In an effort to pay off his corporate debt, Hurwitz radically altered PL's forestry practices, instituting clearcutting and more than doubling the rate of logging old-growth redwood. Suddenly old-growth-dependent species such as the marbled murrelet, spotted owl, and coho salmon were threatened with wholesale destruction of their already-limited habitat. Furthermore, Maxxam's greedy clearcut logging practices have resulted in devastating mud flows and mass wasting of streams and hillsides. Thus Humboldt County is bearing the ecological and economic costs of such disconnected corporate-style management in multiple ways.

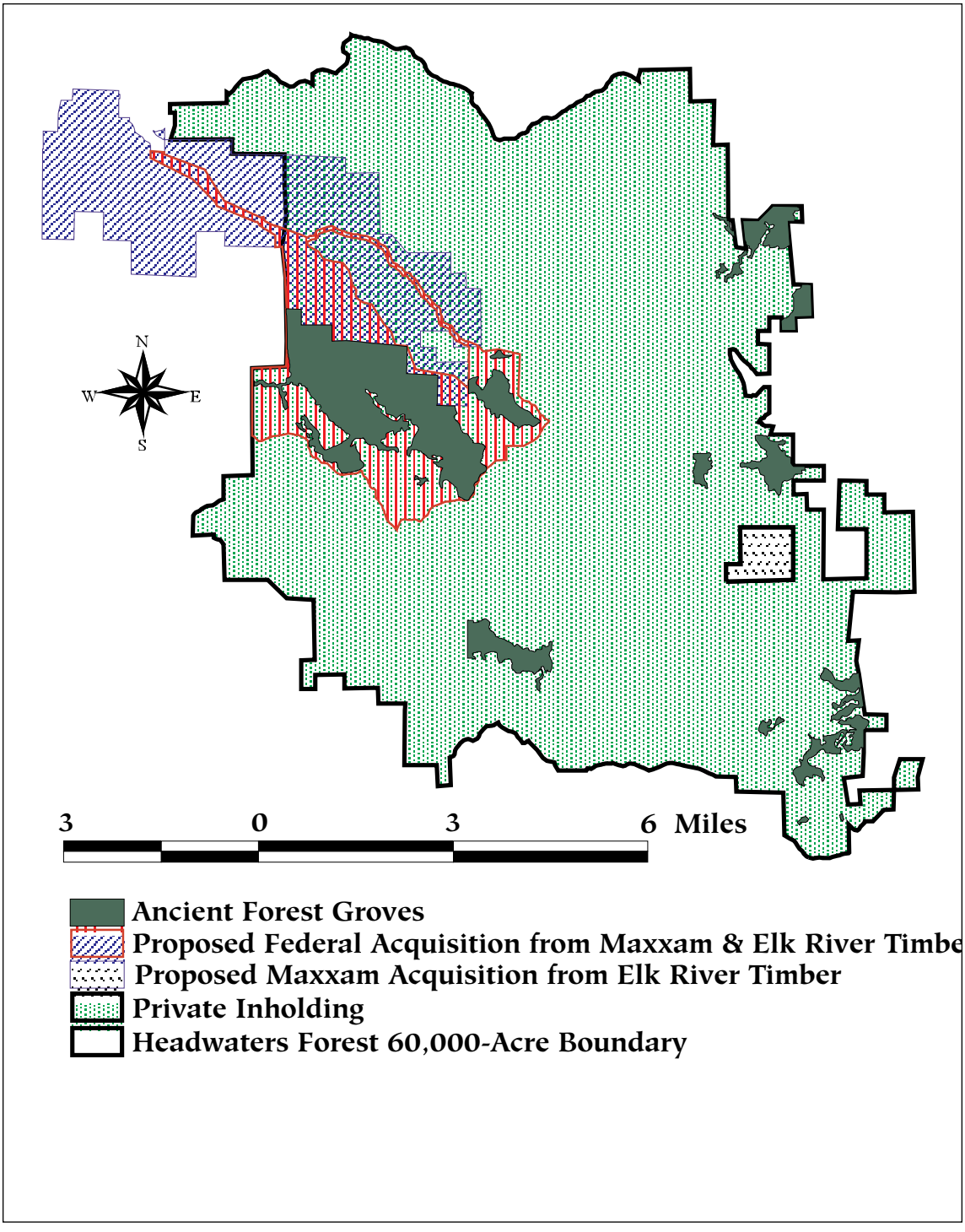
Meanwhile, despite milking $1.2 billion from PL over the past decade (including liquidation of the $60 million pension fund), Maxxam has not used that money to pay off the debt incurred by purchase; instead Maxxam is just barely making interest payments. Between now and the year 2003, Maxxam owes $70-80 million in interest alone, with a balloon payment on the principal in 2003 of more than $500 million(SEC 1996). Such astro-

nomical debts force the liquidation of valuable old-growth redwoods, with little concern for endangered species or the next generation's logging jobs. Is it any wonder that Maxxam can't see the woods for the dollar signs?

Citizens concerned about the rapid disappearance of important tracts of ancient redwood forest have worked tirelessly for eleven years since Maxxam's corporate raid to halt the destruction of Headwaters. A series of lawsuits by the Environmental Protection Information Center (EPIC) and Sierra Club based on federal and state environmental laws has held off much of the planned logging, and there is today strong, widespread support for the permanent protection of Headwaters Forest. Acknowledging this public outcry, the Clinton Administration and California's Senator Dianne Feinstein brokered a politically-motivated deal with Charles Hurwitz in September 1996, known as the Headwaters Agreement, or "the deal." (The deadline for finalizing the deal is February 1998.) Unfortunately, the deal addresses only a fraction of the 60,000 acres needed for full protection of Headwaters' six ancient groves. It provides a temporary moratorium on logging for a mere 7,500 acres of Headwaters Forest, including the Headwaters Grove and Elk Head Springs Grove, leaving the other four ancient groves vulnerable to salvage logging. It also requires PL to submit a Habitat Conservation Plan and Sustained Yield Plan for its entire holdings. These documents are to outline PL's plans for attending to the long-term needs of endangered species and the future of PL timber flow. But if draft plans are any indication of what to expect from PL, these critical documents will fall radically short of what is needed not only to protect existing habitat but to establish conditions favorable to the recovery of listed species to the point where federal protections are no longer necessary. One of the goals of the Headwaters Forest Stewardship Plan is to lay out what we believe a responsible and progressive land-owner with the best interests of the local region in mind would propose for this priceless forest. Citizens are invited to compare and contrast the HFSP with any PL plans for the same area and to decide which model – stewardship or industrial exploitation – is best for the forest and the people of Humboldt County.

Reprinted from the San Francisco Examiner, courtesy of Tom Borromeo.

Map 9 – Comparison of Proposed Headwaters Forest Reserve Boundaries



Appendix 11: Published, August 1996

This is *our* stand.

We need a biological solution to protect the 60,000 acre Headwaters Forest ecosystem.

Immediately protect all the ancient redwood groves.

Headwaters Forest contains the last large remnants of unprotected ancient and residual redwood forest in the world, totalling approximately 14,000 acres. The Headwaters Grove is the heart of Headwaters Forest, and the other five ancient groves are the backbone. All these ancient groves and the additional residual groves are essential for continued survival of the ancient redwood forest ecosystem.

Protect marbled murrelet nesting habitat.

The U.S. Fish & Wildlife Service recently designated nearly 40,000 acres of Pacific Lumber and Elk River Timber Company land in the Headwaters Forest as critical habitat for the marbled murrelet. Headwaters is one of three remaining nesting areas in California for this small seabird that lives in coastal ancient forests.

Protect coho salmon spawning habitat.

The coho salmon are awaiting listing under the federal Endangered Species Act. Five to ten percent of California's remaining wild coho salmon spawn in the waterways of Headwaters Forest. Especially critical is the 15,000-acre Elk River watershed on the north side of Headwaters, where logging is now underway.

Ensure job security for local workers through restoration and sustainable forestry practices.

A real solution must include worker retraining and employment in forest and stream restoration, and new, ecologically sustainable methods of forestry. The Clinton Administration can initiate a model sustainable forestry and restoration project for the Redwood Region in the cutover portions of the Headwaters Forest.

Institute a logging moratorium during negotiations.

The Clinton Administration must seek interim protection for Headwaters Forest by insisting that Pacific Lumber Company cease logging, including salvage operations, in the ancient and residual groves during the current negotiation process. It must also negotiate with Elk River Timber Company to protect coho salmon habitat in Northern Headwaters.

No land trades for other ancient forests.

Federal acquisition cannot be accomplished by trading other old-growth forestlands. A Debt for Nature swap can trade Maxxam Corporation's $1.6 billion debt to the American taxpayers for the ancient and residual groves of Headwaters Forest.

No restrictions on citizen participation in environmental or judicial review.

The federal acquisition process must not include any agreements that would limit future citizen participation in environmental or judicial review of timber corporations' compliance with environmental laws.

The Headwaters Forest Coordinating Committee:

Bay Area Coalition for Headwaters Forest, Earth First!, Environmental Protection Information Center, Forests Forever, Mendocino Environmental Center, Rose Foundation for Communities and the Environment, Sierra Club California, Thron Nature Photography, Trees Foundation

You can reach us c/o EPIC: 707-923-2931, or visit our WEB site: http://www.igc.apc.org/headwaters/

Appendix 12: List of Contributors

Tracy Katelman, Project Coordinator – Employed by Trees Foundation and also working as a Registered Professional Forester, Tracy brings more than a decade of grassroots environmental organizing experience to her role as project coordinator of the HFSP.

Alison Sterling, Project Assistant – A local Headwaters organizer, Alison is coordinating various aspects of this project's fundraising, report writing, and community outreach. She currently is secretary of the Board of Directors for the Environmental Protection Information Center (EPIC) and on the staff of the Trees Foundation.

Robert Parker, GIS Coordinator/Technician – Robert's knowledge of the terrain in Headwaters Forest, his many years of work on the campaign, and his love of maps combine to lead the GIS team in its gathering of data and confirmation of its accuracy. Robert is currently on educational leave from Humboldt State University while developing GIS for Trees Foundation and its Affiliates.

Tim Metz, Forestry Technician – Employed by the Institute for Sustainable Forestry, Tim helped inventory and develop the applied growth and yield modeling for long-term forest management planning in Headwaters. He is taking his Registered Professional Forester exam this fall.

Paul Harper, Forestry Analyst – Paul has worked with the Institute for Sustainable Forestry as the Research and Development Coordinator since 1992. He has several years' experience conducting forest inventories and doing forest growth and yield modeling, having completed a project in the Sinkyone Wilderness for the California State Coastal Conservancy.

Pete Nichols, Biological Consultant – A local biologist and activist. He provided the scientific research for the conservation strategy and the reserve design for the HFSP.
Pete is also a current member of the Board of Directors for the Environmental Protection Information Center (EPIC).

Robert Hrubes, Economist – A consulting resource economist and Registered Professional Forester with 23+ years of professional experience, Robert brings a wealth of knowledge to this project. He is analyzing the economic implications of alternative forest land-use allocations and developing economic projections for the region.

Richard Gienger, Restoration Coordinator – Richard has been actively doing stream restoration, tree planting, and fish hatchery and erosion control work since 1979. He developed the restoration discussion for this project.

Gordon Bonser, GIS Consultant – Gordon brings a diverse background to his consulting role in the development of the Headwaters GIS. He teaches remote sensing and GIS labs at Humboldt State University and does image analysis for the Klamath Bioregional Assessment Project.

Allen Cooperrider, Conservation Biologist – Allen is a conservation biologist with over 25 years of experience dealing with natural resource issues. He has over 18 years' experience with the federal government, primarily with the BLM and U.S. Fish and Wildlife Service. As a consultant Allen has advised many non-governmental organizations on issues related to biodiversity conservation. Allen is volunteering his time on this project on behalf of LEGACY.

Larry Evans, GIS Technician – Larry continues in his role of producing computer-generated maps of Headwaters Forest, which he has done since 1991 in support of litigation, legislation, and public education. He also has 14 years' experience in ecological restoration work.

Kathy Glass, Project Writer/Editor – Kathy is a writer, professional book editor, and forest activist. She has traveled around the world visiting ancient forests. In addition to her

freelance work with various Bay Area presses, she works with the Trees Foundation Media and Public Relations project.

Curtice Jacoby, GIS Consultant – As the GIS consultant with LEGACY, Curtice is volunteering his time on this project. He is a graduate student in the Natural Resources Program, Humboldt State University, and a staff member of the Klamath Bioregional Assessment Research Project (for which he carries out GIS analysis and satellite image analysis).

David Walsh – Currently a Board member for Ancient Forest International and a member of the Board of Directors of the Environmental Protection Information Center, Dave has a strong background in forest conservation and landscape design. He has been active in the Headwaters campaign since 1989 and outlined recreation concerns for this project.

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Collaborations

The Headwaters Forest Stewardship Plan is being developed by the Trees Foundation in collaboration with the Coalition to Save Headwaters Forest (see below), the Institute for Sustainable Forestry, local Native Americans as represented by The Seventh Generation Fund - The Intertribal Coalition for Native Stewardship of the Headwaters, and LEGACY: The Landscape Connection.

Coalition to Save Headwaters Forest

These organizations have not had an opportunity to review and endorse this draft before publication, they are listed here for identification purposes only.

Bay Area Coalition for Headwaters

Earth First!

Environmental Protection Information Center (EPIC)

Forests Forever

Greenpeace

Headwaters Sanctuary Project

Mendocino Environmental Center

Rainforest Action Network

Rose Foundation for Communities and the Environment

Sierra Club

Trees Foundation

Taxpayers for Headwaters

World Stewardship Institute

Voice of the Environment