PROGRAMMATIC ENVIRONMENTAL ASSESSMENT

for

Klamath Basin

Ecosystem Restoration Office Projects

2000-2010

U.S. Fish & Wildlife Service
Klamath Basin Ecosystem Restoration Office
6610 Washburn Way
Klamath Falls, Oregon 97603

Programmatic Environmental Assessment
Summary

This Environmental Assessment (EA) provides compliance with the National Environmental Policy Act (NEPA) for restoration actions undertaken by the US Fish & Wildlife Service's Klamath Basin Ecosystem Restoration Office (ERO) in Klamath Falls, Oregon. These restoration activities are needed due to the large-scale loss of wetland and riparian habitat and degraded water quality. The purpose of these restoration efforts is the improvement of conditions of the watershed with specific regard to habitat and water quality, resulting in, among other benefits, improved conditions for the endangered fish species (bull trout and Lost River and shortnose sucker) populations of the basin. The geographic scope of this EA is defined as the upper Klamath River basin, including the entire watershed from Irongate Dam upstream to the headwaters. This EA is intended to provide NEPA compliance for restoration projects conducted between the years 2000 and 2010.

The ERO was established in 1993 to sponsor and assist with a variety of restoration activities in the Klamath Basin. The ERO funds and provides technical assistance to restoration projects involving private landholders, concerned groups, and other state, federal, and tribal agencies.

Four alternatives are presented in this EA. The proposed alternative (Alternative 1) consists of a comprehensive program of ecosystem restoration, promoting projects in both riparian areas and in upland habitats. This would continue the current program in effect since 1994. NEPA compliance would primarily be carried out via a single, programmatic document saving time and funds. The Fish & Wildlife Service proposes to fund and administer the following projects types:

Riparian Projects: (fencing for livestock management; native plant establishment & diversification; non-native plant removal/control; erosion control; contour re-establishment; impoundment removal; wildlife habitat improvements)

Wetland Projects: (fencing; wetland restoration and enhancement; wildlife habitat improvements)

Upland or Road Projects: (road abandonment, decommissioning, & obliteration; road drainage improvements and storm proofing, re-establishment of historic contours; silvicultural treatments; native plant establishment/diversification; non-native plant removal/control; fencing; landslide treatments; culvert/stream crossing upgrades; erosion control; wildlife habitat improvements).

In-stream Projects: (habitat complexity and diversity improvements; hydrologic regime improvements; coarse woody debris supplementation; natural or artificial barrier removal, modification &/or creation; fish screens installation).

Alternative 2 would concentrate restoration efforts only on riparian, instream, and wetland areas. Road projects would be conducted only within the riparian corridor, as defined. NEPA compliance would also be conducted programmatically.

Alternative 3 would cease all restoration activities conducted and funded by the ERO in the Klamath Basin. This alternative would serve as a benchmark against which the effects of the restoration alternatives discussed above can be compared.

Alternative 4, the "No Action" alternative, would continue current management policies with regard to NEPA compliance, providing compliance on a project by project basis requiring independent analysis for each project.

The affected environment of the region is described in detail. The environment has been changed significantly since the 1890's due to logging, agriculture and urban development. An extensive system of dams, canals, and drainage structures has resulted in the conversion of approximately 80% of pre-settlement wetlands to agricultural uses. Riparian corridors have been similarly impacted, and upland forests regions have been affected by logging, road construction and other factors. These changes have contributed to problems with the water quality in the region, contributing to the listing of several fish species as threatened or endangered; loss of habitat has affected a large number of other species as well.

The environmental effects of each alternative is analyzed. Some short term negative impacts could occur as a result of the projects authorized by both Alternative 1 and Alternative 2, but these would be strongly offset by the expected beneficial results to water quality and habitat conditions. Alternative 1 would be expected to have a greater overall effect on the environment than Alternative 2, since many of the underlying factors with which restoration efforts are concerned originate in upland conditions (i.e. sedimentation and hydrologic functionality). Alternative 3 would result in conditions remaining much as they are currently, although other programs and organizations are making efforts at restoration activities. The environmental impacts of individual projects anticipated under Alternative 4 would be generally the same as for similar projects under Alternative 1. The primary difference between the two alternatives would be the higher efficiency and improved cumulative analysis resulting from a programmatic approach as proposed in Alternative 1.

Public participation in the NEPA process has been, and will continue to be, solicited and welcomed. Compliance with state and federal laws and regulations such as the Clean Water Act, National Historic Preservation Act, and the Endangered Species Act, as well as guidelines for contaminant surveys, will be carried out as detailed.

While these projects are expected to play an important role in the restoration of the region, none of these alternatives are expected to have a significant impact when compared with the loss of wetland, riparian and upland habitats over the past century, impacts which do occur would be of a cumulatively beneficial nature. Other restoration efforts are being carried out in the area by other governmental and private groups, and it is expected that these combined efforts will achieve important beneficial results for the ecosystem.

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I. PURPOSE & NEED

1.1 Introduction:

The mission of the US Fish and Wildlife Service (Service, FWS) is to work with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.(USFWS, 1999). The Ecosystem Restoration Office (ERO), located in Klamath Falls, Oregon, was established in 1993 to plan and coordinate habitat restoration activities between existing federal, state, and local agencies and private landowners, and to conduct outreach to the public. The ERO provides financial and technical assistance in developing projects to improve the ecosystem of the Upper Klamath Ecoregion. Other Service offices in Northern California are responsible for similar programs in the Lower Klamath Basin; however, their activities are not covered by this document.

The ERO funds projects with the goal of reestablishing habitat function through restoration, enhancement, creation, and/or management activities that are designed to benefit native fish and wildlife and to improve water quality, with a focus on water chemistry, temperature and sedimentation effects. These activities are defined as follows (USFWS 1997):
1) Habitat Restoration - the rehabilitation of degraded or lost habitat to the original community that likely existed historically, including natural hydrology, topography, and native vegetation; or the rehabilitation of degraded or lost habitat to an ecological community different from what existed before, but which partially replaces original habitat functions and values and consists primarily of native vegetation.
2) Habitat Enhancement - the alteration of existing, degraded habitat to improve and/or increase specific fish and wildlife habitat functions and values.
3) Habitat Creation - the development of habitat types in order to mimic habitats which occur naturally in the immediate area and did not previously exist on the site.
4) Habitat Management - the periodic, routine, short-term actions that manipulate the physical, chemical, or biological characteristics of habitat to replace or replicate natural events, e.g. wildfire, floods, and drought, that occurred on the landscape prior to cultural intervention.

The funding for these projects comes from several sources, including the Partners for Fish and Wildlife Program (Partners), the Jobs-in-the-Woods Watershed Restoration Program (JITW), the Hatfield Restoration Program (Hatfield), and the US Bureau of Reclamation's (Reclamation) Oregon Resource Conservation Act (ORCA). While these programs contain differences in the specific types of projects, geographic area, and other project restrictions, they have in common an emphasis on the restoration of lands. Since 1994, approximately 1 million dollars has been allocated each year by the ERO for restoration activities from the Partners, Hatfield, and JITW programs. ORCA projects are administered by Reclamation's Klamath Basin Area Office, and have totaled approximately 1 million dollars annually since 1999. This level of funding is expected to continue into the future, although the loss or addition of funding sources resulting in fluctuating funding levels may occur. Additional funding sources which may become available in the future may be utilized, those programs would be covered under this document only if the types of projects authorized are within the range of the projects discussed in this EA.

Substantial increases in funding, and in the number, types, or size of projects funded, would require renewed evaluation and a supplemental or new NEPA document.

The ERO also funds a number of assessment, inventory, and information and education projects annually. These projects types are considered exempt from further NEPA analysis under Department of Interior (DOI) categorical exclusions rules (USDI, 1984), and are not considered further in this document.

1.2 Scope and Purpose of this Document:

Between 1994 and 1999 (fiscal years), the ERO has provided funding and technical assistance for approximately 200 restoration projects. Of these, about 1/3 have been conducted on federal lands or done in cooperation with other federal agencies. Several of these have consisted of large scale projects, the Lower Williamson River Delta restoration project being the most prominent example. Otherwise, projects have been small to medium scale and usually conducted on private lands at the request of the landholder. The National Environmental Policy Act (NEPA) of 1969, as amended and regulated by the Council of Environmental Quality (CEQ, 1986), requires federal agencies engaging in actions on federally owned lands or providing funds for actions on private lands to evaluate the potential environmental consequences of those actions.

Since 1994, the ERO has complied with these regulations on a project by project basis. The use of this project by project approach to NEPA compliance was initially appropriate for the ERO's restoration activities and for evaluating the impacts of individual projects. However, considering the number of restoration projects expected to be implemented in the next ten years, it was decided that a more comprehensive analysis would be more appropriate for NEPA compliance purposes. A programmatic approach was adopted as the most efficient manner (with regard to paperwork and duplication of effort) to describe and evaluate restoration projects which share a strong similarity in terms of techniques and likely outcomes, and which are being conducted in a relatively small geographic area with consistent environmental characteristics. The purpose and objectives of these projects, the types of projects, and their impacts can be characterized in a general (or programmatic) nature based on the observed environmental impacts associated with the past five year's worth of ERO restoration efforts. Individual projects will be evaluated to determine if the scope and impacts of that project are within the scope and impact analysis of this document.

Individual projects are evaluated and reviewed by biologists from the Service and other federal agencies with regard to general environmental affects, potential benefits to endangered species, and social and economic consequences. This process provides a high degree of continuity in the planning and implementation of these projects. Given the similarity of the nature and purpose of the programs discussed, and in the interest of streamlining compliance requirements and reducing paperwork, the Proposed Action described in this document will provide compliance for the entire range of projects discussed. Projects outside of the scope of this document or those substantially different from those described will require supplementary or separate NEPA documentation. This analysis may be incorporated as a part of that additional documentation.

The underlying purpose of this EA is to describe the environmental impacts of proposed restoration projects and to comply with the procedural requirements of NEPA legislation. The EA will be used to determine whether to prepare a Finding of No Significant Impact (FONSI) or prepare an environmental impact statement (EIS). If the EA shows that the proposed projects do not have a significant impact on the human environment, a FONSI will be prepared. If the EA indicates that the proposed action constitutes a major federal action significantly affecting the quality of the human environment, then an EIS will be required.

The Upper Klamath Basin (UKB) as described in this document refers to the entire watershed of the Klamath River upstream of the Iron Gate Dam, located near the town of Hornbrook, California (See Map A.). This document will be used to provide compliance for ERO projects from the year 2000 through 2010.

Reclamation's Klamath Project Office located in Klamath Falls, OR., provides funding for the ORCA program, and administers projects funded through that program. This program has essentially the same goals as those programs administered by the ERO, and the project types are similar. Reclamation is included in this document as a cooperating agency. This document will be used by both the FWS & Reclamation to analyze these programs, but each agency will make official decision records separately. This document is intended to provide NEPA compliance for those projects utilizing federal funds administered by the ERO & Reclamation which occur on private and federal lands. Reclamation intends to adopt this EA and use it to make a decision regarding implementation of projects funded by the ORCA program.

Other federal agencies in the basin, including the Forest Service and the Bureau of Land Management, utilize ERO sponsored funding to carry out restoration projects on the lands they administer. These agencies currently conduct an independent NEPA analysis for these projects, in keeping with their agency guidelines. In the future, this EA may be utilized by other agencies and may be incorporated by reference to those agencies' NEPA documents.

1.3 Proposed Action:

The ERO proposes to implement the full range of restoration projects discussed in this document in order to progress towards the goal of restoring sustainable ecological functions the Upper Klamath Basin eco-region.

1.4 Purpose of Proposed Restoration Activities:

The mission of the ERO is to promote restoration projects within the Upper Klamath Basin, especially with regard to watersheds and wetlands. This is accomplished by providing funds and technical assistance to private landowners, concerned groups, and cooperating federal, state, tribal, and local governments to carry out a wide variety of restoration projects. Project selection is in part based on the ability of the project to result in improved water quality, improvements to fish and wildlife habitat (particularly regarding threatened, endangered, or "sensitive" species), and restoration and improvements to wetlands used by fish and wildlife. An additional purpose of these programs is to provide jobs and economic development to timber dependent communities impacted by the listing of the northern spotted owl as a threatened species (specifically for JITW). The purpose of this programmatic EA is to promote administrative efficiency by streamlining the NEPA compliance procedure and to come to a better understanding of the overall, cumulative impacts of the proposed restoration activities.

1.5 Need for the Proposed Restoration Activities:

Between 1905 and the 1960's, wetlands in the region were reduced from approximately 350,000 acres to 75,000 acres (USBOR, 1992), primarily by the creation of agricultural lands. (Map B shows many of the original lakes and wetlands as they were in 1905, Map C is a contemporary image of the same area.) Water quality has been degraded by increased sedimentation and changes in water chemistry and temperature. Wildlife habitat has been reduced proportionately to wetland loss, especially for migratory and resident waterfowl. Riparian corridors have been affected by both natural and manmade influences, resulting in bare and denuded streambanks and downcut stream channels. Upland areas have also changed due to road construction, landslides, timber activities and livestock use. Upland impacts have manifested themselves in various ways, including further impacts to water quality. Many of these areas have been influenced by the invasion of non-native species, especially exotic animals, plants, and fish. As a result of declining timber harvests, many timber based and associated jobs were lost, resulting in social and economic disruption for many of the local communities. These conditions have resulted in a need for wetlands, riparian, and uplands restoration programs, as well as a need for job creation to help stimulate local economies.

1.6 Relationship to Other Restoration Programs:

The need for restoration projects has been recognized since the 1980's, and a variety of federal, state, and private organizations have initiated restoration programs. Several of these programs continue in conjunction with current ERO efforts. In addition to the restoration activities of the ERO, other federal agencies have similar restoration programs. The U.S. Bureau of Land Management's (BLM) Klamath Falls Area Office annually performs 2-3 miles of riparian fencing projects, 2-3 miles of road obliteration, 1 culvert replacement, and 2000-3000 acres worth of prescribed burns (Dana Eckert, pers. comm.). The Winema National Forest performs 3-5 miles of fencing, 10 miles of road obliteration, and perhaps 5 culvert replacements annually (Mike McNeil, pers. comm.). The Fremont National Forest annually conducts 5-15 miles of road decommissioning, 3000-5000 acres of understory thinning and burning, and perhaps 50 acres of watershed improvements which can consist of juniper removal, check dam removal, and streamside willow planting (Mike Montgomery, pers. comm.). A portion of the funding for these projects is provided by the programs sponsored by the ERO. These agencies only conduct projects on federally owned lands, and each agency performs NEPA compliance separately. The Natural Resource Conservation Service funds restoration projects on private lands, restoring about 1000 acres of wetlands, 5 miles of riparian fencing, 2 miles of streambank stabilization, and approximately 5,000 acres of upland projects annually (Kevin Conroy, NRCS, pers. comm.). In addition, state, tribal and private restoration efforts are also being conducted in the basin.

In addition to these efforts, several large scale projects have been initiated in recent years. Prominent among these is the BLM's Lower Williamson River Delta restoration project (restoring historic stream channels and approximately 3,000 acres of wetlands), Reclamation's Agency Ranch (7,000 acres used for seasonal water storage), and The Nature Conservancy's Tulana Farm (a 7,000 acre farm, approximately 5,000 acres of which are planned for wetlands restoration in the next decade). The ERO has contributed funds to several of these projects, separate NEPA documentation has been performed as necessary by the cooperating land management agency.

II. ALTERNATIVES:

The alternatives described below and summarized in Table 1 are largely predicated upon the funding sources from which the ERO provides funds. This by no means represents all conceivable means by which ecosystem restoration could be accomplished, but does represent a range of alternatives within the larger parameters set forth by these programs.

2.1 Alternative 1: Programmatic Approach to Restoration Projects (The Proposed Action)

This alternative would provide for the implementation of a wide range of ecosystem restoration activities, authorizing all of the discussed project types within the guidelines and limits discussed in this document. Standards and Guidelines (S & G's), as specified in Appendix C, would be utilized to ensure that these projects minimize any potential adverse impacts to the environment. During the evaluation and approval process for each project, separate clearance procedures required by the Clean Water Act, the Endangered Species Act (ESA) and National Historic Preservation Act (NHPA) will be undertaken, in consultation with the Army Corps of Engineers, Service endangered species biologists and the State Historic Preservation Office, respectively. All state and local regulations and permits will be acquired as necessary and appropriate.

Utilizing a programmatic approach to analyze the affects of this program allows for a comprehensive, ecosystem wide evaluation of the proposed restoration activities, recognizing the connection and inherent relationship between differing segments of the environment. A programmatic approach also provides for higher degree of efficiency in the processing of the paperwork for these projects, since individual assessments will not be necessary under this programmatic EA.

The specific projects can be grouped into one or more broad categories as listed below. The specifics on these activities are discussed in Appendix D, Description of Restoration Activities & Analysis of Impacts.

Riparian Projects: fencing for livestock management; alternative watering sources for livestock; non-native plant removal/control; native plant establishment/diversification; erosion control; wildlife habitat improvements.

Wetland Projects: fencing; wetland restoration and enhancement; wildlife habitat improvements.

In-stream Projects: habitat complexity and diversity improvements; hydrologic regime improvements; coarse woody debris & boulder supplementation; artificial barrier removal, modification, & creation: fish screens installation, non-native fish removal.

Upland Projects: re-establishment of historic contours; silvicultural treatments including prescribed burning, thinning, tree planting, and juniper clearing; native plant establishment/diversification; non-native plant removal/control; fencing; alternative watering sources for livestock; landslide treatments and erosion control; wildlife habitat improvements.

Road Projects: Road abandonment, decommissioning, & obliteration; road drainage improvements and storm proofing; culvert/stream crossing upgrades.

2.2 Alternative 2: Implementation of a Limited Range of Restoration Projects

This alternative would differentiate between upland and bottom-land projects, authorizing only those activities occurring in wetland or riparian habitats. Upland projects as discussed above would not be considered. Any other project type such as road projects would be conducted only within riparian and wetland areas (defined as areas with wet soils directly influenced by streams and/or containing vegetation dependant on moist soil conditions). This alternative focuses the restoration efforts of the ERO on riparian and wetland areas, allowing more attention, and funds, to be spent addressing the more immediate issues of water quality, wetlands loss, and riparian degradation. Under this alternative, opportunities to address uplands issues such as logging roads, deforested stands, and landslides which affect streams, primarily through sedimentation and subsurface flows, would be lost.

This alternative would also utilize a programmatic approach for compliance and paperwork, adding to the administrative efficiency of the projects being considered.

The types of projects considered under this alternative are listed below. The specifics on these activities are discussed in Appendix D: Description of Restoration Activities & Analysis of Impacts.

Riparian Projects: fencing for livestock management; alternative watering sources for livestock; non-native plant removal/control; native plant establishment/diversification; erosion control; wildlife habitat improvements.

Wetland Projects: fencing; wetland restoration and enhancement; wildlife habitat improvements.

In-stream Projects: habitat complexity and diversity improvements; hydrologic regime improvements; coarse woody debris & boulder supplementation; artificial barrier removal, modification, & creation; fish screens installation; non-native fish removal.

Road Projects: (within riparian corridors) Road abandonment, decommissioning, & obliteration; road drainage improvements and storm proofing; culvert/stream crossing upgrades.

2.3 Alternative 3: Cease Restoration Activities

This alternative would serve as a benchmark against which the other programs would be compared. Under this alternative, new restoration projects would not be considered or funded by the ERO. Previously contracted or obligated projects would be completed, given the legal complications from which a breach of contract might otherwise result. Current trends in water quality and habitat loss would continue, with the likely continued reduction of habitat for threatened, endangered and “sensitive” species populations, and concurrent wildlife and vegetation losses.

2.4 Alternative 4: Continue Current Non-Programmatic Approach to Restoration Activities (The No Action Alternative)

Under this alternative, the current means of analysis for proposed restoration activities on a case by case basis would continue. Individual project type, size and number would be expected to remain unchanged. The environmental impacts of the individual projects would likewise be the same as similar projects conducted under a programmatic agreement. The primary difference would be that the amount of time dedicated towards administering the NEPA process for individual projects would remain high, especially when compared with a programmatic approach, resulting in decreasing administrative efficiency. The ability to analyze the cumulative effects of these programs would likewise be diminished. The amount of paperwork and time consumed in the NEPA process for individual projects would be considerably greater when compared with a programmatic approach, decreasing administrative efficiency. The ability to analyze the cumulative effects of these programs would likewise be diminished.

2.5 Alternatives Considered but Eliminated from Detailed Study:

Easements--Acquisition of easements is not covered under any of the currently used programs. Easements would require NEPA documentation independent of this document, although projects similar to those listed above may be covered if conducted on those easements.
Habitat/land acquisition--Land purchases fall outside the parameters of the programs goals and are not authorized by any of the four current funding sources.

Table 1: Summary of Alternatives

	ALT. 1	ALT. 2	ALT. 3	ALT. 4
Riparian Projects:				
fencing for livestock management	X	X		X
non-native plant removal/control	X	X		X
native plant establishment/diversification	X	X		X
erosion control	X	X		X
alternative watering sources for livestock	X	X		X
wildlife habitat improvements	X	X		X
Wetland Projects:				
fencing	X	X		X
wetland restoration and enhancement.	X	X		X
wildlife habitat improvements	X	X		X
In-stream Projects:				
habitat complexity and diversity improvements	X	X		X
hydrologic regime improvements	X	X		X
coarse woody debris & boulder supplementation	X	X		X
artificial barrier removal, modification, & creation	X	X		X
fish screens installation	X	X		X
non-native fish removal	X	X		X
Upland Projects:				
re-establishment of historic contours	X			X
silvicultural treatments	X			X
prescribed burning	X			X
tree thinning	X			X
tree planting	X			X
juniper clearing	X			X
native plant establishment/diversification	X			X
non-native plant removal/control	X			X
fencing	X			X
landslide treatments	X			X
erosion control.	X			X
alternative watering sources for livestock	X			X
wildlife habitat improvements	X			X
Road Projects:				
abandonment, decommissioning, & obliteration	X	X		X
road drainage improvements and storm proofing	X	X		X
culvert/stream crossing upgrades.	X	X		X

Fish population enhancement--Establishing a fish hatchery for endangered species would assist with restoring the population levels of endangered fish species, however such improvements would not be sustainable without the necessary improvement of essential habitat and water
quality. Costs would be prohibitive, and generally the Oregon Department of Fisheries and Wildlife has jurisdiction over such issues. This type of activity is also outside of the scope of the funding available.

III. The Affected Environment

3.1 Introduction

This section of the EA describes the environment–natural, physical, and societal-- of the Upper Klamath Basin. In order to simplify, the section is divided into definable elements of the environment. Unfortunately, the boundaries of many of these elements are hard to define, so a certain amount of necessary cross-over exists (i.e. with fisheries and hydrology). Attempts were made to limit redundancy while not minimizing the interconnections that exist in the environment. These sections describe the environment as it is at present, including historical changes (whether man-made or naturally occurring) which resulted in these changes.

3.2 General Description

The Upper Klamath Basin is nestled between the eastern foothills of the Cascade Range and the Great Basin Desert region of eastern Oregon. This includes the upper Klamath River, the Butte Valley, and the Lost, Williamson, and Sprague rivers and their tributaries. This area includes most of Klamath County, Oregon, a large part of Modoc County, California, and small portions of Lake and Jackson counties in Oregon and Siskiyou County in California. Landholding falls under a wide range of ownership, including federal (National Park Service, USDA Forest Service, Bureau of Land Management, and several National Wildlife Refuges), state (Oregon Department of Forestry and Oregon Department of Natural Resources), the Klamath Tribes, and private landholders. The area encompasses approximately 12,000 square miles, or approximately 7.5 million acres. The primary town in the area is Klamath Falls in Oregon.

The elevation of the town of Klamath Falls, near the center of the basin, is approximately 4100 feet above sea level. The highest peak in the area, Mount McLoughlin, rises to 9495 feet. Crater Lake National Park is in the northwest corner of the region, Lava Beds National Monument and Tule Lake National Wildlife Refuge are to the south, and the Winema, Fremont, Modoc, and Klamath National Forests occupy the forested mountains surrounding the basin. Historically, the lowlands consisted of extensive wetlands and broad, shallow lakes--Upper Klamath Lake and it's surroundings being the prime example. Otherwise much of the lowland landscape was characterized by lowland Great Basin shrub types, the forests are composed of a mix of hard and soft woods. As a result of extensive wetlands draining in the first half of the twentieth century, much of the former wetlands are now active agricultural lands.

Historical Background: Ample evidence exists of human habitation dating back almost 9,000 years. Flakes, projectile points, and other artifacts are found throughout the region. Historically, three Native American tribal groups have inhabited the area. The Modocs and the Klamaths (two groups closely related by language and tradition), are thought to have inhabited the Upper Klamath Basin for the previous 7,000 years. The Modocs resided in the southern part of the region, surrounding Tule Lake. The Klamath people lived along the shores of Upper Klamath Lake and along the Williamson and Sprague Rivers. The Yahooskin Band of the Snake Indians, a group closely related to the Paiute Tribe, entered the area more recently and occupied lands east of the Basin, but are now considered a part of the Klamath Tribe (Bettles, 1995). Primarily hunters and gatherers, these peoples practiced little agriculture. Fish (especially sucker species), small and large game, and a wide variety of vegetation were used by these peoples for food, clothing, and shelter (Howe, 1968). Contact with white culture, as was all too often the case, led to conflicts, initially resolved by the establishment in 1864 of a reservation along the Williamson and Sprague Rivers. Some members of the Modoc group, led by Kintpuash or Captain Jack, returned to the area south of Tule Lake, precipitating the Modoc War of 1873. After a six month siege in the lava flows of what is now Lava Beds National Monument, this group surrendered and were sent to Oklahoma. The Klamath reservation continued to exist until it was disbanded in 1954 as part of an assimilation policy by the U.S. Government, but in 1975 a fully functioning tribal government was reestablished, and The Klamath Tribes was recognized by the federal government in 1986. The 1990 census showed the tribe to consist of 2,370 members, many of whom are settled in the area around the town of Chiloquin, OR (Klamath Chamber of Commerce, 1999).

European influence in the region dates back to the 1700's with Russian traders establishing posts along the coast and Spanish missionaries exploring from the south. In the 1820's, American fur traders entered the region. Some settlement followed, but it was not until the 1860's, with the establishment of Fort Klamath at the northern end of Klamath Lake, that any extensive influx of settlers occurred. Linkville, later renamed Klamath Falls, was founded soon afterward. Following the conclusion of the Modoc Indian War in 1873, an influx of settlers entered the region, with ranching and farming being the primary employment. After the railroad arrived in 1909, rapid development of the timber and other industries occurred. (Klamath Chamber of Commerce, 1999)

In the early 1900's, Reclamation instituted the Klamath Project, an extensive system of dikes, canals, and dams constructed throughout the basin to drain the marshes and provide irrigation water to previously dry fields. Construction projects continued until the 1960's and brought approximately 200,000 acres under irrigation (USBOR, 1997), creating prime farming and ranching lands. The Klamath Project is still an important element in the economy of the region. Many of the dams constructed on the Klamath River are also used as an important source of hydroelectric power. Agriculture quickly came to be the dominant economic activity in the lowlands, producing large quantities of potatoes, beets, and alfalfa as well as other products. Extensive grazing of cattle--and to a lesser extent sheep--also takes place, both in the cultivated valleys and on the public lands surrounding the basin. Timber harvesting became an important economic activity in the forests surrounding the basin, especially after major railway connections were established between the basin and outside markets in the early 1900's.

3.3 The Physical Environment

3.31 Hydrology:

The Upper Klamath Basin (UKB) has a range of hydrologic patterns within a relatively small geographic area. High levels of snowfall results in substantial release of water as the snowpack melts in the spring. Large amounts of water are thus released to flow down into the basin, either in streams or as ground water. The streams begin in the mountains as classic mountain streams--swift, clear, and cold. As they reach the middle elevations, they begin to slow and have a greater tendency to gather sediment, especially from disturbed streambank sites. Further downstream, these streams and rivers slow even further as they reach flat areas, meandering back and forth and often disappearing into dense marshlands. The highly porous soils of the region encourage groundwater seepage, providing the streams and flatland regions with a underground reservoir of water. These soils are highly prone to compaction and erosion once disturbed. The flatlands and marshes act as additional reservoirs, allowing spring flood waters to spread out over wide areas, dissipating the potentially harmful force of flood waters (USDA, 1998). This seasonal flooding allows sediment to settle in the lowland plains, creating the loamy soil so highly favored for agriculture in the area. This settling effect also acts to filter the water of potentially harmful chemicals.

The streams of the UKB coalesce into several major rivers, the Williamson and the Sprague in the north and the Lost River system in the South. The Williamson and Sprague systems combined to feed Upper Klamath Lake, which is the origin of the Klamath River. Historically, the Lost River looped around between Clear Lake and Tule Lake, forming an essentially closed system. Through the construction of an elaborate set of dams, dikes and canals, the Lost River has lost much of it historic course, and has been connected to the Klamath River system. The Klamath river is one of only three in the western US (along with the Columbia and Sacramento) with sufficient power and with the proper geography to cut through the Cascade Range and exit into the Pacific Ocean. Once out of the UKB, the river forms a dramatic canyon, strengthened as it runs to the sea by the Shasta, Trinity, Scott, and Salmon rivers.

Riparian areas have historically been affected disproportionately from human activities on the landscape. Activities such as land leveling, tiling, ditching, filling, cultivation and logging practices, irrigation and drainage operations, and urbanization have significantly changed the quantity and quality of riparian systems. As a consequence of these alterations, some riparian areas do not fulfill their historic roles as catchment basins to prevent or minimize flooding, as sediment traps and nutrient/chemical filters, as rearing grounds for aquatic species, as sources of food and cover, or as migration corridors for both terrestrial and aquatic species. Changes in the hydrologic regime have resulted in a reduction in vegetative composition and diversity in wetland habitats. Some grazing in riparian areas has resulted in denuded, weedy, and/or compacted riparian areas which no longer shade stream systems, provide structure, diminish storm surges, or filter surface water runoff prior to entering the stream channel (USDA, 1998).

Instream habitats include areas such as pools, sloughs, and side channels associated with a specific reach of a stream system. Currently, some of these instream habitats may not be fully functioning due to absent or insufficient instream and riparian vegetation or structure, high water temperatures, high turbidity levels, or other factors. Degraded hydrologic conditions result in altered habitat function and are suspected to contribute to the current declines in native aquatic species.

3.32 Air Quality

Air quality in the region is highly variable, varying both by location and in quality. Crater Lake National Park and the Sky Lakes Wilderness Area, both of which are at high elevations and on the edge of the Basin area, are classified as Class 1 air sheds, with excellent air quality and visibility. In contrast, the valley floor and much of the Basin frequently suffer from low air quality, specifically in the form of particulate and carbon monoxide emissions. Mountain ranges to the west and winds out of the same direction create an inversion effect, which retains emissions in the low lying areas. Fires, both wild forest fires and prescribed burns, contribute to low visibility in the late summer and early fall. Vehicle emissions and wood stove fires severely affect air quality in the winter. (Jeff Ross, OR DEQ, personal communication).

3.33 Water Quality

Changes in water quality have the potential for severely affecting many plant and animal species, although most have at least some tolerance for variations in water characteristics. Many of the species considered "at risk" in the Klamath Basin have had their living habitat altered by changes in the chemical composition, temperature and amount of sediment carried in the water. Human activities, such as agriculture, logging, road construction, urban development, and water impoundment and diversion, have contributed to these changes. Natural events such as climate change and landslides are also important factors in water quality issues. The combination of these activities has caused major changes in the water quality of the Upper Klamath Basin during the last century.

<u>Chemical</u>: Due in part to the volcanic based soils of the region, stream flows and much of the surface water in the region is unusually high in phosphorous and nitrogen content(ORDEQ, 1996). This, when combined with other factors such as water depth and temperature, allows for an abnormally high productivity level (or eutrophism) in some of the waters of the region, specifically in Upper Klamath Lake and its tributaries. A eutrophic body of water is unusual, but not necessarily detrimental; life has abounded in and around Upper Klamath Lake for millennia despite, or perhaps because of, its eutrophic state. In the last 100 years, however, this characteristic has been exacerbated by the addition of ammonia, nitrogen and phosphorous into the waters, an occurrence linked to the loss of wetland

areas (USGS, 1996). This has led to Upper Klamath Lake being classified as hypereutrophic, and has drastically changed the characteristics of the lake. The resulting displacement of the diverse community of green algae and diatoms by the current mono-culture of blue-green algae gives rise to algal blooms in late summer. These blooms, which cause "dramatic variations in dissolved oxygen and pH" (Kann & Smith, 1999), are suspected to be a major factor in the decline of sucker species in Upper Klamath Lake. These changes have contributed to markedly degraded water conditions important to fish and other organisms such as aquatic mollusks, potentially resulting in massive fish kills (Mark Buettner, pers. comm.). The Lost River system, including Tule and Clear lakes, are considered to be eutrophic or hypereutrophic, as well (ORDEQ, 1996).

Temperature: Water temperature is of concern in particular with regard to cold water fish and invertebrate species, such as bull troat and redband trout and some species of aquatic mollusks. These species are specifically adapted to colder temperatures, although they have a relatively high tolerance for temperature variations (USDA, 1998). Both Lost River and shortnose suckers tolerate high temperatures, but are susceptible to interactions between high water temperature and high pH, which encourages the development of potentially fatal bacteria. High water temperatures have been a trend for several decades, resulting from, in part, the loss of vegetation along stream and river channels and along lakefronts (OR DEQ, 1998). This is caused by a variety of factors, including logging along streambeds, the impact of cattle and sheep both by grazing on riparian vegetation and trampling, and the development of housing, roads and urban areas.

Sedimentation: Increases in the amount of sediment in the waters of the UKB stem from many of the same factors discussed above. Areas impacted by extensive logging and catastrophic wildfires are subject to extensive erosion (Chamberlin, Harr, & Everest, 1991), and overgrazing of livestock can strip banks of their native vegetation, exposing bare soil and allowing it to contribute to sediment loads (Platts, 1991). Roads frequently follow streams, allowing rainfall and snowmelt to wash roadbed materials into the adjoining streams (Furniss, Roelofs, & Yee, 1991). "Sediments fill in deeper hiding cover for fish and smother aquatic plants that provide cover and forage substrate. Suspended sediments shade rooted aquatic macrophytes and encourage phytoplankton production instead" (USDA, 1998. pg. 48). Sediment also fills in the small spaces in the gravel of streambeds, the preferred site for egg laying for sucker and other fish species, thereby preventing the use of these areas. Freshly hatched fish may also be trapped and smothered under this sediment layer (Hicks, 1991).

3.4 Natural Environment

3.41 Fisheries

The Upper Klamath Basin was once, in the Pleistocene epoch (10-25,000 years ago), dominated by a single large lake--Lake Modoc--which stretched from near Tule Lake to Fort Klamath, covering 1,096 square miles. Upper Klamath Lake is the largest remnant of that historic body of water. Although it may always have had an outlet, it provided enough isolation for the evolution of unique species and stocks of fish. Eventually, coastal stocks, such as salmon, steelhead, and Pacific lamprey, invaded the basin and influenced genetic development, but at the same time these species were shaped by the environment of the upper Klamath Basin (Kostow, 1995). As a result, the basin is home to a number of unique species and stocks of fish including 3 unique catastomid (sucker family) species; another 12 species are recognized as native to the upper Klamath Basin (Bond, 1994).

Anadromous Fish: Anadromous (fish which spend part of their lives in salt water but which return to fresh water, inland areas in order to spawn) salmon and steelhead once utilized the upper Klamath Basin in Oregon. Spring chinook salmon spawned as far as Bly on the South Fork Sprague River and steelhead were documented up to Link River. By the early 1900's, the majority of these runs were being diverted by fish-racks at Klamathon for fish culture activities. Completion of Copco Dam, just south of the state line, in 1917 brought the end to runs of anadromous fish to Oregon's portion of the Klamath Basin (Fortune, et. al. 1965).

Lost River & short nose suckers: Surveys for Lost River and short nose suckers carried out in the Klamath Basin prior to and after the construction of Reclamation's Klamath Project and Link River Dam indicated that sucker populations were very large. Both species are endemic to the Upper Klamath Basin. Cope (1884) noted that Upper Klamath Lake sustained "a great population of fishes" and "was more prolific in animal life" than any body of water known to him at that time. Gilbert (1898) noted that the Lost River sucker was "the most important food-fish of the Klamath Lake region." At that time, spring sucker runs "in incredible numbers" (Gilbert 1898) were relied upon as a food source by the Klamath and Modoc Indians and were taken by local settlers for both human consumption and livestock feed (Cope 1879, Coots 1965, Howe 1968). Sucker runs were so numerous, in fact, that a cannery was established on the Lost River (Howe 1968) and several other commercial operations processed "enormous amounts" of suckers into oil, dried fish, and other products (Andreasen 1975). Even through the 1960s and 1970s, runs of suckers up the Williamson and Sprague Rivers were large enough to support a popular sport fishery. The first concerns were expressed over declining sucker populations in the 1960's (Vincent 1968, Golden 1969). Surveys conducted in 1984-1986 indicated a major decline in Lost River and shortnose sucker populations (Bienz and Ziller 1987) and the fishery was closed in 1987. Both Lost River and shortnose suckers were federally listed as endangered species on July 18, 1988 (Federal Register 53:27130-27134).

Not all of the factors responsible for the decline of these species are clear, but they are thought to include the damming of rivers, dredging and draining of marshes, instream flow diversions, over-harvest, introductions of non-native fish, forestry & road building practices, grazing, and a shift toward hypereutrophication and poor water quality in Upper Klamath Lake and waters downstream (USFWS, 1993).

Bull Trout: On 10 June 1998, the USFWS listed the Klamath River population segment of the bull trout (*Salvelinus confluentus*) and the Columbia River population segment as threatened. Bull trout populations are threatened by habitat degradation, passage restrictions at dams, and competition from non-native brown and brook trout (USFWS, 1998).

Bull trout populations are known to exhibit two distinct life history forms in the Klamath Basin: resident and fluvial. Resident bull trout spend their entire life cycle in the same (or nearby) streams in which they were hatched. Fluvial populations spawn in tributary streams where the young rear from one to four years before migrating to a river, where they grow to maturity (Fraley and Shepard 1989).

Historical references indicate that bull trout were once widely spread throughout much of the Basin. Records report bull trout in Sevenmile Creek and the Williamson River (Cope, 1879; Gilbert, 1897). Bull trout have also been reported in the Wood River (Dambacher et. al., 1992; Buchanan, et. al., 1997). Creel census data from 1953 record angler catches of large bull trout from Long Creek (Buchanan et. al., 1997). No adfluvial bull trout have been recorded from Upper Klamath or Agency lakes.

Bull trout appear to have more specific habitat requirements than other salmonids (Rieman and McIntyre, 1993). Habitat characteristics including water temperature, stream size, substrate composition, cover and hydraulic complexity have been associated with their distribution and abundance (Bottom et. al., 1985; Dambacher et. al., 1992; Jakober, 1995; Rieman and McIntyre, 1993). Elevated water temperatures can act as an impediment to movement and temperature may be a strong determinant of bull trout distribution (Williams and Mullan, 1992; Shepard et. al., 1984). Warm temperatures downstream of reaches occupied by bull trout are likely to preclude the downstream expansion of their distribution. Water temperature also appears to be a critical factor in spawning and early life history of bull trout (Fraley and Shepard, 1989; McPhail and Murray, 1979; Riehle, 1993).

The current abundance, distribution, and range of bull trout in the Upper Klamath Basin is greatly reduced from historic levels and bull trout have been extirpated from at least one, and possibly three streams since the 1970's. Klamath Basin bull trout sub-populations are considered at high risk of extirpation, because each sub-population consists of only the resident form, and currently survives in fragmented and partially degraded habitats. Low numbers of individuals, low reproductive potential, interspecies competition and predation from brook and brown trout, and hybridization from brook trout are also factors in their decline (Light et. al., 1996).

Redband Trout: Redband trout (*Onchorhynchus mykiss*) in the closed Great Basins have been petitioned for listing under the Endangered Species Act, effective in 1999. In the Klamath Basin, the Service is currently conducting an informal population status review.

The Oregon basin redband trout occupy streams and lakes in seven Pleistocene lake beds in Oregon and northern California. Populations in each of these basins are completely isolated by natural geological features, except for those in the Klamath Basin. The Klamath Basin redband trout populations have adfluvial or resident life histories. The Klamath Basin includes several lake/marsh/stream subsystems. The Klamath Lake system supports the most functional adfluvial life history system among the Great Basins. The Wood, lower Williamson and Sprague rivers still provide access to Klamath Lake and regular, annual migrations of redband trout still occur. In the Williamson and Sprague headwater areas, migration corridors between Klamath and Sycan marshes and their adjacent streams are less functional due to irrigation diversions and thermal blockages. Great Basin redband trout have also been impacted by the introduction of non-native species, particularly hatchery raised rainbow trout which are capable of interbreding with local endemic redband.

Human Impacts: The major human impact over the last 150 years has been the fragmentation and loss of components of the marsh/lake/stream systems. The upper basin floor was developed for agriculture, a process which included extensive diking, channeling, draining and loss of marshlands. Irrigation diversions were constructed on most streams and caused dewatering and physical blockages for both upstream and downstream migrating trout. Cattle grazing also contributed to channel destruction in some locations. Changes in water quality, temperature, and sedimentation are also suspected to have adversely impacted fish populations.

3.42 Wildlife

Invertebrates: Knowledge of most invertebrates and their status is minimal (Cooperrider and Garrett, 1997). Mollusk (snails, slugs, mussels, and clams) diversity in the UKB is unusually high (Frest and Johannes, 1998) and there are nearly 30 species of freshwater mollusks found only in the UKB. Most freshwater mollusk species are sensitive to pollution regardless of source (Burch, 1989). Most of the mollusks in the UKB are cold-water forms, preferring clear, cold, unpolluted water with dissolved oxygen near saturation (Frest and Johannes, 1998). Prior to considerable human disturbance, the UKB contained an abundance of mollusk habitat. Grazing, water diversions and similar alterations to springs, rivers and other wetland habitats has influenced the loss of many mollusk communities in the UKB. However, Frest and Johannes (1998) report that Upper Klamath Lake retains the most intact mollusk fauna of any of the pluvial lake systems in the western U.S.

Those macroinvertebrates which serve as a primary food source for many fish, birds, amphibians and bats are concentrated in aquatic communities such as lakes, marshes, rivers, springs and riparian areas. Although many macroinvertebrates have a terrestrial stage to their life cycle, i.e. dragonfly (Odonata), the egg, pupal and larval stages occur in the aquatic stage 95% of the year. Although no macroinvertebrates are federally listed in the UKB, benthic macroinvertebrates are a primary food used by Lost River and shortnose suckers (Scoppettone et. al. 1995, (Markle and Simon 1993), and bull trout (Bowerman, pers. comm), in addition to many migratory waterbirds (Pederson and Pederson 1983).

Each aquatic microhabitat produces a unique community of macroinvertebrates (Thorp and Covich 1991). The type of macroinvertebrate community (the diversity of species and the species abundance) is a function of the physical and chemical characteristics of the aquatic microhabitat (Cummins 1966). The presence or absence of a specific macroinvertebrate community in some aquatic habitats may serve as indicators of water quality and riparian function (EPA 1999). In turn, the presence or absence of specific fish and birds which are species-specific in macroinvertebrate selection may indicate quality of the aquatic or riparian habitat. Macroinvertebrate communities can be affected when gravel habitat becomes buried by increases in sedimentation (Cordon and Kelley 1961, Waters 1995), loss of riparian habitat, non-point source and point source pollution from run-off, and a permanent loss of wetlands (Cooperrider and Garrett 1997).

Since 1998, the ERO has been acquiring data in the Sycan and Sprague Rivers using the Rapid Bioassessment protocol for sampling macroinvertebrates developed by EPA (EPA, 1999). The Fremont NF sampled macroinvertebrates on the South Fork Sprague in 1995 (USDA, 1995), the Winema NF sampled Sycan River below Sycan Marsh in 1989 (USDA, 1997) and the BLM sampled Spencer Creek in the middle 1990's (K. Bail-pers.comm.). This data can be used as a base-line with which to monitor future restoration projects.

<u>Amphibians & Reptiles</u>: Several species of amphibians in the UKB have been identified are sensitive or declining, leading to the belief that many of the amphibians in this region are at risk (Cooperrider and Garrett 1997). Presently, in the UKB, the Oregon spotted frog is only known to occur in five small populations (Hayes 1997), and is currently a candidate species for federal listing. The non-native bullfrog occurs throughout permanent, deepwater habitats at lower elevations in the UKB and competes with and is a predator upon native amphibians (St. John 1987, Leonard et al. 1993). The diversion of springs and elimination of marshes, streams and riparian habitats has eliminated considerable amphibian habitat in the UKB (Hayes 1997). There are 17 species of reptiles found in the UKB. The gopher snake and two species of garter snakes are probably the most frequently observed snakes in the UKB and most commonly seen near riparian areas. Several other species of lizards and snakes occur in the UKB as well, including the colorful California mountain kingsnake and the western rattlesnake.

<u>Birds</u>: The UKB is an essential component of the Pacific Flyway, and the area is heavily used by migratory and resident birds of all types. Waterfowl populations have declined in the UKB as the populations are only about 1/4 to 1/8th of historic populations (J. Hainline, pers. comm.), although the UKB still supports a large seasonal population. Both Lower Klamath and Tule lakes have been considerably reduced in size by reclamation projects, resulting in large losses of critical wetland habitat (D. Mauser, KBNWR, pers. comm.) Several species of colonial waterbirds, including great egrets, great blue herons, & black crowned night herons were nearly extripated from the region as a result of hunting for their feather plumes (used to make ladies hats), until President Theodore Roosevelt established the Lower Klamath National Wildlife Refuge as the nation’s first waterfowl refuge in 1908. Many species of waterfowl and neotropical migratory birds are suspected to have declined across the UKB due to habitat loss (Cooperrider and Garrett 1997). A diversity of marsh and shorebirds occur in the UKB. However, populations of yellow rail, least bittern, long-billed curlew, and tricolored blackbird are declining within UKB. The spread of juniper woodlands across former grasslands and sagebrush habitats has probably altered the abundance and distribution of many shrub-associated species, including sage and sharp-tailed grouse. Native quail and grouse have all suffered declines associated with the loss of their habitats (Cooperider and Garrett, 1997). However, the recent delisting

of the peregrine falcon and the anticipated delisting of the American bald eagle represent a considerable success for wildlife conservation efforts; bald eagles are abundant in the basin during winter months.

Mammals: The reduction of habitat throughout the region has affected a variety of mammal species. Carnivores have been especially impacted. The grey wolf and grizzly bear are no longer found in the basin. The Canada lynx is proposed for federal listing, and another 3 species are considered at risk. A diversity of rodent species occur in the UKB, among these the white-footed vole is a species of special concern in the UKB. Bats are among the most sensitive mammals to alterations to riparian ecosystems (Brown and Berry 1991, Taylor 1995) as changes in their habitat can drastically alter species populations. Five of fourteen species of bats in the UKB are considered at risk. Game species have also been impacted by the loss of riparian habitat, in both upland and bottomland areas. Pronghorn antelope and sage grouse have been affected by the depletion of water by juniper and changes in the fire regime on the plains and hills in the eastern part of the basin (Ron England, pers. comm).

Threatened & Endangered Species: For a complete list of Service listed, proposed, and candidate species, as well as those categorized as species of special concern, please see Appendix B.

3.43 Vegetation

The UKB has several distinct vegetation zones based on the dominant plant species found in the area. These zones are distinguished largely by elevation and exposure. Riparian and wetland areas occur throughout these zones, but have distinct characteristics which are uniform throughout the UKB. Wetlands, due to their importance in the programs under discussion, are considered at some length.

Wetlands: The term “wetlands” is used to describe the wide variety of habitats more commonly described as bogs, swamps, fens and marshes. Wetlands are defined as those areas having predominantly water-loving (hydrophylic) plants at least periodically, where the soils are saturated most of the year, and which are submerged for at least two weeks a year (Guard, 1995). Standing water can be as deep as 2 - 3 feet, but is usually considerably less. Wetland habitats vary greatly, and are usually distinguished by the amount and duration of immersion in water. In deeper water, free-floating and submergent species such as pondweed, watercress, and duckweed are common, and there are also a few species which are rooted in the mud underwater, notably the wocus lily. Closer to shore are species able to survive seasonal fluctuations in water levels, such as the buttercups, speedwells, smartweeds, water parsley, plantains, several grass species as well as sedges, rushes, and cattails. Floodplains and slightly higher ground are often dominated by shrub swamp–featuring Hooker’s & Geyer’s willows, serviceberry, and exotic hawthorn and Russian olives--and forested wetland communities–dominated by aspen, ash, dogwoods, and stinging nettle.

Wetlands play a critical role in hydrologic flow, water quality, and fish & wildlife habitat. Many wetlands are lowlying areas adjacent to streams and lakes. During springtime high flows, these streams often overflow, flooding the nearby terraces. This lessens the potentially destructive flows of water proceeding downstream, helping to minimize downstream erosion. As the waters recede, these wetlands slowly release the accumulated water back into the stream or into the overall water-table, thus acting as impromptu water storage areas. In addition, the heavy soils most frequently associated with wetlands act as sponges, absorbing water and only slowly giving it up. This acts to provide many streams in the UKB with a continuing flow of water though the dry summer months, providing essential habitat to many aquatic and riparian species. Wetlands act as water filtration systems, preserving and improving water quality. Wetland vegetation traps or consumes pollutants and waste products, and the slow moving water allows particles to settle out, reducing the amount of sediment and nutrients in stream flows (Gearheart, 1995). Healthy wetlands vegetation also stabilizes soil, acting with riparian vegetation to help prevent erosion. Wetlands in the UKB provide highly valuable wildlife habitat, the UKB is a critical stopover for waterfowl using the Pacific Flyway as well as supporting a large seasonal population. The wetlands of the region also provides highly valuable habitat to raptors, particularly bald eagles. The Klamath Basin is home to the largest population of wintering bald eagles in the lower 48 states. Mammals, amphibians, reptiles, fish and aquatic mollusks all use wetlands and many are dependent on them for their survival.

It is estimated that prior to white settlement, there were 350,000 acres of wetlands in the UKB. By the 1960's, there were approximately 75,000 acres (BOR, 1985). Thus, approximately 80% of the wetlands in the UKB had been drained, diked, and converted to agricultural use, and removed from their historical role in the landscape. The vast majority of this loss has been in the southern portion of the UKB, where extensive portions of Lower Klamath and Tule lakes were converted to agricultural lands in the first half of the twentieth century. Over 200,000 acres of land were under irrigation by the Klamath Project alone as of 1979, much of this converted wetlands. (BOR, 1999) Extensive lands in the northern portion of the basin, including wetlands surrounding Upper Klamath Lake, and Sycan and Klamath marshes, have also been converted and drained for agriculture.

Riparian: Stream-side vegetation varies to some degree on the elevation and flow characteristics of the stream, but some general statements can be made. Streams in the mountains generally possess fast moving water which cuts deeply into the channel. This results in a narrow corridor of riparian vegetation along the stream, with the dominant forest type nearby (USDI/USDA, 1997). Vernal pools, ponds, and lakes may form, creating wetlands where the water is shallow and forming narrow riparian areas with surrounding forest along steeper banks (Lake of the Woods being an prominent example of the latter). Sedges, rushes, water tolerant grasses, cattails and willows are common at stream-side; aspen, maple, and oak are found further up the banks (Yocom & Brown, 1971). Streams and rivers at lower elevations in the UKB tend to be slower moving, with wider riparian vegetation bands. The rivers' edges are still dominated by sedges, rushes and grasses, the banks are typically dominated by large willows and cottonwoods. Throughout riparian corridors, this vegetation is critically important to stabilize the stream-bank, regulating natural and human caused erosional forces and thus keeping sediment out of the water course. It also provides valuable forage and habitat for a wide variety of wildlife.

In many areas in the UKB, grazing, logging, and development have negatively affected riparian corridor vegetation. Selected streams and rivers adjacent to grazing lands have unstable banks due to a loss of native vegetation. Logging activities have disturbed natural hydrologic patterns, resulting in increased surface flows of water and increased sedimentation (USDI/USDA, 1997; USDA, 1998). Subsurface water seeps into many of the streams throughout the season, providing streams, and the vegetation along them, a steady water source after the snow melts. Disturbing these subsurface flows interrupts this cycle and places stress on the plants in the summer and fall as streams become reduced to trickles, especially in a region with only little rainfall. Urban development has also increased pressure on riparian corridors. Much of the Lost River system has been tamed and rerouted into an extensive system of dikes and canals possessing little riparian vegetation on their banks (USDI, 1999). Many of the rivers and streams feeding Upper Klamath Lake have been similarly channeled, mostly in the lowland areas deemed suitable for agriculture.

Sagebrush grasslands: Historically, many of the valley bottoms of the UKB were composed of cold desert shrub communities which dominate much of the Intermountain West region. In the UKB, this vegetation type is dominated by big mountain sagebrush commonly associated with native bunch-grasses, usually Idaho fescue and wheatgrass (USDI/USDA, 1997). At first glance stark and desolate, there are in reality a surprising diversity of species found here, ranging from rabbit brush shrubs to small annual flowers.

In the UKB, the desert shrub community has been reduced by at least 25% over the last century (USDI/USDA, 1997), as sagebrush lands have been converted to agricultural purposes. In many locations the only areas with pre-settlement vegetation are the hills in the south part of the basin, as all of the flat lands are now farmland. Many of the hills to the north and east of Klamath Falls have been developed for housing, furthering the loss of native vegetation.

Much of the sagebrush desert remaining has been seriously altered by a variety of factors. The invasion of exotic species, including cheat grass, Russian thistle, several knapweeds, and toadflax, has changed the natural species composition. The suppression of brushfires throughout the west has allowed sagebrush to dominate at the expense of native bunchgrasses, degrading wildlife habitat for grazing species such as pronghorn. Wildfire suppression has also been a factor in the expansion of western juniper far beyond it's historical abundance. Juniper is very hardy and is known to consume large amounts of water, and may be responsible for lowering water tables other species are dependent upon (USDI/USDA, 1997).

Forests: The forests surrounding the basin are primarily characterized by eastside types and westside types where elevations range from about 4,000 to 7,000 feet with some mountain peaks above 9,200 feet. From the summit of the Cascade Mountain Range east to Highway 97, the forest is comprised of marshlands and meadows to fir and mixed conifer (west side type). Tree species vary greatly and include shasta red fir, grand fir, white fir, incense cedar, ponderosa, lodgepole, and western white pines. Hardwoods present around meadows and streams would include willows, aspen and cottonwoods. On the eastside, which is characterized by broad, flat valleys alternating with generally low north-south ridges; the forest is comprised of marshlands and meadows to stands of ponderosa pine, lodgepole pine, and western juniper. Subalpine communities occur at the higher elevations (USDA, 1990).

Forest composition, structure, and disturbance patterns have changed significantly with the disruption of natural fires through fire suppression. Human intervention has brought about these changes through a combination of timber harvesting, fire suppression, and/ or livestock grazing. Lack of frequent, non-lethal underburns has resulted in an increase in fuel loading, duff depth, stand density, and a fuel ladder that can carry fire from the surface into the tree crowns. The increase in fire intervals, without equivalent fuel reductions, has resulted in much higher fuel loads, fireline intensities, and fuel consumption when fires do occur. This causes much higher mortality of the dominant overstory, as well as higher potential for soil heating and death of tree roots and other understory plants (USDI/USDA, 1997).

Threatened & Endangered Species: In the UKB, Applegate's milkvetch (*Astragalus applegatei*) is the only currently federally listed endangered plant species. Applegate's milkvetch is a member of the legume family, and is found in only very limited numbers near the town of Klamath Falls. Existing populations and potential habitat have been limited due to habitat changes brought about by the draining of wetlands, regulation of floods, urban development, and invasions of non-native species. A recovery plan has been in effect since 1998 with the goal of achieving six self-sustaining populations. Currently there are three known populations, only one of which is considered large enough to be self-sustaining (Gisler & Meinke, 1998).

3.5 Social Environment

The population of the area under consideration is approximately 70,000, extrapolated for the region from Klamath County's 1997 census figures of 61,000 (Klamath, 1999) The dominant economic activities are still agriculture and timber harvesting, although light industry and service sector jobs have been increasing in importance for the past decade. Tourism is also becoming an increasingly important source of jobs and revenue throughout the area. The timber industry has been declining in recent years, and the listing of the northern spotted owl as endangered in 1990 slowed timber activities occurring on federally owned lands in the region and contributed to the loss of a number of timber industry jobs. Overall unemployment in Klamath County is considerably higher than the national average, most recent figures show an unemployment rate of 8.1% (Klamath, 1999).

IV. ENVIRONMENTAL CONSEQUENCES

This section discusses the short and long term effects of the alternatives defined above. Here the consequences of the overall program of restoration activities will analyzed. This section looks at the direct, indirect, and cumulative impacts of the program options. The effects of the specific projects are analyzed in Appendix D, Description of Restoration Activities and Analysis of Impacts. Appendix C defines the Standards & Guidelines which will be followed to minimize the impacts of these actions.

As defined by CEQ regulations, consequences (or effects), include:

Direct effects, which are caused by the action and occur at the same time and place.

Indirect effects, which are caused by the action and are later in time or further removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air & water and other natural systems, including ecosystems.

Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.(CEQ, 1986)

4.1 CONSEQUENCES of ALTERNATIVE 1: THE PROPOSED ALTERNATIVE

This alternative would authorize the full use of a programmatic approach to ecosystem restoration activities, authorizing all of the discussed project types within the guidelines and limits discussed. More detailed descriptions of these activities and their expected impacts are described in Appendix D, Description of Restoration Activities & Analysis of Impacts. Standards & Guidelines (S & G's), as described in Appendix C, would be utilized to ensure that these projects minimize any potential adverse impacts to the environment. This programmatic approach allows for a comprehensive, ecosystem wide approach to restoration, recognizing the connection and inherent relationship between differing segments of the environment. The use of a programmatic EA is the most efficient means for analyzing the cumulative effects of these projects, especially given the similarity of the project types and the consistency of the environment in the Upper Klamath Basin.

4.11 Direct Effects:

<u>Hydrology</u>: Direct effects resulting in changes to the hydrology would occur from instream projects utilizing a variety of structures designed with large woody debris and other natural materials. These would be designed to alter stream & river flows, resulting in deflected, re-channeled, and dispersed

flows. Flow deflections would improve and promote natural vegetation composition and diversity, decrease flow velocities, and increase water storage and recharge rates. (The type of structures and their effect are described in more detail in Appendix D.)

Air Quality: Many of these projects will result in temporary degradation of air quality, primarily as a result of construction activities (exhaust fumes, dust, etc.). Silvicultural treatments may involve prescribed burns and/or the burning of slash piles, which will result in smoke and ash in the air for short periods of time. Burning activities will be conducted only under conditions and seasons appropriate to such activities, and in full compliance with federal, state and local regulations. Burn permits will be acquired as necessary.

Water Quality: Short-term disturbance to water quality may occur, again as a result of construction activities. This disturbance will primarily take the form of stirred up silt and some soil slumping into streams. By following the attached S & G's, these impacts will be minimized, though a certain amount of disturbance is inevitable.

Fish: Fish species would suffer from some short term decrease in water quality, as well as be directly disturbed by construction activities as part of many restoration projects. Through the utilization of S & G's, these projects would be designed to minimize or eliminate these disturbances altogether, and would be not likely to adversely affect these species. Many of the instream project types would have immediate and beneficial impacts on fish species by adding cover and sheltering areas for fish, as discussed in Appendix D. Although not extensively studied, existing data suggests that efforts to replicate known favorable habitat conditions in degraded areas will provide fish species with improved feeding, resting, spawning and rearing habitats (Reeves, et al, 1991). The installation of fish screens would prevent fish from entering canals and diversions where they may be injured or killed. Fish screens and other access limiting structures may also be utilized to restrict non-native and undesirable fish species from protected stream reaches. The removal of non-native fish species would help prevent the cross-hybridization of species, limit competition for food and cover, and remove potential predators, especially of larval and juvenile stages. The removal of artificial barriers, including small dams, would provide access to new habitat and may be designed to connect previously isolated habitats.

Wildlife: Wildlife of all varieties would similarly be affected by construction and other potentially disruptive activities. Prescribed burns and other silviculture treatments may affect upland species, and riparian area species may suffer temporary disruptions due to restoration projects instituted in riparian and wetland corridors. Very small numbers of individuals may be killed or injured as a direct result of work performed. The adherence to the S & G's would minimize these impacts, both through guidance on work practices and the timing of project activities to least interfere with wildlife species. Wildlife would benefit from the addition of nesting and roosting structures in both upland and riparian areas. Vegetation thinning and clearing would result in improved foraging habitat for various species, while re-vegetation projects would provide additional cover, food sources, and nesting habitat.

Vegetation: Vegetation would likewise be negatively impacted by construction activities, which may result in trampling, crushing, and removal of some or all vegetation at project sites. The attached S & G's also address this issue, and would minimize these impacts. Direct beneficial effects to vegetation would occur as a result of seeding and transplanting of plant species at work sites, resulting in improved species diversity and density. Existing vegetation would benefit from the removal of non-native species and highly water-consumptive species such as juniper, and the thinning of trees to reduce competition, lower water consumption, and open the canopy to sunlight. No projects would be conducted in known locations of Applegate's milkvetch which would have potential adverse impacts, and surveys would be conducted under Section 7 of the Endangered Species Act in potential habitat. Restoration projects may be designed to provide habitat in conjunction with recovery efforts for this species.

Social/Economic: Some of the funding sources currently used have provisions to encourage the employment of local workers, many of whom were displaced by recent declines in the timber trade. These projects would provide needed employment opportunities to these workers, a factor especially important given the current high unemployment rate in the Upper Klamath Basin. Materials and supplies would be purchased, when extent possible, locally, providing an additional economic benefit to the area. Training in a variety of construction techniques for habitat restoration would be provided to these workers, providing them with additional job skills.
In order to prevent potential adverse impacts to cultural resources, archeological clearances for all work site will be obtained in coordination with state historical preservation offices.

4.12 Indirect Effects:

Hydrology: Many of the proposed projects would have indirect effects on the hydrology of the region. Upland projects such as reforestation, de-compaction and re-contouring are designed to slow flows of surface water and allow moisture to seep into the soil and flow as sub-surface groundwater. This would restore a more gradual release pattern of water into streams and springs, allowing formerly perennial streams renewed sources of moisture and improve the timing of the flows in streams. Projects such as juniper control and native tree thinning would help reduce excessive water consumption, also releasing water for percolation into sub-surface flows. Lowering levels of sediment in streams--by land slide and stream-bank stabilization, road work, and fencing banks from grazing–would lower the scouring potential of stream flows, thus lessening the undercutting and gullying associated with high sediment loads. Creation of new or restoring old wetland areas allow for spring flood surges to disperse, again slowing high and potential destructive flows, and allowing for a gradual release of moisture to downstream areas. Road decommissioning and improvement projects also help with problems resulting from surge flows and spring runoff, some roads are inappropriately designed and allow runoff to become channeled, instead of allowing more natural downhill flow patterns.

Air Quality: No indirect impacts would result to air quality from this alternative.

Water Quality: A primary focus of the restoration efforts in the basin are oriented towards improving water quality, although most of the benefits are indirect results of other activities. Improvements in the chemical composition of water would result from the establishment of wetlands which have well established qualities for filtering chemicals out of water (Guard, 1995). Wetlands are especially good at absorbing phosphorous and nitrogen, chemicals which are primarily responsible for the hyper-euthropic conditions in the lakes of the basin. Fencing around riparian and wetland regions restricts access by livestock, minimizing potential impacts from grazing and trampling. Establishment of rotational grazing patterns via fencing projects lessens concentrations of livestock in potentially sensitive areas and allows vegetation opportunities to filter excessive nitrogen and other potentially harmful chemicals out of the water prior to its flow further downstream.

Temperature improvements occur from the shading of streambanks by trees and other vegetation. This comes about both as a direct result of re-vegetation projects and from the exclusion (by fences and alternative grazing procedures) of livestock from riparian and wetland areas, which is often sufficient to encourage natural recruitment of native plant species. Shade does not in of itself lower water temperatures, rather it prevents solar radiation from heating the water, with an end result of lower water temperatures further downstream.

Alterations in stream patterns which slow flows would allow for sediments to drop out of the water column, decreasing sedimentation loads. Wetlands and flood plains act as filters for sediment as well as chemicals, further reducing sediment loads downstream. Restrictions of livestock along streambanks would help prevent streambank erosion, the muddying of water and stirring up of stream beds by livestock hooves, and the loss of stream side vegetation resulting from livestock consumption and trampling. In-stream structures would act to slow flows and trap sediment, lessening sediment loads downstream.

Sedimentation would also be indirectly affected by upland and road projects. By encouraging sub-surface flows (as describe above) instead of surface runoff, less soil will be moved downwards with the water. Unless stopped, these particles will eventually enter streams, adding to the sediment load (FISRWG, 1998). Landslide stabilization and rehabilitation and other erosion control projects are also very important for the same reason. Road projects, either removal or improvement, would be designed to lessen the amounts of fine roadbed material which otherwise may be washed off roads and into the streams.

Fish: Favorable conditions for fish species would result from improvements in water quality. Water chemistry and temperature are documented as being limiting factors for the special status fish of the region; it is assumed that improvements in these characteristics would result in improved conditions for these fish species which would assist efforts for species recovery. Reductions in sediment loads in streams would improve spawning habitat, improve fry survivability, and prevent sediment from adhering to fish gills and interfering with respiration. Streamside and wetlands re-vegetation projects would provide shade to fish, increase numbers of invertebrates used as food sources, and create resting and spawning habitat.

Wildlife: The indirect effects of these programs would be largely beneficial to wildlife species. Re-vegetation projects would provide increased cover, forage, and living habitat for a wide variety of species. The restoration program would improve physical characteristics (e.g., width, depth, substrate, riparian zone) of streams, water quality (e.g., temperature, dissolved oxygen) and in many cases, the immediate upland habitats (Cooperrider and Garrett 1997). It is expected that such habitat improvements would have a positive effect on the mollusk fauna and other invertebrates within the UKB. The restoration of riparian and wetland habitats has a strong potential to benefit reptiles and amphibians, in particular the Oregon spotted frog. Invertebrate populations would similarly benefit by the re-establishment of their primary habitat. Bald eagles and spotted owls would benefit primarily as a result of habitat improvements resulting in increases in prey species. Game animals would benefit from new sources of browse and cover resulting from riparian projects.

Vegetation: Vegetation will benefit indirectly from changes in the hydrologic regime, changes which would allow more gradual release of water from improved sub-surface flows and from wetlands and floodplains. Some areas not directly impacted by re-vegetation projects would see natural recruitment of native vegetation as water availability rises. Erosion and landslide control projects would stabilize soils, allowing vegetation to become established on previously unstable slopes. Fencing projects would exclude livestock or minimize grazing, allowing native vegetation to become re-established.

Social/Economic: The indirect impacts on the social and economic environment are difficult to define. For each job created, there is a certain "trickle down" effect to the economy, as other people and businesses benefit from the spending of the employed. An even less tangible, but very important benefit results from improved public relations and perceptions of the public towards federal government programs; many federally funded restoration activities result in visible improvements to the landscape performed in cooperation with local landholders. Equally important is the education and outreach effect of these programs, promoting improved public understanding on the means, goals, and availability of restoration programs.

4.13 Cumulative Effects:

Ecosystem restoration is a relatively new field, and the long-term effects are not clearly understood. The assumption is that by restoring areas negatively impacted by natural processes and human activities during the last century, water quality and habitat conditions would be sufficiently improved so as to allow key indicator species (threatened, endangered, or sensitive) greater opportunities for recovery to sustainable population levels. In the Upper Klamath Basin, the environment has been significantly impacted by the human activities of the past 100 years. As stated earlier, an estimated 80% of the original wetlands in the basin had been converted to farmland and grazing pasture. Riparian corridors have also been significantly impacted, though no exact figures are available for the extent of this impact.

The types, numbers, and sizes of projects funded annually by the ERO varies greatly from year to year.

Since 1994, the ERO has been involved in almost 200 restoration efforts in the Upper Klamath Basin conducted on both federal and private lands. These projects have resulted in the restoration of approximately 3,200 acres of wetland and the enhancement of another 42,000 acres. Riparian fencing projects have resulted in approximately 110 miles of new fence lines along riparian corridors, with associated revegetation. Upland work has resulted in 54 miles of road work, and 30 miles of fencing projects (Table 2)

Table 2: Estimated annual totals for ERO funded restoration projects (table based on current ERO project data; 1999 data incomplete).

Project type	1994	1995	1996	1997	1998	1999	Total
Riparian fencing	37.56 miles	18.5 miles	13.5 miles	27 miles	9.0 miles	3.5 miles	109.06 miles
Riparian vegetation	425 acres			25 acres	155 acres		615 acres
Wetlands enhancement	15741 acres	12005 acres	9800 acres		5020 acres		42566 acres
Wetlands restoration	770 acres	160 acres		860 acres	820 acres	660 acres	3270 acres
Instream			1.25 miles	2 miles		1.5 miles	4.75 miles
Soil Stabilization	2.5 miles		.5 miles			.5 miles	3.5 miles
Road work	2 miles	2.5 miles	.25 miles	24.5 miles	.25 miles	24.8 miles	54.3 miles
Upland restoration	15 acres			505 acres	1546 acres	180 acres	2246 acres
Upland fencing	16 miles	9.2 miles		5 miles	.5 miles		30.7 miles

It is expected that funding will continue for these types of projects over the next ten years, and that projects would reflect trends similar to those above. These future projects would constitute an important element to the overall goal of ecosystem restoration, and contribute to improvements in water quality and in habitat conditions. In addition, these impacts are of a beneficial nature to the species concerned and to the environment as a whole. However, given the enormity of changes which have taken place in the basin in the last 100 years, continuing the current scope of restoration efforts would not constitute a significant impact to the overall environment. When compared with the loss of over 200,000 acres of wetlands, and habitat degradation from a variety of human and natural caused factors, current restoration efforts conducted by the ERO are important but not of a highly significant nature. This conclusion will require re-evaluation when the time frame for this EA concludes in the year 2010.

As discussed in the introduction, the ERO is one of several organizations conducting restoration projects in the basin. The Forest Service and the BLM each have independent programs, and The Nature Conservancy has two large projects (approximately 5,000 acres each) in progress along the north side of Upper Klamath Lake. Increasing public awareness of water quality issues has resulted in numerous private landholders conducting restoration projects on their land independent of government programs, as well as in cooperation with various federal, state and local initiatives (i.e. NRCS). Although the overall results of these combined projects are difficult to accurately predict, it is assumed that they will result in beneficial results to the water quality of the region, especially in terms of the needs for the endangered fish species of the region. Other environmental and social benefits are also expected to be realized by these programs. The ERO's projects are an important contributing element to this as well as the overall goal of ecosystem improvement, and play an especially important role in positively influencing public opinion.

The proposed alternative offers the best opportunity for achieving the ERO's goal of promoting restoration, and for resolving the stated need and purpose of this restoration program. It allows for a wide range of projects, in both the uplands and in riparian and wetland areas, which promotes achieving sustainable ecological balance throughout the ecosystem. Furthermore, by utilizing a programmatic approach to the administrative requirements of NEPA legislation, this alternative would minimize the time and costs associated with administering the ERO environmental compliance processes, thus enhancing administrative efficiency.

4.2 CONSEQUENCES of ALTERNATIVE B: IMPLEMENTATION of a LIMITED RANGE of RESTORATION ACTIVITIES

This alternative would differentiate between upland and bottom-land projects, authorizing only those activities occurring in wetland or riparian habitats. Upland projects as discussed above would not be considered. Any other project type such as road projects would be authorized only within the riparian reserve area. This alternative focuses the restoration efforts of the ERO on riparian and wetland areas, allowing more attention, and funds, to be spent addressing the more immediate issues of water quality, wetlands loss, and riparian degradation, at the expense of conditions away from streams and wetlands which may be less directly influencing these issues, primarily regarding sedimentation. This distinction between uplands and bottom-lands fails to acknowledge the interconnectedness of the environment as a whole, segmenting it on the basis of arbitrary distinctions.

The direct effects of this program would be the same as for the full range of projects, for those projects types implemented. The exclusion of upland projects would limit the adverse impacts to air quality from prescribed burns, to wildlife from burns and disturbance, and to vegetation by construction work which would not occur. Beneficial effects to wildlife resulting from thinning and re-vegetation, and to the native plant life due to those same re-vegetation efforts would likewise not occur. Potential employment from these projects would be lost, but would likely be made up were uplands funds redirected to riparian projects.

Indirect effects would be similar to those for the full program, with important distinctions. Water quality would not benefit as much under this alternative, since many of the upland projects have as their primary focus the reduction of sedimentation into streams channels below the project area. Issues such as landslides, deforestation, and some grazing which occur away from defined riparian areas initiates the movement of sediment which eventually becomes suspended in streams. Failure to address these issues would result in sediment movement which could otherwise be prevented. Juniper stands may continue to influence the hydrology of upland areas, and roads would continue to allow sediments to be washed into streams. Uplands vegetation would continue to be affected by non-native species, excessive fuel loads, and deforestation. Current trends for upland wildlife would remain the same. Social & economic effects would be similar to those for the entire program, although indirect economic effects may be altered by the change in emphasis, and the orientation of education and outreach would necessarily be shifted away from upland issues.
Cumulative impacts would be similar to those for Alternative A, although a shift in emphasis away from upland projects would result in a less comprehensive approach to the restoration efforts being conducted. The overall effect would be similar, in that the environment would likewise not be significantly affected by these programs. However, beneficial results would still be discernable to water quality and habitat conditions. Projects and programs conducted by other agencies and organizations would presumably not be affected by this alternative.

This alternative would partially achieve the overall goal of ecosystem restoration, but only in those areas within the riparian corridor, excluding the uplands which are an important part of the ecosystem. A focus on the riparian corridor may result in more immediate, short-term gains in water quality, but would not resolve many of the deficiencies in the uplands which cause problems in riparian areas. A programmatic approach would also be utilized here, saving time and funds in administrative costs and increasing administrative efficiency.

4.3 CONSEQUENCES of ALTERNATIVE 3: CEASE RESTORATION ACTIVITIES

This alternative would result in no new restoration activities being sponsored by the ERO in the Upper Klamath Basin. Although currently funded and projects previously agreed upon would be completed, no new projects would be instituted. This alternative is included primarily as a means of providing a benchmark against which the other alternatives can be compared, and represents a continuation of the environmental conditions and trends described in Section III, The Affected Environment.

Direct & Indirect Effects: Current trends and conditions in the environment as described in the Affected Environment section of this document would continue in the absence of ERO sponsored restoration projects, although the beneficial results of other restoration programs would presumably continue to make improvements. Given the state of the economy in the region and the already high degree of land use, it is unlikely that major new urban or industrial development will occur which may worsen existing conditions.

Hydrology: Current hydrologic conditions would continue into the future. Inadequate groundwater flows resulting from compaction and highly water consumptive non-native plant species may continue, resulting in insufficient recharging of springs and streams, especially during critical dry periods. Downcutting and gullying of streams may continue and the potential for floods and high flow rates may remain unabated.

Air quality: Air quality would be unaffected by this alternative.

Water quality: Current trends with regard to high nutrient loads (particularly phosphorous and nitrogen) would continue while present land management practices remain. Water temperature would remain high, as streambanks remain denuded of shading vegetation. Sedimentation problems would likewise continue to increase as streambanks would be further eroded, adversely affecting the region's fish populations.

Fish: Fish populations, especially the endangered suckers and bull and redband trout, would continue to be adversely affected by water quality problems already existing in the region. Recovery of these fish populations to acceptable levels is believed to require a substantial improvement in water chemistry, temperature, and sedimentation levels. Habitat conditions would likely remain at current conditions, assuming no major development occurs along the streams and rivers of the region. Changes in the economy or in land use patterns could result in renewed development along waterways, acerbating current problems; but this is not likely in the time frame of this EA.

Wildlife: Aquatic species such as aquatic mollusks and spotted frogs would likely continue to be adversely affected by water quality problems and habitat loss. Many of these species have henceforth had little attention paid to their status, continued degradation of their habitat could prompt federal listing of one or more of these species. Terrestrial species are unlikely to be adversely affected so long as conditions remain stable, although further development throughout the region could further trends in habitat loss.

Vegetation: Wetlands areas would continue to be inadequate to perform their historic roles as flood plains, fish and wildlife habitat, and in the filtration of water, causing water quality conditions to remain in their current inadaquate state. Riparian vegetation would continue to be denuded, allowing resultant streambank stabilization, sedimentation, water temperature, and fish and wildlife habitat problems to continue or potentially worsen. Non-native plant species would potentially continue to spread in riparian and wetlands areas, as well as areas defined as upland such as sagebrush grassland and forests. The spread of juniper thickets would continue, with associated water consumption issues. Forests would continue to have degraded conditions resulting from logging, grazing and fire prevention strategies.

Social/Economic: Present high levels of unemployment in the region would continue, although the numbers of workers typically employed by restoration activities is low so the overall impact on the economy would be minimal. No incidental economic affects would result from the purchase of supplies and equipment, nor would a trickle down affect occur as workers spend their incomes. Training and educational opportunities would not take place, continuing misunderstandings between the public and land management agencies. Archeological resources would not be disturbed by project construction; on the other hand, the absence of project related archeological surveys may result in not identifying potentially significant cultural resources.

Cumulative Effects: The absence of ERO sponsored restoration projects would not necessarily affect projects sponsored by other agencies or independent organizations. However, many of these organizations partially utilize ERO funds for their projects, and the absence of this funding source would likely lessen the number and size of their projects. As discussed earlier, the Forest Service, BLM, and other federal and state land management agencies have independently funded and administered restoration projects which would continue. In addition, The Nature Conservancy has several large scale projects oriented towards restoring wetlands around Upper Klamath Lake, and private efforts are conducted throughout the basin. Over time, it is hoped that the combined influence of these projects, even in the absence of ERO funded projects, would result in major improvements in the habitat and water quality conditions in the Upper Klamath Basin, although the absence of ERO sponsored projects would slow this process and limit projects conducted on private lands, an important aspect of the ERO program.

This alternative would not meet the goals of the ERO, nor achieve the need and purpose for restoration projects as set forth in this document. The primary purpose of the inclusion of this alternative has been to set a benchmark against which the proposed restoration activities can be compared. Given the presence of several federally listed species in the area, some restoration activities would still have to take place to achieve compliance with the Endangered Species Act and other state and federal mandates.

4.4 CONSEQUENCES of ALTERNATIVE 4: PROVIDE COMPLIANCE on an INDIVIDUAL PROJECT BASIS (NO ACTION)

This option would continue the current practice of performing NEPA compliance on a project by project basis as opposed to conducting a programmatic EA for the entire range of restoration activities.

Conducting compliance on a project by project basis would allow for detailed analysis of the impacts of each project to be examined closely and with specific attention to the characteristics of the work site. However, this requires substantial staff time and costs relating to administrative details which can be avoided by utilizing a programmatic approach. Efficiency would be greatly diminished and NEPA compliance may be less consistent when working with individual projects. Moreover it would enhance the difficulties in regarding the ecosystem as a whole, and makes an evaluation of the cumulative effects of these projects more piecemeal and less comprehensive.

Continuing this approach to NEPA compliance is not expected to make a major difference in the type, size, or number of restoration projects which will be approved annually. Nor will it affect the environmental impacts of these projects once on-the-ground work commences. The environmental impact of these individual projects will generally be the same as similar projects conducted under the programmatic EA, as described above.

The use of this project by project approach to NEPA compliance was appropriate initially for the ERO's restoration activities and for evaluating the impacts of individual projects. However, it was decided that a comprehensive NEPA analysis was appropriate for assessing the near future impacts of continuing the ERO's restoration program for the next ten years, hence the development of this programmatic analysis.

The individual projects foreseen under this alternative would also meet the goals of the ERO and achieve the need and purpose of this restoration program as set forth. In order to be in compliance with NEPA, however, this project-by-project approach would require inefficient and repetitive paperwork and analysis. Writing project specific EA's would be inefficient, time consuming and costly, probably resulting in fewer projects being implemented annually and lessening the overall beneficial impacts to the ecosystem resulting from this program. This alternative would not affect other ongoing restoration programs.

Table 3: Comparison of Impacts (Direct & Indirect).

	Alternative 1 – The Proposed Action: Full Range of Restoration Projects (Programmatic NEPA)	Alternative 2 – Limited Restoration Projects (Programmatic NEPA)	Alternative 3 – Cease Restoration Projects	Alternative 4– Continue Project byl Project Compliance
Hydrology	Slow flows, recharge subsurface flows, water conservation, lessen flood & scour potential.	Slow flows, lessen flood & scour potential, lowered water conservation.	Higher flow rates, higher flood & scour potential.	Same as Alt. #1 for individual projects
Air Quality	Short-term dust, exhaust fumes, smoke from prescribed burns; no long term effects.	Dust, exhaust fumes along riparian corridors. No smoke and no long term effects.	No effects.	Same as Alt. #1
Water Quality	Short term disturbance from construction, long term lowering of sediment loads, chemical content, and water temperature	Same as Alt. 1, except less lowering of sediment loads.	Continued inadequate water chemistry, temp ., & sediment conditions.	Same as Alt. #1
Fish	Short term disturbance from construction. Improved spawning, feeding & resting habitats. Protect endangered fish from hazards and predator/ non-native species. Restore access, improve water quality, improve vegetation cover.	Same as Alt. 1, except lower improvement in water quality.	Slower recovery of endangered species & less protection from hazards &/or non-natives. No improvements in habitat.	Same as Alt. #1
Wildlife	Short term disturbance from construction. Improved nesting & roosting areas, forage habitat, cover, and food sources.	Short term disturbance from construction. Improvements would only benefit riparian corridor species.	Continued degraded habitat and slower improvement of water quality conditions.	Same as Alt. #1

Vegetation	Crushing and destruction from construction. Improved species composition & density. Lessened competition from non-natives and water consumptive species. Improved watering regimes & exclusion of grazing & trampling livestock.	Crushing and destruction from construction. Improvements would only benefit riparian corridor species.	Continued trampling and damage from livestock. No removal of non-native &/or invasive species. Continued accumulation of fuel loads in understory.	Same as Alt. #1
Social/ Economic	Local employment of workers, local expenditure for supplies and materials. Training in restoration techniques. Public relations and education & outreach to public.	Similar to Alt. 1, though projects would not be conducted in upland areas.	No additional relief to continued high unemployment rates in region. No training and/or education programs.	Same as Alt. #1

V. CONSULTATION & COORDINATION

5.1 Public Participation

In keeping with NEPA guidelines, efforts have been made to inform the public of the preparation of the EA. A scoping letter was sent on October 4, 1999 to approximately 400 concerned individuals and organizations in the local and regional area, summarizing the purpose of the EA and soliciting comments on the restoration program. A newspaper article regarding this process appeared in the Klamath Fall Herald and News on October 10, 1999. Public meeting were not organized due to the lack of interest generated by the scoping letter. The availability of this EA will be advertised in local newspapers, and the EA will be made available for a 30 day comment period, after which a decision will be made by the Fish & Wildlife Service. Copies of the mailing list, scoping letter, and any correspondence received regarding this EA will be available at the Klamath Basin Fish & Wildlife Service Office.

5.2 Permits & Clearances

<u>Natural Historic Preservation Act</u>: All projects funded by the ERO will be in conformance with the Natural Historic Preservation Act (NHPA), which requires the FWS to consider the affects of any federally funded project on cultural resources. A Programmatic Agreement (PA) exists between the FWS and the State Historic Preservation Offices for California and Oregon, which regulates the compliance with the NHPA. Record searches and/or on-the-ground field surveys will be conducted as appropriate for all projects funded by the ERO.

<u>Endangered Species Act</u>: The Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), requires federal agencies to conserve endangered or threatened species. Section 7 of that Act requires that federal agencies consult with the Fish and Wildlife Service to insure that any action authorized, funded, or carried out by that agency is not likely to jeopardize the continued existence of any endangered species or result in adverse modification of designated critical habitat. To facilitate that consultation, a biological assessment is prepared for major construction projects if any of those species or their critical habitat is present in the proposed action area. All projects funded by the ERO will be in compliance with the Act.

<u>Clean Water Act</u>: All projects will be in compliance with local, state and federal requirements relating to Section 404 of the Clean Water Act prior to commencing ground disturbing acts. All necessary permits will be obtained, including 404 permits from the US Army Corps of Engineers, as appropriate.

<u>Hazardous Materials Determinations</u>: Prior to conducting projects, a Level 1 Environmental Contaminants Survey will be conducted by certified personnel to determine the existence of any hazardous materials at the work site. A Level 2 survey will be conducted if hazardous materials or materials of a suspicious nature are discovered, and if necessary projects will be redesigned or abandoned in accordance with the procedures set forth in the Department of Interior Manual, Chapter

341 FW3.

All other pertinent federal, state, and local laws and regulations will be upheld and all appropriate permits will be obtained from the regulating agency.

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Acknowledgments:

This EA was written utilizing 2 previous documents prepared by the Oregon State FWS Office as models: the Jobs in the Woods in Western Oregon Programmatic EA was written by Dan Perritt, Alan Wetzel, and Patrick Wright, and the Partners for Fish and Wildlife Programmatic EA which was written by Maureen Smith, Brendan White, and Eileen Stone. Portions of these documents, in particular those materials in Appendices C & D of this EA, were adapted for use in this EA. Thanks are extended to the Ecological Services and Contaminants staffs of the Klamath Falls FWS Office for their technical input and support. Especially sincere thanks are due to Ben Harrison and Dan Fritz for their patient tolerance of and very helpful responses to numerous inquiries.

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