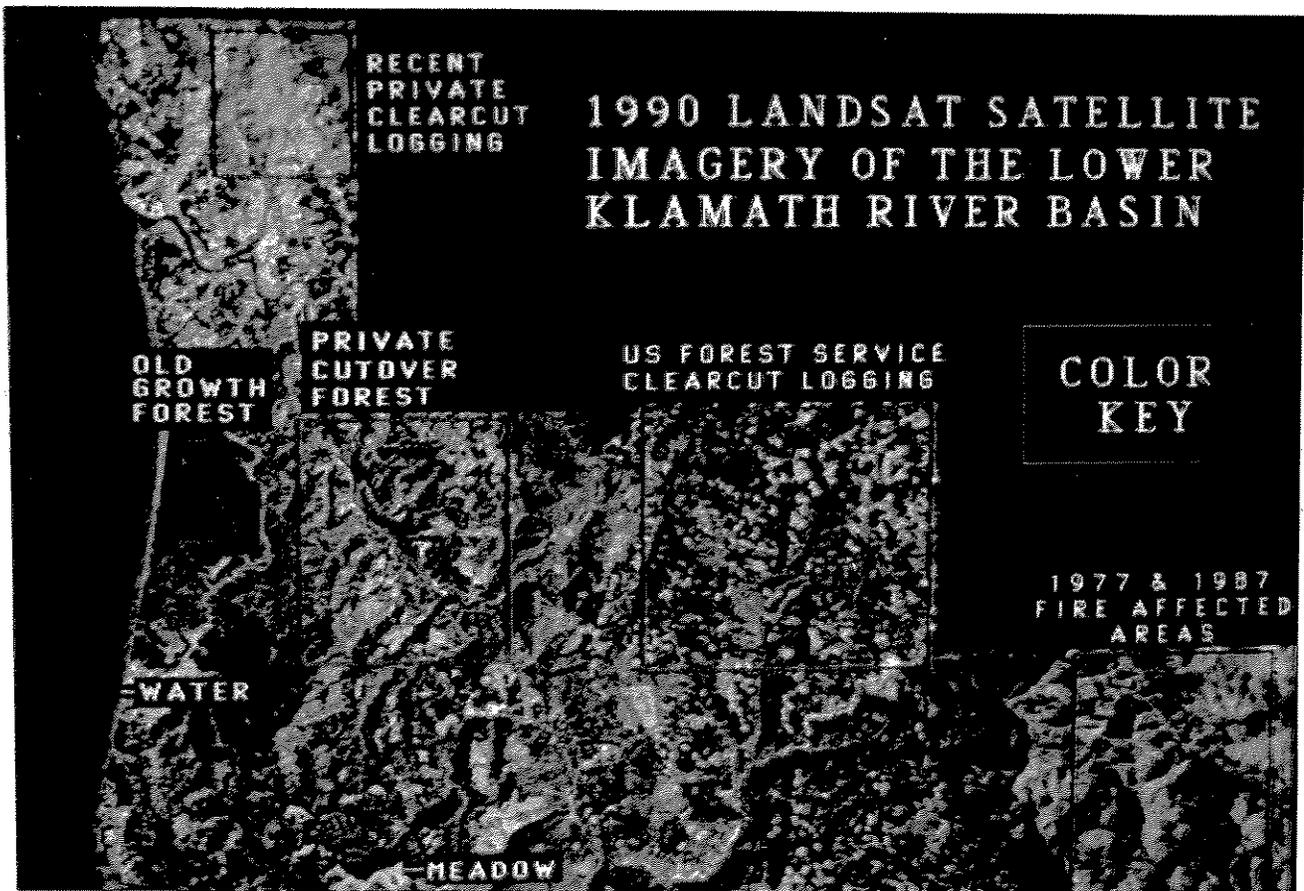


**A REMOTE SENSING AND GEOGRAPHIC  
INFORMATION SYSTEM (GIS)  
FEASIBILITY ANALYSIS OF THE  
LOWER KLAMATH AND SALMON  
RIVER BASINS**

**FINAL REPORT**



**Prepared by:**

**Energy and Resource Advocates  
in cooperation with the  
U.S. Fish and Wildlife Service for  
The Klamath River Basin Fisheries Task Force**

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**Final Report**

**October 1993**

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## I. Abstract

Despite numerous efforts to protect and restore the valuable anadromous fish populations of the Klamath River Basin, these native fish have continued to decline along with the land and water resources they depend on for survival. In addition, no agency or organization has been able to keep track of the factors and impacts which are contributing to the decline of the fishery, or prioritize the most efficient use of available resources to help their recovery.

In recognition that remote sensing imagery and a geographic information system (GIS) could be useful in assisting the Klamath River Basin Fisheries Task Force (Task Force) in prioritizing and monitoring its fishery restoration efforts, the Task Force approved a proposal by the non-profit group Energy and Resource Advocates (ERA) to conduct a remote sensing and GIS feasibility analysis of the Lower Klamath and Salmon River Basins (Project Area).

ERA utilized 1984 and 1990 Landsat imagery to provide the Task Force with a visual image of the project area. In addition, ERA contacted various agencies, tribes, private and non-profit organizations to identify the availability of maps, aerial photographs, studies, file reports and other forms of information throughout the project area.

An analysis of the satellite imagery and a sample of the available resource information clearly shows that the Lower Klamath River Basin has been significantly altered by human activities and natural processes. Logging clearcuts throughout the project area, and forest fires in the Salmon River Basin, are the most noticeable impacts.

A GIS is feasible for the Lower Klamath and Salmon River Basins. A GIS will provide the Klamath Task Force and the Technical Work Group with an efficient method of assessing cumulative effects, prioritizing annual fisheries restoration projects, monitoring results over time and justifying the acquisition of additional funds. Existing computerized resource information should be linked to the satellite imagery and map overlays to implement a basin wide approach to Klamath River Basin fishery restoration.

## II. Introduction

The Klamath River and its tributaries once provided an abundance of salmon, steelhead, sturgeon and other fish populations. Klamath River Native Americans thrived as a result of the natural bounty and were described as the richest of California Indians (McEvoy 1986). Native anadromous fish stocks were also very important to the Europeans who began migrating into the Klamath Basin in the mid-1800's.

The Klamath River Basin anadromous fishery has been declining steadily for many decades (Snyder, 1931; USFWS, 1991). "Floods, the construction and operation of dams, diversions and hydroelectric projects, past mining, timber harvest practices, and road building have all contributed to sedimentation, reduced flows, and degraded water quality which has significantly reduced the anadromous fish habitat in the Klamath-Trinity River System" (Klamath River Basin Act, 1986). The Act also noted that "overlapping federal, state, and local jurisdictions, inadequate enforcement of fishery harvest regulations, and ineffective conservation efforts have prevented the federal government and the State of California from fulfilling their responsibilities to protect the river's anadromous fishery values."

In response to these and related problems, Congress passed the Klamath Act in 1986 to establish a 20 year, \$20 million dollar program to restore and maintain the Klamath River fishery to optimum levels by 2006. The 14 member Klamath River Basin Fisheries Task Force (Task Force), created by the Act, was directed by Congress to assist the Secretary of Interior in creating and implementing the restoration program and to coordinate "Federal, State, and local governmental or private anadromous fish restoration projects within the Area" (Long Range Plan for the Klamath River Basin Conservation Area Fishery Restoration Program, 1991 [hereafter cited as "Klamath Plan"], p. 1-3).

After six years of fishery restoration efforts, sedimentation, reduced flows, and degraded water quality continue to be major contributing factors to anadromous fishery decline. In addition, the number of wild fish returning to reproduce in the Klamath River System has continued to decline for several reasons:

- Multiple jurisdiction or ownership on a given watershed or basin often prevents land management activities, that may impact a stream, from being viewed as part of a continuous landscape in the planning process.
- Data collection, storage and retrieval systems are not standardized between agencies.
- Funding to achieve the needed habitat protection and restoration is inadequate.

- Corporate and agency priorities (i.e. timber extraction) often divert the use of scarce resources and staff away from needed habitat protection and repair.
- A general lack of coordination and cooperation between agencies, corporations and user groups hampers the effective use of the limited funds that are available for fishery protection and enhancement.
- No one agency or organization can keep track of the factors and impacts which are contributing to the decline of the fishery, or prioritize the most efficient use of available resources to guide its recovery.

As a result, anadromous fish populations in the Klamath River Basin are still declining at alarming rates and some fish stocks are now at a high risk of extinction (Nehlsen, et al., 1991).

The fishery of the Klamath Basin remains a vital component of the region's economy and culture. However, the steady decline of fishery and forestry resources has, in turn, threatened the long-term economic stability of the region and placed an even greater burden on remaining resources. In addition, commercial, sport and native uses are competing for rapidly declining resources.

In recognition that LANDSAT satellite imagery and a computerized mapping technology, termed Geographic Information System (GIS) ( Figure 1 - GIS Information Layers), could improve the Task Force's understanding of basin watershed conditions over time (Klamath Plan, p. 3-27), the Task Force endorsed a proposal by Energy and Resource Advocates (ERA) to undertake the following:

- Provide the Task Force with a visual image of the Lower Klamath and Salmon River Basins using Remote Sensing/Landsat Thematic Mapper imagery from 1984 and 1990.
- Conduct a comprehensive search for available computerized and non-computerized natural resource information which can be assembled into a GIS.
- Explore the feasibility of a remote sensing and geographic information system analysis of the Lower Klamath and Salmon River Basins.

This proposal developed into a cooperative agreement between ERA and the U.S. Fish and Wildlife Service (USFWS) to perform a series of tasks to complete the objectives of the proposal. As part of the agreement, ERA purchased a 1991 satellite image of the Upper Klamath Basin for future analysis. In addition, ERA also provided examples of specific watershed conditions on five study areas within the Lower Klamath and Salmon River Basins to illustrate how a Remote Sensing/GIS would aid the Klamath Task Force in its fishery restoration efforts.

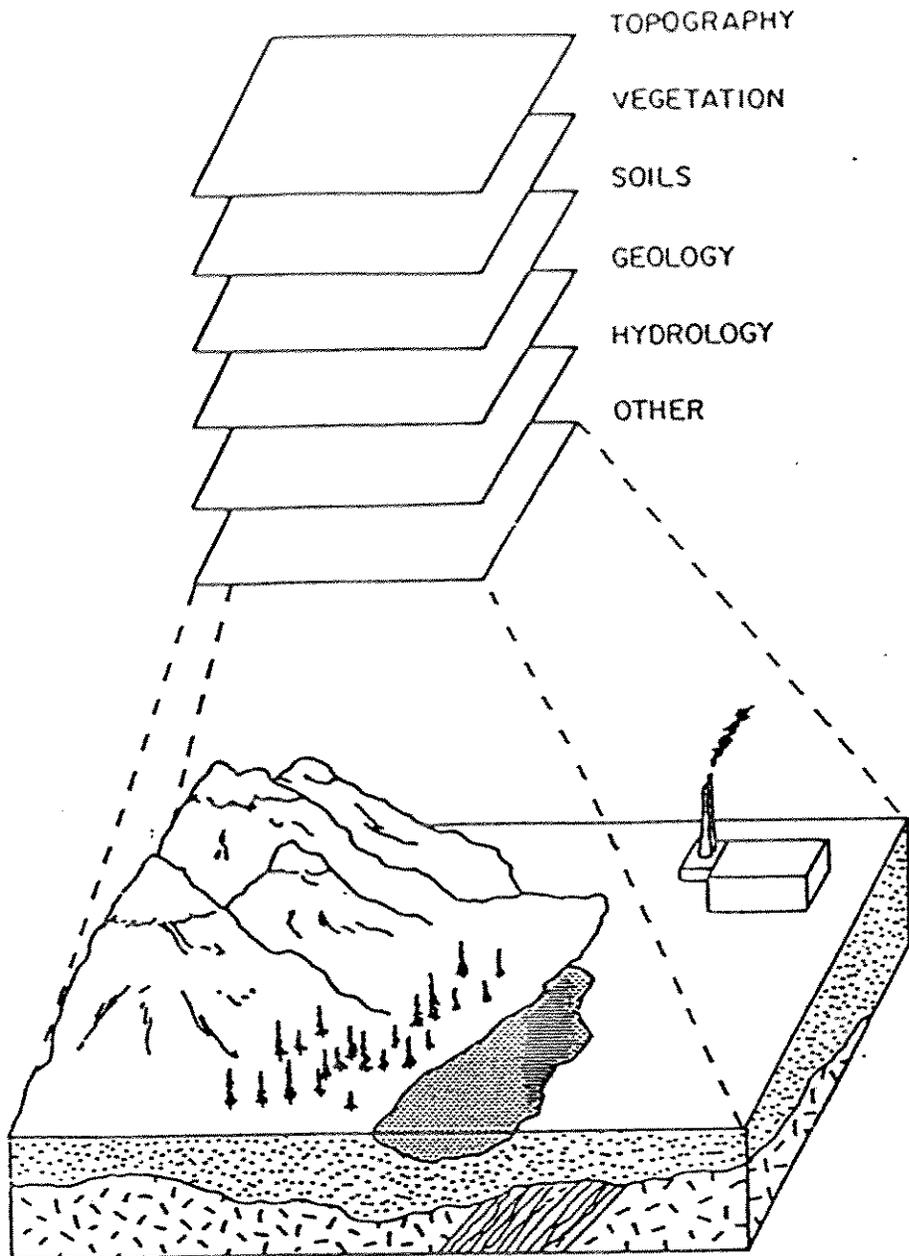


Figure 1 - An illustration of GIS information layers

Adapted from Scott, et al. 1987

## **Project And Study Area Descriptions**

The project area for this analysis is the Lower Klamath and Salmon River Basins from the Marble Mountains downstream to the Pacific Ocean (see Figure 2). This project area was separated from a larger basin-wide proposal to present the Task Force with an affordable and manageable pilot project. Moreover, this portion of the Basin provides a useful contrast between watershed management on public and private lands. It is also recognized as having major problems with watershed instability and fish habitat degradation related to sedimentation (Klamath Plan, p. 2-8).

The Lower Klamath and Salmon River Basins are part of the geologic provinces of the Klamath and Coastal Mountains. This area is characterized by steep mountains, deep and narrow gorges, unstable soils, large streams, considerable winter rainfall, and forest vegetation (ESA 1980; Coates et al 1981; DWR 1982). Inherent instability throughout these regions are a result of complex geologic processes such as up-lifting, shearing from faults, and intense rainfall near the coast. Many of the rock types within both these provinces give rise to highly unstable watershed conditions (Klamath Plan 1, p. 2-7).

Rivers and streams in the project area are deeply incised in steep inner gorges. Despite inherent geological instability, these streams once supported large fish populations. Steelhead trout colonized all but the steepest of tributaries, while salmon migrated throughout the Basin from the Pacific Ocean to the headwaters of Upper Klamath Lake. In general, the project area was very productive prior to the migration of Europeans into the region in the mid-1800's.

### **Five Study Areas**

Due to the large number of maps, aerial photographs, studies, file reports and other information identified during the natural resource information survey, ERA decided to focus on five specific study areas which represent land-use patterns throughout the project area. These study areas are Terwur Creek, Blue Creek, Weitchpec, Somes/Butler and the Salmon River landscape.

#### **Terwur Creek**

Terwur Creek flows into the Klamath River at the town of Klamath Glen, just upstream of the Highway 101 bridge. The steep Terwur Creek watershed, approximately 33 square miles in area, has been the subject of several studies which addressed cumulative impacts on fish habitat in the Lower Klamath Basin (USFWS 1979; ESA 1980;

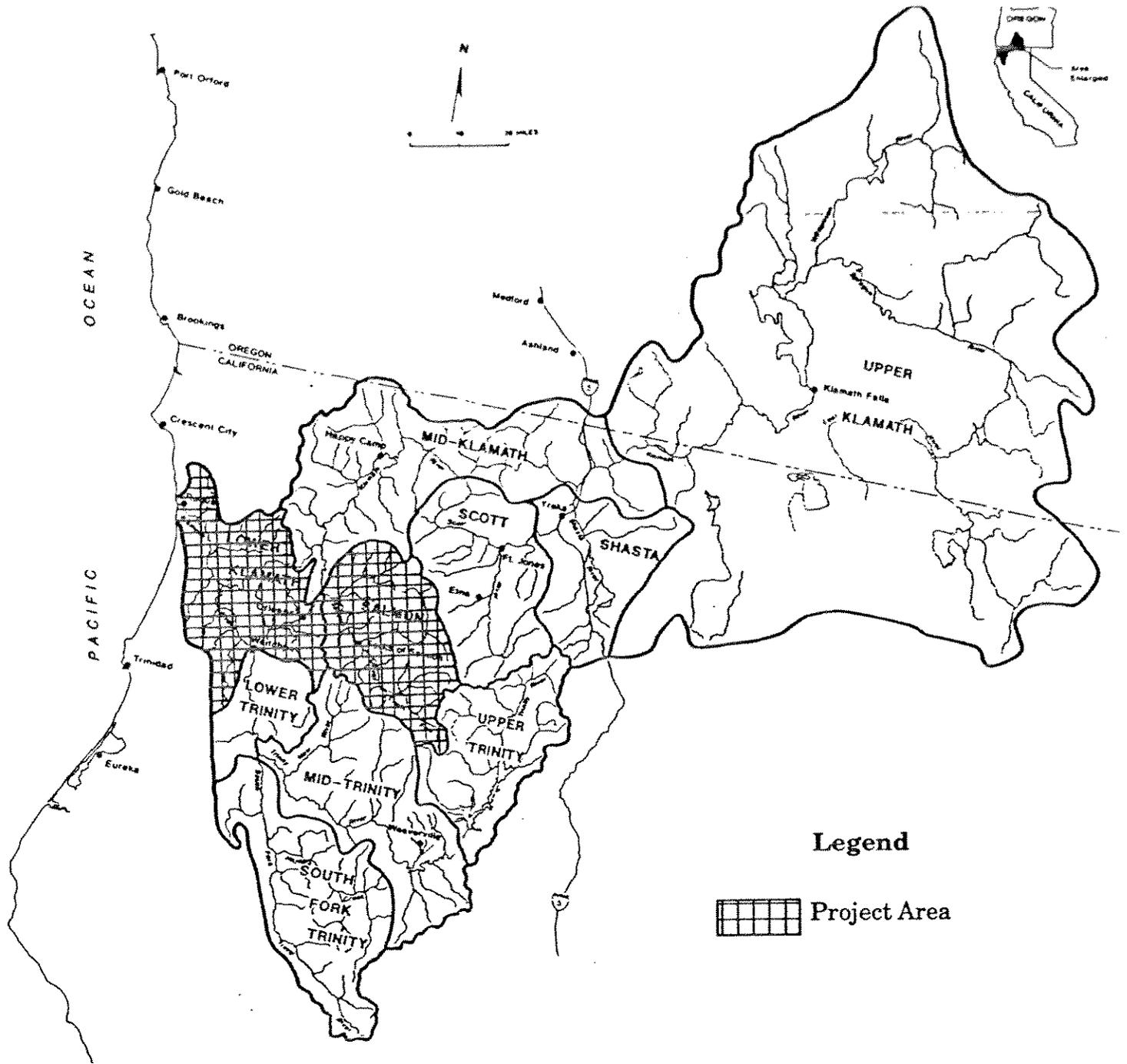


Figure 2. Project Area  
 Lower Klamath and Salmon River Basins

Adapted from Klamath Plan, p. ES-2

Coats and Miller 1981; and DWR 1982). Terwur Creek has an average rainfall of about 100 inches per year and has an extremely unstable geology with over 50% of its slopes formed by current or past landslides (DWR 1982).

### **Blue Creek**

Blue Creek is the largest tributary within the Lower Klamath Basin, 127 square miles in size. The headwaters are protected as part of the Siskiyou Wilderness area, while the lower portion is in private ownership. Blue Creek is the most important spawning tributary to the Lower Klamath for salmon and steelhead (DWR 1982). Dewitt estimated that 10,000 fall chinook salmon spawned in Blue Creek in the 1950's (USFWS 1979). Today, Blue Creek supports a fraction of the once abundant anadromous fishery. The USFWS is currently completing an assessment of the condition of Blue Creek's fish habitat and population.

### **Weitchpec**

Weitchpec is located at the confluence of the Trinity and Klamath Rivers. It was selected as one of the five study areas because of its proximity to public, private and tribal lands. The Weitchpec area remained relatively undisturbed until the 1950's, but has been subjected to patch clearcutting in the last forty years.

### **Somes/Butler and Salmon River Landscape**

The Somes/Butler are two U.S. Forest Service management landscapes on the Salmon River within the Klamath National Forest. The Salmon River Basin is a steep rugged watershed where catastrophic wildfires occurred in 1977 and 1987. The Somes/Butler and Salmon River landscapes provide sharp contrast between watersheds that are relatively intact versus those which have been heavily impacted.

## **III. Methods and Materials**

To better acquaint the Task Force members with watershed conditions in the project area and to advise them on the feasibility of assembling a GIS, ERA performed a number of tasks.

### **Satellite Imagery**

ERA purchased two Landsat satellite "scenes" of the Klamath River Basin from Earth Observation Satellite Company (EOSAT, 4300 Forbes Blvd., Lanham, Maryland, 20706). A satellite scene is a geographic area approximately 100 miles square that

provides a level of visual detail down to 28.5 meter ground resolution from 438 miles above the Earth. The 1990 satellite scene purchased for this project contains the Lower Klamath and Salmon River project basins (Photo 1-satellite scene). The Task Force and USFWS also approved the purchase of a 1991 satellite scene of the Upper

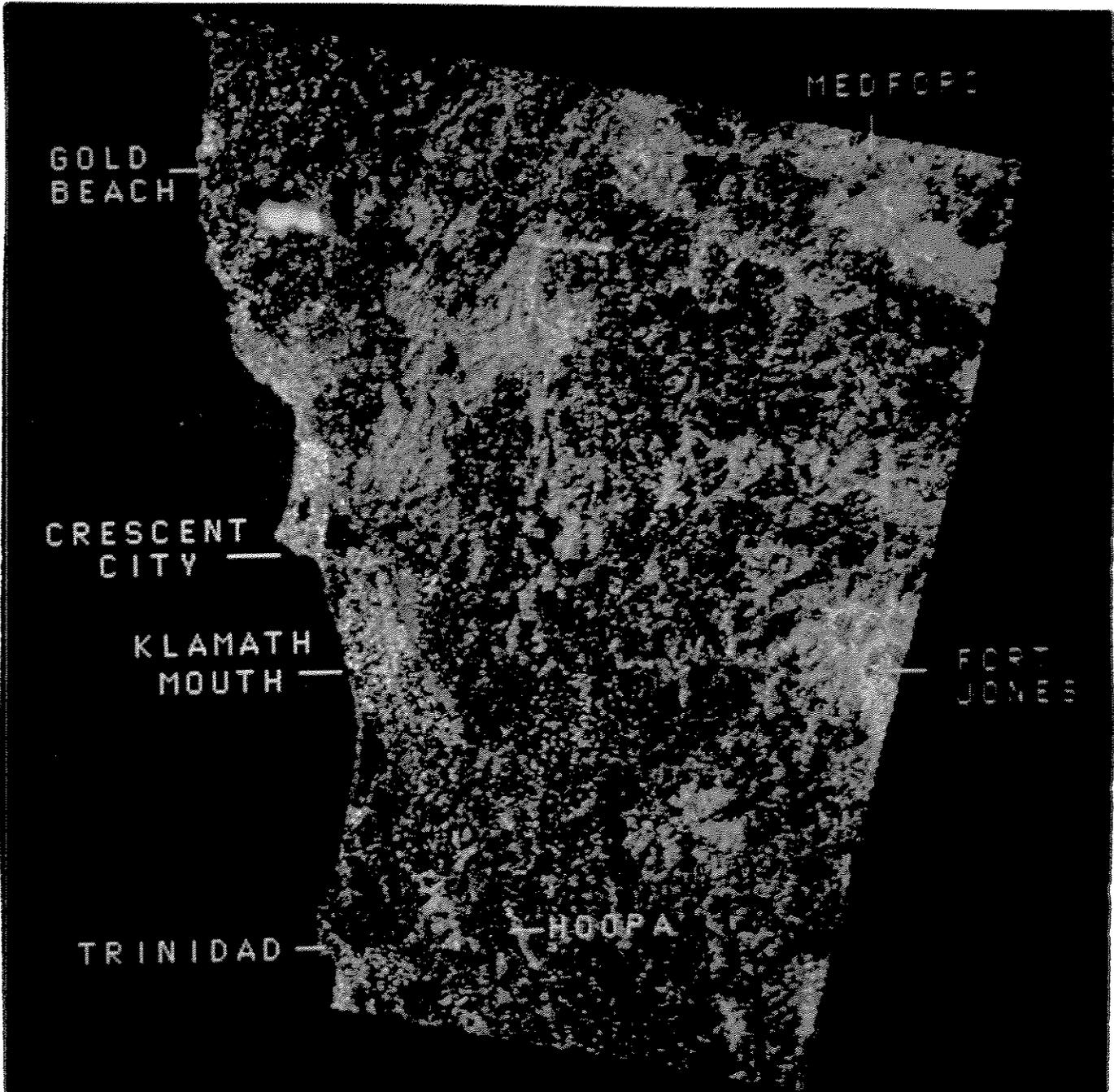


Photo 1 - 1990 Satellite scene containing the Lower Klamath and Salmon River Basins

Klamath River Basin for future analysis.

A 1984 Landsat satellite scene of the same area, previously acquired by ERA's principal GIS consultant, was compared with the 1990 imagery for this project. Several steps were taken to enhance the Lower Klamath Basin imagery.

- EOSAT fixed the satellite imagery to a worldwide coordinate system ("georectified") so that available computerized information identified during ERA's natural resource information survey could be utilized by the Task Force as additional GIS layers. The 1990 and 1984 satellite imagery were relatively cloud-free and for the purposes of this project required no atmospheric corrections.
- The Lower Klamath and Salmon River project area was cut from the larger Landsat scene using the color-graphic Mapping and Image Processing System (MIPS) (MicroImages, 201 North 8th Street, Suite 15, Lincoln, Nebraska 68508-1347) on an IBM-compatible computer.
- This image processing system and equipment were also used to produce three color schemes to help illustrate several watershed conditions. The three color schemes are displayed in the Integration of Satellite Imagery with Natural Resource Information section of this report (Pgs. 15-17).
- An image processing technique termed "normalized difference vegetation index" (NDVI) was also used in the initial phase of this project to identify how forest resources have changed since 1984.
- A number of computer images were photographed off the computer screen with a 35 mm camera using either black and white or color prints and slide film.
- The 35 mm aerial color photographs provided in this report were taken during airplane flights over the project area.

### **Natural Resource Information Survey**

To find out what other information was available for use in a GIS, ERA mailed a natural resource information questionnaire (Appendix A) to Task Force members, government agencies, tribal governments, private companies, and non-profit organizations which have resource management jurisdiction or other interests in the Lower Klamath and Salmon River Basins. (See Appendix B for a list of GIS survey contacts).

ERA initiated personal follow-up interviews to refine the process of evaluating and sharing relevant information about the Klamath River Basin. These interviews gave respondents an opportunity to express their views on fishery restoration problems, goals and methods.

Written responses to the survey questionnaire were categorized by:

- geographic area
- natural resource category
- data format
- computerized and non-computerized information
- availability.

See Appendix C for further information on the responses to the questionnaire.

A number of studies and field reports collected in response to the GIS questionnaire were identified that complemented the satellite imagery.

### **Integration of Satellite Imagery with Selected Natural Resource Information**

In order to link the natural resource information to the satellite imagery, ERA used the 1:24,000 scale topographic map system developed by the U.S. Geological Survey (USGS) (Figure 3). This quadrangle mapping system is commonly used by federal and state agencies to display a variety of natural resources. ERA overlaid these map grid lines onto the satellite imagery of the project area (Photo 2). Five grid map study areas were then selected to illustrate how a GIS could be used to analyze watershed conditions (Photo 3).

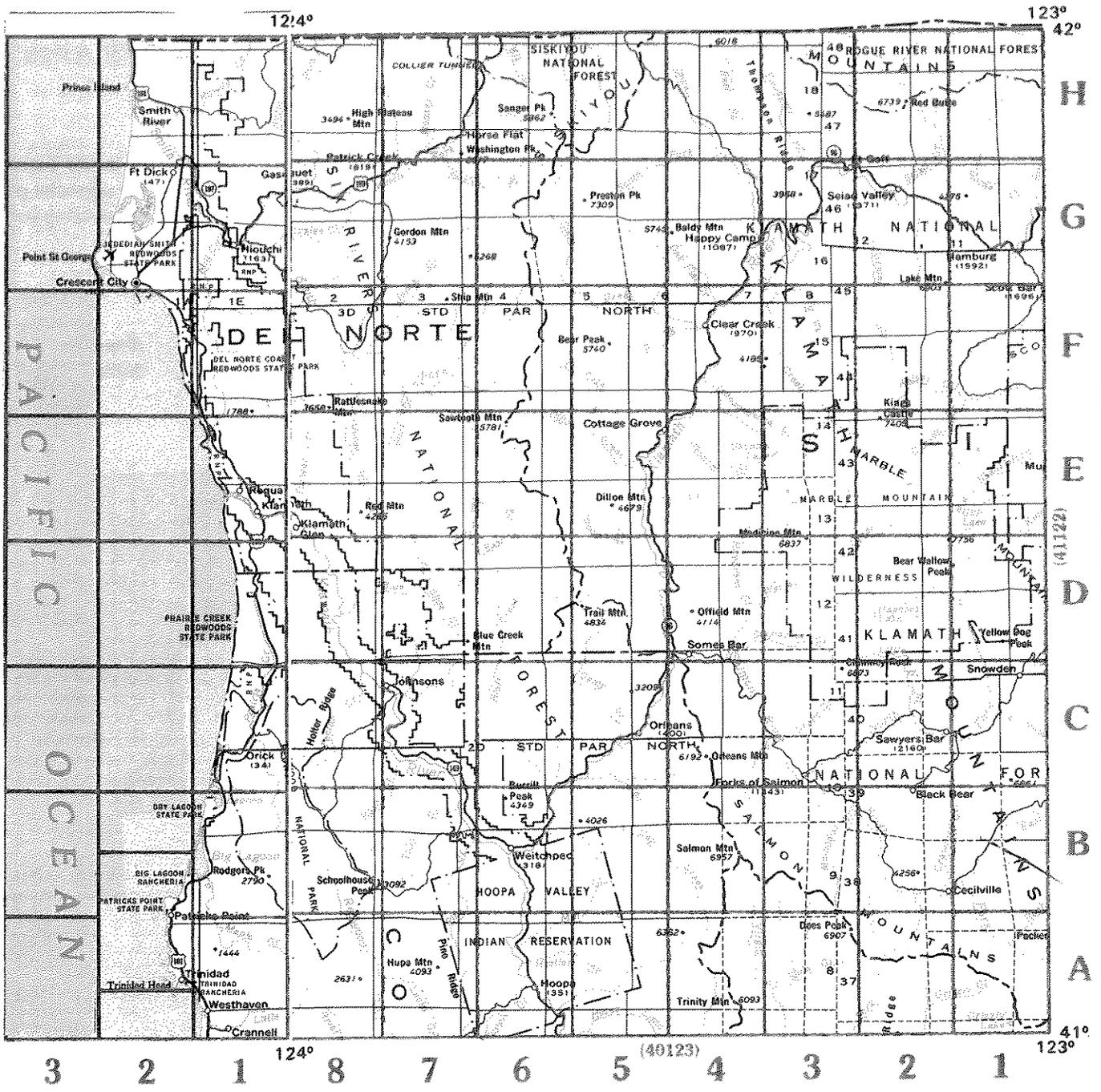


Figure 3 - US Geological Survey Quadrangle Map of Northwestern California (US Geological Survey Mapping System)

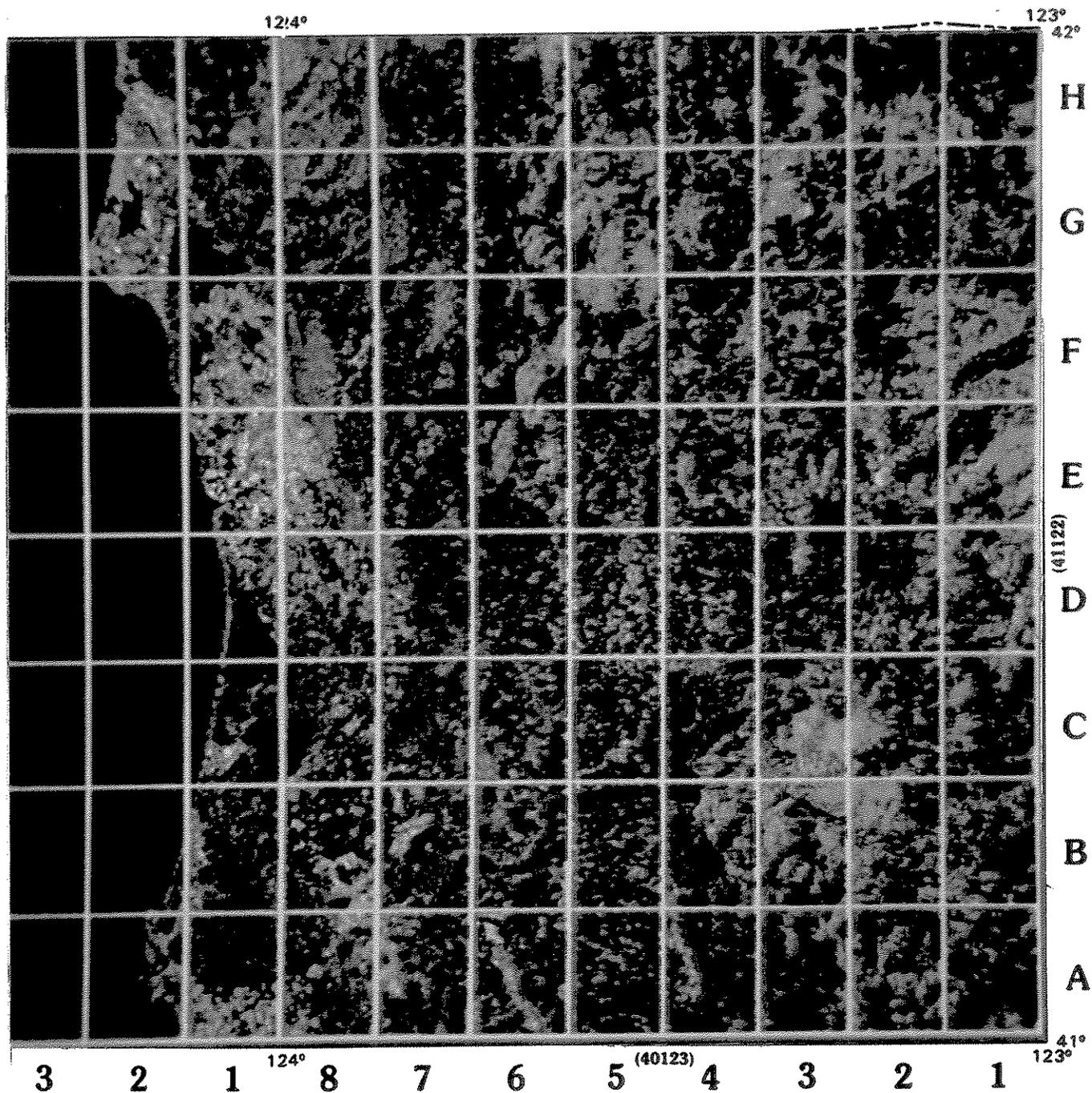


Photo 2 - Project area with USGS gridlines overlay.



**E**

**D**

**C**

**B**

**8**

**6**

**4**

**3**

Photo 3 - Five grid map study areas.

Historic mid-1970s large scale aerial photographs (orthophotoquads) of the five study areas were obtained from the USGS and scanned into the computer, labeled, and filed for further GIS analysis.

### **Terwur Creek**

Three color schemes were produced for the project area and Terwur Creek to help illustrate watershed conditions:

- A black and white color scheme (photos 4a and 4b).
- A color infrared simulation (photos 5a and 5b).
- A red and green color scheme (photos 6a and 6b).



Photo # 4a- Black and white color scheme of the project area and 4b - Terwur creek (below right). These display:

- a) Mature forest canopy in dark grey tones;
- b) Beaches, gravel bars, recent clearcuts, burned areas, and other highly reflective surfaces, such as road networks, agricultural areas, shallow soils with sparse vegetation, meadows, stream-side vegetation and other features are displayed in white or light grey.

Note: Terwur and Turwar are two accepted spellings of the same creek.

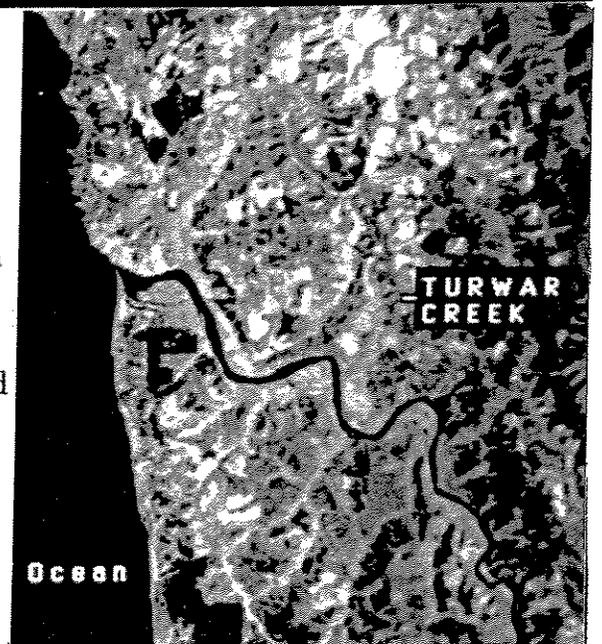




Photo #5a- A color infrared simulation of the project area and 5b - Terwur creek (below right). These display:

- a) Mature forest canopy in dark brown tones;
- b) Beaches, gravel bars, recent clearcuts, burned areas, and other highly reflective surfaces, such as road networks, agricultural areas, shallow soils with sparse vegetation, meadows and other features are in light blue.
- c) Streamside vegetation, such as dominant hardwoods near the mouth of the Klamath, in light brown.

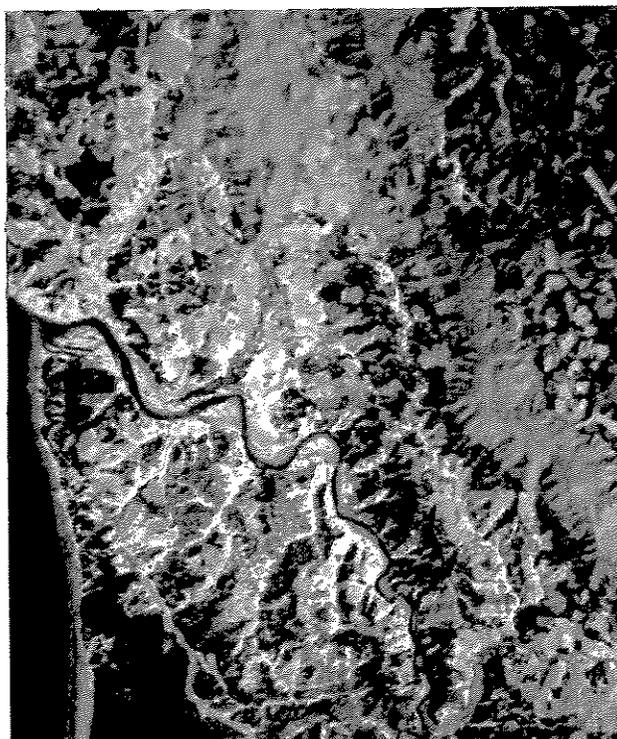




Photo #6a- Red and green color scheme of the project area and 6b - Terwur Creek (below right). Red and Green helps to contrast recent forest cutting with remaining forest canopy:

- a) Mature forest canopy is displayed in dark green;
- b) Beaches, gravel bars, recent clearcuts, burned areas, and other highly reflective surfaces, such as road networks, agricultural areas, and shallow soils with sparse vegetation, meadows and other features are bright red;
- c) Streamside vegetation is displayed in light green.



## Blue Creek

ERA obtained color aerial photographs taken of Blue Creek in 1972. These photographs were compared with a 1975 USGS 1:24,000 scale orthophotoquads of the same area which ERA scanned into the computer for analysis (Photo 7-Black and white scanned image of USGS Ah Pah Ridge Quad).

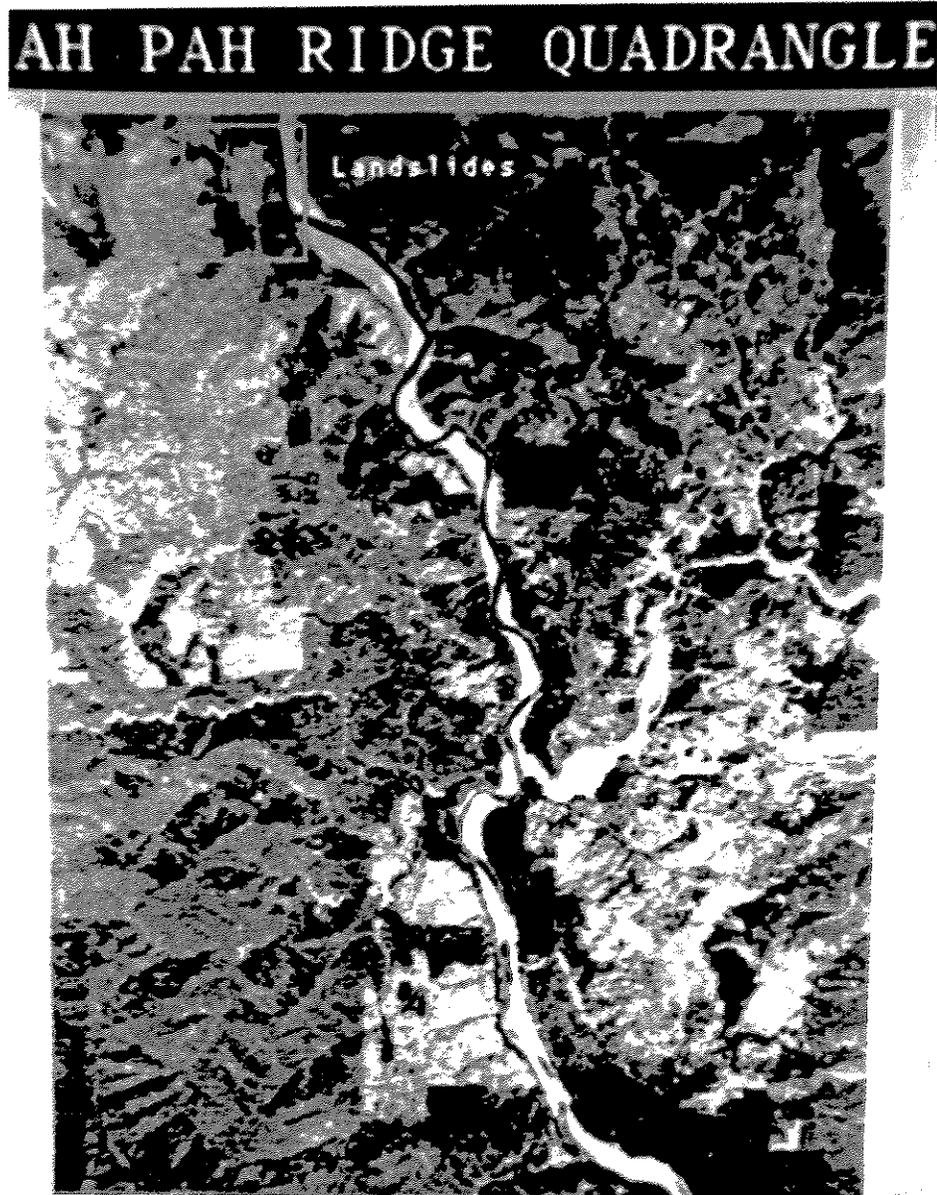


Photo 7 - A 1975 Black and White scanned image of USGS Ah Pah Ridge  
Orthophotoquad  
Courtesy of D. Van de Mark.

## **Weitchpec**

A 1947 photograph centered over Weitchpec was purchased from US Geological Survey (USGS) by ERA for this project after it was identified in the USGS Aerial Photograph Record System (USGS, 345 Middlefield Road, Menlo Park, CA, 94025). To illustrate the diversity in remote sensing and GIS applications, this 1947 photo was compared to a 1991 color aerial photograph to document changing watershed conditions near Weitchpec.

## **Somes/Butler and Salmon River Landscapes**

Several photographs were taken of the satellite imagery using different color schemes to highlight the contrast between the undisturbed Somes/Butler area and the severely burned Salmon River Basin. The photographs were compared to a 1991 color aerial photograph and two photographs taken on the ground.

## **IV. Results and Discussion**

### **Satellite Images**

Satellite imagery, as demonstrated by the photographs in this report, graphically displays a number of land features of interest to resource managers. Among other things, satellite imagery provides a convenient tool for contrasting geographic areas that are relatively free of land-use with those areas that have received large scale watershed impacts.

Some features of interest include:

- Areas with contiguous mature forest canopy are mainly confined to federal/state parks and wilderness areas (Redwood National Park, Prairie Creek Redwoods State Park, Siskiyou and Marble Mountain Wilderness).
- Private lands in the Lower Klamath Basin show widespread removal of vegetation from the mouth of the Klamath upriver to Weitchpec.
- U.S. Forest Service lands above Weitchpec are dotted with clearcuts, regeneration sites and dispersed patches of hardwood and softwood forest.
- The Salmon River drainage is characterized by massive burned areas from the 1977 and 1987 fires, as well as bare rock formations.

The NDVI approach used in the initial phase of this project was useful in separating recent from older resource conditions. There are some areas, such as the intensively clear-cut private industry lands, or large acreages affected by fire, where the rate of change was too dramatic to generate a NDVI color image that could be easily inter-

puted. Therefore, during the analysis of Terwur Creek, ERA used the 1984 and 1990 black and white satellite imagery side-by-side instead of the NDVI image to illustrate land use change over time.

### Natural Resource Information Survey

ERA's natural resource/GIS information questionnaire produced a large volume of information which can be combined with the satellite imagery to produce a Lower Klamath Basin GIS. Natural resource information, such as topography, vegetation, soils, geology, hydrology, and land-use histories are available from one or more sources listed in Table 1.

**Table 1 - Natural resource information**

<u>TYPE</u>	<u>SOURCE</u>
Topographic and geology maps	US Geological Survey (USGS)
Vegetation maps	US Soil Conservation Service (USCS), US Forest Service (USFS)
Soil surveys	USCS, USFS
Hydrology maps	California Department of Water Resources (DWR), USFS Bureau of Reclamation (BOR), USGS
Timber sale maps	USFS, California Department of Forestry (CDF)
Stream surveys and fish Population data	California Department of Fish and Game (CDF&G) USF&W, USFS
Aerial photographs	USGS Aerial Photography Summary Record System (APSRs), USFS, Redwood National Park (RNP)
Climate data	DWR

Some agencies are developing additional mapping and data base systems which can be used in resource management. The U.S. Fish and Wildlife Service, Klamath River Fishery Resource Office, is working with Kier Associates, through funds provided by the State Water Resources Control Board, to determine how available water quality information can be integrated together into the EPA Reach File System. The Reach File System is a computerized map and database system that can be accessed by state and federal agencies. Relevant information is assigned to specific stream reaches along a map line at 1:100,000 scale.

### **Integrating Satellite Imagery and Natural Resource Information to Improve Cumulative Impact Assessment**

Merging satellite imagery with natural resource information is critical to determine how land-use practices combine with the natural features of the Klamath River Basin landscape to affect the anadromous fishery. In order to improve cumulative impact assessment, satellite imagery and natural resource information can be combined in a GIS format to analyze land-use impacts over time. Large geographic areas can be viewed with satellite imagery, overlaid with other GIS layers and reviewed with more detailed maps, aerial photographs and field studies. Field verification of satellite imagery, using aerial photos, field surveys, and site histories is an essential GIS function to determine both short and long term land-use impacts on the Klamath River fishery.

There is a strong connection between land use management practices, peak flood events, and the increase in fish habitat degradation. Many Lower Klamath tributaries are so clogged with sediment and debris that they lack surface flow during the summer (Photo 8 - Mouth of Terwur Creek). Timber cutting is considered to be a contributing factor to the sedimentation problem. While greatly improved in recent years, timber harvest practices are still causing harm to local stream habitat. (Klamath Plan, p.8-2)

Timber cutting has both immediate and potential long-term cumulative effects on fishery survival. Coats and Miller (1981) describe how timber harvesting relates to cumulative effects on fish habitat:

“Cumulative effects are long-term effects that accumulate over space or time... In one sense, any lasting effects are cumulative over time, but because of the nature of watersheds, some effects of silvicultural activities may occur off site, downslope or downstream from the area of the original timber harvest plan... Thus, the overall effect of an operation, and of multiple operations in the same watershed, may be quite different than the immediate on site effects of a timber operation reviewed in isolation.”



Photo 8 - 1992 photograph of the mouth of Terwur Creek showing lack of surface flow during summer. Photo courtesy of P. Higgins.

The delayed but widespread watershed damage from these accumulated or "cumulative effects" include: destruction of fish habitat, deterioration of water quality, altered stream channels, destruction of roads, bridges, and other structures, along with magnified damage to fish habitat from any given storm event. (DWR 1982) The chances for adverse cumulative impacts on fisheries habitat increase as the forest resources are cut on more inaccessible and unstable terrain (Frissell and Liss 1987).

To illustrate how cumulative impacts have already occurred within the Lower Klamath Basin, a landslide adjacent to the Klamath River, associated with timber harvest, was identified on the scanned USGS Ah Pah Ridge quadrangle (as noted above in the Methods and Materials), enlarged on the computer screen (Photo 9-magnified landslide), and compared with a 1972 aerial photograph (Photo 10).

Other areas demonstrating a high intensity of use, and posing potential fisheries habitat damage for future cumulative impact assessment are:

- The areas affected by the 1977 and 1987 catastrophic forest fires throughout the Salmon River Basin on the Klamath National Forest;
- Aikens, Bluff, Camp, Red Cap and Slate Creeks on the Orleans Ranger District, Six Rivers National Forest;

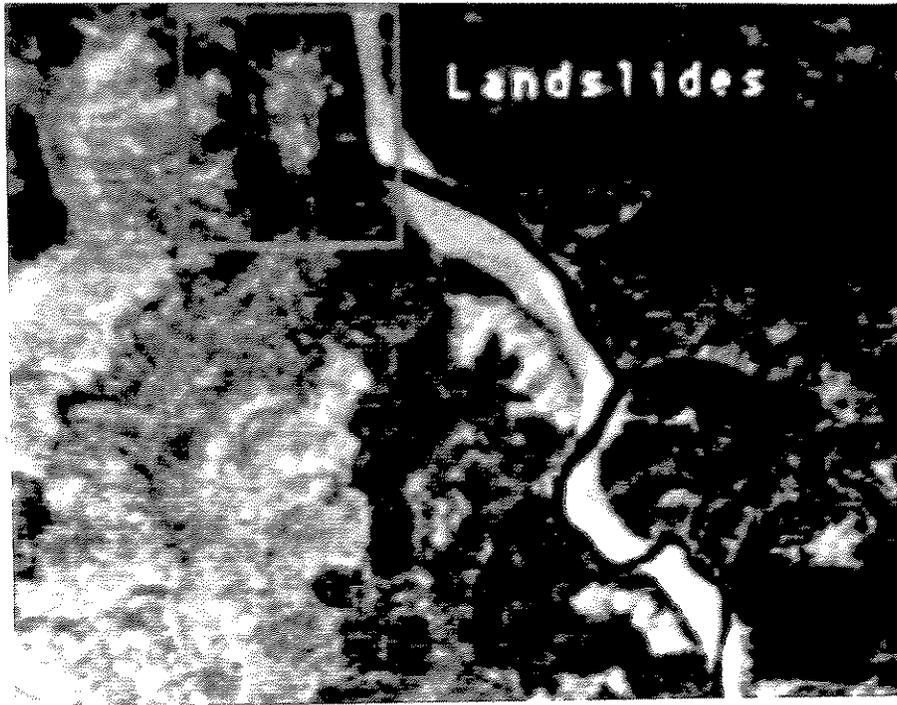


Photo 9 - Magnified view of landslides adjacent to Klamath River



Photo 10 - 1972 aerial photograph of landslides adjacent to Klamath River  
Courtesy of D. Van DeMark

- Private land from Weitchpec to the mouth of the Klamath River (Terwur and Blue Creeks have received the greatest recent impacts).

## Five Study Areas

### Terwur Creek

The 1984 and 1990 satellite images of Terwur Creek were displayed side-by-side in black and white (Photo 11-1984 and 1990 Terwur Creek) to illustrate land use change. These images show that areas with forest canopy, shown in dark grey in 1984, are white or light grey in 1990, indicating that the forest canopy is gone. Although this method was useful in documenting recent land use change, ERA was able to locate studies that provide a more complete explanation of Terwur resource conditions over time.

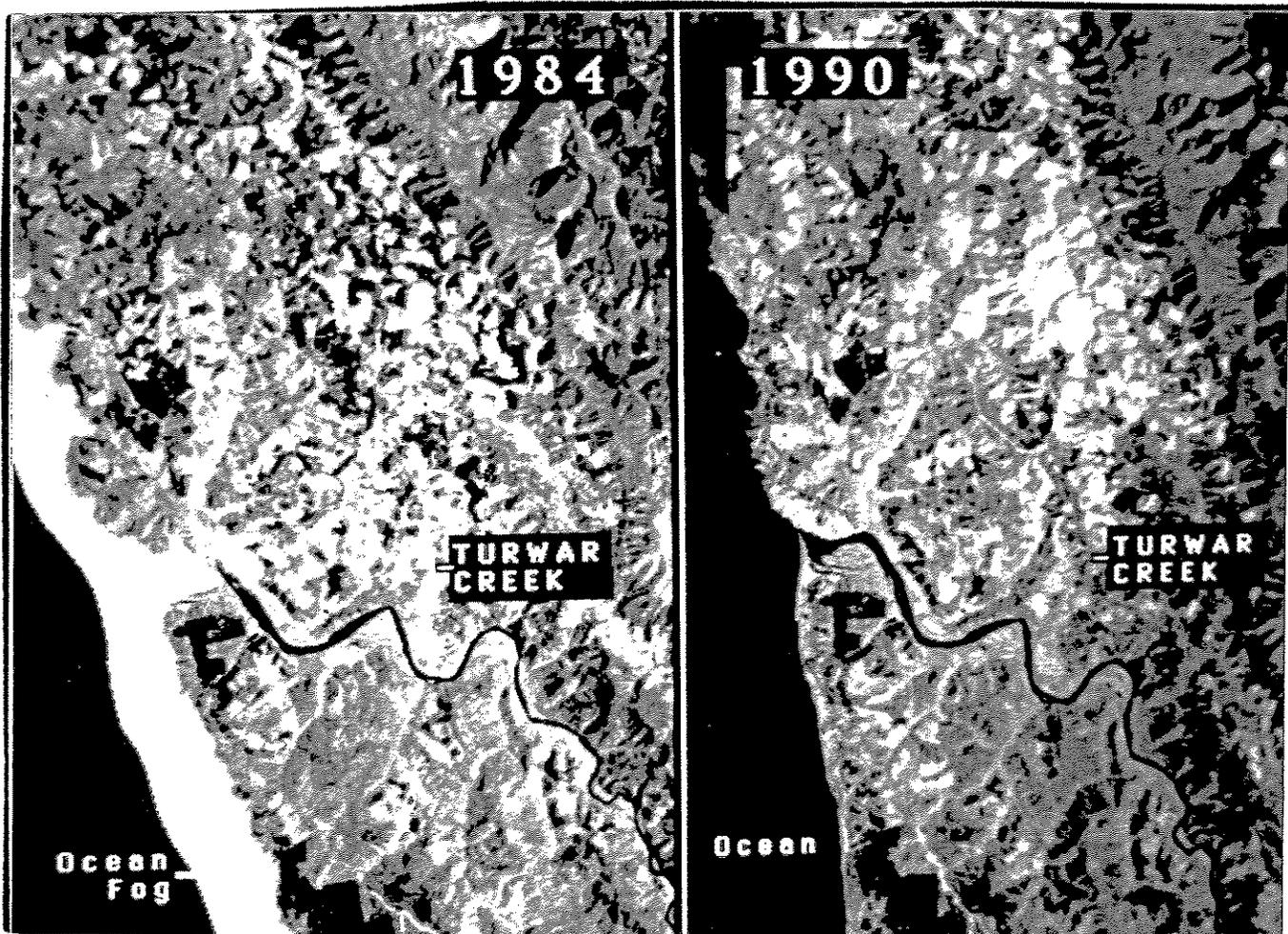


Photo 11 - A comparison of 1984 and 1990 black and white satellite imagery was conducted to illustrate the rate of land use change in the Terwur Creek drainage.

Prior to 1979, Terwur appeared to be one of the least affected streams in the Lower Klamath Basin (USFWS 1979). This report concluded that Terwur had great potential for salmon and steelhead production if the habitat quality remained good. Despite past efforts by researchers to call for immediate action to prevent further water degradation, the Terwur drainage has been continually logged to the detriment of anadromous fish populations (Photo 12-Terwur Creek showing extensive clearcutting).

The lower part of Terwur Creek was logged in the 1950's and early 1960's. Coates and Miller (1981) noted that between 1970 and 1978, over thirty percent of the lower watershed was clearcut. They found that there was a "dramatic increase in frequency and activity of mass movement associated with progressive timber harvest, but with a delayed time reaction." Coates and Miller also noted that the high level of watershed disturbance had created an extreme risk of erosion:

"Given the extent of recent soil disruption in Terwur Creek, the probability of continued timber harvest activities and the documented impacts in watersheds of comparable climate and geology, it appears that the stage has been set for significant accretion of sediment from hillslopes to tributaries and to the main channel of Terwur Creek. The timing of such impacts, however depends to a large degree on the timing of future storm events."

A substantial area within the Terwur basin was burned and salvage logged following the transfer of upper Terwur to private ownership.

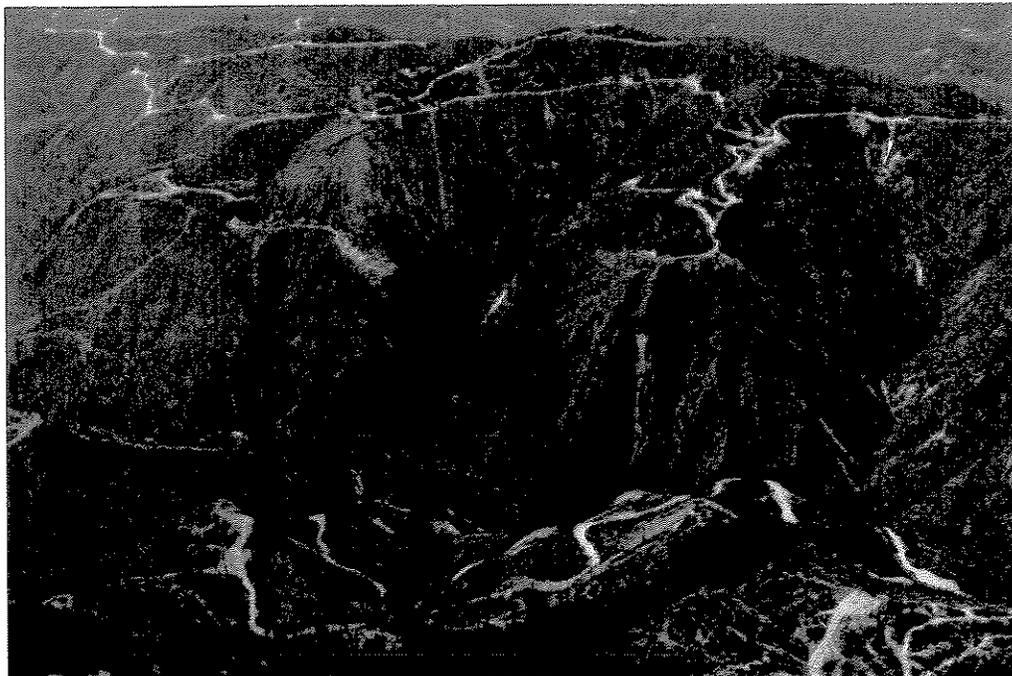


Photo 12 - Lower Terwur creek drainage showing extensive clearcutting.  
Courtesy of P. Higgins

## Blue Creek

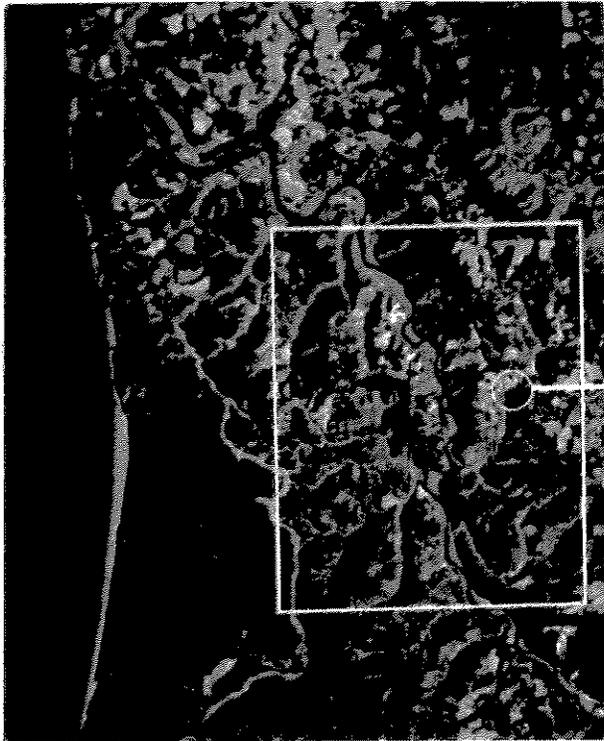
The headwaters of Blue Creek are protected as part of the Siskiyou Wilderness, while the lower portion is in private ownership (Photos 13 & 14 - upper/lower Blue Creek). These photographs illustrate a sharp contrast between undisturbed watershed conditions and those altered by timber management. By developing a GIS which contains information on the Blue Creek watershed, the fish population information collected by USFWS in the lower portion of Blue Creek (Photo 15 - data next to imagery) can be compared with stream surveys and watershed analysis to help identify how restoration could improve anadromous fish recovery.



Photo 13 - Upper Blue Creek watershed.  
Courtesy of P. Higgins



Photo 14 - Lower Blue Creek watershed.  
Courtesy of P. Higgins



Records	DATE	LOC	TRAP	CHINCK	STHD
1	06/26/90	BC 1	FM	94	20
2	06/27/90	BC 1	FM	61	38
3	06/28/90	BC 1	FM	63	11
4	06/28/90	BC 1	FM	54	16
5	06/28/90	BC 1	FM	13	143
6	06/29/90	BC 1	FM	11	23
7	06/29/90	BC 1	FM	7	14
8	06/29/90	BC 1	FM	29	5
9	06/22/90	BC 1	FM	32	28
10	06/07/90	BC 1	RO	8	1
11	06/08/90	BC 1	RO	3	0
12	06/12/90	BC 1	RO	120	12
13	06/13/90	BC 1	RO	152	5
14	06/14/90	BC 1	RO	136	7
15	06/15/90	BC 1	RO	82	2
16	06/19/90	BC 1	RO	24	7
17	06/20/90	BC 1	RO	21	2
18	06/21/90	BC 1	RO	18	3
19	06/22/90	BC 1	RO	37	5
20	06/23/90	BC 1	RO	204	5
21	06/24/90	BC 1	RO	143	4
22	06/25/90	BC 1	RO	145	5
23	06/26/90	BC 1	RO	98	7
24	06/27/90	BC 1	RO	40	6
25	06/28/90	BC 1	RO	53	6
26	06/29/90	BC 1	RO	112	8
27	06/30/90	BC 1	RO	77	5

Photo 15 - 1990 Blue Creek Salmon & Steelhead population survey data positioned next to 1990 a color infrared satellite image of Blue Creek.

## Weitchpec

As noted in the Methods and Materials section above, a 1947 photograph of the Weitchpec area (Photo 16 - 1947) was acquired from the USGS Aerial Photograph Record System (APRS). For a nominal fee, any individual, agency, or organization can purchase the APRS microfiche to locate historical aerial photographs for watershed analysis. The 1947 photograph shows that the forest canopy southwest of the Klamath-Trinity confluence at Weitchpec is still intact except for a few scattered meadows.

This 1947 photograph can be contrasted with a 1991 aerial photograph (Photo 17 - Weitchpec color) which shows current conditions. Clearcuts and areas in various stages of regeneration can be seen in the more recent photograph.

It is important, whenever possible, to obtain historical photographs and other information that illustrate land use conditions prior to periods of significant change, to help guide watershed analysis and fishery restoration efforts.

# AERIAL PHOTO RECORD SYSTEM - WEITCHPEC

7-18-47

4-25

63 E

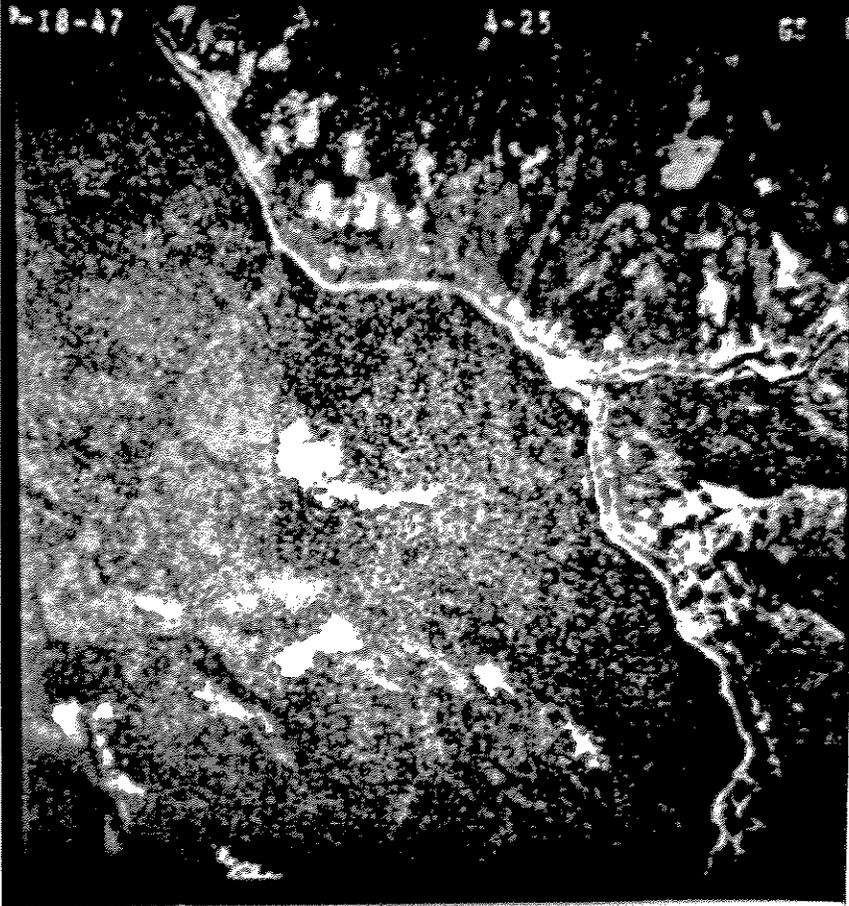
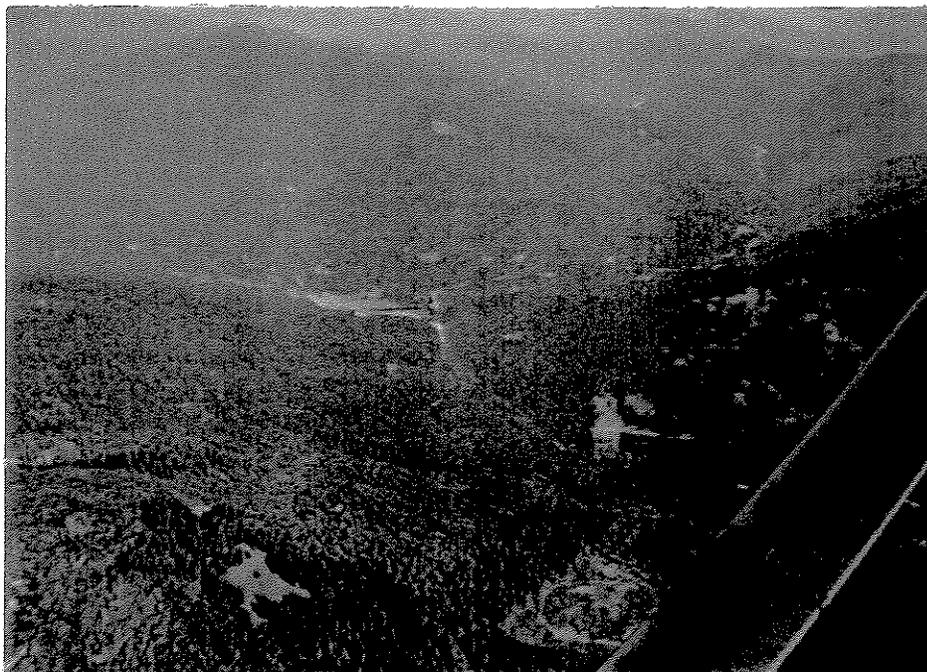


Photo 16 - 1947 aerial photograph of Weitchpec area acquired from APRS, USGS.

JULY 18, 1947

Photo 17 - 1991 aerial photograph of Weitchpec area.



## Somes/Butler and Salmon River Landscapes

Satellite imagery provides a convenient tool for locating relatively undisturbed areas like Some/Butler (Photo 18), and comparing them to areas that have received large scale watershed impacts, such as the massive fire scarred Salmon River Basin. Somes/Butler, located in the top left corner of the quadrangle highlighted in the photograph, is bordered on the left by random clearcuts, and on the lower right by the fire impacted Salmon River Basin.

A color infrared image of the Salmon River study area (Photo 19), to the right of the quadrangle of the previous photograph, displays the large area affected by the 1977 and 1987 fires. The red and green satellite image (Photo 20) is another way of illustrating in red, the fire damaged area.

These satellite images were contrasted with an aerial photograph (Photo 21), and two photographs taken on the ground (Photos 22 & 23) shortly after the 1987 fire.

This series of photographs demonstrates how satellite imagery, combined with aerial and ground photographs can be used to focus in on areas in need of restoration. Once problem sites have been located, field surveys and restoration projects can be identified.

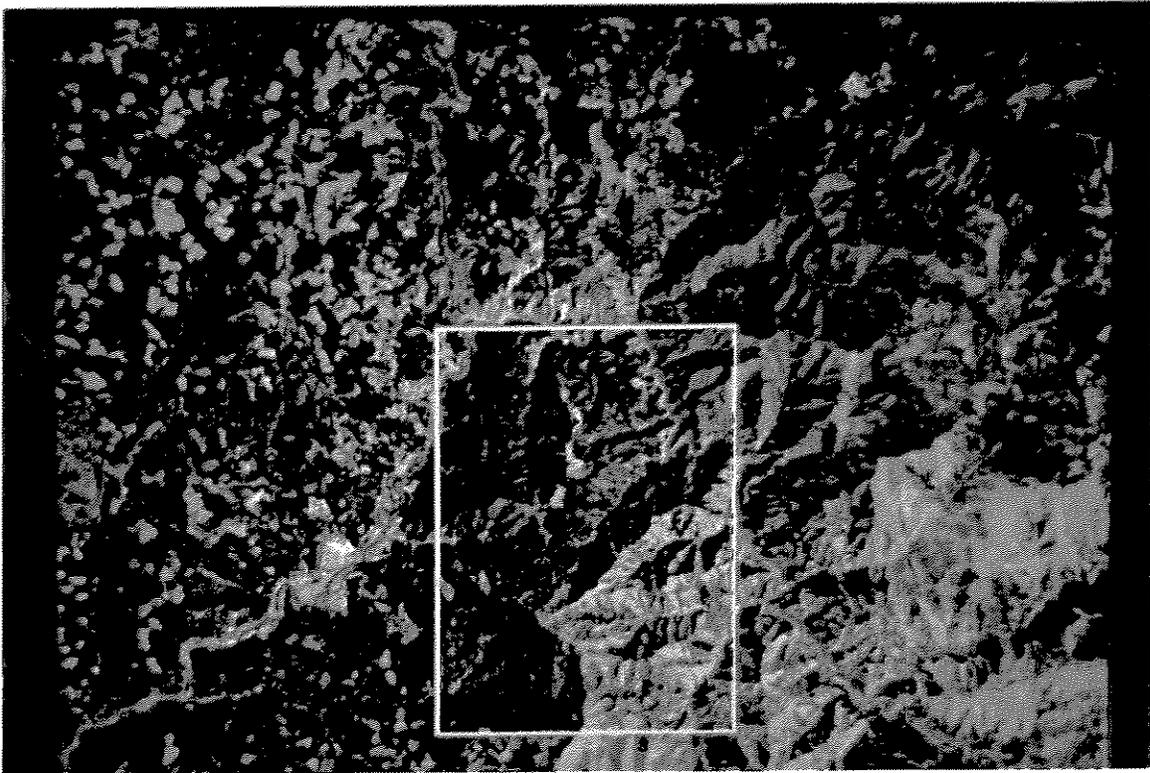


Photo 18 - 1990 false color infrared image of Somes/Butler, Wooley Creek drainages within the Salmon River landscape.

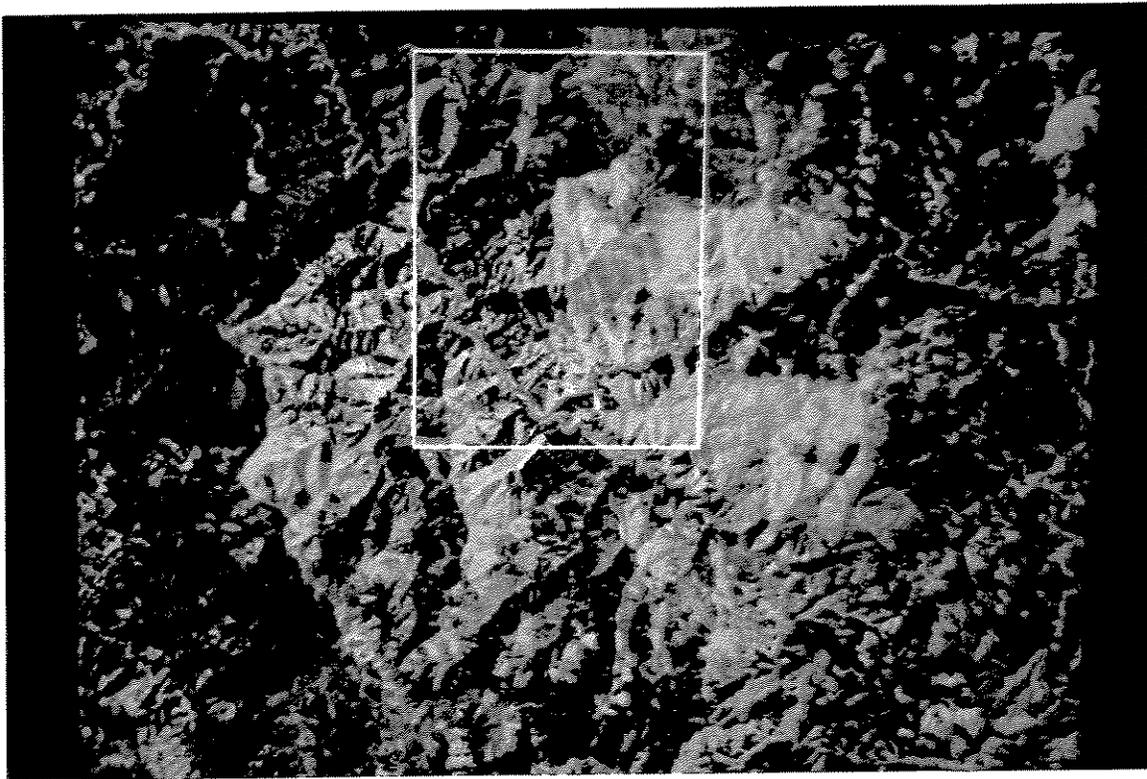


Photo 19 - 1990 false color infrared image of Salmon River landscape highlighting burned areas.

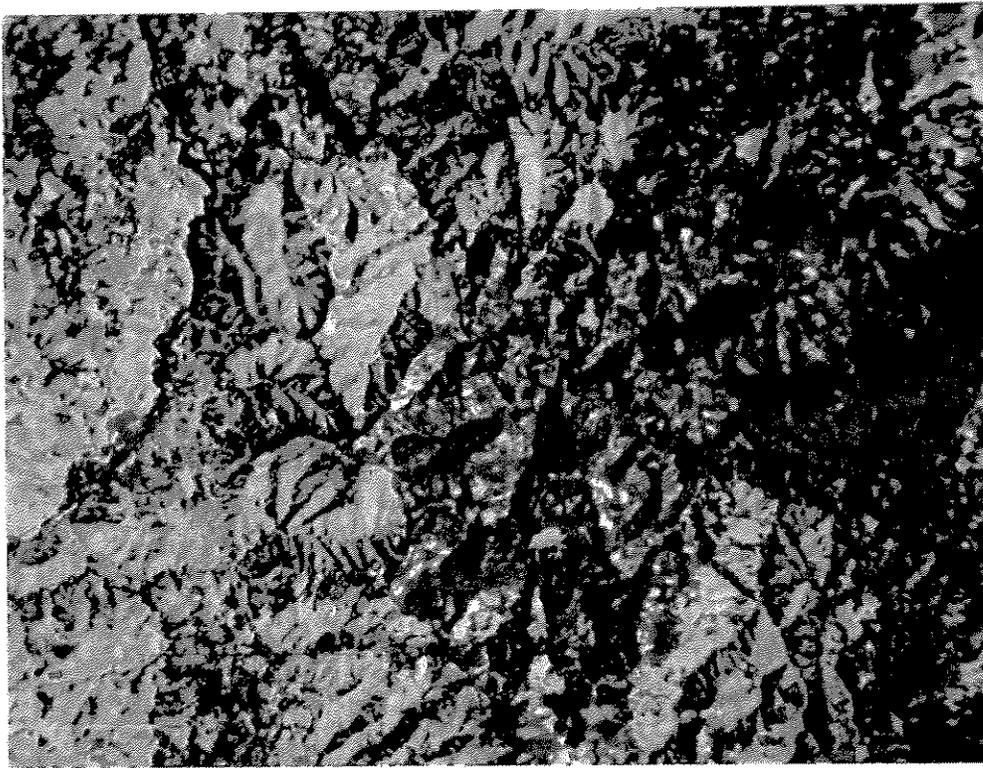


Photo 20 - 1990 red and green color infrared image of Salmon River landscape highlighting extensive burned areas.

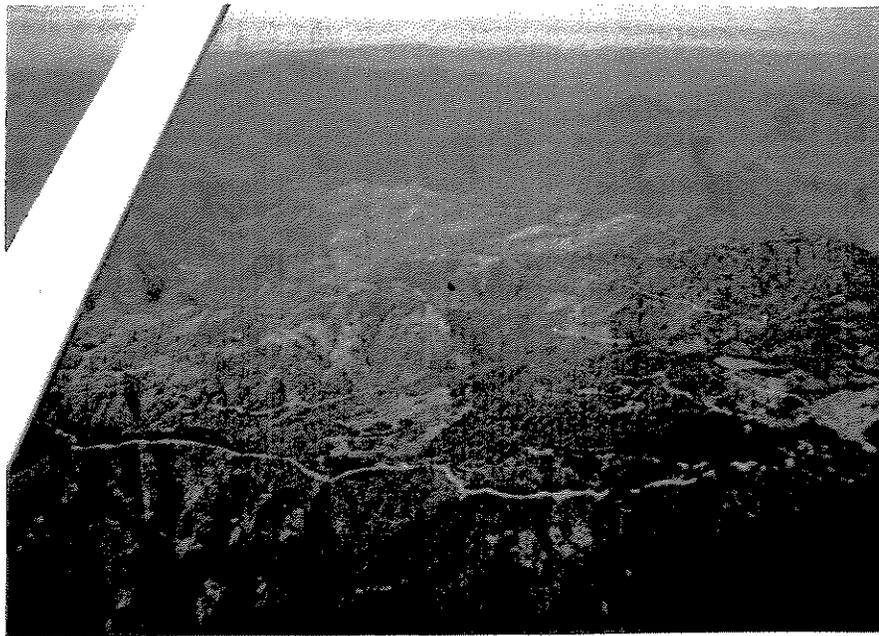


Photo 21 - 1991 aerial photograph of Salmon River landscape highlighting burned areas.



Photo 22 - 1987 color photograph of a burned hillside in Salmon River Basin.  
Courtesy of P. Brucker



Photo 23 - 1987 color photograph closeup of a burned drainage in the Salmon River Basin. Courtesy of P. Brucker

## Geographic Information Alternatives

As explained in the previous discussion of the study areas, there is a variety of natural resource information that can be assembled into a remote sensing based GIS for the Lower Klamath and Salmon River Basins. Certain types of information are already computerized and can be accessed from various sources to assist the Task Force in fishery restoration planning, implementation, and monitoring. Other information, such as maps, photographs, and file reports, is non-computerized but can still be integrated into a GIS analysis. Certain types of information (i.e. the location of previous fishery restoration efforts) would be more useful if they were brought into a computerized GIS format.

The EPA Reach File System being developed by Kier Associates will be useful in orienting the user to hydrographic and water quality information, but it is currently limited to 1:100,000 scale.

There are several GIS choices which the Task Force should consider regarding the process of data integration:

- A central organization or facility that has already invested in a large computerized system could be selected to act as the repository for all pertinent information. All interested parties would have access to this information either through a written data request procedure or through computer phone access.
- The Task Force could invest in a computerized system of its own and coordinate the standardization of information over the life of the anadromous fishery restoration program.
- The diverse information currently available throughout the project area could be recognized as an informal GIS. To implement this option, each organization that has available computerized information would establish a data acquisition policy/procedure. Anyone with a computer could request information from other organizations, then structure the information into their preferred format, and utilize it independently. Organizations which have not already purchased a computerized GIS could select computer equipment and software that is widely compatible with database management and GIS systems already in use by Task Force members.

## ERA Analysis of GIS Alternatives

The Task Force should consider the following:

- The centralized approach to GIS integration has potential, but no one organization appears to be perfectly suited at this time to be designated as the centralized facility.
- The Task Force could begin the development of a GIS on its own by working with other agencies and organizations to determine what combination of information could be assembled over the life of the restoration program to improve fisheries restoration planning, implementation and monitoring.
- None of the agencies and organizations that have useful GIS related information appear to have the time or money to initiate a full scale information integration effort on their own. An integrated approach to GIS development is needed to pool available resources.

### GIS Costs

A preliminary cost analysis of GIS information demonstrated that interagency cooperation would minimize the cost of data integration throughout the Klamath River Basin. Costs for GIS systems range from a few thousand dollars to several hundred thousand dollars depending on the software and platforms chosen.

The USFWS National Ecology Research Center in Fort Collins, Colorado, Bureau of Indian Affairs Geographic Data Service Center in Golden, Colorado, U.S. Forest Service Geodetic Service Center in Salt Lake City, Utah, U.S. Geological Survey Region center in Menlo Park, California, Teal Data Center in Sacramento, California and other agencies, tribes and organizations need to be become part of the information sharing process before data sharing costs can be fully understood.

For those organizations that have not invested in a GIS, several factors will influence their ability to display and conduct detailed analysis on satellite imagery, map layers, scanned images and other various information sources. Federal/state government agencies generally purchase whatever GIS system they are authorized to buy. In many cases, governments generally buy the GIS software produced by ESRI called Arc/Info. Arc/Info is widely used throughout the world, and therefore has become the preferred choice for GIS acquisitions. However, Arc/Info is principally a map layer ("vector") and database type GIS package. For satellite and other "raster" data integration, a separate software package may be needed. For full integration between vector, raster, and data base management, a GIS that can work aggressively in both mediums is advised.

## **V. Summary and Conclusions**

Energy and Resource Advocates (ERA) began work on this project in January 1991 following endorsement by the Klamath Task Force. ERA purchased one 1991 Landsat satellite scene of the project area (from the Marble Mountains to the mouth of the Klamath River at the Pacific Ocean), and compared it with a 1984 Landsat scene of the same area to identify where current management activities and related impacts are concentrated. An additional 1991 scene of the Upper Klamath River Basin was also purchased for future analysis.

In reviewing the satellite imagery and the photographs displayed in this report, as well as the resource information and studies obtained for this project, it became clear that there are very few areas in the Lower Klamath and Salmon River Basins that have not been affected by a combination of human activities and natural processes.

A variety of steps were taken to enhance the satellite imagery and integrate various forms of natural resource information on five study areas to illustrate how a GIS can be assembled for the project area. In conclusion, ERA believes that a GIS is feasible for the project area.

## **VI. Recommendations**

In order for the Task Force to improve its efforts to protect and enhance the fishery resources of the Lower Klamath and Salmon River Basins, and in view of the information presented in this report, ERA offers the following recommendations:

1. The Task Force should begin the development of a coordinated GIS by working with other agencies and organizations to determine what combination of information could be assembled over the life of the restoration program to improve fisheries restoration planning, implementation, and monitoring.
2. The computerized map overlays which currently exist for portions of the Klamath River Basin, such as those on national forest lands, should be overlaid onto the satellite imagery purchased for this project to provide the Task Force, Technical work Group, and USFWS with an overview of resource conditions.
3. Existing computerized resource information should be linked to the satellite imagery and map overlays.
4. The information assembled in points #2 and #3 should be used to evaluate cumulative effects throughout the project area.
5. Forest management throughout the project area should be monitored on a continuous basis by tracking current and proposed U.S. Forest Service and private land management activities.

6. The Task Force should utilize existing information to assess resource conditions in the Salmon River Basin to determine if current restoration efforts are adequate to protect anadromous fish from the effects of past or future catastrophic fires.
7. The information currently being assembled under the State Water Resources Control Board Reach File project should be developed so that it is compatible with other commonly used GIS systems.
8. The development of a GIS should include the 1991 Upper Klamath River Basin satellite imagery purchased during this project.

## VII. Summary of Expenditures

### Energy and Resource Advocates Lower Klamath and Salmon River Project

1991-92

<b>Receipts</b>	<b>Budget</b>
Contract Income	\$34,677
Accounts Receivable	\$2,153
<b>Total Contract Amount</b>	<b>\$36,830</b>
<b>Expenses</b>	
Consulting Fees	\$22,863
Travel	\$1,744
Purchase of Materials	\$11,183
Administration	\$1,040
<b>Total Expenses</b>	<b>\$36,830</b>

## VIII. Bibliography

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- California Department of Water Resources. 1981. Water Resource Data. U.S. Geological Survey water data report. Prepared in cooperation with other agencies.
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- Coates, R.N. and T.O. Miller. 1981. Cumulative silvicultural impacts on watersheds: a hydrologic and regulatory dilemma. *Environmental Management*. 5(2):147-160.
- Earth Science Associates. 1980. Lower Klamath River Basin Investigation. Prepared for the USDI Bureau of Indian Affairs. Palo Alto, @200p.
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- McEvoy, A.F. 1986. *The fisherman's problem: ecology and law in the California fisheries, 1850-1980*. Cambridge University Press, New York. 368 pgs.

- Nehlsen, W., J.E. Williams, and J.A. Lichatowich. 1990. Pacific salmon at the crossroads: west coast stocks of salmon, steelhead, and sea-run cutthroat trout at risk. Western Division of the American Fisheries Society, Portland, Oregon.
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- Siskiyou Forestry Consultants. 1989. Karuk ancestral lands forest management plan. Prepared for the Karuk Tribe of California, Happy Camp, California.
- Snyder, J.O. 1931. Salmon of the Klamath River. California Department of Fish and Game. Fisheries Bulletin No. 34. 130 pgs.
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- U.S. Fish and Wildlife Service. 1991. Same as Klamath Plan 1991 reference listed above on page 39.

**A REMOTE SENSING AND GEOGRAPHIC  
INFORMATION SYSTEM (GIS)**

**FEASIBILITY ANALYSIS OF THE LOWER  
KLAMATH AND SALMON RIVER BASINS**

**APPENDICES**

APPENDIX A

Computerized GIS Data Sheet

Organization Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip Code \_\_\_\_\_

Contact Person \_\_\_\_\_ Date \_\_\_\_\_

Phone ( \_\_\_\_\_ ) \_\_\_\_\_ Extension \_\_\_\_\_

Computerized GIS Information

Primary Computer Hardware \_\_\_\_\_  
(examples: IBM, Intergraph, Data General, Vax, Macintosh, etc.)

Computer Operating System \_\_\_\_\_  
(examples: DOS, VMS, UNIX, etc.)

Number of Terminals at facility \_\_\_\_\_

Geographic Information System \_\_\_\_\_  
(examples: Arc/Info, Terra Mar, Geo Base, GRASS etc.)

Vector \_\_\_\_\_ (yes/no) Raster \_\_\_\_\_ (yes/no)

Satellite Image Processing System \_\_\_\_\_  
(examples: Erdas, GRASS, etc.)

Spread Sheet Software used \_\_\_\_\_  
(examples: Lotus, Excel, Quattro, etc.)

Data Base Management Software used \_\_\_\_\_  
(examples: DBase, R:Base, Info, etc.)

Data Base Contents: \_\_\_\_\_  
(Please provide an index of subject categories)

Data Base Format: \_\_\_\_\_  
(Please provide data legends, index headings and examples of how information is entered and displayed in the data base)

ASCII OR DLG COMPATIBLE ? \_\_\_\_\_ (YES/NO)

Data Availability: \_\_\_\_\_ (Public/Proprietary)

Data Origin and Date: \_\_\_\_\_

\_\_\_\_\_  
[Please use additional sheets if needed]  
\_\_\_\_\_  
(Please describe how the information was collected, including but not limited to: Field inventory procedures, sampling methods, accuracy assessment standards, etc.)



Map and Aerial Photo Data Sheet

Date \_\_\_\_\_

What maps are used at your facility? \_\_\_\_\_

(examples: U.S.G.S. Topographic Maps, Timber Management Maps, Soils Maps, Habitat Maps, Fish Stream Survey Maps, etc.)

Please list the map, approximate date, scale, source and location.

<u>Map</u>	<u>Date</u>	<u>Scale</u>	<u>Source</u>	<u>Location</u>
(examples)				
Topographic	1976	1:24,000	USGS	Yreka, Ca.
Stream Profile	1980	1:200 ft.	Ca. F&G	Redcap Creek

What photographs are used at your facility (including aerial photography)? \_\_\_\_\_

(examples: Before and after plot photographs, stream restoration sites, aerial inventory photography, etc.)

<u>Photograph</u>	<u>Date</u>	<u>Scale</u>	<u>Format</u>	<u>Location</u>
(examples)				
Timber Inventory	1989	1:15,840	Color prints	Klamath N.F.
Fire reconnaissance	1976	1:12,000	Color IR	Hog Fire

(Please use additional sheets if necessary)

APPENDIX B

ORGANIZATIONS CONTACTED

DURING ERA'S GIS REVIEW

KLAMATH TASK FORCE MEMBERS

<u>Name</u>	<u>Representing</u>
Nathaniel Bingham	California Commercial
Salmon Fishing Industry	
Don DeVol	Del Norte County
Mitch Farro	Humboldt County
	National Marine
	Fisheries Service
Leaf Hillman	Karuk Tribe
Walter Lara, Jr.	Yurok Tribe
Tom Stokley	Trinity County
Forest Reynolds	California Department
of Fish and Game	
Michael Orcutt	Hoopa Valley Tribe
Barbara Holder	.S. Department of
Agriculture	
William Shake	U.S. Department of
	Interior
Fishing Community	California In-River Sport
George Thackeray	Siskiyou County
Keith Wilkinson	Oregon Department of
Fish and Wildlife	

PUBLIC

U.S. DEPARTMENT OF AGRICULTURE

U.S. Forest Service

Klamath National Forest - Yreka  
Ukonom Ranger District - Orleans  
Salmon River District - Etna  
Redwood Science Laboratory - Arcata  
Six Rivers National Forest - Eureka  
Gasquet Ranger District - Gasquet  
Orleans Ranger District - Orleans

U.S. DEPARTMENT OF INTERIOR

U.S. Fish and Wildlife Service - Yreka & Arcata  
National Marine Fisheries Service - Santa Rosa  
National Park Service - Arcata  
Soil Conservation Service - Davis & Arcata  
U.S. Bureau of Reclamation  
U.S. Geological Survey

STATE OF CALIFORNIA

Cal. Conservation Corp - Klamath  
Cal. Department of Fish and Game - Arcata, Eureka & Sacramento  
Cal. Department of Forestry - Sacramento & Fortuna  
Cal. Department of Water Resources - Red Bluff  
Cal. Trans - Eureka  
Cal. Water Quality Control Board - Santa Rosa

CALIFORNIA COUNTIES

Del Norte - Crescent City  
Humboldt - Eureka

Siskiyou - Yreka  
Trinity - Weaverville

TRIBES

Karuk Tribe - Happy Camp  
Hoopa Valley Tribe - Hoopa  
Yurok Transition Team - Klamath

PRIVATE

Geographic Resource Solutions - Arcata  
Simpson Timber Company - Arcata  
Trinity Associates - Arcata  
Vestra Resources - Redding

PRIVATE NON-PROFIT

Del Norte County Historical Society - Crescent City  
Humboldt County Historical Society - Eureka  
Klamath Forest Alliance - Etna  
Northcoast Environmental Center - Arcata  
Redwood Community Action Agency - Eureka  
Wilderness Society - Seattle Washington

## APPENDIX C

### KLAMATH RIVER BASIN FISHERIES TASK FORCE LOWER KLAMATH RIVER BASIN DATA INDEX

<u>ORGANIZATION</u>	<u>PAGE</u>
<u>PUBLIC AGENCIES</u>	
<u>U.S. DEPARTMENT OF AGRICULTURE</u>	
Fish and Wildlife Service - Yreka .....	C1
Fish and Wildlife Service - Arcata .....	C1
U.S. Forest Service	
Klamath National Forest - Yreka .....	C2
Salmon River District - Etna .....	C3
Ukonom Ranger District - Orleans .....	C3
Redwood Science Laboratory - Arcata .....	C4
Six Rivers National Forest - Eureka .....	C4
Gasquet Ranger District - Gasquet .....	C5
Orleans Ranger District - Orleans .....	C6
<u>U.S. DEPARTMENT OF INTERIOR</u>	
Bureau of Indian Affairs - Redding .....	C8
Bureau of Land Management - Sacramento .....	C8
National Marine Fisheries Service - Santa Rosa .....	C8
National Park Service - Arcata .....	C9
Soil Conservation Service - Davis & Arcata .....	C12
U.S. Bureau of Reclamation - Sacramento .....	C13
U.S. Environmental Protection Agency - San Francisco .....	C13
U.S. Geological Survey - Menlo Park .....	C13
<u>STATE OF CALIFORNIA</u>	
Cal. Conservation Corp - Klamath .....	C14
Cal. Department of Fish and Game - Arcata, Eureka and Sacramento .....	C14
Cal. Department of Forestry - Sacramento & Fortuna .....	C17
Cal. Teal Data Center - Sacramento .....	C17
Cal. Department of Water Resources - Red Bluff .....	C18
Humboldt State University - Arcata .....	C19
<u>California County</u>	
Humboldt Assessors Office - Eureka .....	C20

ORGANIZATION

PAGE

TRIBES

Karuk Tribe - Happy Camp .....	C21
Hoopla Tribe - Hoopa .....	C21

PRIVATE COMPANIES

Geographic Resource Solutions - Arcata .....	C23
Simpson Timber Company - Arcata .....	C23

PRIVATE NON-PROFIT

Humboldt County Historical Society - Eureka .....	C25
Klamath Forest Alliance - Etna .....	C25
Wilderness Society - Seattle Washington .....	C25
Northcoast Environmental Center - Arcata .....	C25

PUBLIC AGENCIES

U.S. DEPARTMENT OF AGRICULTURE

U.S. DEPARTMENT OF INTERIOR

STATE OF CALIFORNIA

CALIFORNIA COUNTY

<u>Contact</u> <u>Organization</u>	<u>Person</u>	<u>Natural Resource</u> <u>Information</u>
U.S. Fish & Wildlife P.O. Box 1006 Yreka, Ca. 96097 (916) 842-5763	Ron Iverson	Klamath River Basin Report

Computer: IBM compatible  
Software: Lotus, DBASE III

The Klamath River Basin Report is a list of all Klamath River Basin Fisheries Restoration Projects up to February 1988. Each project is presented in spread sheet form. Also provided are 1989 Klamath Field Review Comments provided by the contractor.

<u>Contact</u> <u>Organization</u>	<u>Person</u>	<u>Natural Resource</u> <u>Information</u>
U.S. Fish & Wildlife Coastal Ca. Fisheries Resource Office 1125 16th St., RM 209 Arcata, Ca. 95521 (707) 822-7201 Computer: IBM compatibles Software: Lotus, DBASE III & IV	Tom Kisinuki	Monitoring fish populations, fish habitat evaluations, harvest management, & juvenile migration monitoring Computerized Klamath Data: Beach seining (Adult) Juvenile seining Screw Trapping Net Harvest Blue Creek Population data Lower tributary surveys

Klamath River Computerized Data

Fish Populations

Beach Seining  
Juvenile Seining  
Screw Trapping  
Net Harvest

Computer Software

DBASE III Plus  
DBASE III Plus  
DBASE III PLUS  
DBASE III PLUS

Fish Habitat Evaluations

Blue Creek Surveys

DBASE III Plus

Fish Habitat Evaluations

Lower Klamath River

DBASE III Plus

Klamath River Non-Computerized Data

Raw Data Sheets  
Coded Wire Tag Raw Data  
Chinook Scale Samples  
Steelhead Scale Samples  
Sturgeon Pectoral Fin Rays

<u>Organization</u>	<u>Contact Person</u>	<u>Natural Resource Information</u>
Klamath National Forest 1312 Fairlane Road Yreka, Ca. 96097 (916) 842-6131 ext. 2224	Jim McGinnis	Natural resource surveys, reports and GIS layers

Computer: Data General 8000  
Operating Syst: AOSVS  
Software: LTPlus, Oracle  
GIS: DWRIS

Computer: Compac Deskpro 386/20  
Operating Syst: DOS, Xenix  
Software: Paradox

On August 12, the Klamath National Forest hosted a landmark meeting of top level representatives in the fields of resource management, ecological research and the technology of Geographic Information Systems (GIS). The team will focus on meeting the challenges of managing the forest on a

landscape level. The partnership currently joins the U.S. Forest Service with scientists from the Pacific Southwest Forest and Experimental Research Station and world class GIS technologists from Penn State who specialize in computer hardware and software (Siskiyou Daily News, Tuesday, August 13, 1991).

Any available information that is requested from the Klamath National Forest must comply with the Freedom of Information Act (FOIA) and receive completed/specialist approval. Formal requests should be directed to the Information Officer in Yreka, California.

<p>Salmon River District Etna, California, 96027 (916) 467-5757</p>	<p>Orin Dicks</p>	<p>Project Level: Timber, Geology, Soils, Wildlife, Cultural, Fire and other resource management records &amp; maps (Information incomplete)</p>
---	-------------------	--

The Salmon River District has computerized maps. They also have 1:24,000 scale SPOT panchromatic (black and white) satellite maps with timber type overlays. The Salmon River District planner has recently ordered a SPOT panchromatic mosaic that can be used at the District to display the conditions of the entire Salmon River Basin. The District is currently engaged in conducting a work plan for Salmon River Watershed Restoration following the 1987 catastrophic fires. The Klamath National Forest regional staff are also working with District personnel to conduct a sediment budget of fire affected areas.

<u>Organization</u>	<u>Contact Person</u>	<u>Natural Resource Information</u>
<p>Ukonom Ranger District U.S. Forest Service Drawer 410 Orleans, Ca. 95556 (916) 627-3291</p>	<p>Barry Cohn (Resources)</p> <p>Millie Graber (Data Base Manager)</p>	<p>Project Level Timber, Geology, Soils, Wildlife, Cultural, Fire, and other resource management records &amp; maps</p>

The Ukonom Ranger District uses 1:24,000 scale 1990 SPOT panchromatic (black and white) satellite maps with timber overlays to plan and track timber harvesting. Geology, Soils, Fire and Timber related information is site specific to each timber sale file folder. They have an atlas of past fire occurrences. Staff Fisheries personnel are located at the Happy Camp Ranger District where fish population and habitat data is being computerized in Oracle database format.

Landslide and soil maps are available at 1:24,000 scale. There is a road atlas, but road miles are not represented. Mining, cultural, trails and recreation information is available in various file formats.

Aerial Photographs

<u>Year</u>	<u>Type</u>	<u>Scale</u>	<u>Comment</u>
1944	Black & White		
1960	Black & White		
1964	Black & White		
1965	Black & White		Not Complete
1971	Color	1:15,840	
1972	Black & White	1:60,000	
1975	Color		
1980	Color		
1981	Black & White		
1982	Black & White		
1982	Color Infrared		
1985	Color	1:15,840	
1990	Color	1:15,840	Purchased but not received

<u>Organization</u>	<u>Contact Person</u>	<u>Natural Resource Information</u>
Redwood Sciences Laboratory US Forest Service 1700 Bayview Drive Arcata, Ca. 95521 (707) 822-3691	Diane Rainsford	Watershed Research  Computer: SUN Sparc Operating System: UNIX GIS: Arc/Info

<u>Organization</u>	<u>Contact Person</u>	<u>Natural Resource Information</u>
Six Rivers National Forest 500 5th Street Eureka, Ca. 95501 (707) 442-1721	Lea Stuart	Forest-wide Land and resource management information.

(Information responses have been delayed due to the development of the Six Rivers National Forest Land and Resource Management Plan)

In the process of developing their Ten Year Land and Resource Management Plan, Six Rivers National Forest planning staff have built a detailed data base management system that is capable of generating maps which illustrate commercial forest and other multiple-use resource distribution. The resource data base on the Six Rivers National Forest consists of a computerized mapping and multiple-use resource information retrieval and

storage system on a Data General mainframe computer.

The location of each resource feature, such as timber and geology distribution, has been formatted on sixty 7.5 minute (1:24,000 scale) United States Geological Survey (USGS) topographic maps. Each vegetation or land feature, that was drawn on a USGS 7.5 minute scale map, was assigned a unique number. These 'polygon' numbers correspond to a 132 column computerized data record which lists the type of resource information assembled for each feature on the Forest (Rohde 1989).

### Fisheries

National Forests use the Fish Habitat Relationships (FHR) approach to stream habitat classification.

### Reference

Rohde, R.B. 1989. A Spatial Timber Inventory of Six Rivers National Forest. A Masters Project Presented to The Faculty of Humboldt State University, pgs. 44.

<u>Organization</u>	<u>Contact Person</u>	<u>Natural Resource Information</u>
U.S. Forest Service Gasquet Ranger Dist. P.O. Box 228 Ca. 95543 (707) 457- 3131	Dave Webb Timber Mgr.  Phil Bono	Timber stand and plantation computer data. (Proprietary)  Stand Record Cards, Plantation Exams, 1% sample plots. (Public)

Computer: Data General (20 terminals)  
Operating Syst: MOS-DS  
Software: DG (spreadsheet),  
ORACLE, S2K.

<u>Maps</u>	<u>Date</u>	<u>Scale</u>	<u>Source</u>	<u>Location</u>
USGS topo	1978	1:24,000	USGS	Gasquet District
Timber Sales	1990	1:24,000	USFS	Gasquet District
Timber Sale Areas	1960- 1990	1:15,840	USFS	Gasquet District
Sale Unit Maps	1960 - 1990	(Traverse) 1: 3,168	USFS	Gasquet District
Orthophoto Compartment Map	1975	1:12,000	USGS	Gasquet District
SPOT Satellite Quads	1989	1:24,000	Vestra	Gasquet District

<u>Photographs</u>	<u>Date</u>	<u>Scale</u>	<u>Format</u>	<u>Location</u>
Aerial Photo's	1970	1:15,840	Color Prints	Gasquet District
Aerial Photo's	1975	1:15,840	Color Prints	Gasquet District
Aerial Photo's	1980	1:24,000	Color Prints	Gasquet District
Aerial Photo's	1985	1:15,840	Color Prints	Gasquet District
Aerial Photo's	1986	1: 4,000	Color Prints	Yurok Exper For.

<u>Organization</u>	<u>Contact Person</u>	<u>Natural Resource Information</u>
Orleans Ranger District U.S. Forest Service Drawer 410 Orleans, Ca. 95556 (916) 627-3291	John Larson Dist. Ranger	Project Level Timber, Geology, Soils, Wildlife, Cultural, Fire, and other resource management records & maps

The Orleans Ranger District uses black and white photographs that have been pieced together into 1:24,000 quad maps. Timber sales are then drawn by hand on mylars over the top of each map. Land ownership is also displayed on the mylar overlays. Wildlife specialists use the timber type maps and categorize them down to habitat and species needs. Geology, Hydrology, Fire and Timber related information is site specific to each timber sale file folder. Soils have been inventories down to level 3 categories.

Fire historical records are available back to the 1920's. County assessors information is available on microfiche which could be used to locate specific information such as mining claims.

"GO-ROAD" environmental documents offer an in depth review of high country conditions on the Orleans and Gasquet Ranger Districts.

### Fisheries

The Orleans Ranger District has a list of fisheries projects that have occurred on the District since 1975. The fisheries staff are writing summary reports of the work that has been conducted on each Klamath fisheries tributary.

Aerial Photographs - Sale Preparation Department

<u>Year</u>	<u>Type</u>	<u>Comments</u>
1942	Black & White	Incomplete coverage
1948	Black & White	Coverage questionable
1954	Black & White	Coverage questionable
1958	Black & White	Coverage questionable
1959	Black & White	Coverage questionable
1960	Black & White	Coverage questionable
1963	Black & White	Coverage questionable
1965	Black & White	Coverage questionable
1966	Black & White	Incomplete coverage

<u>Year</u>	<u>Type</u>	<u>Comments</u>
1970	Color	District-wide coverage
1975	Color	District-wide coverage
1980	Color	District-wide coverage
1985	Color	District-wide coverage
1990	Color	(Due to arrive soon)

(Scales of all photo's vary from 1:24,000 to 1:12,000)

<u>Organization</u>	<u>Contact Person</u>	<u>Natural Resource Information</u>
Bureau of Indian Affairs Redding, Ca.	Rick Felitz	Stream restoration & fish rearing projects

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U.S. Bureau of Land Management (BLM) 2800 Cottage way Sacramento, Ca. 95825 (916) 978-4781	Fern Shepard Prime Sys. Adm. GIS Specialist	Land Management
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Computer: Prime  
Operating System: PRIMOS  
GIS: MOSS, MAPS (public domain)

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National Marine Service 777 Sonoma Ave., RM 325 Santa Rosa, Ca. 95404 (707) 578-7513	Chris Mobley	Section 404 permit Fisheries tracking.  Numerous 7.5' & 15"  USGS maps of California. NOAA Charts
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Computer: IBM compatible  
Software: Lotus, R:BASE for DOS

<u>Organization</u>	<u>Contact Person</u>	<u>Natural Resource Information</u>
Redwood National Park 1125 16th Street Arcata, Ca. 95521 (707) 822-7611	Lee Purkerson	Maps and Aerial Photo's

Computer: Tektronix &  
IBM compatibles  
Operating Syst: UNIX & DOS  
Software: SAGIS, IDRISI, Lotus, & DBase

### MAP INDEX 7/23/90

<u>Map Title/Description</u>	<u>Location</u>
Composite Aerial Photo Index, 1954, Humboldt Co. Composite Topographical Map (15') of North Coast, Weaver	Tech Room
Geomorphology Maps Concerning Landslides: 7.5' Quadrants Crescent City, Hiouchi, High Divide, Smith River, Child's Hill, Requa, Arcata North.	Tech Room
Klamath River Basin, Erosional Landforms, Land Use, Hagans & Channel Conditions; Salmonid Distribution; by Earthy Sciences Assoc.	
Requa Quadrant - Coastal (Mylar & Paper Blow-up): Weaver Quarry Rock to Footsteps Rock.	
Soil & Vegetation Map, Crescent City Quad, Ship Mountain & Klamath.	Tech Room
Tectah Creek ,Weaver	
THP Cutting History: Tectah Creek SW, Rodger's, Hagans Peak, Coyote Peak, Orick, OPQ's.	
Timber Assessment Map, Humboldt Co., 1958, T5N	Tech Room
Timber Assessment Maps, Humboldt Co., BLM, 1958	Tech Room
Timber Assessment Maps, Humboldt Co., BLM, 1958/1967	Tech Room
Historical RNP Redwoods Agreement Cutting Maps, 1977-78 Hagans	
Regional Geology, Fault Maps & Photos, Madej A Requa Road and Slope (unfinished? mylar), Weaver Tectah Creek, Coyote Peak, Weaver	

### Coastal Topographic Maps

MYLAR CT 1 Klamath Quadrangle, SE, Requa

Timber Harvest Planning Maps

Cutting History Tectah Creek, Blueline map

Flight Lines and Air Photo Indices

Tectah Creek, SW/4, Air Photo Enlargement, paper, 7

DRAW 8 Humboldt County North, 1966

Air Photo Index Mylar

Redwood Nat'l Park Air Photo Index, Klamath 1977

Requa Maps

R 1 Road & Slope Map, mylar

Soil & Vegetation Maps

SV 1 Klamath North Quadrant, 1977, marked, paper

Geology & Geomorphology Map Features Related to Landslides

LF 1 Requa Quadrant, paper

Mylar & Slope Maps

DRAW 5 Tectah Creek SW, topo, mylar

Tectah Creek NW, topo, mylar

Tectah Creek NW, (SW/4), topo, mylar

Tectah Creek SW, (SW/4), topo, mylar

Tectah Creek SW, (NW/4), topo, mylar

Tectah Creek SW, topo, mylar negative

Tectah Creek NW, topo, mylar negative

Tectah Creek, SW/4, USGS topo enlargement, mylar

Ah Pah Ridge, SW/4, USGS topo enlargement, mylar

Requa, top, mylar negative

US Maps

Draw 10 National Atlas, Forest Types, paper

National Atlas, Federal Lands, paper

National Atlas, Land Surface Form, paper, 4

National Atlas, Physiography, paper

National Atlas, Relief, paper

National Atlas, Vegetation, paper

USGS US Base Map, paper

Additional Maps

<u>Record #</u>	<u>Paper Maps</u>	<u>Description</u>	<u>Site</u>	<u>Dates</u>
53	16760344	Proposed Water Source	Salt Crk	4/87
54	82401	Renovation	Requa Hill	1/89
55	3026	Plant Plan	Klamath	9/50
60	16741017	Coastal Trail Parking	Klamath	4/71
61	16780010	Klamath Lagoon Parking	Klamath	6/67
63	16760368	Maintenance Plan	Requa	3/90
67	7840101	Aerial Photograph	Requa	---
94	0	Klamath Geo Survey	Del Norte	1952
100	1678008	Backwash Settling Sys	Requa	1958
101	813006	Sewage Treatment	Requa	1958
118	1670307	Veg Types		
		Fire Mgmt	Klamath Unit	--
133	16740322	Site Plans	Requa	11/84

Aerial Photographs

<u>Dates</u>	<u>Description</u>	<u>Scale</u>	<u>Photo Type</u>
1954	Northern Humboldt County	1:20,000	Black & White
1958	Northern Humboldt County	1:12,000	Black & White
1962	Northern Humboldt County	1:12,000	Black & White
1965	Northern Humboldt County	1:20,000	Black & White
1965	Del Norte County	1:10,000	Black & White
1965	Del Norte County	1:12,000	Black & White
1966	Northern Humboldt County	1:12,000	Black & White
1966	Northern Humboldt County	1:15,000	Black & White
1969	Del Norte County	1:12,000	Black & White
1970	Northern Humboldt County	1:12,000	Black & White
1974	Northern Humboldt County	1:12,000	Black & White
1978	Coastline to Klamath River	1:32,000	Black & White
1981	Redwood Nat'l Park Edge	1: 6,000	Color
1988	North Coast	1:31,360	Black & White
1988	South Half 101 Bypass Hwy	1: 6,000	Black & White

<u>Organization</u>	<u>Contact Person</u>	<u>Natural Resource Information</u>
Soil Cons. Service 2121-C 2nd Street Davis, Ca. 95616 (916) 449-2862	Mike Whiting (STATGO)	Computerized Soils Maps 1:24,000 scale in Arc/Info.
Computer: Data General Operating Syst: AOS/VS GIS: Arc/Info	Aerial Photographs: 1983 1:24,000 B&W Humboldt 1983 1:24,000 Color IR Del N.	USGS Topo Maps, CDF Soil-Veg Maps, Flood Maps.
Computer: Tektronix TEK 4317 Operating Syst: UNIX UNIX Software: Prelude DOS Software: Lotus, R:BASE		

Computerized soils maps are available through the Soil Conservation Service (SCS) by making a formal request to Carol Jett (State Soil Scientist) at the above address.

<u>Organization</u>	<u>Contact Person</u>	<u>Natural Resource Information</u>
US Bureau of Reclamation 2800 Cottage Way Sacramento, Ca. 95825 (916) 978-5063	Chuck Johnson	General waterway maps.

Computer: Prime 4150, 8 unlimited remote terminals  
 Operating Syst: PRIMOS  
 Software: Lotus, Supercalc 5.0, DBASE, & Ingres  
 GIS: Arc/Info

Computer: Tektronix 435  
 Operating Syst: UNIX  
 GIS: Arc/Info

<u>Organization</u>	<u>Contact Person</u>	<u>Natural Resource Information</u>
US Envir Protection Agency  1235 Mission Street San Francisco, Ca. 94103 (415) 556-6535	Cheryl Henley Environmental Protection	

Computer: SUN Sparc 370  
 Operating System: UNIX  
 GIS: Arc/Info

Reference

U.S. Environmental Protection Agency 1991. Monitoring Guidelines to Evaluate Effects of Forestry Activities on Streams in the Pacific Northwest and Alaska - Draft. Region 10, 1200 Sixth Avenue, Seattle WA 98101, NPS Section (WD-139), pgs. 162.

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<u>Organization</u>	<u>Contact Person</u>	<u>Natural Resource Information</u>
U.S. Geological Survey 345 Middlefield Road Mail Stop 531 Menlo Park, Ca. 94025 (415) 329-4259	Barry Napier Chief Western Region GIS Lab	Mapping/Earth Sci.

Rick Heimes  
(415) 329-4441

Water Resources

Patrick Showalter Geologist  
(415) 329-4965

Computer: Prime 9955II  
Operating System: PRIMOS  
GIS: Arc/Info

Computer: Tektronix 4325  
Operating System: UNIX  
GIS: Arc/Info

Computer: AST 386  
Operating System: MS-DOS  
GIS: SPANS

The U.S. Geological Survey (USGS) provides a variety of natural resource services that may be useful to the Klamath Basin Fisheries Task Force. One such service is the Aerial Photograph Summary Record System. At the USGS facilities in Menlo Park, California, a computer-generated summary of all known available photography throughout the United States is stored on microfiche.

<u>Organization</u>	<u>Contact Person</u>	<u>Natural Resource Information</u>
California Conservation Corp Klamath, Ca.	John Schwabe (Cal. F&G)	Stream restoration on Salt, Hunter, High Prairie, McGarvey, Tarup, Blue Creek, Ah Pah, Tectah, Bluff, Boise and Redcap Creeks.

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Ca. Fish & Game  
5431 Ericson Way  
Arcata, Ca. 95521  
(707) 822-0328

Mike Wallace

Aerial Photographs  
of the Klamath estuary.

1941 1:18,000 B&W  
1948 1:24,000 B&W  
1963 1:12,000 B&W  
1965 1:10,000 B&W  
1969 1:12,000 B&W  
1986 1: 6,000 B&W  
1988 1:12,000 Color

List of Additional Photograph Sources

<u>Organization</u>	<u>Contact Person</u>	<u>Phone Number</u>
Redwood National Park	Lee Purkerson	707-822-7611
USFWS Service	Craig Tuss	707-822-7201
HSU Archives	Eric Shemp	707-826-3419
US Coast Guard	Lt. Comdr. Murray	707-839-6114
Simpson Timber Company	Ted Schutte	707-822-0371
NASA Aimes Research	Bob Extranger	415-604-6252
Agricultural Dept. Humb. Co.	Don Buchanan	707-442-6058
State Water Res. Cont. Board		Dave Conrad
HSU/Native American Studies		Jack Norton
707-826-3821		
Earth Science Info Center	Mike Moore	415-329-5009
	Jane Wegge	916-322-3317
CA Dept. Water Res.		916-445-9259
Soil Conservation Service		801-524-5856
Corps of Engineers		415-974-0421
Del Norte Co. Hist. Society		707-464-3089
Humb. Co. Hist. Society		707-443-3515
WAC Corporation		800-845-8088
Eros Data Center		605-594-6151
Delano Studios and Aerial Surveys		503-236-2139
USGS Map Sales		303-262-5829
Richard Davis and Associates		707-464-9571
Whittier College (Fairfield Photo Coll.)		213-907-4200

<u>Organization</u>	<u>Contact Person</u>	<u>Natural Resource Information</u>
Ca. Fish & Game Natural Heritage Program 1416 Ninth Street 12th Floor Sacramento, Ca. 95814 (916) 322-2495	John Ellison	Natural Diversity Data Base

Computer: Hewlet Packard 9000/370  
 Operating System: UNIX  
 Software: Oracle  
 GIS: Genamap

There are 473 occurrences of endangered, threatened and rare plants, animals and natural communities in the Klamath River Basin, recorded in the Natural Diversity Data Base. This information is available either digitally, which could be imported in GIS format, or in paper form consisting of text, reports and map overlays. The cost of acquisition at the State of California's lower "government" rate is approximately \$900 in either format.

Questions about transferring the digital data should be directed to Tom Lupo, Geographer, at (916) 445-6264. Purchase requests of the data in either format should be directed to Karen Fleming, Marketing Manager, at (916) 324-3812.

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Ca. Fish & Game 619 2nd Street Eureka, Ca. 95501 (707) 445-6493	Karen Kovars	Habitat, harvest, inventory and sampling data.
Computer: IBM compatible Software: Lotus, DBASE		USGS Topo, Soil, Veg, and tream survey maps.
		Numerous before and after aerial photographs.

<u>Organization</u>	<u>Contact Person</u>	<u>Natural Resource Information</u>
Ca. Dept. of Forestry 1416 9th Street Sacramento, Ca. 94244 (916) 322-9101  Computer: PRIME Operating Syst: PRIMOS Software: Lotus, Info GIS: Arc/Info Computer: DEC 5000 Operating Syst: UNIX	Janine Stenback	Maps: BLM surface mgmt status maps 1:100,000.  Veg. Maps 1930's 1:62,500 scale.  Orthophotos: 1981 1:24,000 Photographs: 1986 1:130,000 Color Infrared
Ca. Dept of Forestry 118 Fortuna Blvd. Fortuna, Ca. (707) 725-4413		Maps, photographs and timber harvest plans on private lands.
Ca. Teal Data Center 2005 Evergreen Street Sacramento, Ca. 95815  Computer: SUN Operating System: UNIX GIS: Arc/Info	Roger Ewers	GIS Lab, Data Processing

Organization

Ca. Dept. of Water Res.  
2440 Main Street  
Red Bluff, Ca. 96080  
(916) 527-6530

Computer: IBM (30)  
Software: Lotus, SQL

Contact  
Person

Koll Buer

Natural Resource  
Information

Fisheries Habitat and Stream  
Morphology data.

Data Origin: Klamath and  
Shasta Rivers Spawning Gravel

Enhancement Study, March  
1981

GIS: Geo 5, Auto Cad  
Photographs: Stream  
restoration and work sites.

References

Department of Water Resources 1981. Klamath and Shasta Rivers  
Spawning Gravel Study Environmental Atlas. Prepared for the  
Department of Fish and Game, pgs. 42.

Department of Water Resources 1981. Water Resources Data. U.S.  
Geological Survey water-data report, Prepared in cooperation with the  
California Department of Water Resources and with other agencies.

California Department of Water Resources 1982. Watershed Management  
For Unstable and Erodible Areas in North Coastal California. Prepared  
for the U.S. Environmental Protection Agency and the State Water  
Resources Control Board, pgs. 68 plus maps.

<u>Organization</u>	<u>Contact Person</u>	<u>Natural Resource Information</u>
Humboldt State University Natural Resources Department Arcata, Ca. 95521 (707) 826-3438		Dr. Steve Carlson Natural Resource Planning and Interpretation

Computer: IBM compatibles 286/386  
GIS: Arc/Info, pMAP, SAGIS

Humboldt State University Forestry Department Arcata, Ca. 95521 (707) 826-4280	Dr. Larry Fox	Forest Classification & Satellite Imagery
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Computer: IBM compatibles 286/386  
GIS: Terra Mar

#### References

Fox, L. and K.E. Mayer 1979. Using Guided Clustering Techniques to analyze Landsat data for mapping forest land cover in Northern California. Machine Processing of Remotely Sensed Data Symposium, pgs. 364-367.

The U.S. Fish and Wildlife Service (USFWS) in cooperation with Humboldt State University and the NASA Ames Research Center, used Landsat Multispectral Scanner (MSS) data to inventory forest cover and land conditions on the Hoopa Valley Indian Reservation in Northern California. Information gathered from this inventory was used by the USFWS in their continuing investigation of declining anadromous fish populations within the Klamath and Trinity rivers.

Current Humboldt State University has a California Department of Fish and Game Fire Project to inventory the areas that burned on the Klamath National Forest in 1987 on the Klamath National Forest Salmon and Happy Camp Ranger Districts.

<u>Organization</u>	<u>Contact Person</u>	<u>Natural Resource Information</u>
Humboldt Co. Assessors Office  Drafting Department Eureka, Ca. 95501 (707) 445-7391		Vern Rollins Assessors Parcel Maps and Photo's of Humboldt Co. Timber type maps at 1:1,000 scale. Aerial Photographs at 1:1,000 scale.

TRIBES

KARUK TRIBE

HOOPA TRIBE

<u>Organization</u>	<u>Person</u>	<u>Natural Resource Information</u>
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Karuk Tribe PO Box 1016 Happy Camp, Ca. 96039 (916) 493-5305	Leaf Hillman	
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Computer: IBM Compatible 486 (2 gigabyte storage)  
Macintosh office and notebook computers  
Software: Wordperfect 5.0, Lotus, Excel, MacWrite  
Ryan and Umpqua National Forest Water Temperature  
Software, SNAP road area network model  
GIS: MIPS

There is an Ancestral Lands Forest Management Plan that was developed in March 1989.

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<u>Organization</u>	<u>Contact Person</u>	<u>Natural Resource Information</u>
Hoopla Valley Tribal Council P.O. Box 368 Hoopa, Ca 95546 (916) 625-4284 (916) 625-4230 FAX	Kevin Britton	USGS Maps, Soil Survey Maps, Timber Sale Maps Orthophotoquads, CFI aerial photos, Timber typed aerial photos

Computer: IBM Compatible 386 (334mb)  
Software: Lotus 2.2, Quattro 1.0, DBASE IV,  
Foxplus 2.1, Paradox 3.0  
GIS: Arc/Info

Computer: Pericam 7100 Terminal Remote to Golden, Co. B.I.A.  
Operating Sys: Primos (6650 Prime Minicomputer)  
GIS: Arc/Info Version 5.1  
Satellite: ERDAS (Located in Colorado)

Data Availability (Proprietary)

<u>Map</u>	<u>Date</u>	<u>Scale</u>	<u>Source</u>	<u>Location</u>
Planimetric (cutover & timber type)	1965	1:1,000	Harl Pugh	Hoopa I.R.
Planimetric	1972	2:mile	Chickering	Hoopa I.R.
Topographic	1975	1:400	Chickering '65	Hoopa I.R.
Topographic	1976	1:24,000	USGS	Yreka, Ca.
Topographic	1977	1:10,000	USGS	Hoopa, Ca.
Topographic (acetate)	1977	1:24,000	USGS	Hoopa, I.R.
Topographic (reprographic)	1977	1:24,000	USGS	Hoopa, I.R.
Orthophotoquads (prints)	1977	1:24,000	USGS	Hoopa, I.R.
Stream Profile	1980	1:200	Cal. F&G	Redcap Creek
Orthophotoquads	1983	1:24,000	USGS	Hoopa I.R.

PRIVATE COMPANIES

Geographic Resource Solutions

Simpson Timber Company

<u>Organization</u>	<u>Contact Person</u>	<u>Natural Resource Information</u>
Geographic Res. Solutions 1125 16th Street, Suite 213 Arcata, Ca. 95521 (707) 822-8005	Ken Stumpf	USGS Quads, Ortho- photoquads, Timber inventory data, Accuracy assessment plot data.
Computer: Intergraph & IBM compatibles Operating Syst: UNIX & DOS Software: Quattro, DBASE, Informix GIS: Intergraph MGE/MGA & PC Arc/Info Satellite: IDRISI & TIGRIS Imager		

Currently working on a wildlife habitat typing project with the California Department of Forestry (FRRAP) Program covering portions of the Lower Klamath River Basin.

(All information is proprietary)

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Simpson Timber Company  
P.O. Box 1169  
Arcata, Ca. 95521  
(707) 822-0371

Dan Opalach      Forest Resource  
Information

Variable plot  
cruising & surveys

Computer: VAX & 386 PC's  
Operating Syst: VMS & DOS  
Software: Quattro Pro 3.0, Paradox  
GIS: Intergraph  
Satellite: None

Maps

<u>Map</u>	<u>Date</u>	<u>Scale</u>	<u>Source</u>	<u>Location</u>
Topographic	Varies	1:24,000	USGS	Del Norte, Humboldt some Mendocino & Trinity Counties
Planimetric	Varies	1:12,000		
Humboldt Co. Simpson Ownership		1:24,000		
Humboldt Co. Simpson Ownership		1"=1 mile		
Humboldt Co. Simpson Ownership Soils - Veg	Varies		PSW F&R	Del Norte & Humboldt

Aerial Photographs

<u>Dates</u>	<u>Scale</u>	<u>Format</u>	<u>Location</u>
1958	1:12,000	Black & White	Simpson Ownership
1962	"	"	"
1966	"	"	"
1969	"	"	"
1971	"	"	"
1975	"	"	"
1978	"	"	"
1981	"	"	"
1984	"	"	"
1988	"	"	"

Note: Not all of the above years have available photos that cover the Klamath River Basin

(Most of the information is proprietary)

PRIVATE NON-PROFIT

Humboldt County Historical Society

Klamath Forest Alliance

Wilderness Society

Northcoast Environmental Center

<u>Organization</u>	<u>Contact Person</u>	<u>Natural Resource Information</u>
Humboldt County Historical Society P.O. Box 8000 Eureka, Ca. 95501 (707) 443-3515	Edie Butler	Maps and assorted information from over 40 years of public donations. Most have not been sorted.

Computer: IBM  
Software: SURPASS, Filing Assistant

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Klamath Forest Alliance, Box Etna, Ca. 96027 (916) 467-5405 (Information response still pending)	Felice Pace	Resource Maps and related information
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Wilderness Society 1424 Fourth Avenue Room 816 Seattle, Washington 98101 (Information response still pending)	Peter Morrison	Resource maps and related information
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Northcoast Envir. Ctr. Library, Maps 879 Ninth St. Arcata, Ca. 95521 (707) 822-6918	Andy Alm	Resource and Published Reports.
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Computer: Apple, Macintosh  
Software: Excel, File Vision