Comments Supporting the Proposed Mineral Withdrawal for National Forest and Bureau of Land Management Lands in the Siskiyou Wild Rivers Area of Oregon and California

USDI Federal Register Notice 66 (14) pp. 6663-6664 (BLM lands)
And USDI Federal Register Notice 66 (14) p. 6664 (Forest Service lands).

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LEGAL DESCRIPTION OF THE MINERAL WITHDRAWAL AREA AND PROPOSED AMENDMENTS

Based on our examination of the legal description in the Federal Register Notices of Proposed Mineral Withdrawal by the BLM (CFR: 66 No. 14, January 22, 2001, pp. 6663-6664) and the U.S. Forest Service (CFR: 66 No. 14, January 22, 2001, p. 6664), we believe there are a number of errors of both commission and omission. We believe the township, range, and section references that appeared in the U.S. Forest Service notice and listed in Table 1 are in error. From our research, we have not been able to find these sections. We believe that the area in Table 1 should have been described as the Humboldt Meridian Township and Ranges listed in Table 2, as this describes the part of the Siskiyou National Forest that extends into California. In addition, we believe a number of omissions were made in both the BLM (orange) and Forest Service (green) notices (Figure 1).

Table 1. List of Township, Range, and Sections believed to be in errors of commission.

Humboldt Meridian, California
T. 47 N., R.'s 3 to 6 E., inclusive
T. 48 N., R.'s 4 to 6 E., inclusive

Table 2. Proposed additions to the Siskiyou Wild Rivers mineral withdrawal on BLM lands, specifically within the Rogue River BLM Recreation watershed and immediate tributaries and within the upper Illinois River watershed (A) and on Forest Service lands in the upper Illinois River watershed and the Chetco River watershed (B).

(A) Willamette Meridian (33)	T. 39 S., R. 8 W., secs. 1-30, 32-36
T. 33 S., R. 7 W., secs. 1-17, 20-29, 32-36	T. 40 S., R. 7 W., inclusive
T. 33 S., R. 8 W., secs. 1-4	T. 40 S., R. 8 W., secs. 1-6, 8-9, 11-14, 16, 21, 23-32, 35-36
T. 34 S., R. 6 W., inclusive	T. 40 S., R. 9 W., inclusive
T. 34 S., R. 7 W., secs. 1-6, 8-17, 20-29, 32-36	T. 41 S., R. 8 W., inclusive
T. 35 S., R. 6 W., inclusive	T. 41 S., R. 9 W., secs. 1-8, 10-36
T. 35 S., R. 7 W., secs. 1-2, 11-14, 16, 21-36	
T. 36 S., R. 7 W., inclusive	
T. 37 S., R. 6 W., secs. 31-33	**(B) Humboldt Meridian (15)**
T. 37 S., R. 7 W., secs. 19-36	T. 17 N., R. 5 E., inclusive
T. 37 S., R. 8 W., inclusive	T. 18 N., R's 3 to 6 E., inclusive
T. 38 S., R. 6 W., secs. 4-9, 17-19, 27-30, 32-34	T. 19 N., R's 3 to 6 E., inclusive
T. 38 S., R. 7 W., inclusive	
T. 38 S., R. 8 W., 1-8, 10-14, 16-20, 22-27, 29-36	**(B) Willamette Meridian (33)**
T. 39 S., R. 6 W., secs. 3-5, 7, 9	T. 37.5 S., R's 11 and 12 W., inclusive
T. 39 S., R. 7 W., secs. 3-36	

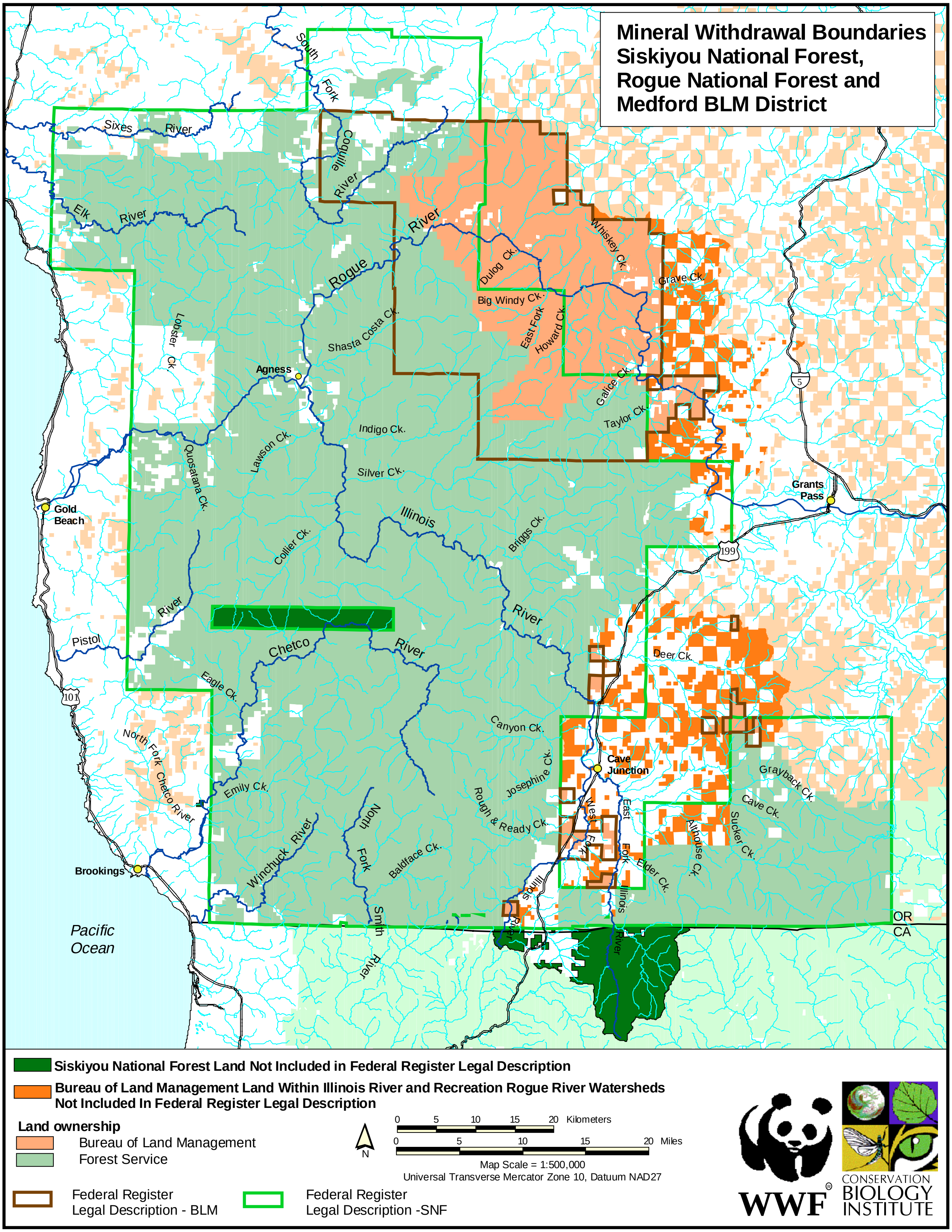

Figure 1. Map of mineral withdrawal boundaries in the Siskiyou Wild Rivers Area.

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NATIONAL AND INTERNATIONAL SIGNIFICANCE OF THE ECOLOGICAL AND BIOLOGICAL DIVERSITY OF THE KLAMATH-SISKIYOU

The Klamath-Siskiyou Forests ecoregion (19,420 mi^2, or 12,428,800 ac, as defined by World Wildlife Fund) is located in southwestern Oregon and northwestern California and has long been recognized for its global biological significance (Whittaker 1960, Kruckeberg 1984b). Preservation of the area began when Bob Marshall, Forest Service Director of Lands and Recreation, protected the "Kalmiopsis Wild Area" in 1936 - this area later became the Kalmiopsis Wilderness in 1964. The Klamath-Siskiyou is considered an Area of Global Botanical Significance by the World Conservation Union (IUCN), a global Centre of Plant Diversity (Wagner 1997), and has been proposed as a World Heritage Site and UNESCO "biosphere reserve" (Vance-Borland et al. 1995). More recently, World Wildlife Fund U.S. scored the Klamath-Siskiyou as one of their Global 200 sites reaffirming its global importance from the standpoint of biodiversity (Ricketts et al. 1999).

Conservationists have long been aware of the importance of protecting ecologically representative portions of the world's biota to the goal of saving what remains of the world's biodiversity (Noss and Cooperrider 1994, The Nature Conservancy 1996, Soulé and Noss 1998). A variety of factors contribute to the extraordinary biodiversity of the Klamath-Siskiyou. As a centrally positioned montane environment, it is transitional to the Great Basin, Oregon Coast Range, Cascades Range, Sierra Nevada, California Central Valley, and coastal region of northern California with an extensive overlap of plant communities (Whittaker 1960, Wallace 1983, Smith and Sawyer 1988). Extraordinarily high physical heterogeneity characterizes this ecoregion due to its geographic position and geologic history. The Klamath-Siskiyou is noted for its highly-dissected, complex terrain with varied and often abrupt changes along environmental gradients in bedrock geology, soils, elevation, and climatic regimes. This complexity is associated with correspondingly high levels of regional biodiversity (Whittaker 1960, Wallace 1983, Kruckeberg 1984a, 1984b, Schoenherr 1992).

The Klamath-Siskiyou supports a continental maximum of temperate conifer species (30) with as many as 17 conifer tree species recorded living together within a single stand. A comparison of the 30 temperate coniferous forest ecoregions of the U.S. and Canada ranked the Klamath-

Siskiyou 5th in combined richness of all species, 5th in vascular plant richness, and 2nd in combined species endemism (DellaSala et al 1999). Approximately 7% of the total species identified in the region occur nowhere else in the world, and over 155 plant and animal species are on the federal or state endangered species list (DellaSala et al. 1999). The high species richness and endemism (Table 3) has led to references of the region as the Smoky Mountains of the west (Whittaker 1960). Much of the endemism is a direct result of the harsh environmental conditions created by the extensive areas (approximately 13% of the ecoregion) of serpentine geology. This bedrock formation supports many localized and highly specialized taxa (Whitaker 1960, Sawyer 1984, Kruckeberg 1984a, 1984b, McCarten 1997, Coleman and Kruckeberg 1999).

Table 3. Species richness and endemism totals for eight taxonomic groups for the Klamath-Siskiyou Forests ecoregion (Abell et al. 2000, DellaSala et al. 1999, and Ricketts et al. 1999).

Taxonomic Group	Species Richness (#)	Species Endemic (#)
Vascular Plants	1,859	131
Conifers	30	6
Mammals	69	2
Birds	222	0
Reptiles	18	0
Amphibians	14	3
Butterflies	141	1
Fishes	33	14
Freshwater Mollusks	107	64
Land Snails	54	31
Totals	**2,517**	**252**

Although most rare species reported in the ecoregion are terrestrial, aquatic species also display high levels of aquatic endemism. For example, 14 of 33 native fish species are classified as being endemic. Of these, 11 species have special status designation due to extensive habitat degradation and changes in hydrologic flows and water quality (DellaSala et al. 1999). The area also boasts 38 native species of amphibians and reptiles, making it the most species-rich herpetofauna area of any similarly sized mountain range in the Pacific Northwest (Bury and Paerl 1999). Freshwater mollusks are another taxonomic group that has gained little attention, but has extremely diverse speciation in the Klamath-Siskiyou. According to Frest and Johannes (1998, 1999) the combined freshwater habitats of the Klamath-Siskiyou ecoregion support 107 mollusk taxa; 64 (60%) of these taxa are endemic. Frest and Johannes (1998, 1999) have identified four centers of mollusk species endemism within the Klamath-Siskiyou, including a good portion of the Siskiyou Wild Rivers (Appendix A). The ancient terrain and heterogeneity of parent material has created a refugia for active speciation of mollusks (Frest and Johannes 1998).

Based on a recently compiled protected areas database (DellaSala et al. 2001), the Klamath-Siskiyou Forests ecoregion is moderately represented by reserves with slightly over 11% in strict (GAP 1) protection and slightly over one percent in moderate (GAP 2) protection. The GAP 1 lands are predominantly comprised of nine wilderness areas, most of which are concentrated on the highest elevation sites in the ecoregion.

SISKIYOU WILD RIVERS AREA - CURRENT MANAGEMENT PROFILE

The Siskiyou Wild Rivers area covers approximately 14% of the Klamath-Siskiyou ecoregion (279 mi^2, or 1.8 million ac), including all of the Siskiyou National Forest (67% of the subregion) and much of the surrounding BLM lands (15%). The remaining 18% is privately owned, and while excluded from the withdrawal notice, it is important to know the magnitude and spatial configuration of the private component. While not every ecological value known and recorded for the Klamath-Siskiyou is contained in this smaller subregion, it is a stronghold for most of the ecological attributes of the ecoregion, some of which will be discussed later in this document, truly making the Siskiyou Wild Rivers Area the heart of the ecoregion.

Currently, approximately 17.5% (312,838 ac) of the subregion is classified as strictly (GAP 1) or moderately (GAP 2) protected. GAP 1 status lands include wilderness areas, research natural areas, and wild rivers. GAP 2 status lands include scenic rivers and state parks. BLM and Forest Service Late Successional Reserves (LSR) make up approximately 37% (666,831 ac) of the subregion. Inventoried roadless areas, which show a high degree of coincidence with LSRs (Figure 2), cover 328,818 ac (18%) of the subregion. [Note: All GIS data layers used to create the maps in this report are listed in Appendix B]. If the recent inventoried roadless area policy goes into effect, the total area in some form of protection increases to approximately 35%. Although this value is high compared to many regions of comparable size, it does not necessarily translate into adequate protection of important natural resources. It should be noted that the Forest Service's Roadless Areas Conservation Rule does not provide any protection from mineral exploration and extraction. Mining is exempt from the prohibitions on road construction and reconstruction (Siskiyou Project 2000).

Designated and Proposed Wild and Scenic Rivers in the Siskiyou Wild Rivers Area

The area being considered for mineral withdrawal contains five rivers with sections designated as wild and scenic river corridors. The entire Illinois River, the Wild, Scenic and Recreation sections of the Rogue River and portions of the Chetco River, Elk River North Fork of the Smith River and South Fork of the Coquille are all within the boundaries of the Siskiyou Wild Rivers Area (Table 3). The total length of designated wild river is approximately 98 miles. Total designated scenic and recreational river length is 38 miles and 75miles, respectively.

Another ten streams that have been proposed for wild and scenic river status including, Silver Creek, Indigo Creek, Canyon Creek, and Rough and Ready Creek on the Illinois River, Baldface Creek on the North Fork Smith River, Big Windy Creek, East Fork of Big Windy Creek, Howard Creek and Dulog Creek on the Rogue River, and the South Fork Coquille River (Figure 3; Table 4). All total, the length of proposed wild and scenic rivers is approximately 115 miles. These rivers were chosen because they possess remarkable scenic, recreational, geologic, fish and wildlife, historic, and/or cultural values. The intent of the wild and scenic river system is to preserve these river corridors for the benefit and enjoyment of present and future generations. One of the stated goals of the program is to preserve rivers in their free-flowing condition to protect the water quality of such rivers and provide for national conservation areas. It is important to note that many of these rivers designated, or being proposed, are based on watershed characteristics that stretch beyond the actual river corridors. High quality habitat for salmonids and other aquatic species depends not only on impacts applied directly to stream channels, but also on upstream and hillslope activities.

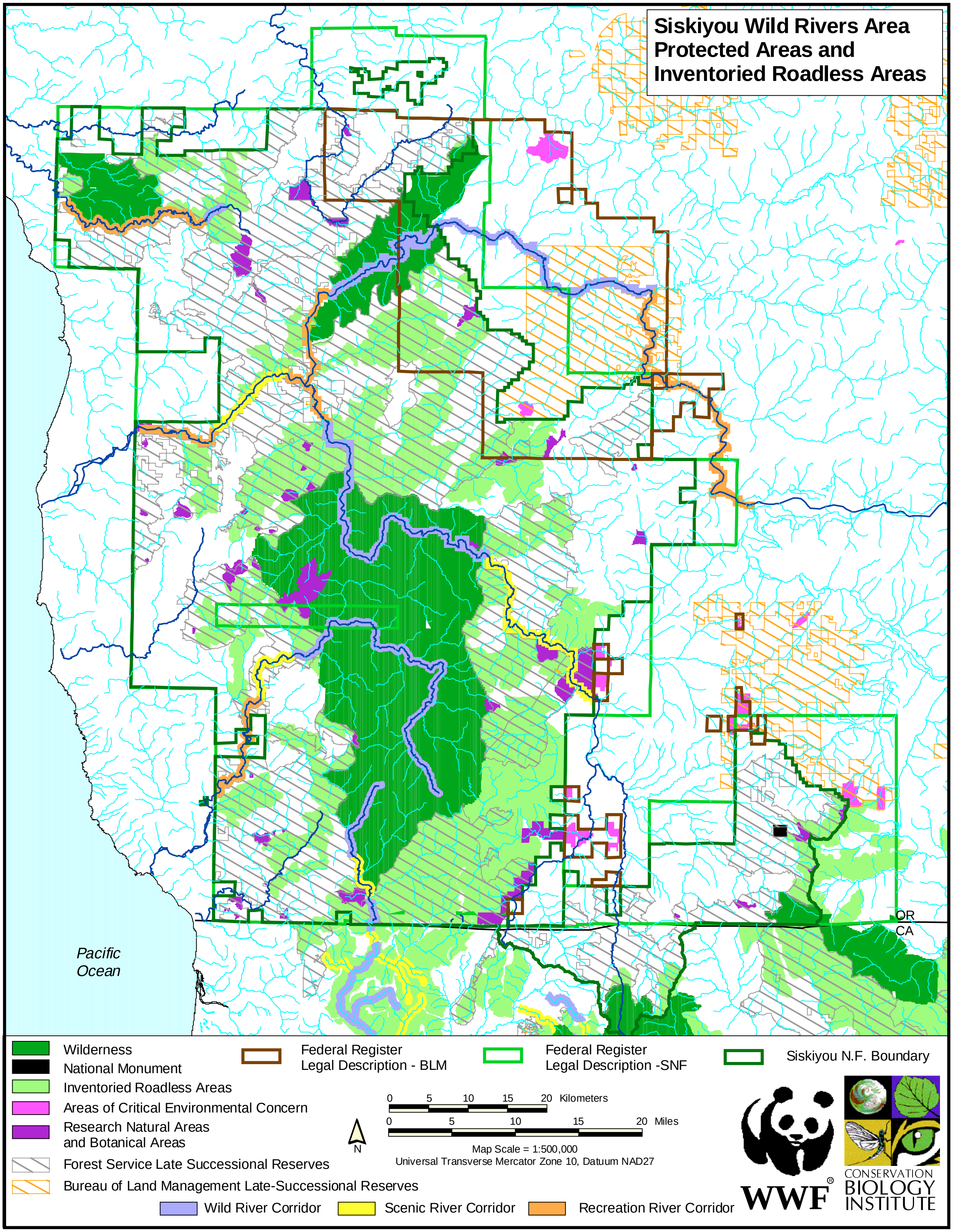

Figure 2. Map showing existing protected areas and inventoried roadless areas of the Siskiyou Wild Rivers Area.

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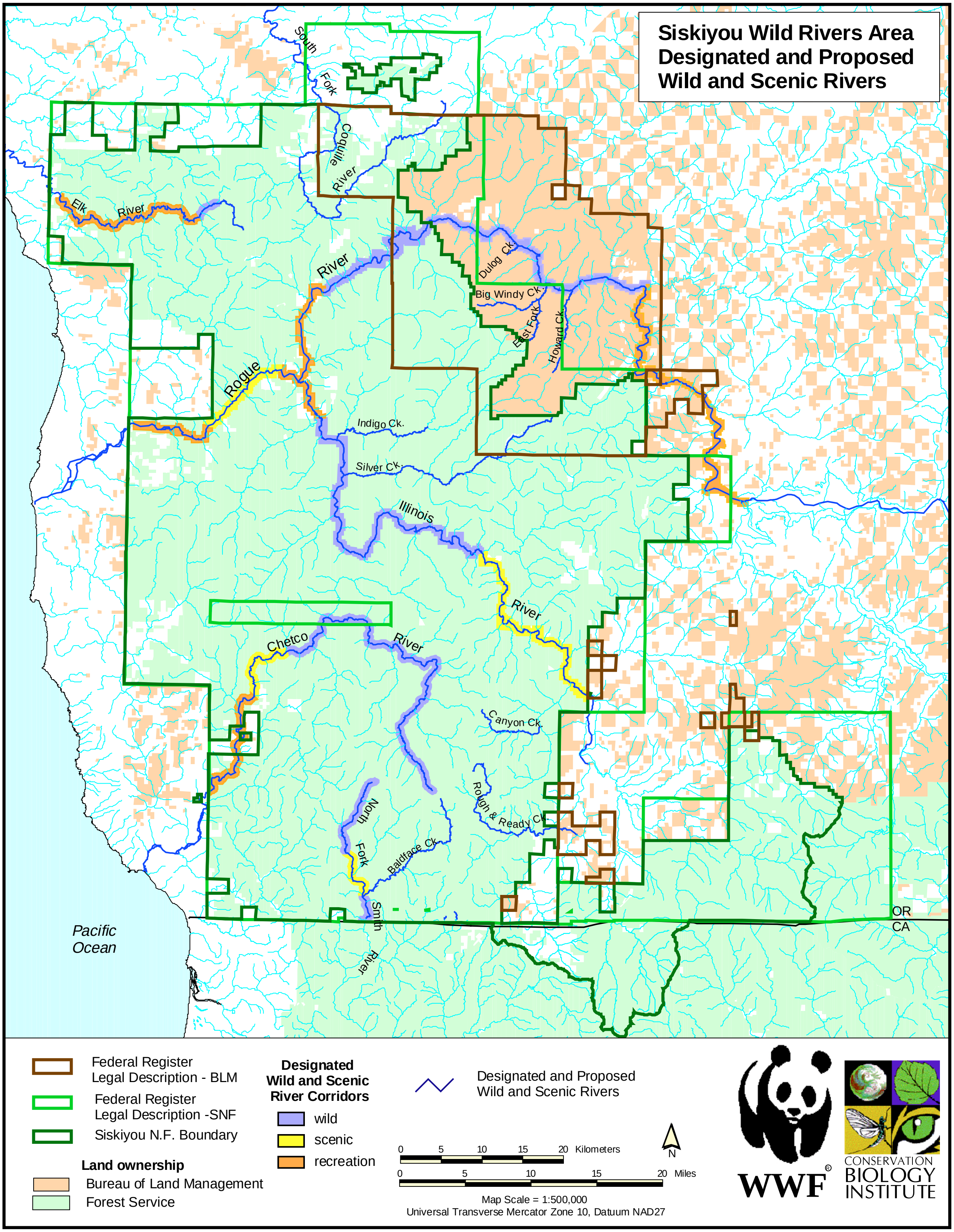

Figure 3. Map showing designated and proposed Wild, Scenic, and Recreation Rivers in the Siskiyou Wild Rivers Area.

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Table 4. Designated and Proposed Wild and Scenic Rivers within the Siskiyou Wild Rivers Area.
[1] Northwest Forest Plan Key Watershed
[2] American Fisheries Society Critical Watershed

Designated Wild and Scenic Rivers	**Key Features**
Rogue River[1,2] (1968)	The Rogue was one of the eight original National Wild & Scenic Rivers established by Congress in 1968. Thirty-seven miles of the Wild & Scenic Rogue River is managed by the Forest Service and 47 miles by the BLM. **The Rogue's outstandingly remarkable values are its excellent fisheries, white water recreation and natural character of the landscape it flows through.** Thousands of people float the lower Rogue River each year and it is known world wide for its salmon & steelhead fishing.
Illinois River[1,2] (1984)	The Illinois River, tributary of the Wild & Scenic Rogue River, was a congressionally designated study river in 1968 . Fifty miles of the river, from its mouth to the Forest boundary was added to the Wild & Scenic River system 16 years later**. The Illinois River's outstandingly remarkable values are – fisheries, botanical, water quality, scenery, recreation and the wilderness character of its wild section.** The Illinois River Scenic Corridor from Deer Creek to the Wild Section is withdrawn from mineral entry. The Scenic Section, from the Forest boundary to Deer Creek is open to mineral entry. The Illinois is a wild fishery with no hatchery supplementation.
Chetco River[1,2] (1988)	Approximately 44 miles of the Chetco River from its mouth to the Forest boundary were added to the National Wild & Scenic River system in the Oregon Omnibus Wild & Scenic Rivers Act. **The Chetco River's outstanding remarkable values are fisheries, water quality and recreation.** The Chetco Scenic Corridor is open to mineral entry. The Chetco is known as a world class fishery and for its large chinook salmon and wild winter steelhead. Much of the Chetco flows through the Kalmiopsis Wilderness. The river has exceptional water clarity.
North Fork Smith River[1,2] (1988)	Thirteen miles of the North Fork Smith River in Oregon, from its headwaters in the Kalmiopsis Wilderness to the California border, were added to the National Wild & Scenic River System in the Oregon Omnibus Wild & Scenic Rivers Act. **The North Fork Smith's outstandingly remarkable values are – fisheries, water quality, recreation and scenery.** The Scenic Corridor of the North Fork is recommended for mineral withdrawal. The North Fork in Oregon provides about 7 miles of near-pristine steelhead and cutthroat trout habitat, with emerald hued waters and contributes to the world class fishery of the National Wild & Scenic Smith River in California.

Elk River[1,2] (1988)	Nineteen miles of the Elk River was added to the National Wild & Scenic River system in the Oregon Omnibus Wild & Scenic Rivers Act. **The Elk River's outstandingly remarkable values are fisheries, water quality and natural values.** The Scenic Corridor of the Elk is withdrawn from mineral entry. The Elk is known an exceptionally productive fishery and for its ability to clear quickly after storm events.
Proposed Wild and Scenic Rivers (Assessment Date)	**Key Features**
Silver Creek[1,2] (1994) Illinois River	Silver Creek runs through a 53,000 acre Key Watershed, is a tributary of the National Wild & Scenic Illinois River and an exceptionally productive steelhead stream, making a significant contribution to the famous lower Rogue fishery. **Silver Creek's outstandingly remarkable value is anadromous fisheries.** Much of its watershed is within the North Kalmiopsis Roadless Area.
Indigo Creek[1,2] (1994) Illinois River	Indigo Creek is a tributary of the National Wild & Scenic Illinois River, a Key Watershed and an exceptionally productive salmon and steelhead stream. **Indigo Creek's outstandingly remarkable value is anadromous fisheries** and a large area of its watershed is within the North Kalmiopsis Roadless Area.
Canyon Creek[2] (1992) Illinois River	Gold was first discovered in southwest Oregon at the confluence of Canyon and Josephine Creek in 1851. The area may contain 200 or more potential historic mining sites. Canyon Creek lies within the South Kalmiopsis Roadless Area along with Rough & Ready and Baldface Creeks. **Its outstandingly remarkable value is cultural/historic. In addition the watershed has a rich history of sightings of rare and sensitive plants going back to the mid-1870's.**
Rough and Ready Creek[2] (1993) W Fork Illinois River	Rough & Ready Creek flows through a 22,000-acre mostly roadless watershed onto a broad flood plain. It has exceptional water clarity. Out of 1400 watersheds in Oregon, the West Fork Illinois River and its tributary Rough & Ready Creek have the highest number of rare and sensitive plant species in the State. **Rough & Ready Creek has been found to have outstandingly remarkable botanical/ecological, geologic/hydrologic and wildlife values**.
Baldface Creek[1,2] (1994) North Fork Smith River	Baldface Creek is a roadless area tributary of the National Wild & Scenic North Fork Smith River, is one of the most productive steelhead and cutthroat trout streams on the Siskiyou Forest and has exceptional water quality. **Its outstandingly remarkable values are fisheries and water quality.** It is a Key Watershed.
Big Windy Creek (1994) Rogue River	**Big Windy Creek is a tributary of the National Wild & Scenic Rogue River.** Its outstandingly remarkable values are scenery, recreation and wildlife**. It has very clear water and is a wilderness stream.**

East Fork Big Windy Creek (1994) Rogue River	**The East Fork of Big Windy Creek is a tributary of Big Windy Creek with** outstandingly remarkable scenery, recreation & fisheries.
Dulog Creek (1994) Rogue River	Dulog Creek is a small tributary of the National Wild & Scenic Rogue River with **outstandingly remarkable values of scenery and recreation**.
Howard Creek (1994) Rogue River	Howard Creek is a direct tributary of the National Wild & Scenic Rogue River. **Its outstandingly remarkable values are Scenery, Recreation and wildlife.** Water is clear with small cascading waterfalls from a few feet to twelve feet.
South Fork Coquille River[1,2] (1993)	The South Fork Coquille River is a Key Watershed and also a very productive and diverse anadromous fishery. **Its outstandingly remarkable values are fisheries and botanical/ecological**.

Adapted from the Siskiyou Wild Rivers Proposal (2000).

LOCATABLE MINERALS IN THE SISKIYOU WILD RIVERS AREA

Mineral Availability

The extensive mineral deposits in the Klamath-Siskiyou region are due to the host rock lithology combined with magnetic, hydrothermal, and weathering processes accompanying their deposition (Coleman and Kruckeberg 1999). There are two primary geologic sources of locatable minerals in the Siskiyou Mountains, oceanic crust deposits (ophiolite) and island arc deposits. The oceanic crust deposits of the Triassic and Jurassic period contain chromite, which occur within peridotites, which form as a primary igneous mineral. These ores are found as podlike bodies in olivine-rich rock (dunite). Platinum is also present within some peridotites in association with chromite, but in small quantities. Long-term weathering, over periods of 100,000 to 1,000,000 years, of these peridotite deposits has formed nickel–bearing laterite surfaces (Trescases 1986). The ocean crust deposits also contain sulfide deposits present within basalts with these sulfide masses containing gold, zinc, cobalt, and copper (Coleman and Kruckeberg 1999). The island arc deposits, which occur as terraces, contain concentrations of copper, gold, silver and platinum. The most important of these have been the gold deposits resulting in a long history of placer mining in the rivers of this region (Orr and Orr, 1996). The Cretaceous age granite, diorite and gabbro in the region generally have limited mineral deposits (Heylmun 1998).

Mining History

Placer gold deposits were discovered in the Siskiyou Mountains in the 1850s. Since that time, Josephine County, in the middle of the Siskiyou Wild Rivers Area, has produced more than 1,250,000 ounces of lode and placer gold (Heylmun 1998). Much of this production occurred in the first 100 years of mining in the region. By 1911, most of the principal placer deposits in the county had been found and worked (Heylmun 1998). Today, mining in the region is generally on a smaller scale, from low-grade ore.

More specifically, the initial placer claim in 1850 was made along the Illinois River at the mouth of Josephine Creek. Gold was discovered on Althouse Creek in 1852, on Galice Creek in 1854 and on Briggs Creek in 1868. The Illinois River and its tributaries were mined extensively from 1850 through 1945. Early placer and hydraulic mining profoundly altered riparian and stream habitats that are still in various degrees of recovery (USDA Forest Service 1999a). Hydraulic excavation methods were introduced as early as 1856 and proved to be very effective wherever the gravels were not cemented. These methods created large cuts in the stream banks and radically changed stream channels. In some cases, streams were redirected to gain access to placer deposits. Around the turn of the century, bucketline dredges and dragline excavators were introduced and used to increase the rate of excavations. These methods were used up until 1952 on some streams and placed the streams under severe environmental stress (Coleman and Kruckeberg 1999). Evidence of many of these mines is still apparent today along these rivers and streams. Suction dredge mining has been the most extensive method used since 1960 (Heylmun 1998).

Data for the Siskiyou Wild Rivers area was downloaded from the BLM Land and Mineral Records-LR2000 online database in February 2001 from http://www.blm.gov/lr2000/index.htm. This database provides data on the Township, Range and Section locations of unpatented mining claims located on federal lands. The data showed that over 19,000 claims have been made on U.S. Forest Service and BLM lands within the area described in the Federal Register notices (CFR: 66 No. 14, January 22, 2001, pages 6663-6664 OR-958-1430-ET, OR-56288 and OR-56289). Of these, over 12,500 of the claims were classified as lode claims, 6,500 as placer claims, 59 as tunnel claims, and 10 as mill site claims; however, most of these are classified as closed (Figure 4). This figure and subsequent figures depicting location of mining claims shows claim density organized by township, range, and section within the Siskiyou Wild Rivers Area based on a methodology developed by Harry Campbell at the USGS (Campbell 1996). Appendix C summarizes all mining claims within the Siskiyou Wild Rivers Area according to 6th field HUC watershed. Since precise spatially explicit data on mine claim location is currently unavailable, it was necessary to overlay watershed boundaries with mining claim densities depicted by township, range, and section to do the tabulation. Therefore, in instances where two or more watersheds occur in the same township, range, and section, mining claim totals were recorded in both watersheds. Total area covered by township, range, and a sections containing closed claims was approximately 45% of the Siskiyou Wild Rivers Area.

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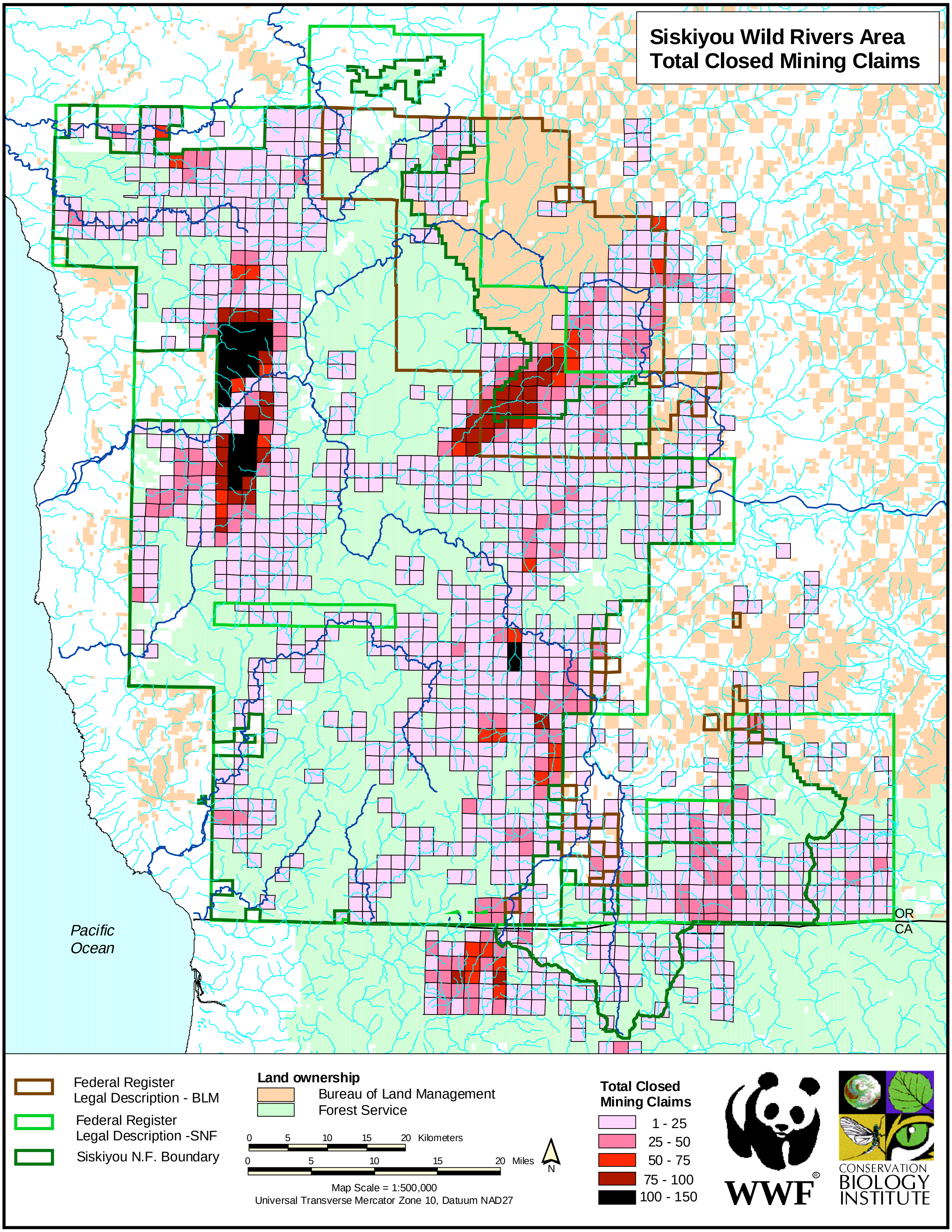

Figure 4. Map showing density of all total closed mining claims in the Siskiyou Wild Rivers Area.

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While placer deposits were the first to be discovered in the area, the most numerous claims have been lode mining (Figure 5). The lode mining has focused on the veins of gold in the region and on nickel laterite and chromium deposits. A highly productive lode mine, the Benton mine, was located near the headwaters of Whiskey Creek and the Gold Bug mine was located at the confluence of Whiskey Creek and the Rogue River (Heylmun 1998). Figure 5 also shows historical concentrations of lode mines in the headwaters of Lobster Creek, Quosatana Creek and many of the smaller tributaries on the lower section of the Rogue River. Further up the Rogue there were concentrations of claims on Whiskey Creek, Grave Creek, Galice Creek, and Howard Creek. Extensive activity occurred in the headwaters of Lawson Creek and within the drainage of the North Fork of Silver Creek, along Briggs Creek, throughout the Josephine Creek, Rough and Ready Creek, Althouse Creek, Sucker Creek and Elder Creek watersheds. In some sections over 100 claims are documented.

Concentrated areas of placer mine activity covered many of the rivers and streams in the Siskiyou Wild Rivers Area (Figure 6). Concentrations of closed claims are found along the Sixes River, Elk River, Chetco River, Baldface Creek on the North Fork Smith River and South Fork of the Coquille River. Extensive activity has occurred in the Illinois River watershed along Lawson Creek, Collier Creek, Silver Creek, Onion, Red Dog, Secret, Soldier and Swede Creeks on Briggs Creek, Canyon and Josephine Creek, Rough and Ready Creek, Althouse Creek, Sucker Creek, Whiskey Creek, and the scenic section of the Illinois River. Dragline excavators worked the upper section of Sucker Creek extensively in 1945 and 1946 above the confluence with Grayback Creek (Heylmun 1998). There are sections along Josephine creek where as many as 75 claims are documented. Many areas along Josephine Creek were mined to bedrock and areas of large cobbles (USDA Forest Service 1999a). Activity on the Rogue River has been concentrated in Taylor Creek, Galice Creek, Whiskey Creek and Grave Creek. Galice Creek is the location of the largest placer pit, 2000 feet wide and 100 feet deep, created in southwestern Oregon by hydraulic methods (Heylmun 1998). Grave Creek was the location of a large dredging operation on the south side of the creek east of Leland and dragline excavation was used on Coyote Creek (Heylmun 1998).

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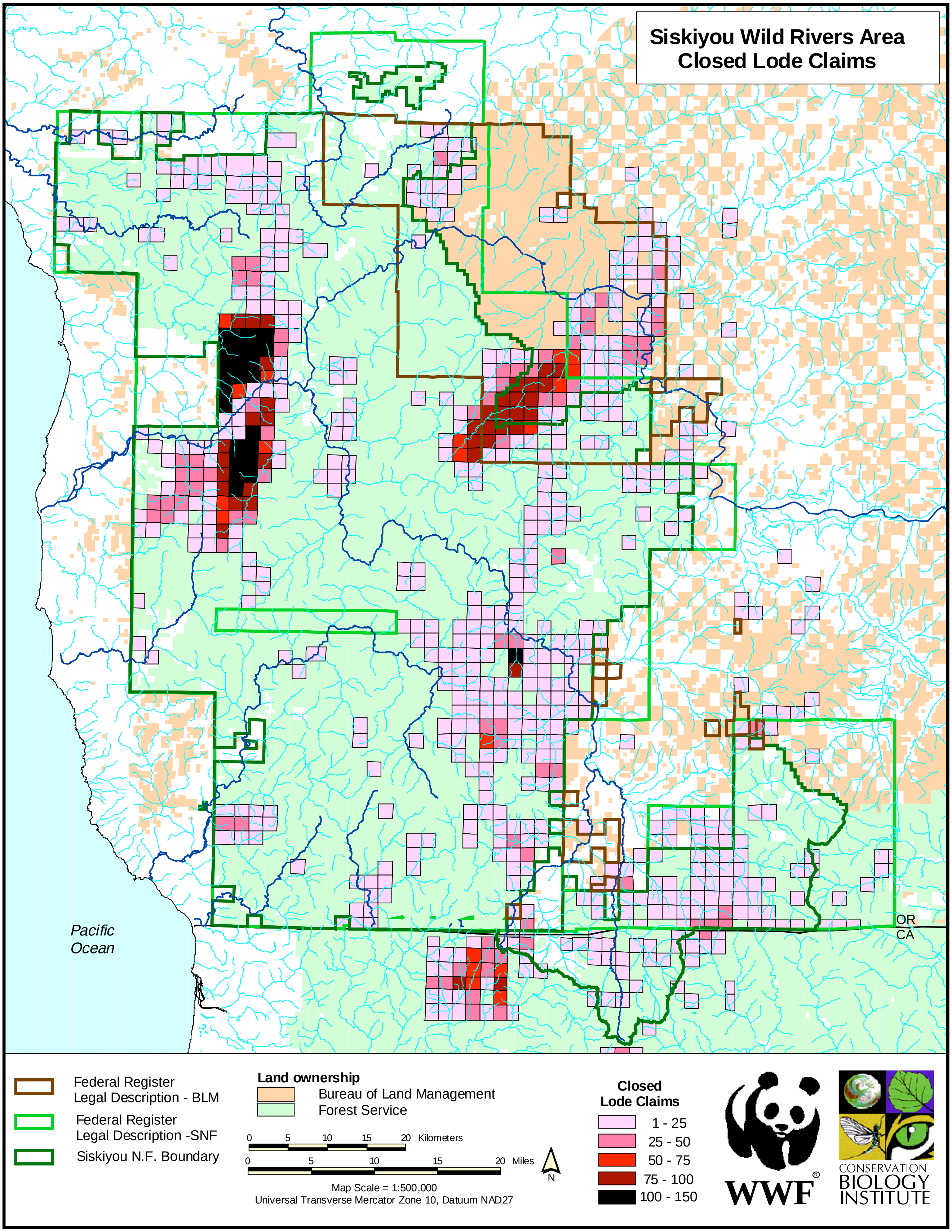

Figure 5. Map showing density of all closed lode mining claims in the Siskiyou Wild Rivers Area.

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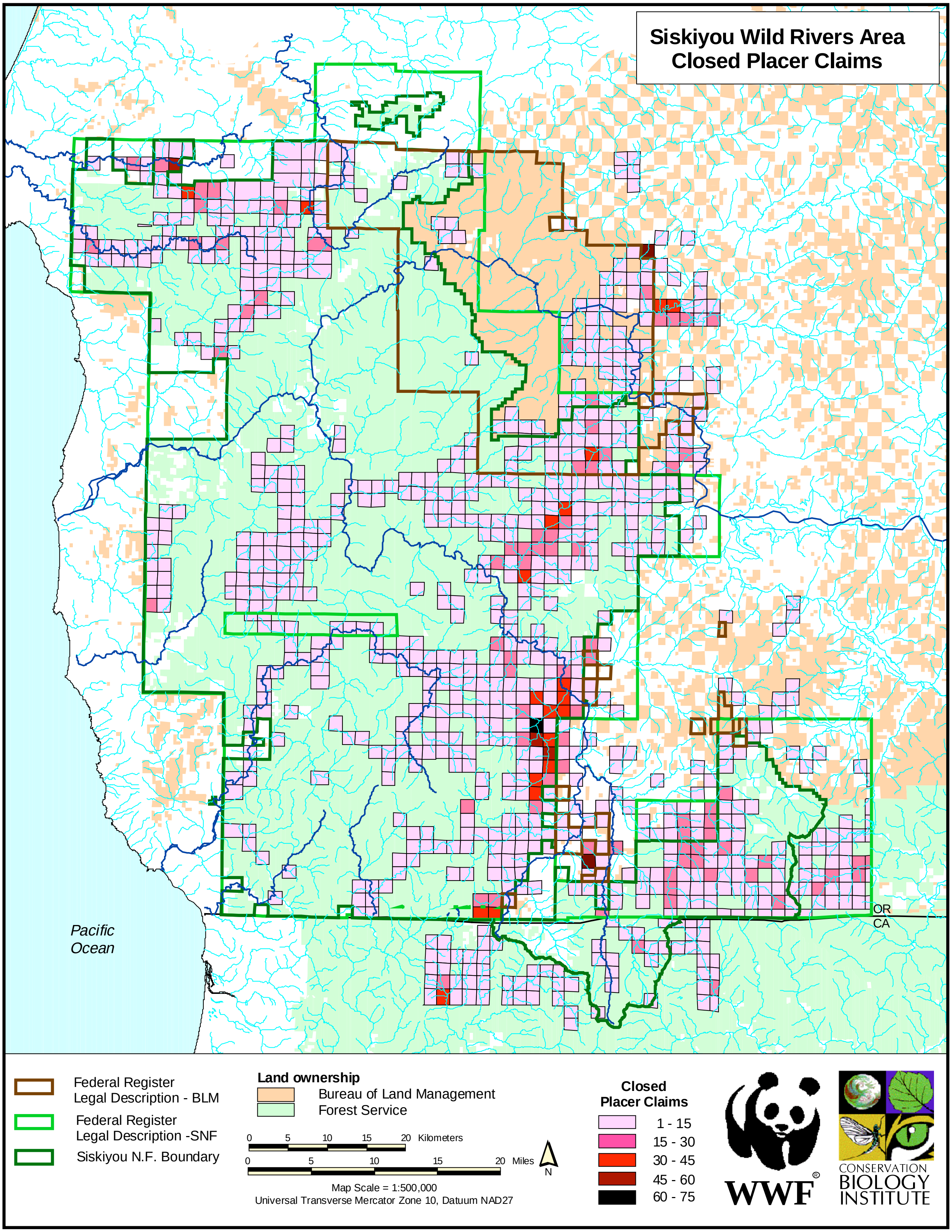

Figure 6. Map showing density of all closed placer claims in the Siskiyou Wild Rivers Area.

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Some of the largest hydraulic cuts were worked along tributaries of the East Fork Illinois River, notably Esterly Cut on Frey Gulch, which was worked from 1874-1945 and covered 30 acres, and High Gravel Cut and Deep Gravel Cut, which covered 65 acres (Heylmun 1998). Additional large hydraulic mines operated on Allen, Sailor, Scotch, and Waldo Gulches in the Althouse Creek watershed (Heylmun 1998).

Current Mining Activities

Of the 19,000+ mining claims, 1,190 are considered open and actively held by the claimants as of February 2001. Of the 1,190 total active claims (Figure 7), most (918) are placer mines, with concentrations along Silver Creek and Briggs Creek in the middle Illinois Watershed, along the Chetco River, Josephine Creek, Canyon Creek, and the mainstem of the Scenic Illinois River. Other concentrations include Rough and Ready Creek on the West Fork of the Illinois River, on Taylor, Galice, and Grave Creeks along the Rogue River, and along the South Fork of the Sixes River (Figure 8). The remaining 272 are lode claims with concentrations within the North Fork of the Pistol River, at the confluence of Canyon and Josephine Creek, along tributaries of Elk Creek in the East Fork Illinois headwaters, in the Althouse Creek watershed, in the Whiskey Creek watershed and in the Galice Creek watershed (Figure 9).

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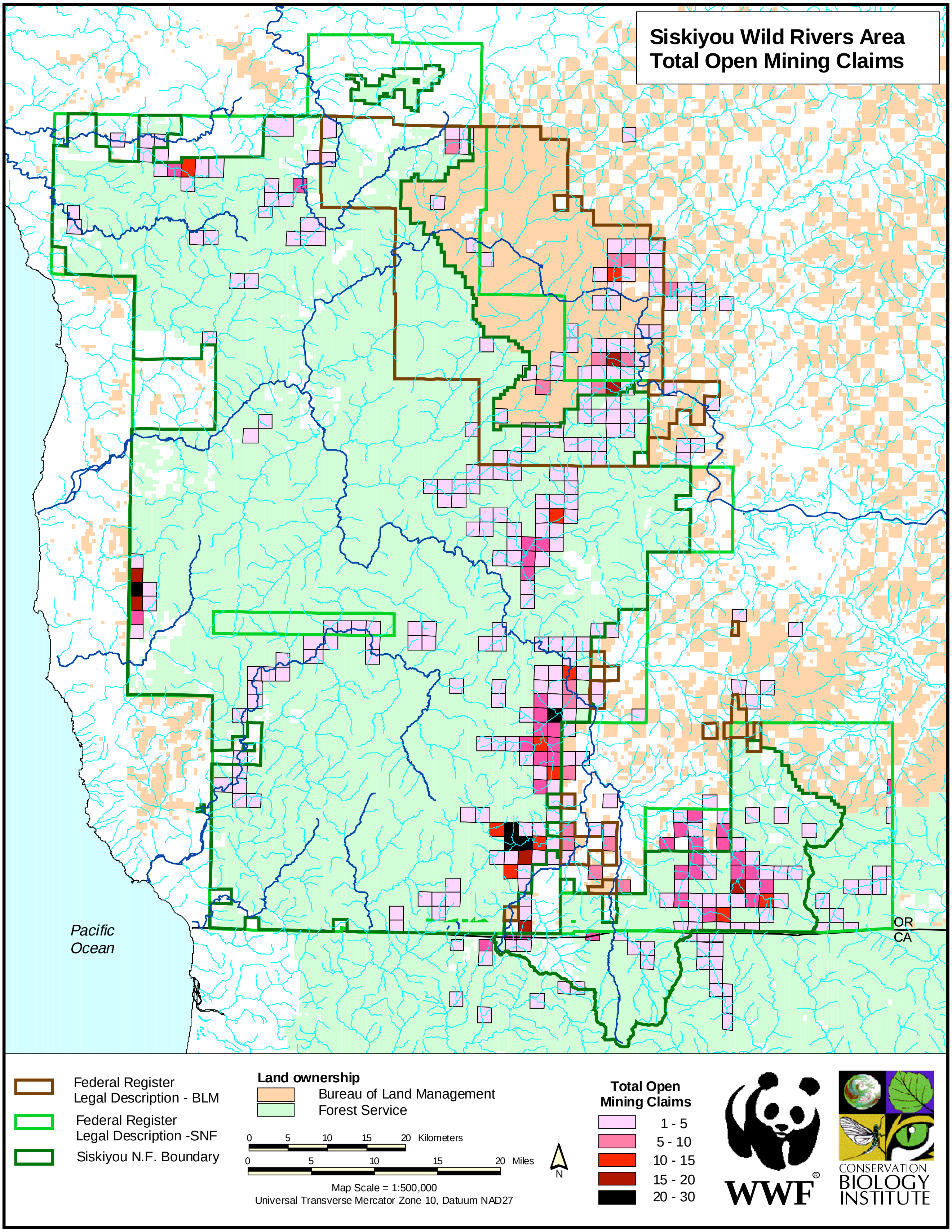

Figure 7. Map showing density of total open mining claims in the Siskiyou Wild Rivers Area.

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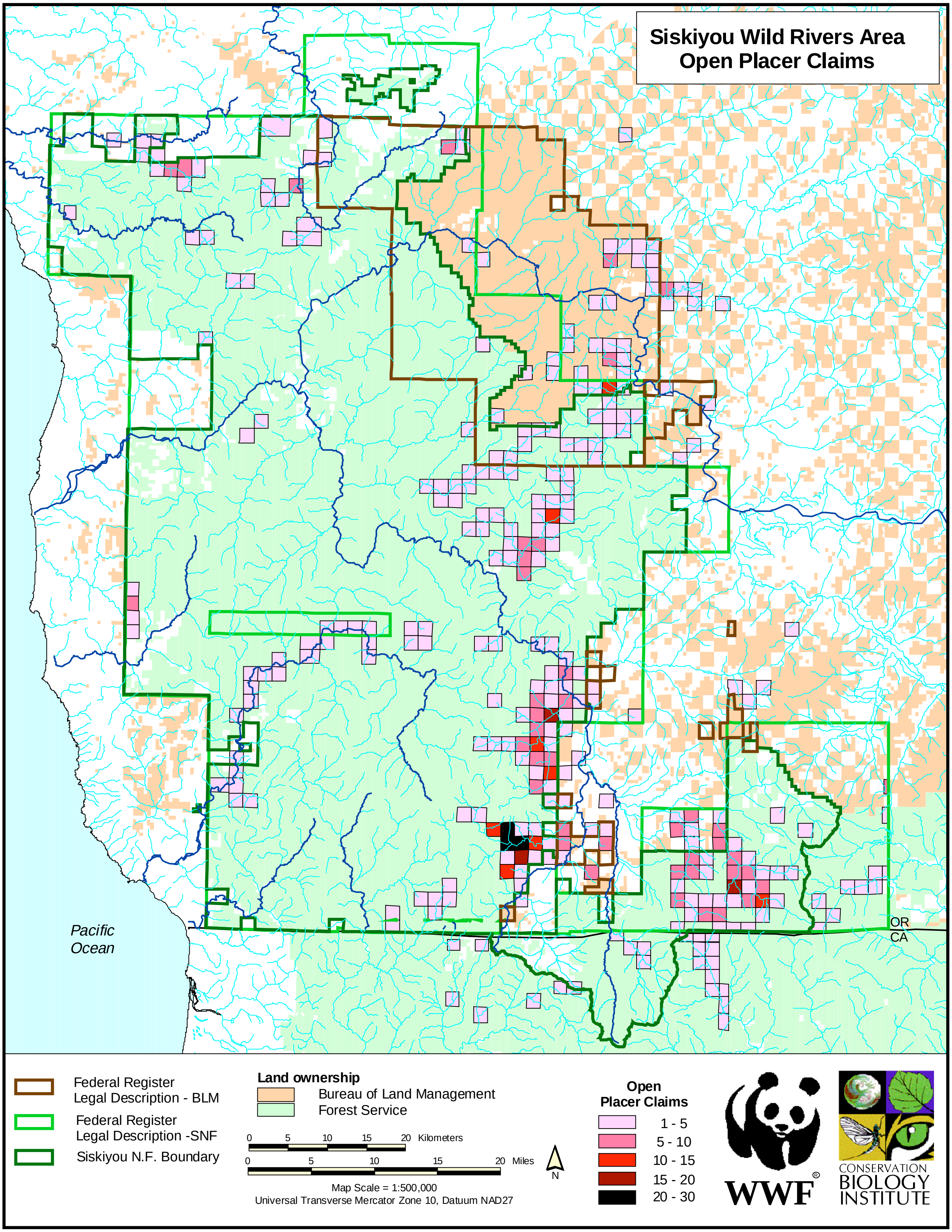

Figure 8. Map showing density of open placer mining claims in the Siskiyou Wild Rivers Area.

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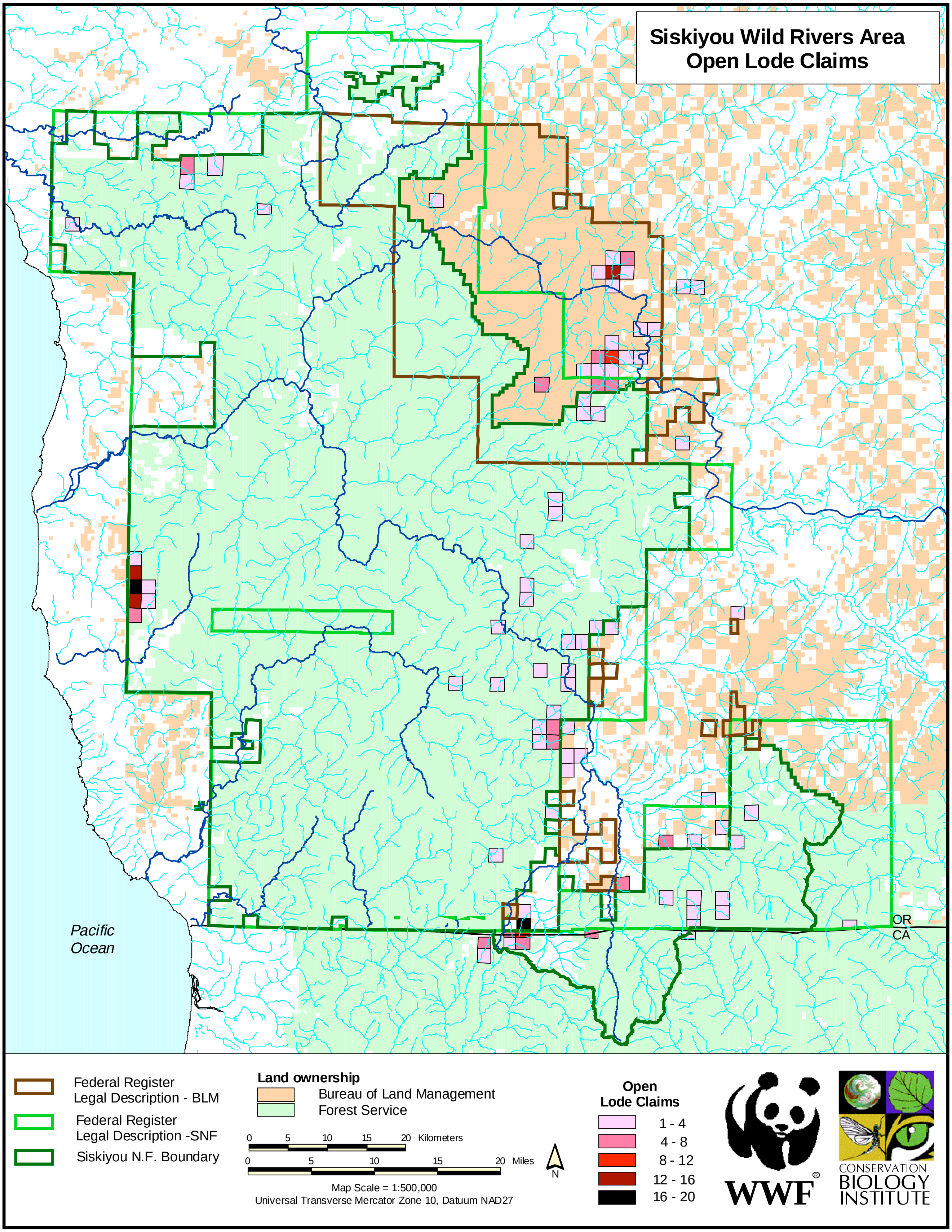

Figure 9. Map showing density of open lode mining claims in the Siskiyou Wild Rivers Area.

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Current Mining Activities and Protected Areas

While wilderness and wild river corridors have been closed to new mineral exploration, there are still claims within these areas that were made prior to the protected area designations. Based on the BLM data, there may be as many as 4 open lode claims and 40 open placer claims within designated wilderness areas, and the potential for additional claims in inventoried roadless areas and late successional reserves is significant. There are currently over 500 open claims within the regions inventoried roadless areas (Table 5). The mining database provides evidence that some of these protected areas were heavily impacted by mining activities before receiving protected status (Table 6). It should be noted that, these figures were derived from overlaying the maps of mining claim density and the protected and special designation areas. This resulted in some of the township and range densities being counted more than once.

Table 5. Open mining claims in designated protected areas, including inventoried roadless areas and late successional reserves.

Protected Areas	Open Lode Claims	Open Placer Claims	Open Mill Claims	Total Open Claims
Wilderness	4	40		44
Wild Rivers	4	14		18
RNA, ACEC, and Botanic Areas	33	242		275
Scenic Rivers	5	40		45
Recreation Rivers	10	17		27
Inventoried Roadless Areas	62	496		558
FS LSRs	141	590	1	732
BLM LSRs	94	90	2	186

Table 6. Closed mining claims in designated protected areas, including inventoried roadless areas and late successional reserves.

Protected Areas	Lode Claims	Placer Claims	Tunnel Claims	Mill Claims	Total Claims
Wilderness	644	675		1	1320
Wild Rivers	56	128			184
RNA, ACEC, and Botanical Areas	1180	971	7		2158
Scenic Rivers	174	390			564
Recreation Rivers	227	292	1		520
Inventoried Roadless Areas	6154	2923	8	1	9091
FS LSRs	10177	3686	58	5	13926
BLM LSRs	2673	506		2	3181

Lode and placer mining are serious threats to the Siskiyou Wild Rivers exceptional botanic and aquatic ecological values as discussed in the next section. In a given year, the Siskiyou National Forest may have from 150 to 200 notices of intent for small-scale mining operations within Northwest Forest Plan Riparian Reserves (USDA Forest Service 1996, Personal communication, Barbara Ullian). Mining also occurs in Riparian Reserves on adjacent BLM lands. In recent years, the majority of mining proposals in the Oregon Siskiyou have been for placer gold along rivers and streams or for nickel-laterites found in upland and alluvial deposits on Josephine ophiolite exposures. Since the 1950s, most of the placer gold found in Josephine County has been finely divided, and is mined by small companies and individuals (Heylmun 1998).

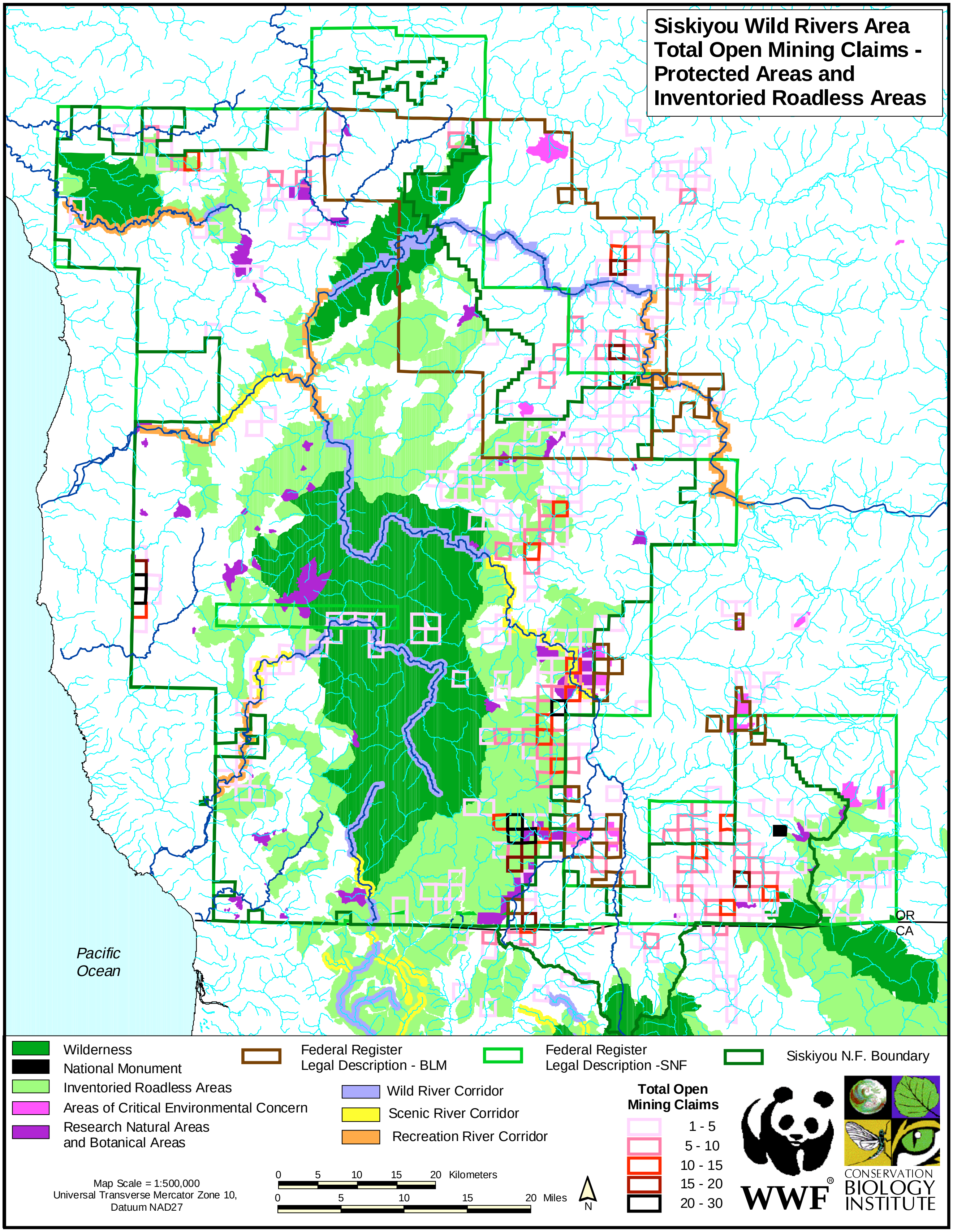

Figure 10. Map showing density of total open mining claims in relation to existing protected areas and inventoried roadless areas in the Siskiyou Wild Rivers Area.

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ECOLOGICAL VALUES AT RISK FROM MINING IN THE SISKIYOU WILD RIVERS AREA

Mining is a constant threat to the ecological integrity of the area in a number of ways. Lode mining of nickel, cobalt and chromium physically disturb the soils, crushing and uprooting vegetation, displacing plants and animals, and fragmenting habitats by creating gaps and road corridors with heavy traffic. Gold mining operations along stream benches utilize heavy equipment and withdraw water from streams. These operations alter the landscape by creating mine pits, tailings piles and settling ponds for mine wastes. Instream placer deposits occur where stream velocities are slower and bedload and suspended sediments are deposited. Additional placer deposits are found in stream terraces, along ancient stream courses. Instream gold mining operations congregate along ecologically important, low gradient stream reaches where gold is most likely to be deposited along with gravel or sand (USDI Bureau of Land Management 1997). Many of these low gradient reaches are critical spawning habitat for wild salmon, steelhead and cutthroat trout (National Marine Fisheries Service 1998a).

Mining Threats to Special Status Terrestrial Species and Serpentine Habitats

Serpentine (or Ultramafic) geology produces soils that are unique in many of their physical and chemical properties and produce the greatest number of endemic plant species (Coleman and Kruckeberg 1999). Serpentine soils have high concentrations of toxic elements, particularly nickel, chromium, iron, magnesium, and cobalt, and low nutrient availability, in particular calcium. The mineral imbalance and toxicity of these soils contribute to the unusual flora of the area. Many plants have evolved mechanisms to tolerate these soils, through improved nutrient acquisition and methods for excluding or sequestering toxic elements (Kruckeberg 1997). Wet serpentine soils support diverse wetland communities, the most spectacular of which is the *Darlingtonia* fen. These wetland communities are particularly sensitive to changes in hydrologic regimes. If their water supply is diverted, these bogs will disappear within only a few dry seasons. Serpentine soils also support Jeffrey pine savannah communities on drier flats and gentle slopes. On steeper slopes, serpentine soils support xeric shrub communities, including endemic shrub forms of tan oak, huckleberry oak and Brewer oak. Along ridge-tops, serpentine soils have sparse, low-growing patches of Siskiyou mat and Juniper interspersed with widely spaced herbs such as evergreen everlasting and the Siskiyou fritillaria. This sparse vegetation has been referred to as the serpentine “syndrome” (Kruckeberg and Lang 1997). These sparsely vegetated areas may look like a desert during the later summer, fall and winter, but come alive in the spring and early summer with beautiful displays of wildflowers. Appendix D lists the rare and endangered plants that occur within the Siskiyou Wild Rivers Area.

Disturbances at mined sites include surface disturbance, compaction, sub-soil exposure, displacement of soil organics, loss of soil structure, and mixing of soil horizons. Plants may be uprooted, buried or crushed during excavation and ore storage. Serpentine soils revegetate slowly, if at all, after disturbance. Herbaceous serpentine species are generally difficult to propagate. Seeding and planting to encourage revegetation has generally been unsuccessful. Traditionally, revegetation efforts on serpentine soils have incorporated agricultural techniques such as application of fertilizers, amendments to alter pH and irrigation. These have promoted growth of weed species outcompeting native species. (Martin et al. 1953, Bradshaw et al. 1964, Woodell 1975, Smith and Kay 1986, McCarten 1987). Calcium enrichment enhanced growth of fungi that limited the survival of native species (Tadros 1957). A successful planting of woody species on an old mining site in California, included extensive site preparation through soil decompaction and hill-slope contouring and used container-grown, locally collected native species (Hoover et al. 1999).

Ironically, the feature that makes the region such a botanical treasure (highly mineralized soils) also creates a major conservation conflict (Kruckeberg and Lang 1997). Difficulties in revegetation and often-stunted nature of the tree species make commercial logging impractical. In addition, the low nutrient value of the herbaceous layer makes the area of little value for livestock (Sawyer 1996). Soil surveys report the highest and best use of serpentine soils is as natural areas for specialized flora and fauna (Coleman and Kruckeberg 1999). Hard-rock mining is the most significant threat to the species-rich serpentine communities as evidenced by the extent and density of open mining claims on serpentine soils, particularly along Rough and Ready Creek, Canyon Creek, Briggs Creek, Silver Creek, Josephine Creek, Galice Creek, and portions of the Upper Illinois River (Figure 11). Commercial mining is considered the greatest threat to the serpentine fens species and is the primary reason that *Hastingsia bracteosa and*

Hastingsia atropurpurea are candidates for ESA listing (USDI Fish and Wildlife Service 2000a). There are mining claims in and around all of the serpentine fens which provide habitat for these species, and risks are greatest on Eight Dollar Mountain, Free and Easy Pass, Rough and Ready Creek, Woodcock Mountain, and on the upper reaches of Josephine Creek (USDI Fish and Wildlife Service 2000). A map of special status (rare and endangered) terrestrial species for the same area shows the expected relationship between rare plant and animal species locations and serpentine soils (Figure 12). However, not all concentrations of rare and endangered species are found on serpentine soils. Several concentration nodes, particularly in the northern portion of the region, are not associated with serpentine habitats and these northern nodes are not threatened by mining except the node in and around Taylor Creek. It is also important to note that these are concentrations of species, therefore not showing all individual species locations that are threatened by mining activities.

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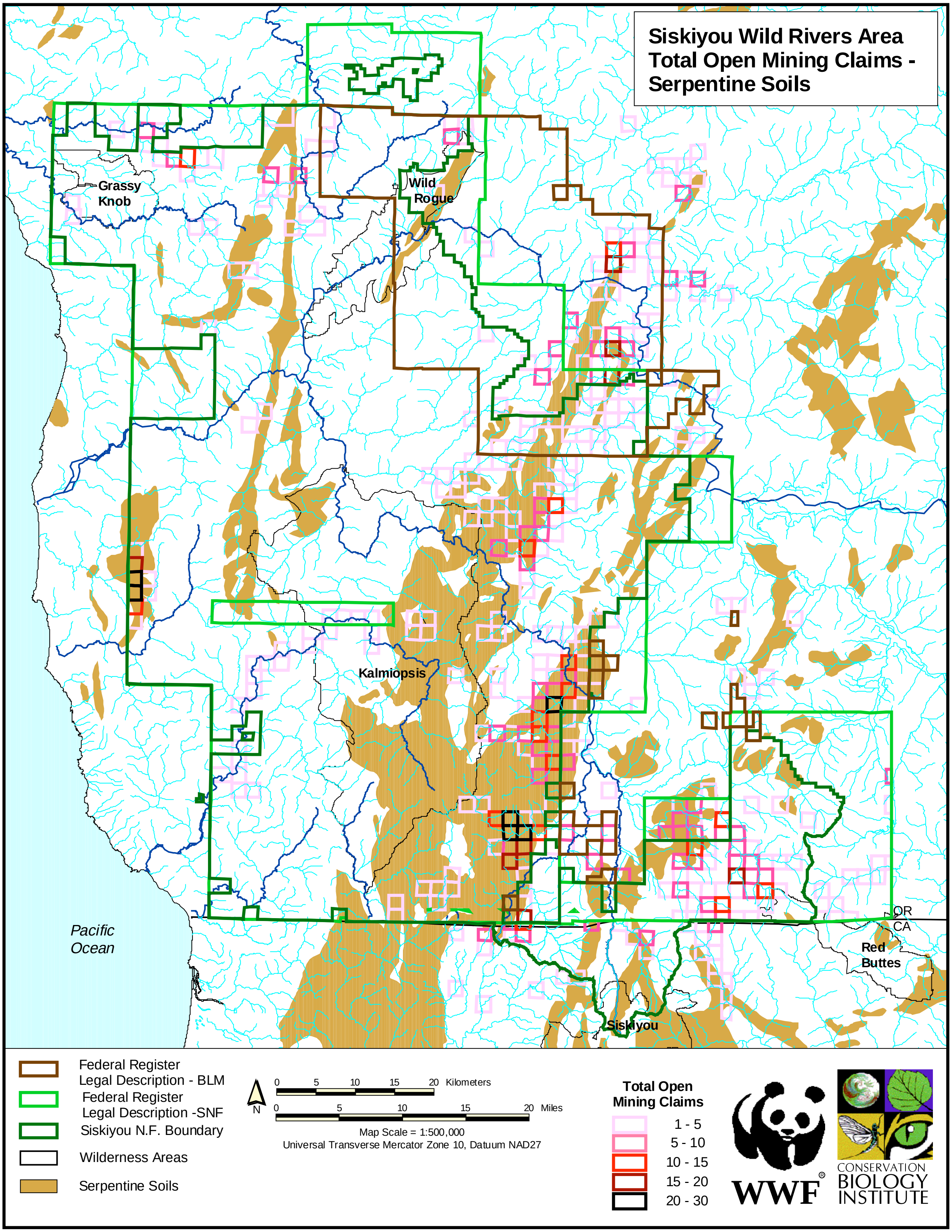

Figure 11. Location of serpentine soils in relation to density of total open mining claims for the Siskiyou Wild Rivers Area.

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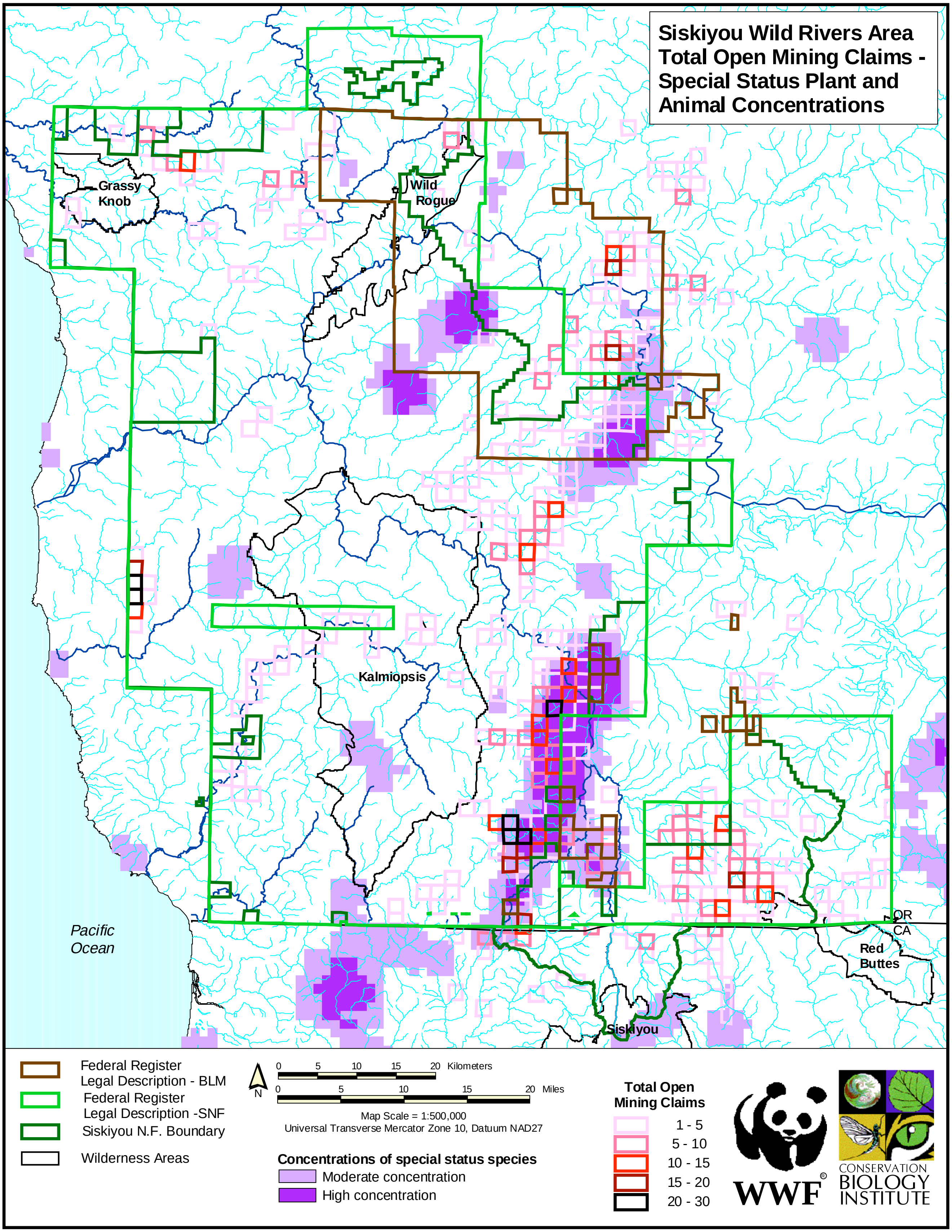

Figure 12. Concentrations of special status plants and animals in relation to density of total open mining claims in the Siskiyou Wild Rivers Area.

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Twenty-two percent of the serpentine soils in the Siskiyou Wild Rivers Area exist in designated protected areas, but that was not by design. Many areas, whether inside and outside protected areas, remain untouched through benign neglect, except in cases where mining interests or off-road vehicle access points are present. Impacts from the exploration and mining of nickel-laterites on serpentine soils threaten rare plant habitat and wetlands, and are considered irreversible because of the reasons outlined above. One area of particular concern is in the Rough and Ready Creek drainage where a large proposed lode mining operation (Nicore Mine) could cause severe and irreversible damage to the serpentine communities there. The nickel-laterite deposits in Rough and Ready Creek are low grade, 0.6%-1.2% nickel content, and small in comparison to those being exploited in other areas of the world (USDA Forest Service 1999b). Economic evaluation of this project, and Oregon laterite ores in general, shows that the project would have a negative net return, currently the costs of mining and processing the ore is expected to be higher than the value of the processed nickel and associated metals (USDA Forest Service 1999b). Most of the world's nickel production from laterites occurs with ores containing 1.8%-3.5% nickel content (Reimann et al. 1998). Globally, the most significant nickel laterite deposits are located in New Caledonia, Cuba, Indonesia and the Philippines (Russell 1998). The last open nickel smelter in the United States, near Riddle, Oregon, imported ore from New Caledonia for two years prior to closing in 1998 due to low nickel prices (USDA Forest Service 1999b). The cobalt and chrome concentrations in the Rough and Ready Creek soils are 0.07%-0.14% and 1.06%-2.56%, respectively (USDA Forest Service 1999b).

Bench and terrace mining inherently disturb large areas in the process of extracting mineral ores. Mining activities in and surrounding stream channels impact critical habitat for birds, amphibians and aquatic insects. These indirect effects include fragmentation of the forest system by mining roads, off-road vehicle tracks and stream crossings, stream channel debris flows resulting from bank instability, compaction of soils by heavy equipment, long-term, high intensity camping on and surrounding mining claims, and the associated introduction of invasive species along road and stream corridors. Increase in roads and access by off-road vehicles (ORVs) are important threats to serpentine communities. Whether ORV use will ever match, or even someday surpass, mining impacts is unclear at this time, but the rise in ORV use in the region is of concern and should be monitored and managed carefully. Recently, a meadow in the

Siskiyou National Forest's Days Gulch Botanical Area was destroyed by 4-wheel drive vehicles. There is also evidence of 4-whell drive impacts in the BLM French Flat Area of Critical Environmental Concern (Siskiyou Project New Release 2001).

Port-Orford Cedar

While Port-Orford cedar (*Chamaecyparis lawsoniana*) is not considered an endangered species, it is of particular conservation interest as a regional endemic of southwest Oregon and northern California and an important component of riparian and wetland ecosystems (Trione 1959, Zobel et al. 1985, Roth et al. 1987). This species grows throughout the region at various densities (Figure 13A), but is most noted as a dominant canopy tree in riparian zones providing important streamside shade and instream large woody debris. Figure 13A also shows the location and density of open mining claims, which pose a threat to Port-Orford cedar in these areas, and based on the closed mining data depicted in Figure 13B, are in areas currently uninfected. The ecological integrity and stability of the stream habitats within the Siskiyou Wild Rivers Area can be partially attributed to Port-Orford cedar and its tendency to colonize streambanks and the active stream channel. Port-Orford cedar is particularly important for serpentine lands because it is the only tree species found in serpentine wetlands that grows to a size large enough to create stable debris jams and adequate shade for steep mountain streams (Nawa 1997).

A persistent and damaging invasive species, *Phytophtora lateralis* (a fungus that causes root rot) is seriously impacting Port-Orford cedar populations in portions of the region (Figure 13B). Port-Orford cedar declines in these areas have led to a cascading degradation of streamside communities and habitat. *Phytophthora lateralis* is a water-borne fungus meaning it is primarily dispersed in water with spores that can be carried in mud on vehicles and equipment from infected sites to uninfected ones. Road-building and vehicular traffic from logging, mining and recreational activities are primary vectors for spreading this disease (Jimerson and Creasy 1997). Both Port-Orford cedar and Pacific Yew are killed by this non-native pathogen, and once *Phytophthora lateralis* is introduced into a watershed, it is irreversible. The disease spreads from infected roots through soil and surface water to infect additional trees making Port-Orford cedar along streams and lakes the most vulnerable. In addition to regular access by car and trucks on roads, the growing use of old logging and mining roads by ORVs threatens the integrity of the region's Port Orford cedar populations.

Another *Phytophthora* species has recently been identified as the fungus causing sudden oak death in the San Francisco Bay Area. This fungal species affects two oak species that are common in the Siskiyou Wild Rivers Area, tanoak and California black oak. The species has also been identified on rhododendron and implicated in the death of evergreen huckleberry, a member of the heath family. The implications of infections of this pathogen in the Siskiyou Wild Rivers Area could be extensive and devastating. The two oak species are important to a number of plant communities and huckleberry is widespread and important for wildlife, providing food and shelter for many species.

Impacts of Mining on Salmon and Other Aquatic Organisms

Salmon of the Siskiyou Wild Rivers

The Siskiyou Wild Rivers Area is considered to contain the most ecologically intact salmonid habitat and remnant wild salmon populations south of the 49th parallel. At a time when salmon stocks are dwindling throughout the Pacific Northwest, the Siskiyou Wild Rivers Area remains one of the last refuges even though populations are depressed from historic levels even in this region. The Siskiyou National Forest contains approximately 1,150 miles of salmonid-bearing streams and has a high stream density, 8.5 miles of stream per square mile (USDA Forest Service 1989). The rivers in the Siskiyou Wild Rivers Area do not have any high dams, so salmon and steelhead have access to much of their historic range and the Illinois River has no fish hatchery program which could interfere with native populations. The populations of wild coho salmon (*Oncorhynchus kisutch*) are listed as threatened under the endangered species act, winter and summer steelhead (*Oncorhynchus mykiss*) populations were considered for listing under the endangered species act, and Chinook salmon (*Oncorhynchus tshawytscha*) and cutthroat trout (*Oncorhynchus clarki*) are Forest Service Region 6 sensitive species.

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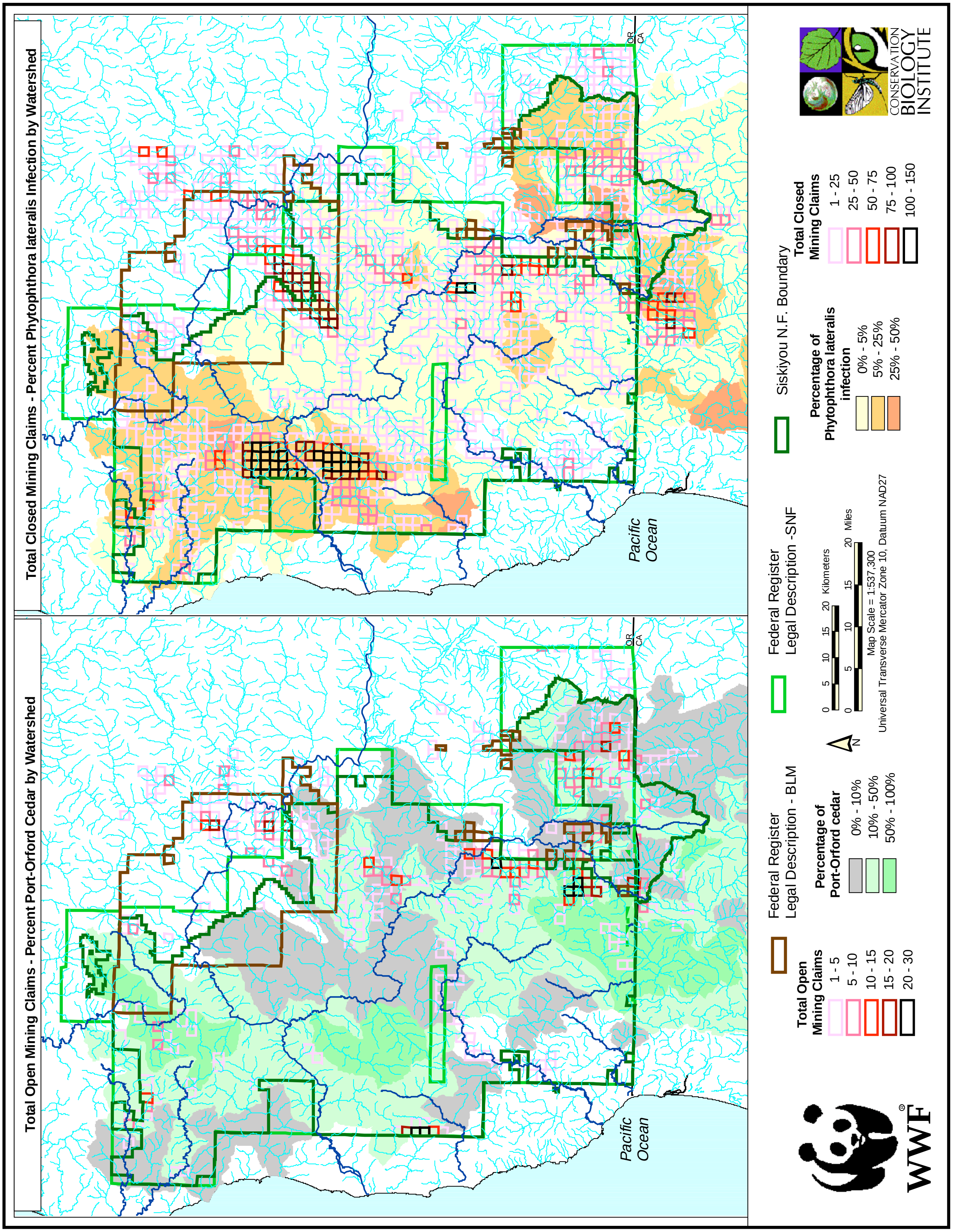

Figure 13. Maps showing percent of POC in relation to total active mining claims (A) and percent of *Phytophthora* in relation to total closed mining claims (B) in the Siskiyou Wild Rivers Area.

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While the Klamath Mountain Province steelhead ESA listing has been ruled to be unwarranted by the National Marine Fisheries Service (2001), there is evidence that the populations in the Siskiyou Wild Rivers Area is considerably lower than historical levels. Fish surveys on the Illinois River show a ten-fold drop in steelhead numbers between the 1970's (2500 fish) and the 1990's (200 fish) (USDA Forest Service 1999a).

These species have a variety of life-history patterns, but have shared habitat requirements. As a group, these species do best in cool, clear water with good shade and regular pools and large woody debris for shelter. They use mixed alluvial deposits as substrates for spawning. Spring-run chinook choose riffles on low-gradient streams for spawning (West et al 1990). After they emerge, the fry move into shallow areas near the stream banks. Their territory seems to be related not only to slack water, but to objects that provide points of reference to which they can return (Hoar 1951). Juvenile rearing usually occurs in tributary streams with gradients of three percent or less, although they may move up to streams of four- or five-percent gradient. The conservation of salmon depends on protection of low-gradient stream reaches, which have historically provided the majority of their habitat (National Marine Fisheries Service 1998a). Many of the existing salmon populations now concentrate in upstream reaches, due to the extensive lowland degradation (National Marine Fisheries Service 1998a). These low-gradient streams reaches, < 3%, occur in valley bottoms and are extremely important for rearing and spawning and all stream reaches with channel gradients less than 20% are considered to be potential fish bearing streams except where fish barriers exist (National Marine Fisheries Service 1998a). One example of the overlap of prime steelhead spawning habitat and mining operations occurs in Silver Creek on the Illinois River. Within Silver Creek active mining operations occur from the confluence of the north fork and the mainstem to the confluence of Todd Creek and the mainstem (Personal communication, Rich Nawa). During 1997 and 1998 surveys done for the Siskiyou National Forest found that approximately 67% of the steelhead redds on Silver Creek were found in this area above the north fork. The highest densities were above the Old Glory Mine. The average number of steelhead reads per reach ranged from 4 to 26 for the two years (Bennett and Bowman 1997, 1998).

Coho incubation is temperature dependent and can be as short as 38 days at warmer temperatures (11 °C) and as long as 100 days at cooler temperatures (4 °C)., spawning occurs from September to January, hatching between October and May followed by emergence a month later, as late as June (Laufle et al 1986). Coho salmon juveniles remain in freshwater rearing habitats for a year after hatching. After spending two years in the ocean, they return to freshwater in the fall and spawn in the late fall and winter and hatch in the spring. Steelhead are separated into two subspecies in Oregon. Most fish spawning in inland rivers return to freshwater habitats in the summer and most of those spawning in coastal rivers return to their spawning grounds during the winter. Summer-run steelhead pass through the Siskiyou Wild River Area on their way up the Rogue River and the streams in the region are used extensively by winter-run steelhead. Summer-run steelhead require cold, deep pools where they hold until spawning. Steelhead generally spawn in the winter and hatching and emergence occurs in the spring; however, steelhead on the tributaries of the Illinois River have been observed to spawn in June and as late as July (Personal communication, Rich Nawa). Juveniles rear in fresh water for one to two years prior to migrating to the ocean in the spring. Chinook salmon spawn in the fall, September and October, on large gravel bars within the mainstem rivers. Chinook juveniles migrate to the ocean the first fall after they hatch and return to freshwater as three to five year old adults. Chinook return to freshwater during the spring, summer and fall. Those that return in the spring and summer spend the summer months in deep, cool pools. Cutthroat trout spawn in the winter and early spring on small pockets of gravel and prefer small streams.

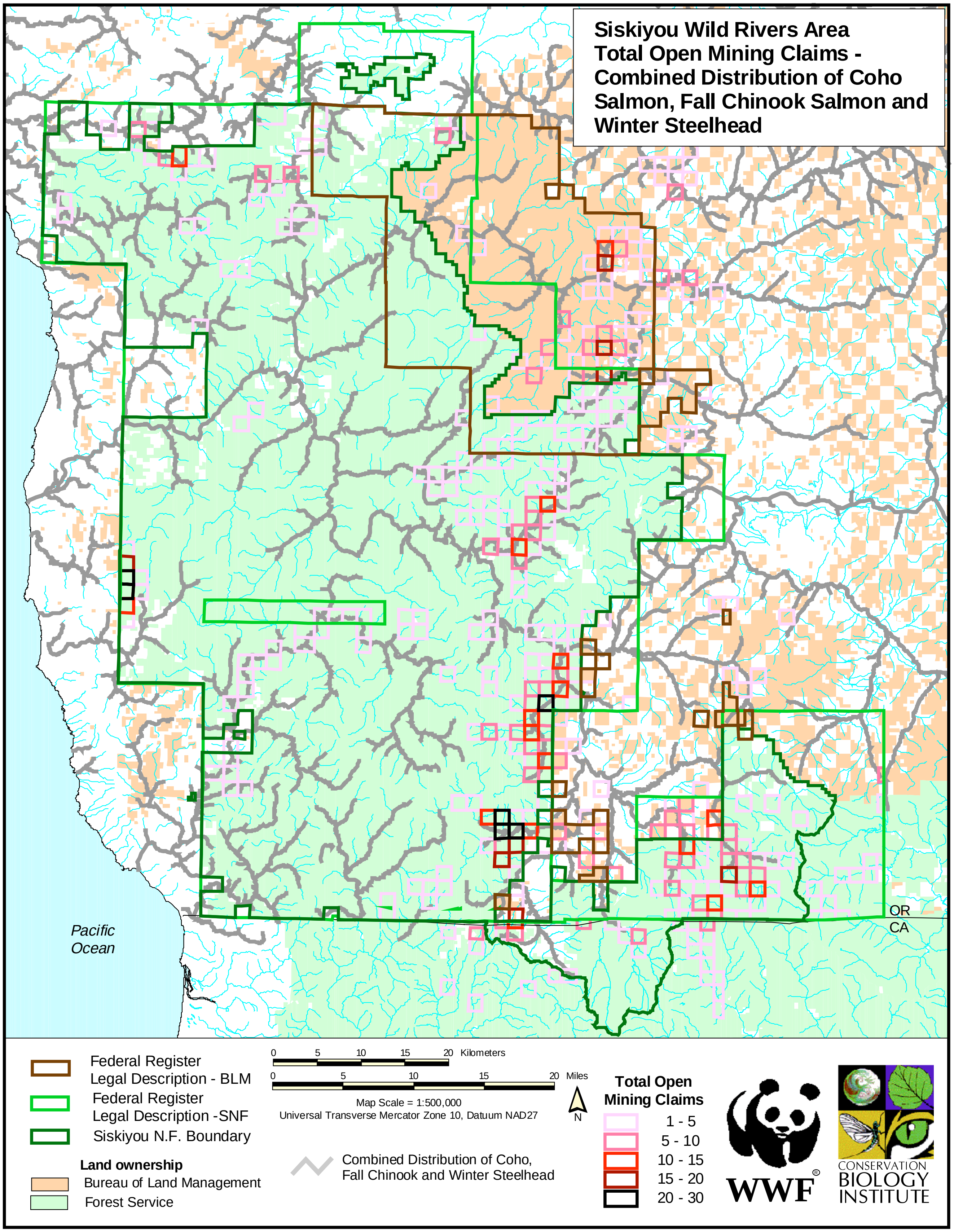

Figure 14. Map showing streams reported by ODFW to contain salmonids in relation to density of total active mining claims in the Siskiyou Wild Rivers Area.

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American Fisheries Society Critical Watersheds and Northwest Forest Plan Key Watersheds

In 1993, the Oregon Chapter of the American Fisheries Society established a watershed classification strategy for protecting the indigenous aquatic fauna of Oregon. This strategy had three principal biodiversity objectives: 1) Protect diversity of watersheds (catchments), aquatic habitats, and indigenous aquatic fauna; 2) Provide refugia for aquatic species and assemblages and corridors for their dispersal and migration; 3) Maintain a comprehensive set of reference catchments and aquatic habitats that can be used to evaluate the effects of human disturbance, provide minimally disturbed research sites, and allow state agencies to assess the attainment of biological criteria. Sixteen watersheds and three migration corridors in the Siskiyou Wild Rivers Area were identified as being critical to the conservation of Oregon’s aquatic species. These include the Lower Rogue River and its tributaries Shasta Costa Creek, Lobster Creek, Quosatana Creek, and Taylor Creek; the Illinois River and its tributaries Silver Creek, Indigo Creek, Lawson Creek, Canyon Creek, Rough & Ready Creek and Sucker Creek; the Chetco River and its tributary Emily Creek; the Oregon section of the North Fork Smith River and Baldface Creek; Winchuck River, Elk River and the South Fork Coquille River (Oregon Chapter American Fisheries Society 1993). Many of these watersheds were also recognized by the Northwest Forest Plan as key watersheds for salmon protection.

Salmonids were the major aquatic focus of the Northwest Forest Plan (FEMAT 1993) with the goal being to protect, maintain and restore the distribution, diversity and complexity of watershed features necessary to maintain and restore the native salmon and steelhead populations within the region. Maintaining and restoring the physical integrity of stream channels as well as the physical, chemical and biological integrity of the aquatic system were key objectives.

Within the area being considered for mineral withdrawal, there are 15 watersheds designated as key watersheds for conservation and restoration of habitat for at-risk stocks of anadromous salmonids and resident fish species (Figure 15). Several of these watersheds include sections of streams designated or proposed as wild and scenic rivers, including the Elk River, South Fork Coquille River, North Fork Smith River, and the Illinois River tributaries Indigo Creek and Silver Creek. Additional key watersheds include the East Fork of the Illinois River and its tributaries Cave Creek, Grayback Creek and Upper Sucker Creek; lower Illinois River tributary Lawson Creek, Chetco River tributary Emily Creek, and Rogue River tributaries Quosatana Creek, Taylor Creek, and Shasta Costa Creek and the Winchuck River (USDA Forest Service 1998). In addition to the watersheds designated as key watersheds a number of the other watersheds in the Siskiyou Wild Rivers area provide high quality salmonid spawning and rearing habitat. These include Illinois River tributaries Collier Creek, Deer Creek and Althouse Creek; Rogue River tributaries Lobster Creek and Elder Creek, and Chetco River tributary Eagle Creek.

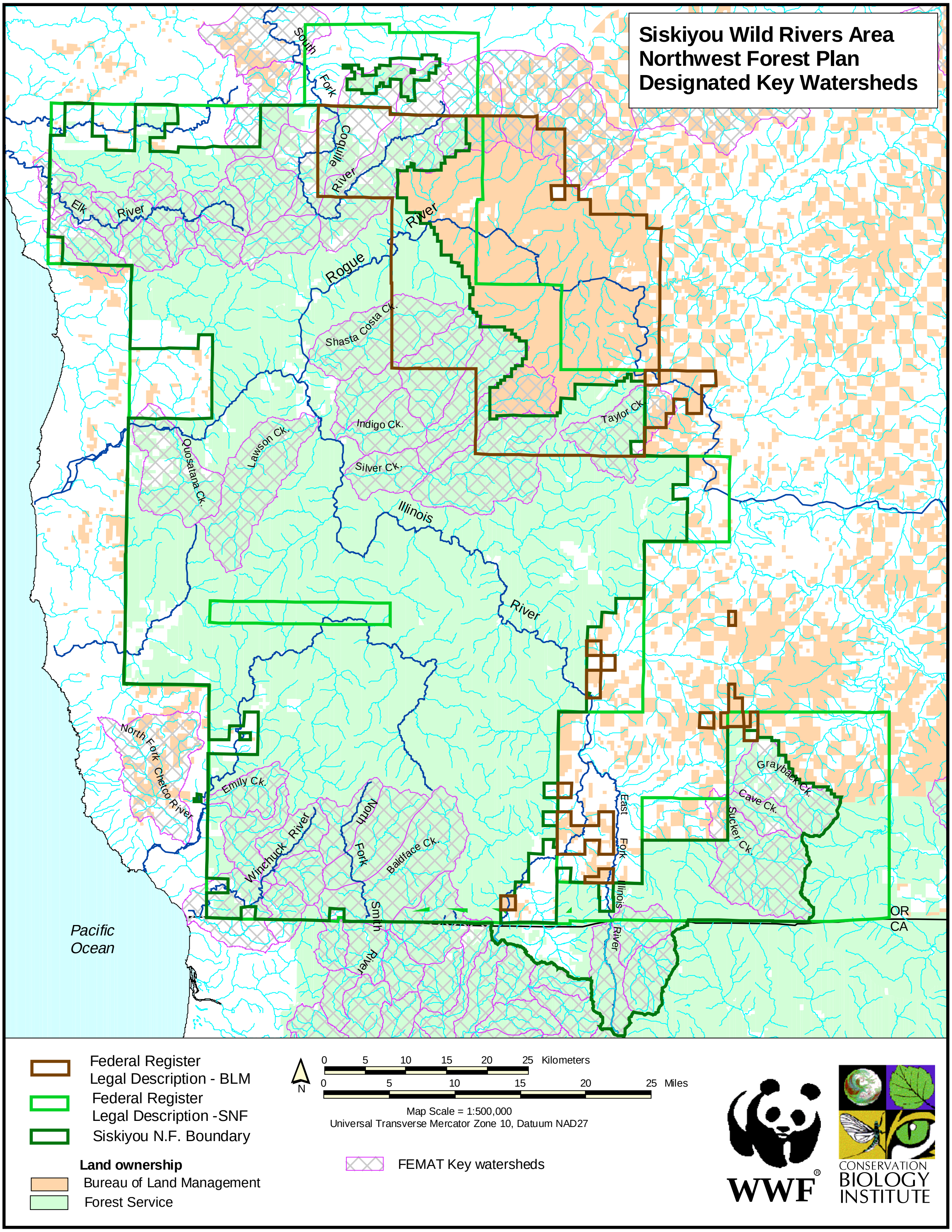

Figure 15. Map showing location of key watersheds as defined by the American Fisheries Society in the Siskiyou Wild Rivers Area.

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Major Threats to Freshwater Ecosystems form Suction Dredge Mining

Major threats to freshwater systems in the region include channel morphology changes, substrate changes, loss of instream roughness, loss of estuarine habitat, loss in water quality, altered stream flows, fish passage impediments, and elimination of spawning and rearing habitat (National Marine Fisheries Service 1997, 1998b, 1999a, 1999b). Both instream and adjacent mining inherently create changes in channel morphology, substrate and channel roughness, and can impact water quality and stream flows. These impacts can lead to the elimination of spawning and rearing habitats. There are few peer-reviewed studies of the effects of suction dredging in the scientific literature; however, Harvey and Lisle (1998) encourage fishery managers to be conservative based on their knowledge of mining practices, the biology of salmonids and the physics of streams. Situations of special concern are periods and locations where dredging occurs in conjunction with incubating embryos in stream gravels or precedes spawning runs, which are followed by high flows (Harvey and Lisle 1998). The impacts of suction dredging have generally been found to be localized, but added to other landscape scale changes, may cause significant impacts on fish habitat (Harvey and Lisle 1998).

Impacts of Suction Dredge Mining on Water Quality

Dredge operation increases local suspended sediment loads and fine bedload deposition. These increases have the potential for decreasing primary productivity through decreased sunlight, altering the localized densities of aquatic insects, and impacting fish reproduction by suffocating fish redds (Parker 1991). Studies have shown evidence of increased embeddedness of sediments in downstream reaches, and decreases in microhabitat availability, for benthic fish and amphibians, due to movement of cobbles and boulders (Parker 1991). The increases in suspended sediments have generally been measured to be below lethal levels and fine sediments (clay, silt, and fine sand) are generally carried downstream for short distances (Harvey and Lisle 1998). While the impacts of suspended sediments may be not cause direct mortality in salmon, dredging may inhibit fish movement upstream by creating high-suspended sediment levels and stressing the individuals faced with these conditions. This could be detrimental to fish survival and species overall fitness, particularly under conditions when stream temperatures are elevated above optimal levels (Harvey and Lisle 1998). Related to this concern for the cumulative effects of impaired water quality, Oregon Circuit Court Judge William C. Snouffer ruled in 1999 that suction dredge permits were illegal in northern Oregon streams, which were already water quality limited due to high temperatures. This ruling was based on the anti-degradation provision of state law for water quality limited streams. Many of the streams in the Siskiyou Wild Rivers Area are listed by Oregon Department of Environmental Quality as impaired because of high temperatures and several streams, including the East and West Forks and mainstem of the Illinois River to the confluence with Briggs Creek and the South Fork Coquille River, are listed due to low flows (ORDEQ 1998). Decreased prey capture in steelhead and coho salmon is an additional impact of increased suspended sediment. This is associated with decreased growth rates in turbid water (Sigler et al 1984).

Measurements of water quality impacts in Alaska showed that localized water quality impacts included increased turbidity to a distance of 160 m and increases in total filterable solids and heavy metals concentrations, copper and zinc, to a distance of 80 m (Prussian et al. 1999). These localized increases in heavy metal concentrations suggest that riverbed sediments may accumulate heavy metals in the vicinity of dredge plumes (Prussian et al. 1999). The impacts that these accumulations might have on invertebrate and fish ecology have not been studied. An additional concern for areas where mercury has been used historically in mining operations is the remobilization of liquid mercury from within the sediments being worked (Prussian et al. 1999).

Impacts of Suction Dredge Mining on Stream Habitat

Suction dredging generally involves excavation of the deeper, largely uninhabited sediments and the deposition of these sediments on top of the ecologically more important surface substrates (Prussian et al. 1999). Streambank and terrace excavation may produce long-term impacts, including extensive erosion and stream channel alterations, as streambanks are commonly slow to rebuild naturally (Wolman and Gerson 1978). Prior to dredging, large boulders, down woody debris, stumps and rootwads may be moved to facilitate excavating a site. Rocks too large to enter the intake pipe are stacked nearby creating cobble and boulder piles, which tend to persist through peak flows. Movement of these large structures may change channel morphology and can lead to bank and channel instability and a reduction in streambed complexity (Harvey and

Lisle 1998). Removal of these structures causes reductions in streambank roughness and may increase streambank erosion due to increased hydraulic force and less drag (Harvey and Lisle 1998). Removal of large woody debris from the stream channel impacts instream ecological processes and conditions such as microbial nutrient uptake and transfer of organic matter (Tank and Winterbourn 1996); species composition and productivity of benthic invertebrates (Benke et al 1984); and density of fish (Fasch and Northcote 1992; Crispin et al 1993). Large woody debris and boulders serve important habitat functions as shelter for fish during winter (Heggenes et al 1993; Smith and Griffith 1994) and as microhabitats for benthic fish species such as sculpin and dace (Baltz et al 1982; Harvey 1986).

Direct disturbance of streambeds tend to destabilize natural processes that mold stream channels. Dredge excavations can vary in area from a few small pits to the entire wetted area in a stream reach and can exceed several meters in depth, depending on depth to bedrock (Harvey and Lisle 1998). These excavations result in dredge piles, which alter channel topography and substrate conditions. In small streams these piles may increase local scour or fill in other areas of the stream. The influence of dredge related streambed alterations varies from year to year due to interannual variability in stream discharge levels and the relative physical size of dredge features to the size of the river (Harvey and Lisle 1998, Prussian et al. 1999). Location of dredging activity is also relevant, dredging near riffle crests, has been observed to cause riffle crest erosion, and as a result destabilization of spawning sites. In addition erosion of these natural barriers has been implicated in upstream pools becoming shallower, decreasing holding habitat for fish during the summer (Harvey and Lisle 1998). Decreases in stream and pool depth are associated with decreases of fish abundance and size (Everest and Chapman 1972). It has been suggested that dredge pits provide some localized, improvements in habitat by increasing pool depths and providing increased shelter from predators and additional influxes of cool water from subsurface, groundwater flows (Nielsen et al 1994). While there may be some benefits from these excavations, they appear to be temporary; the pits tend to fill during peak flows (Harvey and Lisle 1998)

Direct Impacts of Suction Dredge Mining on Fish

While instream work in Oregon streams is guided by Oregon Department of Fish and Wildlife (ODFW) in-water work guidelines, much of the placer mining in the Siskiyou Wild Rivers Area is done between February and September when there is sufficient water in the streams for dredge operation (Heylmun 1998). These guidelines are not currently backed by enforcement regulations. The ODFW preferred work season for instream work for many of the rivers in the Siskiyou Wild Rivers Areas is July 15 - September 30th (October 31st in some cases). On the Rogue River, Rogue tributaries above Mariel, and the Illinois River and it's tributaries the preferred work season begins earlier, June 15th - August 31st (September 15th in some cases). As mentioned above, steelhead are known to spawn in these streams as late as June and July and this creates a direct overlap between the heaviest season of instream activity and the most vulnerable life stages of these steelhead populations. These guidelines allow dredging to overlap with fish embryo incubation and emergence during the summer and overlap with non-salmonid spawning (Moyle 1976; Harvey and Lisle 1998). One of the key concerns regarding suction dredge activity is the potential for mortality of early life stages of fish – particularly eggs and fingerlings. Studies of the effects of dredge entrainment of un-eyed eggs of cutthroat trout led to 100% mortality and 30-62% mortality for eyed eggs (Griffith and Andrews 1981). In addition, sac fry (alevins) entrained by suction dredging experienced a significant increase in mortality of >80% (Griffith and Andrews 1981). Based on comparisons of egg characteristics entrainment likely kills larvae of other non-salmonid fishes, including sculpin, suckers, and minnows, which all have small larvae and eggs are likely to be adhered to rocks and gravels (Harvey and Lisle 1998). Based on observations of rainbow trout, brook trout and sculpin, most juvenile and adult fishes are likely to avoid or survive entrainment (Griffith and Andrews 1981, Harvey and Lisle 1998).

Another concern is that fish may spawn on unstable dredge pile substrates (Harvey and Lisle 1998) and there is evidence of fish selecting dredge tailings for spawning (Hassler et al 1986). Substrate stability is critical to fall spawning species (Chinook salmon and coho salmon) because the period of embryo development coincides with seasonal high flows (Holtby and Healey 1986;

Lisle and Lewis 1992). The scour of Chinook salmon redds located on dredge tailings has been observed to exceed scour of redds on natural substrates (Harvey and Lisle 1999).

Impacts of Suction Dredge Mining on Benthic Invertebrates

There are 235 terrestrial mollusk taxa in the Klamath-Siskiyou region and 142 of these taxa are endemic. Of the 235 taxa, 138 have state or federal listing status. Most mollusk populations have declined dramatically (>90% historic range contractions), due to extensive habitat degradation and changes in hydrology and water quality (DellaSala et al. 1999). The Siskiyou Wild Rivers Area is one of the important centers of freshwater mollusk endemism in the Pacific Northwest (Frest and Johannes 1998).

Suction dredging has been shown to dislodge or kill organisms attached to substrate particles (Resh et al 1988). Working streams in southeastern Idaho (Burns Creek, Yankee Fork, Napias Creek, and Summit Creek), Griffith and Andrews (1981) found mortality of benthic invertebrates to be low for most taxa (<1%), but higher for emerging mayfly species. Dredging generally creates localized areas of reduced benthic invertebrates (Thomas 1985, Harvey 1986), but recolonization appears to happen fairly quickly, for some organisms within days of dredging activity and substantial community recovery generally occurs within a year following dredge operation (Mackay 1992; Boulton et al 1991; Stevenson 1991; Stevenson and Peterson 1991; Harvey and Lisle 1998; Prussian et al. 1999). However, close examination of the species that colonize artificial substrates up and down stream of active dredges show differences in species assemblages from natural conditions (Somer and Hassler 1992). The ecological impact of these community-level changes is unknown, but our lack of knowledge regarding the comparative functionality of benthic organisms under normal or disturbed conditions does not dismiss it as unimportant. One group of benthic invertebrates that are not found to rapidly recolonize dredged areas are mollusks, which generally have slow dispersal rates (Gallardo et al 1994), and because of the narrow distribution of some species, suction dredge mining could result in the extirpation, or even extinction of certain species.

Grimes (1975) found that instream dredging for gold not only disrupts streambed plant communities, but it also can lead to increases in downstream bacterial counts by releasing bacteria associated with bottom sediments. Another concern for the health of benthic invertebrates is the potential for heavy metal accumulation under conditions of chronic exposure, due to contaminated runoff or exposure to high concentrations during dredging. At this time, not much is known about the bioaccumulation of heavy metals in macroinvertebrate tissues and the influence on life-history (Prussian et al. 1999).

Unlike salmonids, mollusks are not the focus of extensive conservation and management efforts. Currently there are no federally published guidelines for management of these organisms. These organisms fill fundamentally important ecological roles as filter feeders and grazers, and can be used as indicators of water quality, yet they garner little interest or concern. These organisms generally live on lake and river bottoms, in riparian areas and in moist upland habitats. Conservation of these habitats should take into account the vulnerability of benthic invertebrates, especially mollusk species, to habitat disturbance by mining.

Other Vertebrates

The Klamath-Siskiyou ecoregion is an overlap zone of two major biogeographic elements, the Madro and the Arcto Tertiary geofaunas. There are 38 native species of amphibians and reptiles within this region. Making it the most herpetofauna species-rich area within the Pacific Northwest (Bury and Paerl 1999). Amphibian species are particularly vulnerable to activities that disturb riparian corridors, ponds and wetlands. Alterations of hydrologic regimes, due to surface disturbance can lead to local loss of species (Bury and Paerl 1999). Headwater streams also are critical habitat for several species of amphibians endemic to the Pacific Northwest, in particular tailed frogs (*Ascaphus truei*) and torrent salamanders (*Rhyacotriton variegatus*). These species require cool temperatures and persistent waters (Bury and Paerl 1999). Suction dredge mining is largely incompatible to the long-term survival of most amphibians.

The Klamath-Siskiyou ecoregion also is home to five federally listed threatened or endangered birds, the northern spotted owl (*Strix occidentalis caurina*), marbled murrelet (*Brachyramphus marmoratus*), peregrine falcon (*Falco peregrinus*) , snowy plover (*Charadrius alexandrinus*) and bald eagle (*Haliaeetus leucocephalus*). In addition the region includes 31 of the 38 species associated with old-growth forests (USDA/USDI 1994), and 17 species on the ODFW list of sensitive species (ODFW 1991). The birds that inhabit the region are a complex blend of species, with 37 of the breeding species being at the edge of their ranges (Trail et al. 1997). Not all bird species are equally sensitive to mining activities. For some species (e.g., snowy plover), there is virtually no impact. For others, continual degradation of aquatic habitats and reduction in numbers of prey species from mining activities could cause negative impacts (e.g., wading birds). Also, some bird species (e.g., bald eagle) are particularly sensitive to human activity near nesting and roosting sites leading to stress, displacement, and even direct mortality of some individuals.

Mining threatens forest species mostly through indirect effects. These include fragmentation of the forest system by mining roads and off-road vehicle tracks, landslides resulting from road or culvert failure, compaction of soils by heavy equipment, long-term, high intensity camping on and surrounding mining claims, introduction of invasive species along road and stream corridors. Mining activity has helped to create an extensive road network across the Siskiyou Wild River landscape. Many of these roads include numerous stream crossings, leading to placer deposits in streams and along river terraces. This has led to hyperfragmentation of the landscape. Hyperfragmentation is the decrease in intact habitat areas due to the combination of road corridors and stream corridors (Trombulak and Frissell 2000). Many large mammals require large areas of intact habitat. The Klamath-Siskiyou region is home to the fisher (*Martes pennanti*), martin (*Martes americana*), wolverine (*Gulo gulo*), black bear (*Ursus americanus*), cougar (*Felis concolor*) and deer (*Odocoileus hemionus*). The Klamath-Siskiyou is one of the last refuges for the Pacific fisher. The Pacific fisher is one species that requires relatively large home ranges. They are habitat specialists, using old forests, and are sensitive to human altered landscapes (Buskirk et al 1994). Based on habitat suitability modeling by Carlos Carroll, the Siskiyou Wild Rivers Area contains the only remaining areas of suitable fisher habitat in Southwestern Oregon (Strittholt et al. 1999). One of these areas overlaps the Kalmiopsis Wilderness and the wild section of the North Fork Smith River, the other significant area is in the headwaters area of Indigo Creek.

STATEMENT OF SUPPORT FOR SPECIAL MANAGEMENT DESIGNATION FOR THE SISKIYOU WILD RIVERS AREA

The Klamath-Siskiyou has been the focus of scientists for many years from a wide variety of disciplines, but we still have much to learn and understand about the ecology and biology of the region. We perhaps know more about the general ecological condition and have gone further in regional conservation planning in the Klamath-Siskiyou than for any other ecoregion in the Pacific Northwest (Strittholt et al. 1999), and the protection of core habitat along with management objectives to increase the ecological integrity of both terrestrial and aquatic ecosystems remains fundamentally important if the ecological values of the region are to be protected and maintained. Because of the region's global and regional significance and the threats posed by mining and other human activities to the numerous ecological values of the region, it is the view of the Conservation Biology Institute and World Wildlife Fund that a long-term mineral withdrawal in the area is required and fully warranted for conservation of the ecological and biological diversity of the Siskiyou Wild Rivers Area to be achieved. This conservation imperative arises from the ecological value of the special status plants and animals and their ecological communities that live within this area. These ecological values stem from the unique terrestrial plant and animal communities that have developed in and are endemic to the region and the importance of this area as key spawning and rearing habitat for anadromous fish species. The Siskiyou Wild Rivers area overlaps 15 of the watersheds designated as key watersheds to serve as refugia and recovering habitat for at-risk stocks of anadromous salmonids and resident fish species. As stated in the federal register notices (CFR: 66 No. 14, January 22, 2001, pages 6663-6664 OR-958-1430-ET, OR-56288 and OR-56289), this is also an area of nationally outstanding scenic and recreation value. There are five rivers with wild, scenic and recreation designations and nine streams, which have been proposed for wild and scenic river designation.

As stated in the Environmental Assessment for the San Francisco Mountain/Mount Elden Mineral Withdrawal, the "BLM considers the uniqueness of resource values the most significant measurement in assessing whether or not a withdrawal will be approved. When used for withdrawal justification, the BLM defines the term unique as, 'A resource feature of limited occurrence, on a regional or national basis, that has unusual value for scientific or scenic purposes, or as an outstanding example of natural phenomenon. Characteristics that make a feature unique are its rarity, significance, fragility and irreplaceability." The species and habitats in the Siskiyou Wild Rivers Area are extremely rare, ecologically significant, fragile and irreplaceable.

The ecological significance of the Klamath-Siskiyou region and more specifically the Siskiyou Wild Rivers Area clearly outweighs the short-term consumptive benefits that might be derived from mineral extraction. Due to the sensitivity of these ecosystems, once destroyed the region's natural treasures may never recover and these wonders of nature could be lost forever (Coleman and Kruckeberg 1999). Surface mining has been documented as a threat to many of the rare plants and associated habitats in the Siskiyou region including *Lomatium cookii* and *Limnanthes floccosa ssp. Grandiflora* (USDI Fish and Wildlife Service 2000a), and the proposed NICORE nickel-laterite project could disturb as many as 12 sensitive plant species (USDA Forest Service 1999c). Stream channels and riparian areas have been significantly impacted over the 150-year history of placer mining in the region (USDA Forest Service 1999a). The Northwest Forest Plan recognizes that mining in and near streams can severely harm salmon habitat and includes requirements for plans of operation for all operations occurring in riparian reserves. In addition, while suction dredge mining is generally produces limited surface disturbances by comparison, there is evidence that the instream impacts can be significant to aquatic species (Harvey and Lisle 1998).

The Siskiyou Wild Rivers area provides large unroaded, undeveloped watersheds that provide some of the best remaining habitat for salmon south of the 49th parallel. At a time when salmon stocks are dwindling throughout the Pacific Northwest, this is one of the best places left to establish a refuge, or stronghold for salmon. There is no other place like it left in the coterminous U.S. Both the U.S. Forest Service and BLM view science as an invaluable tool needed to guide public policy and land management. The science is clear and compelling about the biological importance of the region and the potential for great irrevocable harm due to continued mining activity. We believe the evidence is overwhelming and feel special protections should be granted to the Siskiyou Wild Rivers Area. Furthermore, all landscape scars and past abuses (including mining) should be examined to prioritize and prescribe restoration management activities. All existing open claims should be evaluated according to federal law regarding their economic feasibility and potential ecological impacts. We further recommend that the environmental impact of mining as well as other extraction activities be examined from an integrated terrestrial/aquatic perspective and from the standpoint of cumulative impacts. Anything short of this will be insufficient to adequately predict the actual ecological costs of extractive activities in the Siskiyou Wild Rivers Area. The biological and ecological values of the Siskiyou Wild Rivers Area, which are of regional and global significance, warrant careful consideration. This places the burden of proof, that management will not cause ecological damage, squarely on those interested in extraction or any other potentially damaging use

CUMULATIVE EFFECTS

Consideration of cumulative effects with regard to resource issues, particularly cumulative watershed effects (CWEs), has been an ongoing topic of research and analysis throughout the Pacific Northwest and elsewhere prompted by a strong legal mandate. The Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA) define cumulative effects as,

> 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 (40CFR § 1508.7; CEQ 1997).

In essence, cumulative effects analysis is to ensure that federal decisions consider the full range of consequences of actions (CEQ 1997). Advances in biological, physical, and computer sciences have contributed greatly to the scientific basis and predictive quantification of CWEs (Reid 1993, Naiman and Bilby 1998). Although many technical challenges remain, developing the analytical tools needed to adequately assess and reliably predict management outcomes in a spatially explicit way is of paramount importance to resource managers and policymakers. Cumulative effects are caused by repeated, progressive, sequential, and coexisting activities on a particular resource (Reid 1993). CWE analysis can look at multiple events of a single type of action (e.g., mining), or it can consider multiple events of multiple actions (e.g., all mines, all logging, all road building, etc.) on a specific site. Management activities may produce a single type of influence; for example, logging, road building, and mining can lead to increased stream sediment. Activities may lead to cascading influences with one type of influence leading to another. Finally, activities may have interdependent (or synergistic) influences; for example, two introduced chemicals added to a stream (harmless alone) mix to form a toxic substance (Reid 1993).

There is no one standard framework for conducting cumulative effects analyses, but several general principles, which differentiate it from traditional environmental impact statements (EISs), have gained wide acceptance (Table 7). The CWE perspective centers on three important issues: (1) large spatial and temporal scales, (2) complex, interacting systems, and (3) an interdisciplinary focus (Reid 1993).

Table 7. Basic principles of cumulative effects analysis (CEQ 1997).

1. Cumulative effects are caused by the aggregate of past, present, and reasonably foreseeable future.

2. Cumulative effects are the total effect, including both direct and indirect effects, on a given resource, ecosystem, and human community of all actions taken, no matter who (federal, non-federal, or private) has taken the actions.

3. Cumulative effects need to be analyzed in terms of the specific resource, ecosystem, and human community being affected.

4. It is not practical to analyze the cumulative effects of an action on the universe; the list of environmental effects must focus on those that are truly meaningful.

5. Cumulative effects on a given resource, ecosystem, and human community are rarely aligned with political or administrative boundaries.

6. Cumulative effects may result from the accumulation of similar effects or the synergistic interaction of different effects.

7. Cumulative effects may last for many years beyond the life of the action that caused the effects.

8. Each affected resource, ecosystem, and human community must be analyzed in terms of its capacity to accommodate additional effects, based on its own time and space parameters.

Multiple Suction Dredge Operations

Many studies of suction dredge mining have focused on individual dredge activity and have shown that individual dredges tend to produce minor, localized impacts (Harvey and Lisle 1998). A few studies have examined multiple suction dredge operations along a stream reach, and have reported minimal cumulative effects (Harvey 1986; Prussian et al. 1999). Prussian et al. (1999) did report evidence of higher macroinvertebrate density in the north fork of the Fortymile River and attributed this result to the greater impact of historical and current mining in the north fork as compared to the south fork of the river. At this point, there have been no studies of intense suction dredge mining in the context of all landscape activities. The cumulative effects of dredging and other human activities deserve attention, particularly where reaches are dredged year after year, such as designated recreational dredging areas (Harvey and Lisle 1998; Prussian et al. 1999). It has been observed that suction dredge mining operations congregate along low gradient stream reaches, overlapping with the critical spawning habitat for salmon, steelhead and cutthroat trout on many streams in the Siskiyou Wild Rivers Area. While the U.S. Forest Service and BLM state that the impacts of mining, on a watershed scale, are "far below the natural sedimentation and erosion rates" (USDA Forest Service 1997a, 1998, 1999d), the cumulative effects of increased suspended sediment and other impacts have not yet been fully evaluated (Harvey and Lisle 1998).

In order to examine the cumulative effects of suction dredge mining on the streams of the Siskiyou Wild River Area, it will be necessary to: (1) identify resources that could be affected by dredging and associated activities; (2) identify and evaluate probable on and off site effects of dredging on conditions and processes important to these resources; and (3) analyze patterns of dredging and associated disturbances with resources of concern (Harvey and Lisle 1998). As identified in the notice of intent for mineral withdrawal, the primary resources of interest are the special status species. Those most vulnerable to the effects of suction dredge mining are the salmonids, endemic aquatic amphibians and invertebrates and rare, endemic riparian plant species. On-site impacts include stream channel changes, alterations of substrates, and increases in turbidity and heavy metals concentrations in the water column. Off-site impacts include compaction, disturbance and erosion of riparian soils and vegetation, fragmentation from roads, and the potential spread of Port-Orford cedar root disease leading to loss of shade and bank stability. The conditions and processes important to the aquatic species include passable streams, cool water temperatures, varied stream structures providing shelter, stable spawning gravels, and low disturbance during incubation and early life stages. The current patterns of reported dredging, where some stream sections have as many as 30 active placer claims, are important in determining ecological impacts. This analysis would fall short of determining the actual impacts on special status species in the Siskiyou Wild Rivers Area, since it only accounts for a single human activity - placer mining.

All Mineral Exploration and Extraction Activities

Although the impact of multiple recreational suction dredge operations is unclear, it should be noted that suction dredge mining is just one type of mining impacting the landscape, habitats and species of the Siskiyou Wild Rivers Area. A true cumulative impacts analysis of mining activities within the Siskiyou Wild Rivers Area would require data describing historical mining activities and locations, an estimation of the resulting environmental impacts, the rate of recuperation of the impacted systems, and the location and extent of current mining and associated activities. Because mining is different from any other activity on public lands, this information may not be readily available. Mining claims are self-initiated and are largely unregulated. By simply going out and staking a claim on public lands, anyone can establish a property right against the federal government that is often considered unequivocal under current agency policy, and the agencies have a long history of leniency towards mining. It also should be noted that, while superior to examining impacts from a single active mining claim at a time, we believe considering all mining claims together also would not adequately assess the health of the special status species or habitats within the Siskiyou Wild Rivers Area alone.

The Cumulative Effects Leading to the Harm of Special Status Species and Destruction of Their Associated Habitats in the Siskiyou Wild River Area

Just as suction dredge mining is just one type of mining impacting the Siskiyou Wild Rivers Area, all types of mining are just one type of human activity effecting the health and survival of special status plants and animals in the Siskiyou Wild Rivers Area. Here, as is true elsewhere, there is increasing evidence that the most devastating environmental effects may result not from the direct effects of a particular action, but from the combination of individually minor effects of multiple actions over time. To truly estimate the impact of mineral exploration and extraction on the unique and valuable species and habitats, an analysis of the cumulative effects of all human activities influencing the health and survival of these unique resources needs to be made. Cumulative effects are the result of multiple land use activities in time or space (Reid 1993); a combination of separate activities that produce similar impacts throughout the landscape and impacts from multiple activities that accumulate over time. The primary objective of a cumulative effects assessment is to identify and predict the interacting effects of multiple human activities on resource values or beneficial uses of concern (Reid 1999). This is achieved by establishing the linkages between past and on-going land management activities, on-site and off-site effects, and alterations in ecosystem dynamics.

As stated in the federal register notices of intent (CFR: 66 No. 14, January 22, 2001, pages 6663-6664 OR-958-1430-ET, OR-56288 and OR-56289), this area contains nationally significant ecological and biological diversity, special status plant and animal species and associated unique habitats, and outstanding scenic and recreation values. These comments support this claim. We further believe these ecological values will only truly be protected through resource management based on cumulative effects analysis for all of these unique resources. Because cumulative effects assessment can quickly become overwhelming in scope, attempting to examine the overall cumulative effects impacting all of the particular species, habitats and wilderness values included in the Siskiyou Wild Rivers Area is an ambitious project. We believe that a more useful approach would be to assess the cumulative effects on overall biodiversity, individual species or species groups with similar life histories, and inherent scenic and recreation values separately. An overall management strategy for the Siskiyou Wild Rivers Area would then be based on the knowledge accumulated from these analyses. Activities that are relevant to the health and survival of the biological resources of the Siskiyou Wild Rivers Area include mining, logging, dams, road-building, grazing, exotic species invasion, urbanization, stream channelization, wetland development, beaver trapping, irrigation activities, fishery management, and pesticide use.

The region would not be starting from scratch. Some progress has been made with past efforts such as the cumulative effects of forest practices work in southern Oregon (Beschta et al. 1995). The concept of cumulative effects has been included in the environmental impact statements and watershed analyses for areas within the Siskiyou Wild Rivers Areas performed by the U.S. Forest Service and the BLM (USDA Forest Service 1999a, 1999b; USDI Bureau of Land Management 1997, 1998, 1999; USDA Forest Service and USDI Bureau of Land Management 2000). Discussions in these reports have predominantly focused on the cumulative effects from a single type of activity or a general description of the combined effects occurring in the watershed. For example, the Elk River watershed assessment included a cumulative effects assessment of the impacts from roading and timber harvest on fisheries focusing on the impacts that these activities cause through increased sediment delivery (Chen 1992). It was found that a detailed quantitative assessment of impacts required data that was not available - climatic and hydrology data as well as measurements of sediment loads (Chen 1992). While these various discussions and analyses are a step in the right direction, they are limited in their ability to guide management decisions until they are grounded in validated spatially explicit models.

We provide an overview of the activities and issues that we believe are important in examining cumulative effects analysis for one of the primary conservation targets, native anadromous fish populations. For the Siskiyou Wild Rivers Area, additional analyses should be made for non-anadromous fish, benthic invertebrates, amphibians, terrestrial mollusks, serpentine adapted vegetation communities, Port-Orford cedar, riparian plant communities, centers of biodiversity and endemism, intact roadless areas, and scenic and wilderness recreation locations. These unique and valuable resources are all being impacted by mining activities and other management activities occurring throughout this landscape.

An analysis of the cumulative effects of mining on salmonid populations within the Siskiyou Wild Rivers Area should include information on overlapping impacts from logging, dams, road-building, pesticide use, grazing, exotic invasion, urbanization, stream channelization, wetland development, irrigation, and fishery management. A true cumulative effects analysis of mining activities within the Siskiyou Wild Rivers Area would require data describing historical mining activities and locations. For example, the Grayback/Sucker Creeks Watershed Analysis (USDA

Forest Service 1997a) included a description of the riparian condition through time (Table 8), which lists an overview of the activities that had occurred in the watershed since the 1850s. These types of qualitative descriptions are valuable, but in order for a cumulative effects analysis to be useful to resource managers, it must be mapped and all impact effects combined accurately over space and time.

Computer-based geographic information systems (GIS) is a rapidly emerging, powerful modeling tool that should be used to assess cumulative effects where possible including the Siskiyou Wild Rivers Area. Perhaps more important than its usefulness in generating important ecological assessments, is its use as a spatially explicit prescriptive decision support tool.

Table 8. Historic record of mining and logging activities described in Grayback/Sucker Creeks Watershed Analysis (USDA Forest Service 1997).

1850-1941: Gold mining on Sucker Creek (to Fehley Gulch) was extensive. Miners set fires to improve access and visibility. Agriculture was developed in the lower reaches. These activities removed riparian vegetation and delivered sediment. Small-scale logging occurred in the lowest elevations.
1941-1964: Mining activity decreased. Some riparian areas in the mid to upper reaches of Sucker Creek became revegetated. Fire suppression became more effective when mechanized equipment became available, following World War II. At the same time, demand for lumber and tractor logging increased. Sidecast and poorly designed, temporary roads; clear cuts; and riparian logging delivered sediment to Sucker Creek. Agricultural development continued to remove riparian vegetation and contribute sediment.
1964: Flood – December rains melted heavy snowpack. Roads failures, culvert washouts, streambank erosion, and debris flows in Cave, Tannen and Grayback Creeks resulted. Riparian vegetation was scoured. The effects of the storm were intensified by human activities, especially the presence of roads.
1964-1970: Timber harvest continued. Large wood created during 1964 storm was salvaged from accessible areas. Agricultural lands continued to be developed, along with land clearing for homes, vineyards, and other uses.
1970-present: Timber harvest continued, but practices became more conservative and effects of harvest lessened. Little riparian harvest occurred on public lands. Large-scale mining resumed on Sucker Creek, but settling ponds and channel diversions reduced sediment delivery. Dredging in the stream loosened bedload and delivered some sediment. Road cuts and fill slopes, older harvest units, and riparian areas began to be revegetated with conifers, alder, and other hardwoods.
Future trends: Higher standards for road and culvert design reduce risk of failure. Some riparian areas near cleared land become revegetated as other lands continue to be cleared. Mining continues at present levels. Areas disturbed by past mining in lower Sucker Creek are susceptible to severe bed and bank erosion during peak flows. Refined land use practices and restoration emphasis result in less riparian disturbance.

Although, all GIS-based cumulative effects models, whether they be focused on making ecological assessments or developed to provide prescriptive planning capability, must be suitably grounded by adequate field data if they are going to be accurate and useful. Only then, will land managers and conservation planners have the tools necessary to make decisions based on the best available science. In our view, if the mining withdrawal is to be subjected to further scientific investigation, anything short of a GIS-based cumulative effects model validated by adequate field data collection would be unacceptable. The tools and expertise are available, what appears to be limiting are the financial resources to obtain the answers. The Siskiyou Wild Rivers Area is literally one-of-a-kind. If society is unwilling to pay for the level of effort needed to develop these spatially explicit decision support tools, then the only prudent management option is to permanently protect the resource.

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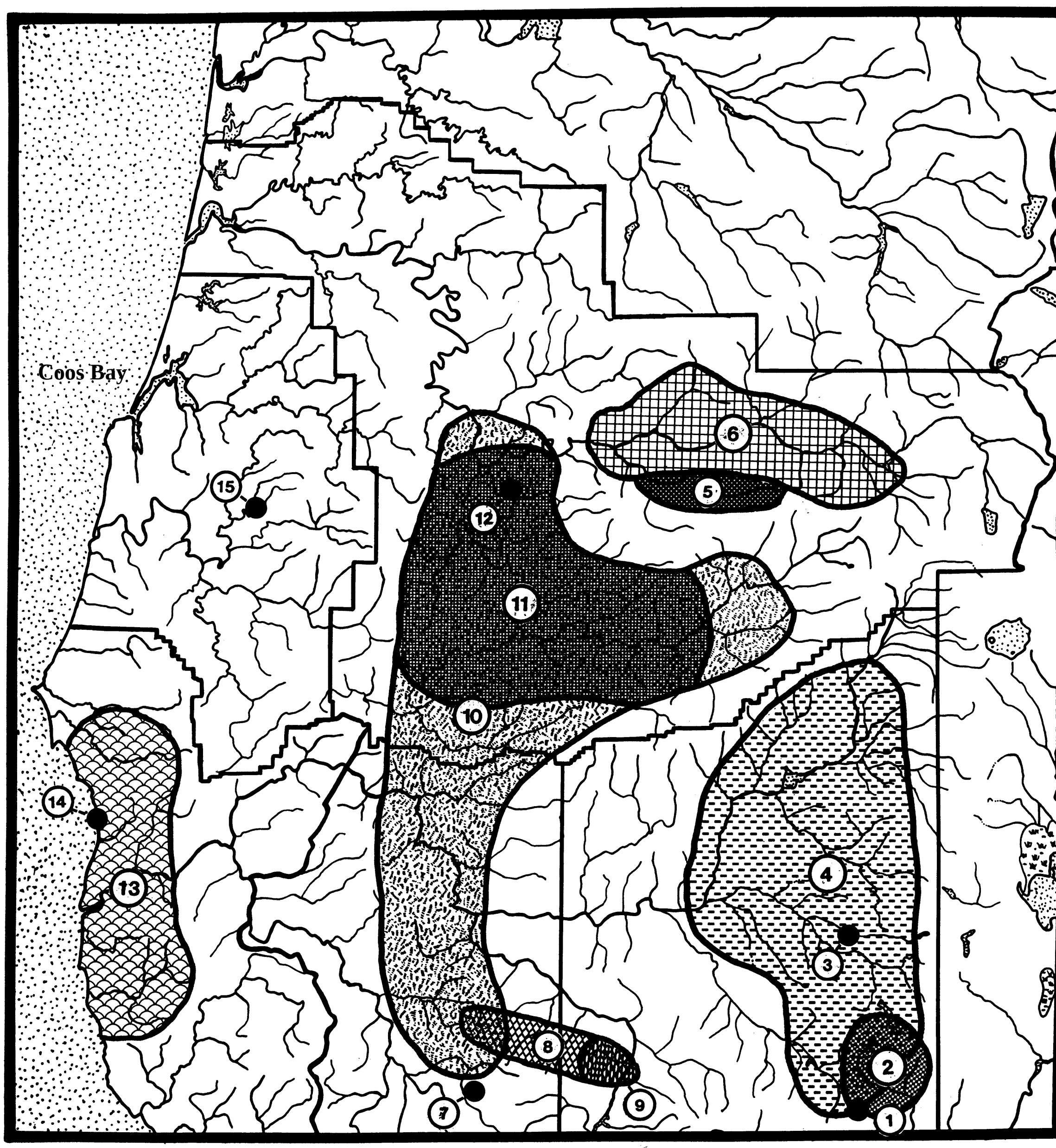
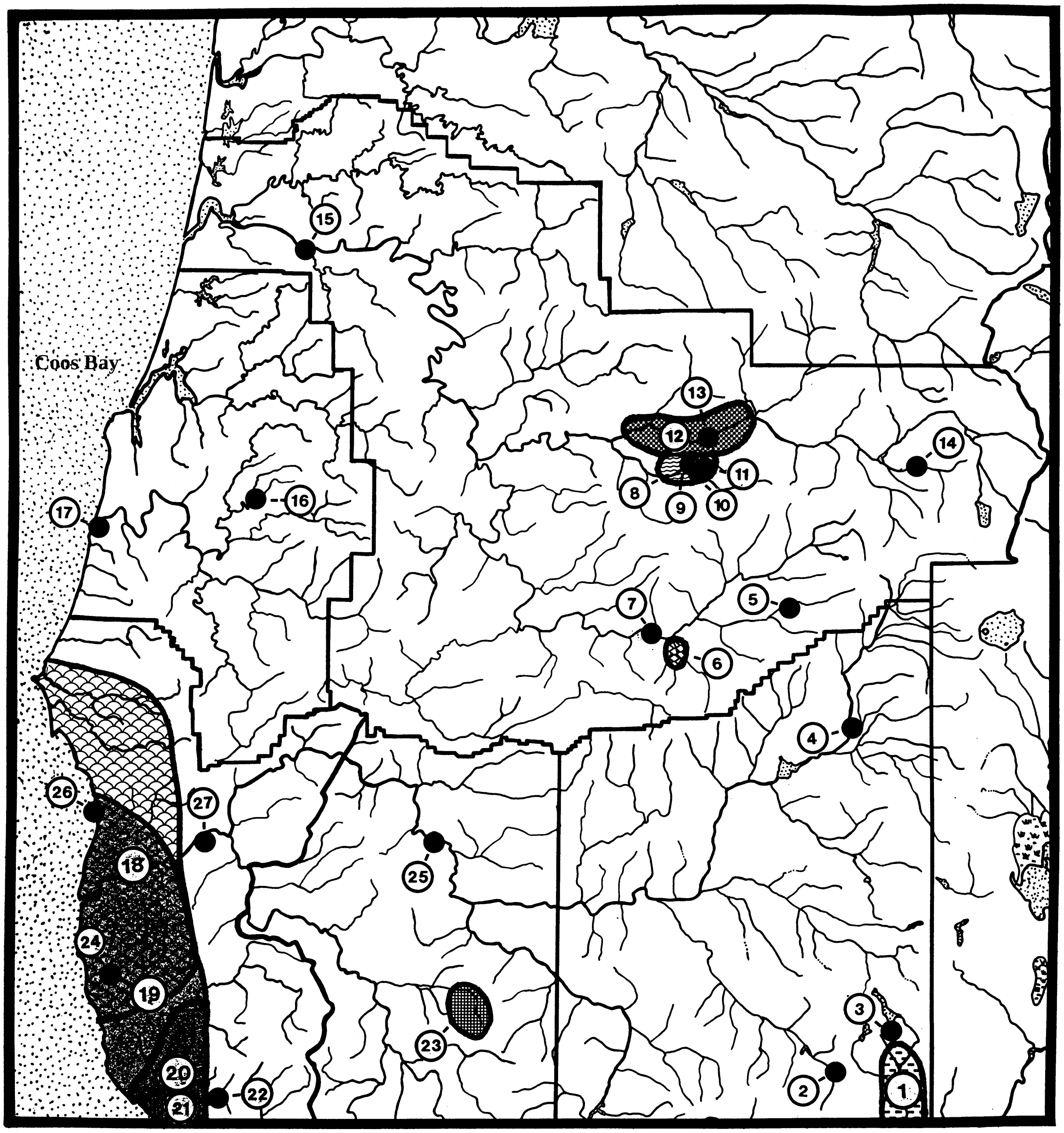
APPENDIX A - MAPS OF TERRESTRIAL AND AQUATIC MOLLUSK RANGES IN THE SISKIYOU WILD RIVERS AREA (FREST ET AL. IN PREPARATION).

In these figures, single black dots represent ranges of taxa known from single sites or a few close colonies (within 5 km distance).

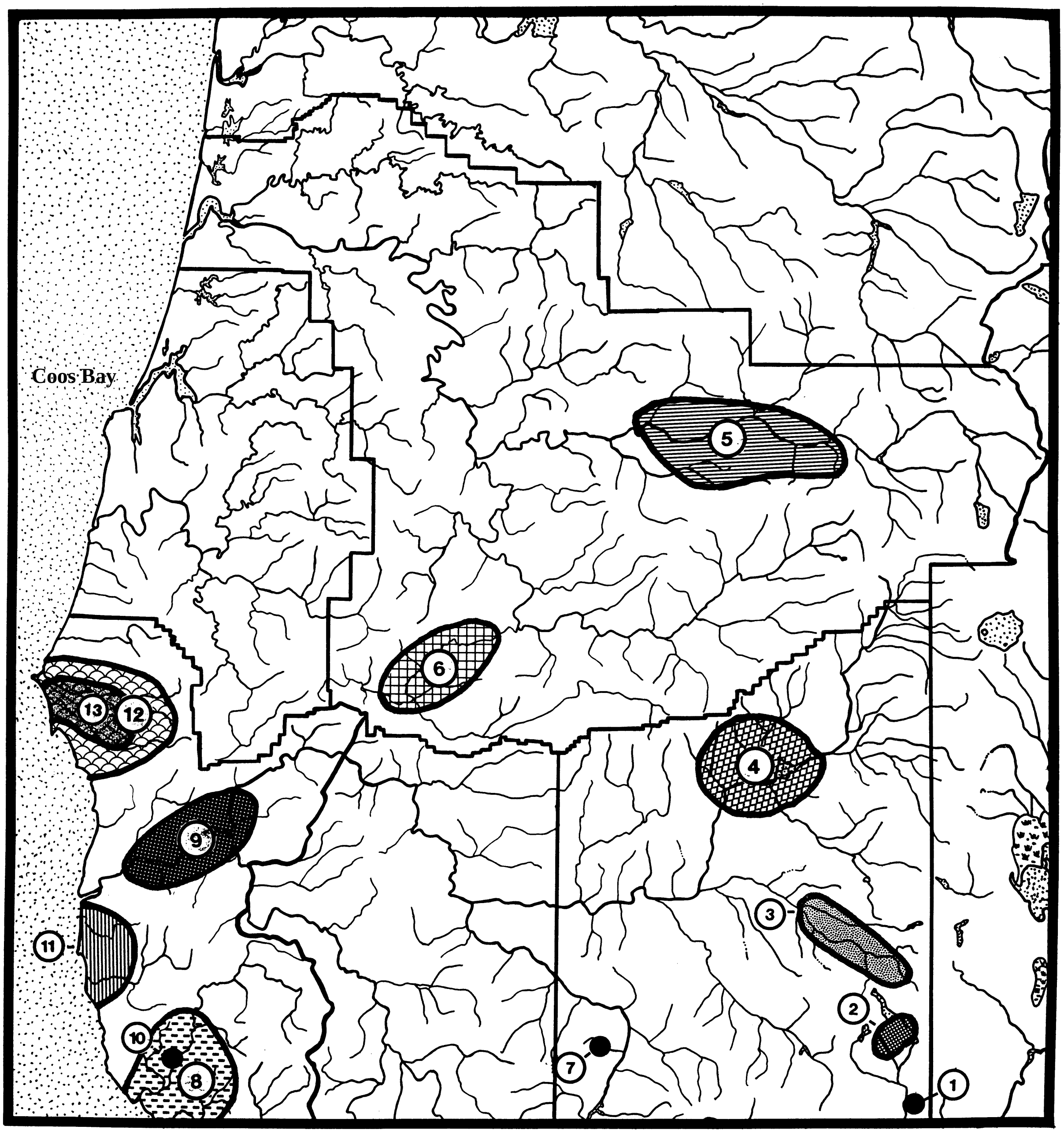
Ranges of selected helminthoglyptid (*Helminthoglypta*), bnadybaenid (*Monadenia*), and haplotrematid (*Ancotrema, Haplotrema*) land snail taxa in the survey area. 1 – *Helminthoglypta hertleini* ; 2 – *Monadenia fidelis* n subsp. 6; 3 - *Monadenia fidelis* n. subsp 1; 4 - *Monadenia fidelis celeuthia*; 5 – *Ancotrema* n. sp. 1; 6 – *Monadenia fidelis* n. subsp. 9; 7 – *Monadenia fidelis* n. subsp. 8; 8 – *Haplotrema* n. sp. 1; 9 – *Monadenia fidelis* n. subsp. 9; 10 – *Monadenia fidelis* n subsp. 7; 11 – *Helminthoglypta* n sp. 1; 12 – *Monadenia fidelis* n. subsp. 5; 13 – *Monadenia fidelis flava*; 14 – *Monadenia fidelis baxteriana*; 15 – *Monadenia fidelis fidelis*.



Ranges of selected polygyrid (*Vespericola s.l.*) land snail taxa in the survey area. These taxa are all endemic to this region, some are strict endemics within their range.1 – *Vespericola sierranus*; 2 – *Vespericola* n. sp. 24; 3 – *Vespericola* n. sp. 29; 4 – *Vespericola* n. sp. 10; 5 – *Vespericola* n. sp. 28; 6 – *Vespericola* n. sp. 23; 7 – *Vespericola* n. sp. 10; 8 – *Vespericola* n. sp. 25; 9 – *Vespericola* n. sp. 24; 10 – *Vespericola* n. sp. 26; 11 – *Vespericola* n. sp. 27; 12 – *Vespericola* n. sp. 5, 7, 8; 13 – *Vespericola* n. sp. 4, 9; 14 – *Vespericola* n. sp. 11; 15 – *Vespericola* n. sp. 30; 16 – *Vespericola* n. sp. 13; 17 – *Vespericola* n. sp. 12; 18 – *Vespericola* n. sp. 13, 14, 15; 19 – *Vespericola megasoma*; 20 – *Vespericola* n. sp. 19; 21 – *Vespericola* n. sp. 20; 22 – *Vespericola* n. sp. 18; 23 – *Vespericola* n. sp. 21; 24 – *Vespericola* n. sp. 17; 25 – *Vespericola* n. sp. 22; 26 – *Vespericola euthhales*; 27 – *Vespericola* n. sp. 16.



Ranges of selected pleurocerid (*Juga s.l.*) freshwater snail taxa in the survey area. *Juga* (*Juga*) *silicula shastaensis* is found throughout much of the survey area. 1 – Regional endemic *Juga* (*Juga*) *acutifilosa* and strict endemic *Juga* (*Oreobasis*) n. sp. cf. *nigrina*; 2 – *Juga* (*Oreobasis*) n. sp. 6; 3 – *Juga* (*Oreobasis*) n. sp. 5; 4 – *Juga* (*Juga*) n. sp. 7; 5 – *Juga* (*Oreobasis*) n. sp. 4; 6 – *Juga* (*Oreobasis*) n. sp. 3; 7 – *Juga* (*Juga*) n. s.p. 6; 8 – *Juga* (*Oreobasis*) n. sp. 1; 9 – *Juga* (*Juga*) n. sp. 3; 10 – *Juga* (*Juga*) n. sp. 1; 11 – *Juga* (*Juga*) n. sp. 2; 12 – *Juga* (*Oreobasis*) n. sp. 2; 13 – *Juga* (*Juga*) n. sp. 4.



APPENDIX B - LIST OF GIS DATA LAYERS

Physical Features	**Scale / Resolution**	**Source**
Hydrography – Digital Line Graphs (rivers and streams)	1:100,000	U.S. Geological Survey
Serpentine Geology	1:500,000	U.S. Geological Survey
Watersheds (5th and 6th order)	1:24,000	California Department. Of Fish & Game & U.S. Bureau of Land Management
Key Watersheds	1:126,720	FEMAT (1993)
Cultural Features	**Scale / Resolution**	**Source**
US Public Land Survey System	1:2,000,000	US Geological Survey
Oregon Public Land Survey System	1:100,000	Oregon Department of Water Resources
General Ownership	1:100,000	Interior Columbia Basin Ecosystem Management Project (ICBEMP)
Research Natural Areas	1:24,000	U.S. Forest Service
Wild & Scenic Rivers	1:24,000	U.S. Forest Service and Bureau of Land Management
Wilderness Areas	1:24,000	U.S. Forest Service
U.S. National Forest Administrative Boundaries	1:24,000	U.S. Forest Service
U.S. BLM Special Management Areas	1:24,000	U.S. Bureau of Land Management
Designated Conservation Areas (DCAs)	1:100,000	FEMAT (1993)
Late Successional Reserves	1:24,000	U.S. Forest Service
Siskiyou National Forest Boundary	1:24,000	U.S. Forest Service
Inventoried Roadless Areas	unknown	U.S. Forest Service
Transportation – Digital Line Graph	1:100,000	U.S. Geological Survey
Biological Features	**Scale / Resolution**	**Source**
Heritage Elements CA	1:24,000	California Department of Fish & Game
Heritage Elements OR	1:24,000	Oregon Natural Heritage Program
Salmon Distribution	1:100,000	Oregon Department of Fish and Wildlife
Port-Orford-cedar Occurrence and *Phytophthora* Infestation	1:24,000	U.S. Forest Service

APPENDIX C - MINING CLAIM DENSITY WATERSHED SUMMARY

[1] Watershed contains Designated Wild, Scenic, Recreation River
[2] Watershed contains Proposed Wild, Scenic River
[3] Northwest Forest Plan Key Watershed

	Open Lode Claims	Open Placer Claims	Open Tunnel Claims	Open Mill Claims	Total Open Claims	Closed Lode Claims	Closed Placer Claims	Closed Tunnel Claims	Closed Mill Claims	Total Closed Claims	Total Claims
Sixes River	9	33	0	0	42	125	323	2	0	450	492
Elk River [1,3]											
Lower Elk River	0	0	0	0	0	0	6	0	0	6	6
Recreation Elk River [1]	1	3	0	0	4	33	159	1	0	193	197
Wild Elk River [1]	0	4	0	0	4	155	169	3	0	327	331
South Fork Coquille River [2,3]	1	35	0	1	37	304	385	8	1	698	735
Rogue River [1,2,3]											
Lower Rogue	0	0	0	0	0	42	6	0	0	48	48
Lower Scenic and Recreation Rogue River [1]	0	4	0	0	4	3756	46	15	0	3817	3821
Lobster Creek	0	4	0	0	4	1909	147	42	0	2098	2102
Quosatana Creek [3]	0	0	0	0	0	1066	12	1	0	1079	1079
Shasta Costa Creek [3]	0	0	0	0	0	8	0	0	0	8	8
Wild Rogue River - FS Section [1]	0	0	0	0	0	4	1	0	0	5	5
Wild Rogue River - BLM Section [1,2]	49	37	0	0	86	964	184	1	1	1150	1236
Taylor Creek [3]	0	20	0	0	20	24	213	0	0	237	257
Grave Creek	6	32	0	0	38	155	333	0	2	490	528
Galice Creek	39	40	0	1	80	552	232	0	0	784	864
Recreation Rogue River - BLM section [1]	33	26	0	2	61	369	240	0	0	609	670
Jump Off Joe Creek	0	3	0	0	3	3	8	0	0	11	14
Illinois River [1,2,3]											
Wild and Scenic Illinois River [1]	0	2	0	0	2	86	143	0	0	229	231
Lawson Creek [3]	0	1	0	0	1	2009	206	0	0	2215	2216
Collier Creek [3]	0	0	0	0	0	17	302	0	0	319	319
Indigo Creek [2,3]	0	3	0	0	3	815	30	0	0	845	848
Silver Creek [2,3]	7	46	0	0	53	2320	233	0	1	2554	2607
Briggs Creek	10	96	0	0	106	128	641	0	0	769	875
Josephine Creek [2]	34	153	0	0	187	529	783	4	0	1316	1503
Scenic Illinois River [1]	52	91	0	0	143	581	600	4	0	1185	1328
Deer Creek	19	24	0	0	43	128	143	0	0	271	314

East Fork Illinois River [3]	14	38	0	0	52	195	268	0	1	464	516
Sucker Creek [3]	9	122	0	0	131	259	388	0	1	648	779
Althouse Creek	24	115	0	0	139	518	453	0	2	973	1112
West Fork Illinois River	57	139	0	0	196	380	504	0	1	885	1081
Rough and Ready Creek [2]	1	170	0	0	171	239	216	0	0	455	626
Applegate River (Headwaters Areas)											
Carberry Creek	2	15	0	0	17	23	247	0	0	270	287
Slate Creek	0	0	0	0	0	17	51	0	2	70	70
Thompson Creek	0	10	0	0	10	0	12	0	0	12	22
Williams Creek	0	8	0	0	8	7	35	0	0	42	50
Pistol River	59	14	0	0	73	46	108	0	0	154	227
Chetco River [1,2,3]											
Lower Chetco River [3]	0	3	0	0	3	177	12	0	0	189	192
Recreation Chetco River [1]	0	7	0	0	7	11	26	0	0	37	44
Boulder Creek	0	2	0	0	2	7	13	0	0	20	22
Eagle Creek	0	5	0	0	5	0	9	0	0	9	14
Scenic Chetco River [1]	0	13	0	0	13	10	72	0	0	82	95
Wild Chetco River [1]	1	26	0	0	27	310	201	0	1	512	539
North Fork Chetco River [3]	0	0	0	0	0	0	0	0	0	0	0
South Fork Chetco River	0	0	0	0	0	2	8	0	0	10	10
North Fork Smith River [1,2,3]	0	13	0	0	13	219	143	0	0	362	375
Baldface Creek [2]	0	10	0	0	10	82	94	0	0	176	186
Winchuck River [2,3]	0	0	0	0	0	146	23	0	0	169	169
Coastal Creeks											
Brush Creek	0	0	0	0	0	0	0	0	0	0	0
Hunter Creek	59	13	0	0	72	189	50	0	0	239	311
Euchre Creek	0	0	0	0	0	0	6	0	0	6	6
West Fork Cow Creek [3]	0	12	0	1	13	65	21	0	1	87	100

APPENDIX D – PLANT SPECIES OF INTEREST IN THE SISKIYOU WILD RIVERS AREA

Adapted from Siskiyou Wild Rivers Proposal (2000)
Information compiled from Kirkpatrick et al. 1994, Sawyer 2000,USDA Forest Service 1988, 1989, 1997b, 1999e, 2000, and USDI Fish and Wildlife Service 2000a, 2000b.

Plants Protected or Proposed for Protection Under the Endangered Species Act

Plant Species	Habitat, Threats and other Information
Arabis macdonaldiana (McDonalds's Rock Cress)	The second plant to be listed under the ESA. Found on Serpentine soils in dry open areas or brushy slopes. Plant surveys associated with the proposed Nicore Mine and the Petite Placer Mine have extended the range of *A. macdonaldiana* into Oregon.
Fritillaria gentneri (Gentner's Fritillary)	At the time it was protected under the ESA in 1999 only about 340 plants were known to exist. About half the sites are on private land. One population is found within the Siskiyou Wild Rivers Area.
Lomatium cookii (Agate Desert lomatium)	Proposed for protection under the ESA on May 15, 2000., *L. cookii*, is only known to occur in the Agate Desert in Jackson County and at French Flat in the Illinois Valley. There are 10 populations at French Flat – 3 on private land and 7 either entirely or partially on BLM land. *L. cookii's* habitat in Jackson Co. is restricted to vernal pools. At French Flat it grows in wet meadow areas. Gold mining imminently threatens the French Flat populations, which have been further impacted or lost by uncontrolled use of off-road vehicles.

Species Subject to Proposed "In Lieu of Listing" Serpentine Fen Conservation Agreement

Plant Species	Habitat, Threats and other Information
Hastingsia bracteosa var. bracteosa (largeflower rushlily)	Very local endemic. Limited range from Eight Dollar Mountain along west side of Illinois Valley south to approximately Josephine Creek. *H. bracteosa var. bracteosa* is found in serpentine fens, wet meadows, rocky seeps and open areas on gentle slopes. The principle threat to their habitat is surface mining. Off-road vehicles impacted habitat and significantly reduced population size of *H. bracteosa* and two other serpentine fen species at one location in the Eight Dollar Mountain Botanical Area.
Hastingsia bracteosa var. autropurpurea (largeflower rushlily)	Very local endemic. Limited range from BLM fen near Westside Road on west side of Illinois Valley, south to Parker Creek. Habitat and threats same as *H. bracteosa var. bracteosa* only range more limited. Only 23 total know occurrences world wide encompassing 147 acres.

Elilobium oreganum (Oregon willow-herb)	Found in serpentine fens and other wet serpentine places at low elevations. Limited range on west side of the Illinois Valley and in Siskiyou, Trinity and Humboldt Counties. Less than 800 plants known in Oregon. Total known occurrences worldwide - 26 in Oregon and 3 in California. Principle threats placer mining, nickel and chromium mining and exploration and maintenance of mining claims.
Gentiana setigera (Waldo gentian)	Endemic to Siskiyou Mountains in Oregon and California. All occurrences small. Total population 3-4,000 plants. Most habitat west side of Illinois Valley. Total known occurrences worldwide – 48 (223 acres). Habitat serpentine wet meadows and fens and seeps on slopes at low elevation. Principle threat, same as above serpentine fens species.
Viola primulifolia ssp. occidentalis (western bog violet)	Found in serpentine fens at low elevations. Range is west side of Illinois Valley to California border with disjunct populations at Snow Camp and Hunter Creek Bog (Siskiyou National Forest) and Ship Mtn. in California. Known occurrences worldwide – 17 in Oregon (94 acres) and 16 in California.

Rare, Sensitive or Endemic Plants of Interest Found within the Siskiyou Wild Rivers Area

Plant Species	Habitat, Threats and other Information
Bensoniella oregana (bensonia, bensoniella)	Found in Oregon, only from the Siskiyou National Forest with two disjunct sites reported in Humboldt Co. California. Habitat – Relatively deep soils in moist meadows, and along stream banks, 3,000-4,000 feet. There were 72 known populations in 1988, all but 15 of which were on the Siskiyou National Forest, and over half of which were found in the Shasta Costa Watershed.
Calochortus howellii (Howell's mariposa lily)	Endemic to the west side of the Illinois Valley. Habitat – Serpentine soil, dry rocky slopes, native bunch grass dominated savannas and shrublands . Low to mid elevation. Total known occurrences worldwide – 59 (1,598 acres). C. howellii may exhibit wide fluctuations in the numbers of individuals blooming from year to year. Extremely slow growing. May take 5 years from seedling to mature to flowering size. Primary threats are mining, road building and off-road vehicles. Some populations occur directly on the proposed Nicore mine haul route. Fire suppression may also be a threat.
Cardamine nuttallii var. gemmata (yellow-tubered toothwort)	Endemic to the Siskiyou Mtns. Oregon and California. Known from fewer than 10 occurrences in California. Habitat – Gravelly serpentine soils on ridges, Jeffery pine forests, riparian slopes and near serpentine fens.

Chamaecyparis lawsoniana (Port Orford cedar)	Port Orford cedar is endemic to a narrow band of land in southwest Oregon and northwest California with disjunct population in the Shasta-Trinity Forest. Through out much of its range Port Orford cedar is further restricted to sites with year round seepage or flowing water. In other words along streams and wetlands. Studies in northern California found that Port Orford cedar plant communities were among the richest in species diversity of all forest types and are key elements of the biodiversity of the Klamath-Siskiyou and North Coast Ranges. The cedar are in jeopardy due to the spread of a non-native pathogen which is always fatal to Port Orford cedar and to a lessor extent Pacific yew. Port Orford cedar's stabilizing effects and habitat contributions of decay resistant large woody material and root mass in stream channels is often noted by hydrologists and fisheries biologists. Loss of Port Orford cedar in a riparian ecosystem could, overtime, lead to degradation of the stream channel.
Darlingtonia californica (California pitcher plant)	An insectivorous plant found in wet meadows and seeps or serpentine fens, from sea level to above 7,000 feet. Requires year-round flowing waters. Often found in association with rare plants in the serpentine fen habitat. While quite widespread, *Darlingtonia* need to be protected from habitat disturbance such as surface mining and off road vehicles and from digging or collecting.
Erigeron cervinus (Siskiyou daisy)	Endemic to the Siskiyou Mountains in Oregon and California. Habitat – Rocky places or crevices on solid rock. Also open areas, medium to high elevations and sometimes in glaciated areas. Streambanks at lower elevations, usually near seeps or vernally wet spots.
Fritillaria glauca (Siskiyou fritillaria)	Range - Southern Douglas Co. south through the Siskiyou Mtns. Oregon and California. Habitat – Gravelly serpentine slopes & ridges.
Lewisia cotyledon ssp. purdyi (Purdy's lewisia)	Narrow endemic known only to Kalmiopsis Wilderness and vicinity at five locations. Habitat – Granitic or serpentine rock outcrops at elevations between 2,000 and 4,000 feet in oak or pine woodlands.
Lewisia oppositifolia (opposite-leaved lewisia)	Endemic to the Siskiyou Mtns. Oregon and California. Habitat – Open, rock areas or brush covered slopes, which are generally moist in early spring. Restricted to shallow serpentine soils at elevations ranging from approximately 1,200 to 4,400 feet.
Lomatium engelmannii (Engelmann's desert parsley)	Endemic to the Siskiyou Mtns. of Oregon and California. Habitat – Gravelly, serpentine slopes in coniferous forests and open areas at mid to high elevation (3,000 to 6,000 feet).

Kalmiopsis leachiana (Kalmiopsis)	Known only to the Siskiyou Mtns and one disjunct population on the Umpqua. Diminutive shrub with deep pink flowers. First identified in 1930 by pioneering botanist Lilla Leach at Gold Basin in what is now the Kalmiopsis Wilderness. *K. leachiana* are very sensitive and do not like to be moved. Out of thousands that were removed from their native habitat only a few are known to have survived.
Microseris howellii (Howell's microseris)	Distribution patchy and scattered sites. Known occurrences worldwide 49 (1,359 acres). Found in the Klamath Mtns. southern Josephine, Curry Counties. Most populations occur along the western edge of the Illinois Valley. Habitat – rocky serpentine soils from 1,000 to 3,000 feet.
Monardella purpurea (Siskiyou monardella)	Range – Siskiyou Mtns. and adjacent California. Habitat – Rocky, open slopes on serpentine soils.
Picea breweriana (Brewer Spruce)	Brewer spruce inhabited the mountains of the Pacific Northwest for over 15 million years. Once quite extensive in range, Brewer spruce is now found only in a few remote locations in southwest Oregon and northwest California. Brewer spruce are very slow growing, can reach heights of 170 feet and diameters of 4.5 feet and live over 900 years. Brewer spruce's slow growth rate, pointed crown and drooping branches protect it from the deep moisture laden snows of its range. Its thin bark makes it susceptible to fire. Brewer spruce is usually restricted to cool north facing slopes with thin soils and winter snow pack.
Pinguicula vulgaris ssp. macrocervas (horned butterwort)	Habitat - Perennially wet seeps and fens. Almost always in serpentine wet areas on the Siskiyou National Forest. Found in Del Norte and Siskiyou Counties in California and Josephine and Curry Counties in Oregon. Also in many other parts of North America at higher latitudes (circumboreal). An insectivorous plant.
Senecio hesperidum (Siskiyou butterweed)	Endemic to the Illinois Valley from Cedar Log Flat RNA to Oregon Mtn. Botanical Area. 64 known occurrences world wide (1,656 acres). Only 4 populations, all Josephine County. Range from Cedar Log Flat RNA to Oregon Mountain. Southern most populations in West Fork Illinois.
Sophora leachiana (western sophora)	Endemic to Siskiyou Mtns. Only known from an area 20 miles by 6 miles between the Rogue River Canyon and the Illinois River Canyon except for one site north of the Rogue River.
Streptanthus howellii (Howell's streptanthus)	Endemic to the Siskiyou Mtns. Oregon and California. Habitat – Dry rock serpentine slopes in open conifer/hardwood forests from 1,000 to 4,500 feet. Range approximately 25 miles north to south, 16 miles east to west at widest point. Known occurrences worldwide – 13 in Oregon (94 acres), 119 in California.