NORTH CASCADES GRIZZLY BEAR ECOSYSTEM EVALUATION

FINAL REPORT

SEPTEMBER 1993

FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE

NATIONAL PARK SERVICE
Department of the Interior

WASHINGTON DEPARTMENT OF WILDLIFE

U.S. FISH & WILDLIFE SERVICE

NORTH CASCADES

GRIZZLY BEAR ECOSYSTEM EVALUATION

FINAL REPORT

by

Jon A. Almack, William L. Gaines, Robert H. Naney,
Peter H. Morrison, James R. Eby, George F. Wooten,
Michelle C. Snyder, Scott H. Fitkin, and Ernesto R. Garcia

September 1993

A report to the Interagency Grizzly Bear Committee
in fulfillment of requirements identified in
the 1982 Grizzly Bear Recovery Plan.

This report reflects the opinions of the authors and, therefore, may not represent the policies of participating agencies.

ABSTRACT

We conducted a 6-year evaluation of the North Cascades Grizzly Bear Ecosystem (NCGBE) in north-central Washington to determine the suitability of the area to support a viable grizzly bear population. The presence of grizzly bears in the ecosystem was verified through the confirmation of field observations of bears. Of 238 reported observations, 22 were confirmed as grizzly bears and another 82 were rated as high reliability observations. Capture and marking of resident grizzly bears was unsuccessful. We surveyed areas of the ecosystem with self-activated cameras; no grizzly bears were documented using this method. Analysis of bear scats provided a preliminary list of probable grizzly bear foods in the North Cascades.

We used Landsat Multispectral Scanner (MSS) imagery and a ground-based vegetative inventory to develop a map of vegetation for the NCGBE. An accuracy assessment of the interpreted data showed that the general vegetation types were properly mapped at an accuracy level of 94.8%; a detailed, modeled, vegetation map was produced with an accuracy level of 93.2%. We developed additional data layers in a Geographic Information System (GIS) to evaluate the availability and distribution of vegetation types seasonally, assess the impacts of human activities on the habitat, assess ungulate food sources, and estimate the abundance of probable grizzly bear foods in various vegetation types.

Citation:

Almack, J.A., W.L. Gaines, R.H. Naney, P.H. Morrison, J.R. Eby, G.F. Wooten, M.C. Snyder, S.H. Fitkin, and E.R. Garcia. 1993. North Cascades Grizzly Bear Ecosystem evaluation; final report. Interagency Grizzly Bear Committee, Denver, Colorado. 156 pp.

ACKNOWLEDGEMENTS

Many people have contributed to this evaluation. We greatly appreciate the support we have received from individuals and agencies alike. Our field crews deserve a great deal of credit for the long hours of hard work they provided, we could not have completed the project without them. Many thanks to F. Lapsansky, W. Dean, B. Cunningham, J. Engle, F. Strier, J. Thompson, M. Mancuso, R. McKeown, R. Harrod, R. Strand, and C. Bone. K. Dixon, J. Pierce, T. Juelson, J. Hook, and R. Heath provided project supervision. J. Weaver, R. Richardson, G. Gunderson, P. Lee, R. Dearsley, and W. McLaughlin of the U.S. Forest Service provided support. Primary contacts in the National Park Service were J. Earnst, E. Gastellum, J. Jarvis, J. Dalle-Molle, and J. Reynolds. Fish and Wildlife Service support was provided by J. Michaels, C. Servheen, J. Gore, and J. Haas. The primary contacts from British Columbia included R. Forbes, J. Millar, A. Hamilton, and R. Archibald.

The North Cascades Working Group was established to oversee this evaluation. The members included H. Allen (Chair), J. Michaels, S. Gehr, S. O'Neil, D. MacWilliams, and J. Earnst. Previous members included K. Johnson, J. Reynolds, J. La Tourrette, K. Dixon, and G. McCutchin. In 1992, the Working Group was renamed as the North Cascades Grizzly Bear Steering Committee. New members include J. Haas, E. Summerfield, and A. Peatt.

The Interagency Grizzly Bear Committee Technical Review Team for the North Cascades and Bitteroot ecosystems included S. Servheen (Chair), R. Knight, A. Hamilton, and B. McLellan.

We offer a special thanks to A. Naney for volunteering her editing expertise, M. Allen for the cover drawing, and especially D. O'Connor for producing the graphics for the cover and figures.

This report partially fulfills contract requirements for Washington Department of Wildlife funding from the U.S. Fish and Wildlife Service, as noted in Section 6 of the Endangered Species Act of 1973, as ammended. FFY86 through FFY91; Project No. E-1.

TABLE OF CONTENTS

00697

Chapter | Page

APPENDICES

LIST OF TABLES

Table | Page

Table | Page

LIST OF FIGURES

INTRODUCTION

The U.S. Fish and Wildlife Service (FWS), following requirements of the Endangered Species Act of 1973, as amended, added the grizzly bear (*Ursus arctos horribilis*) to the Endangered Species List in 1975, as a Threatened species in the conterminous states. This listing prompted several important status surveys of the North Cascades. Bjorklund (1978, 1980ab, 1981) documented historical grizzly bear observations and discussed the possibility of population reestablishment in the North Cascades. The Washington Department of Game further listed the grizzly bear as Endangered throughout the state in 1981. The Grizzly Bear Recovery Plan (U.S. Fish and Wildlife Service 1982) identified the North Cascades Grizzly Bear Ecosystem (NCGBE) as one of six possible recovery areas south of Canada (Fig. 1). Implementation of the recovery plan by the FWS began with the 1983 establishment of the Interagency Grizzly Bear Committee (IGBC), which coordinates federal, state, provincial, and private research and management programs designed to promote grizzly bear recovery in designated areas south of Canada.

The IGBC provided the impetus for more research of the North Cascades grizzly bear population. Sullivan (1983) cataloged historical and recent grizzly bear observations in the NCGBE. In 1985, the IGBC established guidelines for a vigorous program in the North Cascades and outlined plans for a 5-year evaluation to determine the suitability of the NCGBE to support a viable grizzly bear population. Under the leadership of the Northwest Ecosystems Grizzly Bear Management Subcommittee of the IGBC, federal, state, and provincial agencies formed the North Cascades Grizzly Bear Working Group (NCWG) to coordinate the ecosystem evaluation. The NCWG included the FWS, Washington Department of Wildlife (WDW), U.S. Forest Service (FS), U.S. National Park Service (NPS), British Columbia Wildlife Branch (BCWB), and B.C. Parks (BCP). Our evaluation of the North Cascades began in May, 1986, and ended in November, 1991.

As directed by the IGBC, our evaluation objectives were to:

1. Collect, confirm, and record data concerning reports of grizzly bear observations and sign in the NCGBE;

2. Evaluate the vegetal components of the NCGBE, documenting the suitability of the area to provide grizzly bear seasonal habitats;

3. Produce a map of general vegetation types with an accuracy level of at least 85%;

4. Provide a baseline list of probable grizzly bear foods identified in the NCGBE; and

5. Collect information concerning the current level of human activities within the NCGBE, including human population centers, livestock allotments, and recreation sites.

Historical Perspectives

When we began this evaluation, the best information available concerning the history of grizzly bears in Washington came from dated taxonomic guides, biological papers, and FWS documents (Hall and Kelson 1959, Ingles 1965, Schneider 1977, U.S. Fish and Wildlife Service 1982, Craighead and Mitchell 1983, Sullivan 1983, Servheen 1985). Records of early grizzly bear observations in the North Cascades stem from ethnological descriptions (Underhill 1945, Gibbs 1972, Collins 1974) and historical accounts of local explorations (Pierce 1883, Thompson 1970, Majors 1984). These earlier accounts indicated that grizzly bears historically occurred over most of Washington, except the Olympic Peninsula and the coastal lowlands below the west slope of the North Cascades (Fig. 2).

The upper drainage of the Nooksack River provides a good example of historical grizzly bear presence on the west side of the Cascade Mountains. While surveying the United States/Canada border in the 1850's, Custer documented observations of several grizzly bears above the North Fork of the Nooksack River (Majors 1984). He reported the killing of the first grizzly bear spotted by his party. They ate the bear and shipped the skin to the Smithsonian Institution in Washington, D.C.. A few days after killing the first bear, he sighted an adult female with 3 large cubs on a talus slope above his camp.

Other historical documentation of grizzly bears on the west slope of the North Cascades stems from discussions of tribal religious ceremonies and quests for powerful medicine (Gibbs 1972, Collins 1974). Men from the Upper Skagit tribe hunted grizzly bears in the mountains above the area now occupied by Ross Lake reservoir. The Swinomish tribe also used grizzly bear hides and skulls in ceremonies; however, we cannot document hunting of grizzly bears by this coastal group (Swinomish Tribal Museum, pers. commun. 1986). Although the impression that we gathered is that grizzly bears historically occurred throughout western Washington, none of these discussions provided dates or general time periods that would allow us to identify when grizzly bears may have been present on the west slope of the Cascades.

One possible reason for the lack of grizzly bear observation data for the lower elevations of the west slope may be the generally closed canopy of the lowland forests. Studies of local Native American tribes indicate that few natural openings occurred in the coastal forest (Underhill 1945, Collins 1974). Most natural meadows occurred along the flood plains of the larger streams, such as the Nooksack, Skagit, Stillaguamish, and Snohomish rivers. Local tribal villages usually occupied these flood plain openings. Some tribes also burned plots to create openings in the forest stands, but village activities rapidly claimed these sites as well (Thompson 1970). It is likely that grizzly bears historically used the river flood plains of the larger coastal rivers on the west slope. Certainly this habitat use has been well-documented for other coastal populations north and south of Washington (U.S. Fish and Wildlife Service 1982, Archibald et al. 1985, Servheen 1985).

Grizzly bear observations occurred more frequently along the crest and the east slope of the North Cascades (Thompson 1970). Studies of early Washington explorations mention observations and killings of several grizzly bears from these areas to the Okanogan and Columbia rivers (Thompson 1970, Sullivan 1983). The Thompson and Methow tribes of the east slope hunted grizzly bears to honor the animal in religious ceremonies and rites of bravery (Brown 1968, Thompson 1970, Collins 1974, Ruby and Brown 1981). Native tales proclaimed the bears as females, believing that tribal women sometimes turned into grizzly bears. Both the Upper Skagits and Thompsons hunted the grizzly bear, placing the head and braided meat of the animal on a pole in the woods; this ceremony assured the perpetuation of the great bear in the Cascades (Collins 1974).

Less information on grizzly bear observations is found in regional exploration journals. David Thompson, the first European-American to enter the North Cascades region, explored the east slope in 1811. He floated down the Columbia River, then up the Okanogan and Wenatchee rivers in search of beaver trapping territory for the North West Company. Also in 1811, David Stuart and Alexander Ross, of the Pacific Fur Company, floated down the Columbia River and established Fort Okanogan, about 48 km from present-day Chelan (Thompson 1970). In 1814, Ross crossed the North Cascades, hiking over the crest and down the west slope to the confluence of the Skagit and Cascade rivers. We found no mention of grizzly bears in Thompson's (1970) account of these journeys.

Sullivan (1983) discussed grizzly bear trapping activity in the Pacific Northwest. Massive trapping mortality likely reduced the local grizzly bear population rapidly. Although he could not identify specific kill locations, Sullivan noted bear hide tallies from Hudson's Bay Company records for the period 1820 to 1860:

> An examination of these records shows that the market for bear hides increased after 1840 and the number passing through each outpost consequently rose. Peak years at the various posts were: Fort Colville, 382 grizzly bear hides in 1849; Fort Nez Perce (Walla Walla), 32 hides in 1846; Thompson's River (B.C.), 11 hides in 1851. Four hides were also taken at Fort Nisqually (near Tacoma) during the period. Unfortunately, the trading areas of these posts overlap the present boundaries of Washington and it is not possible to say how many of these animals were taken in the state.

Following the influx of trappers in the early 1800's, miners poured into the North Cascades searching for gold, silver, lead, zinc, and copper. Following several insignificant ore discovery booms, which led to diggings along the Methow, Twisp, and Okanogan rivers, major mining activity sparked from the Skagit River boom on the west slope in 1858 (Thompson 1970, Roe 1980). Second-hand information from local residents and agency personnel suggests that miners historically killed grizzly bears in defense of property and personal safety. Many bears may have been killed from indiscriminate shooting and dynamiting by miners (D. Tresch, pers. commun. 1986), thus creating the second major impact on the survival of North Cascades grizzly bears.

Rapid human encroachment on grizzly bear habitat followed the mining invasion of the North Cascades and major habitat alteration began immediately. The panning and cradling by the first prospectors matured into placer mining and dredging of streams, "free" mining of gravel bars, dynamiting of adits and shafts, and hydraulic mining. These activities spawned the growth of roads, trails, flumes, power houses, cabins, cook shacks, barns, sawmills, ore tramways, and railroads. Robust mining operations flourished in the North Cascades until the 1950's.

During this same period, other activities likely increased human-induced mortality of grizzly bears in the North Cascades. Cattle and sheep ranges spread over the east slope; one rancher in the 1850's drove over 3,000 head of personal stock to cattle yards at The Dalles in southeast Washington (Pierce 1883). Local forests fell to permanent settlements in the 1860's and logging became the major influence on local resources. A military expedition in 1882, led by Henry Pierce, crossed the Cascades from Stehekin to the Skagit River, opening the way for road planning and extended rail service. By 1890, Chelan boasted stores, hotels, saloons, sawmills, apple orchards, and steam ships. A wagon road, punched over the crest at Cascade Pass in 1896, linked the Skagit River valley with Lake Chelan and the Okanogan area; rural development continued, following major access routes into the area.

Since the establishment of the Washington Forest Reserve in 1897, the administration of the North Cascades has fallen to federal and state agencies. Although human activities severely affected the periphery of the ecosystem, grizzly bear habitat within the interior of the North Cascades remained comparatively intact. Resource conservation policies applied to agency lands and the relative inaccessibility of the backcountry probably prevented the extirpation of the grizzly bear from the North Cascades. The most recent documentation of grizzly bears in the North Cascades was presented by Sullivan (1983), who compiled 234 grizzly bear reports in the area from the early-1800's through 1983.

STUDY AREA

Our evaluation area incorporated all of the NCGBE, which encompasses 2,620,755 ha (Table 1), including all of the North Cascades National Park Service Complex (NCNP), and the majority of the Mount Baker-Snoqualmie (MBSNF), Wenatchee (WNF), and Okanogan (ONF) national forests (Fig. 3). British Columbia (B.C.) bounds the area to the north, with a national forest boundary to the west, and Interstate Highway 90 to the south. The eastern border coincides with national forest and state lands west of the Columbia and Okanogan rivers. The study area is comprised of a large wilderness core surrounded by major units of non-wilderness national forest lands that are mixed with state forest lands, state wildlife management areas, state parks, and private lands. The NCGBE is composed of 82% federal lands, 8% state lands, and 10% private lands. BCWB states that 2,025,000 ha of occupied grizzly bear habitat occur north of the international border and should be considered as part of the NCGBE (R. Forbes, pers. commun. 1992); however, these lands were not included in our habitat evaluation, due to federal and state regulatory restrictions.

Elevations range from about 150 m near the Puget Sound Trough on the west slope to 3,285 m on Mount Baker. The major ridge systems of the west slope are near 1,525 m. The Cascade crest ranges from about 2,100 m to 3,213 m on Glacier Peak. East slope elevations vary from 762 m to 2,712 m.

Pacific Ocean airmasses control North Cascades climatic conditions, although the Cascade crest drastically alters this maritime influence (Franklin and Dyrness 1973, U.S. Weather Service, pers. commun. 1986). West slope weather is pronounced by mild temperatures of moderate extremes, lengthy periods of cloud cover, and abundant annual precipitation (170-300 cm), falling mostly as rain. Fair, dry weather typifies west slope summers, while winters are usually cool and extremely wet.

The Cascade crest blocks much of the westerly maritime flow, shrouding the east slope in a comparably dry rain shadow. Continental airmasses on the east slope interact moderately with Pacific flows, producing more severe temperature extremes and much less annual precipitation (25-50 cm), falling mostly as snow. Hot, dry summers reflect the rain shadow effect on the east slope, while cold, snowy winters resemble a more continental weather pattern.

Climatic variations found in the North Cascades markedly affect environmental gradients over the NCGBE. The volcanic, uplifting, and glacial histories of the Cascades profoundly influence local vegetation patterns (McKee 1972, Staatz et al. 1972, Rowe 1974, Harris and Tuttle 1977). Expanding on the plant community analyses prepared by Franklin and Trappe (1968), Franklin and Dyrness (1973) identified 12 major vegetation zones in the North Cascades. On the west side, these include the western hemlock (*Tsuga heterophylla*), Pacific silver fir (*Abies amabilis*) and mountain hemlock (*Tsuga mertensiana*) zones. Subalpine and alpine life zones occur throughout the mountainous areas. On the east side, major vegetation zones include ponderosa pine (*Pinus ponderosa*), grand fir (*Abies grandis*), Douglas fir (*Pseudotsuga menziesii*), western hemlock, lodgepole pine (*Pinus contorta*), subalpine fir (*A. lasiocarpa*) and shrub-steppe areas.

Other studies provide more detailed descriptions of North Cascades vegetation. Many of these papers originated from botanical surveys of NCNP, while others focus on more specific vegetal relationships of local plant associations (Appendix A).

Access into the North Cascades is restricted to 5 major highways, numerous secondary roads, and a minor trail system. British Columbia Highway 3 penetrates the North Cascades through Manning Provincial Park and allows access by secondary road to the Hozomeen area of Ross Lake National Recreation Area. The North Cascades Highway, State Highway 20, crosses the ecosystem from Sedro Woolley on the west slope to Winthrop on the east slope. State Highway 2 crosses the Cascades from Everett on the west to Wenatchee on the east. Interstate Highway 90, forming the south boundary of the evaluation area, passes west to east from Seattle to Ellensburg. State Highway 97 runs north-south, providing access points by secondary roads along the east slope. Although many secondary and light-duty roads access the periphery of the ecosystem, few of these penetrate the core area. A few secondary roads follow major river courses into the ecosystem core.

METHODS

Objective No. 1. Collect, confirm, and record data concerning reports of grizzly bear observations in the NCGBE.

Confirmation of Grizzly Bear Observations

We compiled a list of North Cascades grizzly bear observation reports received from the cooperating agencies and the public from May, 1986, through November, 1991. These reports included observations that occurred prior to our evaluation. For example, even though we may have recorded an observation report when it was received in 1990, the observation may have occurred in 1970, many years prior to our evaluation period. We considered reports that occurred prior to 1950 as *historical*, since the oldest known wild grizzly bear was 37 years old (Servheen, pers. commun. 1993). We considered all grizzly bear observations that occurred from 1950 through November, 1991, as *current* observations. In this way, bears identified during that 1950-1991 period could still be alive during part or all of our evaluation.

We did not duplicate observation reports presented by Sullivan (1983). We recorded all reports of grizzly bear observations on a standard form (Appendix B) and mapped the general location of each observation.

A "report" refers to the documentation of one or more grizzly bears and/or sign recorded for a specific observation. The term "document" (both verb and noun forms of the root word) refers to the recording of information as evidence to identify the details (Woolf 1992) of a reported grizzly bear observation and does not indicate a particular level of reliability. For example, a "documented" observation is not necessarily a confirmed observation. The term "observation" refers to seeing or photographing a grizzly bear or finding the tracks, scat, hair, digs, or food cache of a grizzly bear. Grizzly bear family groups were identified by the observation of an adult bear with one or more young. Observations of multiple bears of unknown age were considered family groups when one bear in the group was apparently larger than the other bear/s in that group.

We rated the reliability of grizzly bear reports on a class scale from 1 to 4, using methods accepted by the North Cascades Grizzly Bear Working Group and the IGBC (Almack 1986, 1990). All observers were interviewed either in person or by telephone. When possible, we examined the observation site to attempt confirmation of the bear species visually, by photograph of the bear, or by verification of sign.

A Class 1 (*confirmed*) reliability rating indicated a grizzly bear observation confirmed by a biologist and/or by photograph, carcass, track, hair, dig, or food cache.

Grizzly bear sign required verification by a grizzly bear biologist. Tracks were documented by photograph and/or plaster cast and met grizzly bear front foot toe alignment criteria (Herrero 1985, Fig. 4), using the Palmisciano Line Method, named first here. If tracks were not of sufficient quality to allow use of the Palmisciano Line Method, they were rated with a lower reliability.

Hair samples were guard hairs identified by microscopic examination of basal and shaft scale patterns in combination with shaft shield and shaft tip coloration (Moore et al. 1974). If structural characteristics of the hair scaling could not be differeniated, the information related to that hair was rated with a lower reliability.

Digs and food caches required verification by a grizzly bear biologist. Verification of these feeding sites is sometimes very difficult. The presence of tracks, hair, and specific food items contributed to the identification of the bear species. We excluded consideration of other carnivores, such as black bears (*Ursus americanus*), gray wolves (*Canis lupus*), coyote (*C. latrans*), foxes (*Vulpes vulpes*), mountain lions (*Felis concolor*), wolverines (*Gulo gulo*), lynx (*Felis lynx*), and bobcat (*F. rufus*), by noting differences in feeding and caching behaviors, as compared to those behaviors exclusive to grizzly bears.

Scats were identified as grizzly bear only by direct association with a verified observation or tracks (Herrero 1985).

A Class 2 (*high reliability*) report documented an observation of a grizzly bear that was identified by two or more physical characteristics, but lacked verification criteria as noted for a Class 1 observation. The presence of a shoulder hump, long front claws, and concave facial profile were the physical characteristics used to identify Class 2 observations (Appendix C). We did not regard size, color, location, gait, behavior (except caching), or habitat class as reliable indicators to differentiate the species of the bear observed.

A rating of Class 3 (*low reliability*) indicated that the observation report included documentation of only one identifying physical characteristic of a grizzly bear, making it impossible to verify the species of bear observed.

A Class 4 (*not a grizzly bear*) report documented an observation reported as a grizzly bear, but which, upon investigation, was verified to be a species other than grizzly bear. Class 4 reports were not tabulated or mapped for this paper, although all of these reports are kept on file with the WDW Large Carnivore Investigations office.

Capture and Marking Activities

We attempted to capture and radio-mark 4 adult grizzly bears. All trapping efforts were opportunistic; we located capture sites near recent Class 1 or Class 2 observations and in areas of important seasonal habitat components. For capture, we used spring-activated, steel cable foot snares (Aldrich Snare Co., Clallam Bay, WA) placed in cubby and trail sets. Each site was baited with carcasses of deer (*Odocoileus* spp.), elk (*Cervus elaphus*), or beaver (*Castor canadensis*). Each set was checked daily and rebaited as necessary. We maintained a daily log for each trap site to note any trends in capture success or failure based on location, set design, or type of bait.

Each trap site was marked with two types of warning signs approved by the IGBC and designed to inform people of a nearby trap and the danger at that baited site. We mounted "*WARNING*" signs (Appendix D) to form a circle around the trap at about 50 m from the set. We placed a ring of "*DANGER*" signs (Appendix E) within
10 m of the trap. The signs were located at the four cardinal directions around the set and along any obvious travel route into the set.

All captures were recorded on a standard form (Appendix F). Grizzly bears were to be anesthetized with a standard mixture of Ketamine HCl (100 mg/ml) and Xylazine (100 mg/ml) in a 2:1 ratio (Perry 1978). Standard zoological body measurements and tissue samples were to be collected as noted on the capture form. Each grizzly bear was to be marked with a radio transmitter collar, attached by a decomposing cotton spacer, allowing the collar to fall free of the study animal within 2 to 4 years. Each collar contained instantaneous activity switches indicating "head-up" or "head-down" body positions and a "mortality" mode that activated after 6 hours of no body movement. Each grizzly bear would also be marked by a lip tattoo and colored, numbered, ear tags. Black bears were captured incidental to our attempts to capture grizzly bears. Captured black bears were anesthetized, marked, and handled as with grizzly bears, except no radio markers were used.

Self-Activated Camera Survey

Following the methods of Mace et al. (1990), we used 18 self-activated cameras located at different baited sites from 1989 through 1991, to attempt confirmation of grizzly bears by photograph. The self-activated camera system included an Olympus "Infinity Quartzdate", 35 mm, SLR camera, with automatic focus, automatic light meter, automatic flash, automatic wind, and time/date LED features. We used 36-exposure, 200 ISO, color print film.

The self-activated camera was triggered by a signal from a burglar-alarm-style, infrared-activated, motion sensor, powered by a 12-volt, gel-cell battery. These three units were loaded in a military surplus ammunition box. The box was mounted about 3 m above ground and bolted to the side of a tree. The box was aimed at a lure that was placed about 3 m from the base of the camera tree. When an animal entered the 6 m X 6 m X 13 m field of view, the sensor was activated. After a 7-second delay, the sensor signaled and fired the camera. The camera continued to fire at 7-second intervals, until the animal left the field of view, or until the entire roll of film was exposed.

We located camera stations in important seasonal habitat components and in areas near recent Class 1 and Class 2 grizzly bear observations. Each station was placed to allow for safe animal capture and handling activities, should a grizzly bear be identified at the site. We baited sets with carcasses of deer, elk, or beaver, or used wolf or coyote urine scents as a lure. We maintained a log for each camera station to note equipment functions, film and battery use, and success or failure of the site, based on location, camera system design, or type of bait. We mounted "*WARNING*" and "*DANGER*" signs around the camera tree, as for capture sites.

We checked each self-activated camera station at intervals of approximately 5-10 days. During each visit, the film was changed, batteries voltage-tested and replaced as needed, and either fresh bait dragged to the site or the site rescented with a lure. The exposed film was taken to a "1-hour photo shop" for rapid processing.. We viewed all negatives on a light table using an 8X lupe. We produced a print from any negative that showed an animal at the site, or if there was any doubt concerning identification of objects viewed on the negative. All negatives and prints were filed by camera station number for later analysis and record storage.

Objective No. 2. Evaluate the vegetal components of the NCGBE, documenting the suitability of the area to provide grizzly bear seasonal habitats.

Vegetation Type Mapping

A vegetation type map was developed from Landsat satellite data to show vegetation distribution throughout the ecosystem. A detailed and extensive field plot database was constructed to support the Landsat vegetation mapping process and to quantify the abundance of plant species within each vegetation type.

Several methods have been described to map vegetation and evaluate grizzly bear habitat (Christensen and Madel 1982, Craighead et al. 1982, Butterfield and Almack 1985, Butterfield and Key 1986, Leach 1986, Mattson and Knight 1989). The most common method, although very time-consuming, involves aerial photograph interpretation combined with various intensities of ground truthing to identify vegetation types used by grizzly bears. Recent studies have demonstrated the use of Landsat Multispectral Scanner (MSS) data to map grizzly bear habitat (Craighead et al. 1982, Craighead et al. 1985, Butterfield and Key 1986, Butterfield et al. 1989). Because Landsat technology provides an efficient inventory of vegetation over a large area, we selected this method to map vegetation in the NCGBE.

Landsat data from July and August of 1986 were used in our evaluation with portions of four Landsat scenes purchased to cover the entire study area. In raw Landsat MSS data, four separate spectral bands are present: green, red, and two bands of reflected infrared. The digital value of each pixel is related to the intensity of light reflected from vegetation or other surfaces for that spectral band. Using specialized computer software, the raw spectral bands are processed into a single map image where unique spectral classes are identified. On this project, the raw spectral data were processed into spectral classes using a guided clustering technique. Blocks of raw Landsat data, selected using aerial photos, orthophoto maps, and topographic maps, were then submitted to cluster analysis. This clustering identified unique spectral conditions and produced a file of spectral class signatures.

Repetitive clustering of data from many parts of the study area identified the widest possible range of spectral signatures. Each spectral signature was represented as a spectral class by its statistical description in a computer statistics file. The spectral classes were evaluated statistically for overlap and tested in small areas on the ground. A final set of spectral classes was used to process the entire Landsat data set and produce a map layer of spectral classes where each pixel was assigned to the spectral class of highest statistical probability. The spectral class layer was geo-referenced to the Universal Transverse Mercator (UTM) map projection, zone 10, with a pixel size of 57 m X 57 m. The Landsat spectral class map data were transferred in digital form to a geographic information system (GIS).

We conducted a comprehensive field sampling effort in order to identify the vegetation type correlated with each spectral class. A wide geographic distribution of field plots was needed to identify the variation in vegetation conditions and types that any spectral class could represent over the entire study area. We established sample ecology plots where data were collected during the 1986, 1988, 1989, and 1990 field seasons. Data were not collected from ecology plots in 1987, due to the absence of FS funding for the program that year. Plots were located by overlaying 1:24,000 scale orthophotos, with spectral class displays, and selecting areas of identical, contiguous, spectral classes. We selected polygons with a minimum size of 9 pixels X 9 pixels. This size of polygon was chosen, because it could be accurately located on the ground and easily identified on the orthophotos. Although forested vegetation types dominate the ecosystem, nonforested areas were sampled in greater proportion than their occurrence. We used this sampling strategy, because existing forest ecology plot data provided information on forested areas, but little vegetation data existed for nonforested plant communities. Some plots were located in polygons smaller than 9 pixels X 9 pixels, if they could be easily identified on the ground.

Vegetation data for field plots were recorded on a standard form (Appendix G). Elevation, slope, aspect, plot location, and spectral class number were also recorded. We recorded the percent cover for all understory plants, shrubs, and trees within each plot. Trees were sampled in 0-1 m, 1-3 m, and greater than 3 m height classes and by stem percentages in several diameter classes. Densiometer readings of the percent of canopy cover were measured in all four cardinal directions at 5 randomly-chosen sites within the plot. Also noted were the frequency and magnitude of any physical disturbances of the site, the presence of surface water, patchiness of the plant communities present, and the extent of the forested stand. Photographs taken at each plot represented the general appearance of the area.

We identified plants in the field using the nomenclature of Hitchcock and Cronquist (1987) and Hitchcock et al. (1955-1969). Alphanumeric code names for plants followed procedures outlined by Garrison and Skovlin (1976).

A total of 1,726 plots were established during the evaluation, with all data entered into an ecology database. These plot data were supplemented with ecology data collected on the three national forests within the ecosystem. These additional data were compiled from 2,158 plots on the MBSNF (Henderson and Peter 1985), 445 plots on the ONF (Williams and Lillybridge 1983), and 679 plots on the WNF (Williams and Smith 1990). Data from 469 plots located in NCNP (Agee and Kertis 1986) were also incorporated into our database.

The field plot data from all sources were integrated into a single computer database, which was then used for vegetation mapping and for analysis of the abundance of plant species (Wheeler 1987, Hill and Gauch 1980). This database initially contained all of the field plot information and the Landsat spectral class number for each field plot.

The NCGBE has a high degree of geographic variation and plant diversity, making vegetation mapping very complex. We discovered that the analysis of the Landsat spectral classes alone could not produce the level of vegetation map detail required for our study. In addition to the spectral class, vegetation types may be distinguished by geographic location and other environmental factors, such as precipitation and topography. Therefore, additional GIS map layers were needed to refine the Landsat spectral class map into a vegetation type map. We developed additional layers that included elevation, slope, and aspect [U.S. Geographical Service (USGS) digital terrain data], precipitation, sun incident angle, land ownership, and riparian zones. The riparian zone layer was created by digitizing a map of major riparian areas interpreted from high-altitude aerial photos. A GIS forest vegetation map of the MBSNF obtained from The Wilderness Society (Morrison et al. 1990) was also integrated into our GIS for further refinement. All GIS layers were geographically co-registered with the map projection and coordinates of the spectral class layer. In addition, the ecology plot data locations were digitized so that any GIS layer attribute could be extracted and added to the field plot database. In this way, data on precipitation, geographic location, and map coordinates were added to the field plot database.

The attributes from the field plot database were used for the analysis needed to produce the vegetation map. We conducted a multivariate analysis of the field plot data to group the plots into clusters of related vegetation and to relate vegetation type to Landsat spectral class. Analysis of the database was used to produce predictive modeling rules that identified the GIS data layer combinations needed to identify each vegetation type.

A two-step GIS modeling process was used to produce the vegetation map. A general ecological zone GIS layer was developed as the first step. Ecological zone boundaries were determined from an analysis of vegetation preferences with respect to elevation, aspect, slope, precipitation, land ownership, and general geographic location. In the second step, we developed a more refined vegetation model for each ecological zone using spectral class, elevation, aspect and proximity to riparian areas. These ecological models were implemented in the GIS to produce two vegetation maps.

The first map, Level 1, differentiated general vegetation types by physiognomy (Mueller-Dombois and Ellenberg 1974), such as "shrub" and "herb" classes (Appendices H, I). The second map, Level 2, incorporated a computer modeling scheme that provided more detail by using an organization of major plant communities (Franklin and Dyrness 1973, Mueller-Dombois and Ellenberg 1974), such as "montane shrub-east" and "subalpine meadow(mesic/dry)-east" (Appendices H, I). Only the Level 2 map was used in assessing the occurence of potential bear foods.

Note: a portion of the Colockum Elk Range, was added to the ecosystem by the IGBC Technical Review Team at the end of the evaluation. Because this area was not added until late in the study, it was not included in the vegetation mapping analysis. Information on the composition of the adjacent vegetation types and field reconnaissance of the area were used to provide a general description of the vegetation in this area.

Spring Snow Line Analysis

We conducted a snow line analysis to estimate the portion of the ecosystem that may be snow free and available for grizzly bear use during early spring. Using historical weather records, we selected a cloud free Landsat scene taken on April 1, 1975, to represent an "average" snowfall year. Data points were selected at snow line around the ecosystem; 80 points from the east side and 50 points from the west side. At each point, the slope, elevation, aspect, and precipitation zone were determined. This information contributed to a predictive model developed to determine the location of an "average snow line" across the ecosystem.

Note: the spring snowline analysis was added to our objectives during the last year of the evaluation at the request of the IGBC Technical Review Team leader. We caution the reader to recognize that this procedure is not intended to imply a knowledge of local grizzly bear habitat use, it is simply a tool to display general areas that we might expect grizzly bears to use in spring, given "average" snow conditions. This analysis may assist agency evaluation and management of grizzly bears by identifying general areas of possible habitat use and bear-human conflicts.

Objective No. 3. Produce a map of general vegetation types with an accuracy level of 85%.

We assessed the accuracy of the vegetation and cover type maps by conducting a polygon analysis (Dicks and Lo 1990). A total of 21 USGS 7.5 min quadrangle maps were randomly selected throughout the ecosystem (Appendix J). On each quad, 70 to 110 polygons (each 1.6 ha in size) were randomly selected. These polygons were assigned an identification number and classified into one of the vegetation types, either through aerial photograph interpretation, or by making ground or helicopter observations. The classification made during the accuracy assessment was then compared to the mapped classification for both Level 1 and 2 maps to determine the accuracy. Statistical analyses were conducted to determine the level of accuracy for each vegetation and cover type, and for the overall map.

Objective No. 4. Provide a baseline list of probable grizzly bear foods identified in the NCGBE.

We identified probable grizzly bear food items by extracting the information from observation reports, by direct observation of feeding black bears, and by analysis of a subsample of bear scats found in the ecosystem. We compared these data to a list of known grizzly bear foods compiled from several grizzly bear studies conducted south of Alaska (Craighead et al. 1982; Jonkel 1982; McLellan 1982; U.S. Department of Interior 1982; Hamer and Herrero 1983; Servheen 1983, 1985; Aune et al. 1984; Knight et al. 1984; Mace 1984; Almack 1985; Archibald et al. 1985; Herrero 1985; Kasworm 1986). Plant names in our analyses followed Hitchcock and Cronquist (1987).

We used the scat analysis procedures described by Mace and Jonkel (1979), excluding estimates of percent volume for each food item. Without knowledge of individual bear diets and relative digestibility of food items, food volume estimates are inappropriate. We present scat analysis results simply as a table of plant and animal species observed in a subsample of scats. We stored subsamples of scats for possible future identification of plant foods by microscopic examination of cuticle tissues (W. Kasworm, pers. commun. 1986).

No accurate field method exists for differentiating between scats from grizzly bears and black bears (Allendorf et al. 1979, Hamer and Herrero 1980, Wolfe 1983, Goodwin 1984, Picton 1986). Laboratory analyses of bear scats by electrophoresis of blood proteins (Allendorf et al. 1979, Wolfe 1983) or paper-thin chromatography of bile salts (Picton 1986) provide only about 80% confidence in bear species differentiation, so we chose to not use these techniques. Therefore, we considered each specimen only as a "bear scat", with no bear species identified, realizing that the total sample of scats analyzed may contain specimens from both bear species. A genetic comparison laboratory test (S. French, pers. commun. 1993) may provide greater accuracy for bear species differentiation in scats; further analyses of stored subsamples may be conducted after our ecosystem evaluation is completed.

We developed two computer programs to determine the plant species and identify the probable grizzly bear foods present within each Level 2 vegetation type. The first program sorted all sample ecology plots into categories corresponding to the Level 2 map classes. The second program summarized the mean percent cover and constancy of plant species within each vegetation type. Probable bear foods were then identified from this species list through a comparison with a database file of the known grizzly bear foods. This analysis provided an assessment of the diversity and abundance of vegetal foods within each Level 2 vegetation type.

Objective No. 5. Collect information concerning the current level of human activities within the NCGBE, including human population centers, livestock allotments, and recreation sites.

We identified human activities present within and adjacent to the NCGBE and digitized them in our GIS. The GIS layer developed for human activity sites included campgrounds (except backcountry camps in the NCNP), population centers, ski areas, and airstrips. Additional layers were developed for roads (Appendix K), trails, and grazing allotments on national forests. Roads data for the ONF and MBSNF came from GIS transportation databases from each forest. The roads data for the WNF came from a combination of their GIS data and USGS 100k digital line graph (DLG) data. The roads data for private and state lands were collected from existing national forest databases or were obtained from USGS 100k DLG data.

Assuming that road density has a measureable effect on grizzly bear use of habitat (McLellan and Shackleton 1988; Frederick 1991; C. Servheen, pers. commun. 1991; R. Mace, pers. commun. 1991), we produced a map to illustrate the density and distribution of roads throughout the NCGBE. Road density was determined from roads data entered into the GIS, using a system of grids, 15 pixels x 15 pixels in size. We then assigned each pixel to one of the following road density zones, based upon the kilometers of road per grid: Zone 1 = 0 km/km^2; Zone 2 = > 0 to 1 km/km^2; Zone 3 = > 1 to 3 km/km^2; and Zone 4 = > 3 km/km^2. The area and percentage of the ecosystem within each of the road density zones were then calculated as an index to assess the effects of roads on habitat classes.

Population centers, airstrips, campgrounds, and ski areas were identified from state highway maps and forest recreation maps, were transferred to 1:100,000 scale maps, and then digitized as a layer in the GIS. The effects of these activities on habitat classes were expressed using a zone of influence around each activity: 1,500 and 2,000 m for population centers and 500 and 1,000 m for all others. The area within each of these zones was then summarized to estimate the total amount of habitat influenced by these activities.

RESULTS and DISCUSSION

Objective No. 1. Collect, confirm, and record data concerning reports of grizzly bear observations in the NCGBE.

Confirmation of Grizzly Bear Observations

During our evaluation, from May, 1986, through November, 1991, we collected 238 reports of grizzly bear observations in the North Cascades area. Two of the reports duplicated information on the same observation; elimination of the duplicate report reduced the total to 237 reports (Fig. 5). Fifty-two of the reports documented grizzly bear observations that occurred prior to May, 1986; the remaining 186 reports identified observations that occurred during the evaluation period.

We classified 22 reports as Class 1 (Table 2, Fig. 6). One of these confirmed observations occurred in 1859 and is considered the only historical Class 1 observation. Besides being one of the earliest grizzly bear observations recorded by the United States government in the North Cascades, this observation also illustrates that grizzly bears historically inhabited the west slope of the Cascade Mountains in Washington.

One of the confirmed reports documented a grizzly bear family group of an adult and a single cub. Two reports refer to multiple-bear observations and are tabulated only as "adults", because the animals were large and approximately the same size. We cannot determine which type of bear group (family, siblings, or mated pair) these two reports identified. Although we cannot positively identify the family composition of these bear groups, we can make strong inference that all three observations indicate that reproduction does occur in the North Cascades grizzly bear population. However, we cannot estimate the number of reproducing females, cub production, or cub survival. Note also that the presence of reproduction in the population does not imply any knowledge of local population trend, whether increasing, stable, or decreasing.

We classified 82 reports as Class 2 grizzly bear observations (Table 3, Fig. 7). Only 1 of these reports involved an historical observation. Six of these reports involved family groups; these observations further imply that reproduction occurs in this population. Four other reports documented multiple-bear observations where family composition cannot be determined.

We rated 102 reports as Class 3 observations (Table 4), where we could not differentiate between grizzly bear or black bear. Nine of these reports documented sow/cub family groups. One report documented an unaged pair of bears.

We identified 31 reports as Class 4 observations. Observers misidentified black bears as grizzly bears in 28 of the Class 4 reports. Additionally, 2 reports incorrectly identified grizzly bear dens; we confirmed one as a porcupine (*Erethizon dorsatum*) den, the other was identified as a hoary marmot (*Marmota caligata*) excavation. One report misidentified a horse (*Equus caballas*) skull as a grizzly bear skull.

The locations of the North Cascades grizzly bear observations are widely distributed throughout the ecosystem. The clusters of sightings that occur in several areas are likely due to the concentration of human observers in those areas, rather than to a local high density of grizzly bears. Each of the observation clusters occurs at a location of high road or trail density, open canopy habitat, and high human use, all factors which increase the sightability of wildlife.

Our observation data indicate that the North Cascades harbors a resident population of grizzly bears. Considering the confirmed and high-reliability observations, 3 family groups located at the southern end of the ecosystem suggest that at least some of the grizzly bears in our local population are resident to the Washington Cascades. It would be very unlikely that a female with cubs-of-the-year would travel from a winter den in British Columbia to a spring or summer feeding location approximately 200 km south of the international border (C. Servheen, A. Hamilton, and S. Herrero, pers. commun. 1991). It is also unlikely that cubs-of-the-year could survive such a long trip in a one- or two-week period immediately following den emergence. The energetics involved with lactation suggest that the mother could not provide the required volume or nutritive quality of milk for the cubs on such a distant and rapid movement (Sizemore 1980). Even without consideration of the energetics involved, such range shifts are rare for grizzly bear females with cubs-of-the-year.

Three high-reliability reports documented grizzly bear observations in the South Cascades, outside of our evaluation area. These observations indicate that grizzly bears may occupy a more extensive portion of the Cascade Mountains in Washington. Accepting the possibility of a larger grizzly bear range in the Cascades does not equate to a healthier, or significantly larger population of grizzly bears here. Reports of grizzly bear observations in the South Cascades do indicate the need to expand our evaluation activities. Documentation of the full extent of grizzly bear range in the Cascades would help IGBC efforts to conserve the bear in the North Cascades by providing a more precise view of the current grizzly bear population and its habitat requirements.

Capture and Marking Activities

No grizzly bear was captured or radio-marked during our evaluation. The unsuccessful trapping effort does not indicate an absence of grizzly bears in the North Cascades. A very restricted, opportunistic, trapping effort occurred during 4 seasons of the 6-year evaluation. We attempted to capture grizzly bears at only 36 sites (Fig. 8), logging 323 trap nights (1988 - 14 trap sites, with 122 trap nights; 1989 - 13 trap sites, with 105 trap nights; 1990 - 4 trap sites, with 44 trap nights; 1991 - 5 trap sites, with 17 trap nights). Much of the failure of the capture program may be attributed to the interagency decision to trap only opportunistically near recent, reliable grizzly bear observations and to the consistent lack of an adequate bait supply and bait storage capability. The opportunistic trapping effort also made it impossible to adequately identify any trend in bear use of trap sites, bait, or capture method.

We captured 2 black bears incidental to grizzly bear trapping efforts in 1989. Both bears were captured on the ONF, during our last spring trapping effort. The first black bear was a 68-kg, young adult male, trapped on July 16. Due to a malfunction of our air-pump dart rifle, this bear was restrained by a neck noose and anesthetized by hand syringe. To decrease handling time of this animal, following the long delay with capture equipment, we marked it with ear tags and released it on site, without other data collection. We marked this black bear with tags reading No. 102 in the left ear and No. 101 in the right ear, with black numerals on dark blue tags.

The second black bear was a 73-kg, 13-year-old male, trapped on July 19, 1989. This bear was anesthetized, marked, measured, and released with no difficulty. Ear tags for this black bear read No. 103 in the left ear and No. 104 in the right ear, with black numerals on dark blue tags.

Self-Activated Camera Survey

We did not document a grizzly bear with the self-activated cameras. Operating cameras at 71 stations around the ecosystem (Fig. 9), we logged from 1 to 90 camera nights per station from 1989 through 1991 (1989 - 44 camera stations, 1990 - 16, 1991 - 11). Camera nights were not calculated, since variations in equipment application and fluctuations in battery life made this measurement insignificant to our evaluation. Differences in terrain features, habitat classes, and equipment logistics made it impossible to determine trends in camera use by different species or according to variances in bait availability and use.

Our 18 cameras were used in association with Class 1 and Class 2 grizzly bear observations. Typically, we baited these sites with deer, elk, or beaver carcasses; however, during the last 2 years of the evaluation, we began using urine from either wolf or coyote. Nearly all of the animal species documented by camera at baited sites also visited the scented locations (Table 5). We shared 4 of our camera systems with Idaho Department of Fish and Game during the last 2 years of the evaluation. Although this equipment loan allowed WDW to meet cost-share requirements for federal funding, it further reduced our capability to conduct an adequate camera survey.

Compiling all of the observational data we gathered during this evaluation, we believe there is substantial evidence to indicate that grizzly bears still inhabit the North Cascades. Further, our data indicate that grizzly bears historically occupied the west slope of the Cascade Mountains and likely the remainder of the coastal range of Washington and Oregon. We suggest a revision of the FWS map of grizzly bear historical and current ranges (Fig. 2), as illustrated by Figure 10.

Objective No. 2. Evaluate the vegetal components of the NCGBE, documenting the suitability of the area to provide grizzly bear seasonal habitats.

Vegetation Type Mapping

Our analysis of the field plot database and the GIS data layers produced 50 vegetation and cover types for the Level 2 map of the NCGBE. Sixteen of the major types were subdivided into east and west variants along the Cascade Crest, allowing a more detailed analysis of the plant species within the vegetation types. Mean and constancy data for the 50 resulting Level 2 vegetation and cover types are detailed in Appendix L and summarized in Tables 6 and 7. Figures 11-13 illustrate the relative abundance of the major Level 2 types.

Vegetation types dominated by conifer forests covered a total of 62.41% (1,630,467 ha) of the study area. Five conifer vegetation types occurred on 46.86% of the study area. The vegetation type dominated by subalpine fir, Engelmann spruce (*Picea engelmannii*), and lodgepole pine located on the east side of the ecosystem, was the most abundant type, covering 14.28% of the study area. Pacific silver fir forests located on the west side of the ecosystem occurred on 9.27% of the study area. Mountain hemlock forests located on the west side of the ecosystem covered 9.25% of the study area. An east side vegetation type dominated by Douglas fir and mixed with other conifer tree species comprised 8.00% of the area. The vegetation type dominated by ponderosa pine and Douglas fir covered 6.06% of the study area. The remaining conifer vegetation types covered a total of 15.55% of the study area and no single type covered more than 5%.

Vegetation types composed of deciduous forests covered 3.07% (80,312 ha) of the ecosystem. These areas included both riparian and nonriparian habitats.

Nonforested vegetation types covered 37.59% (982,531 ha) of the study area. These vegetation types included areas dominated by shrubs, herbs, and mosaics of shrubs and herbs. The most abundant shrub vegetation type was the montane shrub type, located west of the Cascade crest; it composed 2.51% of the study area. Vegetation types dominated by subalpine heather (*Phyllodoce* and *Cassiope* spp.) and huckleberry (*Vaccinium deliciosum*) composed 2.20% of the study area. Subalpine meadows dominated by huckleberry (*V. scoparium* and *V. caespitosum*) on the east side of the Cascade Crest composed 1.51% of the ecosystem.

The most abundant herbaceous vegetation types occurred in shrub-steppe areas dominated by herbs; these types covered 2.89% of the ecosystem. West side subalpine lush meadows composed 2.43% of the ecosystem, and the east side montane-herbaceous vegetation type covered 2.27% of the study area.

Barren ground, snow, and rock classes harbor an insignificant amount of vegetal cover, according to the satellite imagery. However, as noted in other ecosystems (Almack 1980; Servheen 1981; Mace 1984; Almack 1985), a depauperate vegetative layer does not equate to lack of available grizzly bear foods. For example, in the Cabinet Mountains of Montana, barren ground and rock habitat classes often contained small, but dense communities of glacier lily (*Erythronium grandiflorum*), cow parsnip (*Heracleum lanatum*), biscuit-root (*Lomatium* spp.), or huckleberry (Almack 1980). Glacier lily commonly protruded above the surface of expansive snow fields. In the Mission Mountains of Montana (Servheen 1981) and the high elevation areas of Yellowstone National Park (R. Knight, pers. commun. 1991) army cutworm moths (*Chorizagrostus auxilaris*) and ladybug beetles (Coccinellidae spp.) are sometimes found in extremely dense estivating populations. These insects are key grizzly bear foods in other ecosystems; we would expect a similar importance value for these items in the North Cascades.

The portion of the Colockum Elk Range that was not included in the vegetation mapping analysis was about 7,757 ha and is located in the extreme southeast portion of the NCGBE. Over 90% of this area is managed as state land. The dominant vegetation type in this are is shrub-steppe. Smaller portions of ponderosa pine, ponderosa pine mixed with Douglas fir, Douglas fir, and barren/rocky vegetation and cover types also occur.

Spring Snow Line Analysis

The results of the snow line analysis (Fig. 14) showed that areas snow free during the early spring are also where the highest degree of human use occurs. In addition, only 9% of the snow free area lies within wilderness, national park, or other protected areas. The snow free areas are mainly distributed along the western and eastern boundaries of the ecosystem, where elevations are lower.

The snow line analysis should not be interpreted as an analysis of spring range for grizzly bears. R. Knight (pers. commun. 1991) commented that grizzly bears will use microsites that are snow free at elevations above the snow line. Our analysis does not take these areas into account, thus under-representing the amount of habitat that may really be available.

Den emergence occurs at different dates for each bear in a given population. Older males usually exit the den first, perhaps as early as mid-March. Females with cubs often are the last to leave the den, possibly as late as mid-May (Craighead and Mitchell 1983, Servheen 1983, Aune et al. 1984). Annual weather patterns may also influence grizzly bear habitat use. The spring snow line analysis does not account for such variations in habitat use.

Further local study of radio-collared grizzly bears is needed to determine what areas provide important spring use sites. Until such studies are completed, the results of our snow line analysis provide the best information on the location, amount, and distribution of the snow free areas available for grizzly bear use during the early spring feeding and breeding period.

Objective No. 3. Produce a map of general vegetation types with an accuracy level of 85 %.

The accuracy calculated for the Level 1 map was 94.8% (Table 8), well above the 85% accuracy level outlined in the initial project objectives. The accuracy of the Level 2 map was 93.2% (Table 8). Some of the vegetation types for Level 2 that covered only a small portion of the study area were not adequately sampled, because the location of the sample polygons for the accuracy assessment were randomly selected and the sample polygon was 1.6 ha. Time and personnel resources were not available to sample extensively for the Level 2 map. However, the accuracy calculation for the Level 2 map is based upon an adequate overall sample size and is comparable, or higher than, accuracy levels reported in other studies using satellite imagery (Miller and Conroy 1990).

Objective No. 4. Provide a baseline list of probable grizzly bear foods identified in the NCGBE.

Grizzly bears require a variety of vegetation types, in order to obtain a rich supply of seasonally-important plant and animal foods, and to use as secure areas for feeding, breeding, bedding, and denning (Craighead and Craighead 1972, Glenn and Miller 1980, Servheen 1981, Knight et al. 1984, Almack 1985). Vegetal requirements of grizzly bears often differ by population, according to seasonal availability of ungulate and small mammal concentrations, and by the phenology of local plant communities associated with specific habitats. Vegetal classes also vary in importance to grizzly bears, depending on the nutritive value, variety, and volume of available foods (Craighead et al. 1982, Butterfield and Almack 1985).

We identified 124 plant species as grizzly bear foods from other studies (Table 9). These plant species were used to assess the abundance of probable grizzly bear foods in this ecosystem. It is important to note that additional plants that are located within, and in some cases unique to, the NCGBE may also provide foods for grizzly bears. However, since we have no food habits data specific to this ecosystem and these plants were not identified in other studies, these potential foods were not used in our analysis.

The abundance and diversity of grizzly bear foods is commonly assessed on a temporal scale (Mace 1984). This study was not designed to assess the availability of vegetative food sources over time. This would require a more detailed sampling strategy and a study of the phenology of specific plant species. However, a discussion of potential seasonal food sources, based upon field observations of feeding grizzly bears in other ecosystems and a knowledge of the species of plants within this ecosystem is presented below.

We cataloged all plant species that have been identified as grizzly bear foods in other ecosystems into each of the vegetation types within the NCGBE (Table 9). All of the vegetation types that were identified in this ecosystem contained at least some of the plant species on our probable grizzly bear foods list. A total of 100 of the 124 plant species that are known to be grizzly bear foods from other studies were identified in our ecology plots. The mean number of known grizzly bear foods that occurred within a vegetation type was 37 species (range = 3-90) (Table 10, Appendix L). This indicates that vegetal foods are readily available in the study area. These food sources include a diversity of species and are well-distributed throughout the ecosystem.

Seasonal grizzly bear foods are well documented for other ecosystems in the lower 48 states (Craighead et al. 1982, Jonkel 1982, Servheen 1983, Aune et al. 1984, Knight et al. 1984, Mace 1984, Almack 1985, Kasworm 1986) and for Alaska and Canada (Reynolds 1980, McLellan 1982, Hamer and Herrero 1983, Archibald et al. 1985). Specific grizzly bear food items have not been identified for the NCGBE. However, local vegetal studies, scat analysis, and field observations of feeding black bears identified many items for the North Cascades that are known to be grizzly bear foods in other areas (Table 9).

North Cascades vegetal components have been investigated for many years (Appendix A). These studies suggest that vegetation types common to other grizzly bear ecosystems do occur in the NCGBE. In some cases, due to biogeoclimatic differences in the North Cascades, analogous vegetal communities may occur here, growing on sites similar to those found in other grizzly bear ecosystems, but at different elevations.

For example, low-elevation, wet meadows are considered important spring feeding and breeding sites for grizzly bears in other ecosystems (Servheen 1981, Jonkel 1982, Aune and Stivers 1982, Almack 1985, Archibald et al. 1985). Relatively few of these meadows exist at low elevations in the NCGBE. However, similar vegetal components do exist. Many of the major river systems on the west slope harbor marshes of horsetail (*Equisetum arvense*), sedges (*Carex* spp.), or skunk cabbage (*Lysichitum americanum*) located in small, seasonally-flooded or saturated pockets within forested sites.

Shrubfields of sitka alder (*Alnus sinuata*) that occupy avalanche chutes in other ecosystems often provide spring and summer forb-feeding sites and secure areas for bedding. Willow (*Salix* spp.) shrubfields occupy similar sites at upper elevations in the North Cascades, whereas shrubfields of a willow/vine maple (*Acer circinatum*) composite occur at lower elevations. Dense shrubfields of mountain-ash (*Sorbus* spp.) also occupy some avalanche chutes at higher elevations in the North Cascades, while bittercherry, (*Prunus emarginata*) or western serviceberry (*Amalanchier alnifolia*) shrubfields may occur on lower slopes.

Beargrass (*Xerophyllum tenax*) sidehill parks provide important denning habitat in other ecosystems (Servheen 1981, Jonkel 1982). Although beargrass occurs only in a small distribution in the southwestern corner of the North Cascades (J. Henderson, pers. commun. 1986), high-elevation meadows of sedge or heath (*Phyllodoce empetriformis*) and heather (*Cassiope* spp.) may provide analogous components for grizzly bear denning habitat here.

In other ecosystems, low-elevation stream bottoms often produce open canopy black cottonwood (*Populus trichocarpa*) stands, which are often associated with important understory foods, such as yellow hedysarum (*Hedysarum sulphurescens*) (Jonkel 1982, McLellan 1982, Hamer and Herrero 1983, Mace 1984). Stream flood plains on the east slope of the North Cascades often produce black cottonwood stands. Although we did not document yellow hedysarum, we did note the presence of several species of biscuit-root, which is another important grizzly bear food in other ecosystems (Jonkel 1982, Servheen 1982, Aune et al. 1984, Mace 1984).

North Cascades west slope stream bottoms usually produce mixed stands of red alder (*Alnus rubra*) and big-leaf maple (*Acer macrophyllum*). As with the east slope sites, these areas apparently lack important root foods for grizzly bears. However, these alder/maple stands may still provide spring habitats by supporting an understory of bracken fern (*Pteridium aquilinum*) and lady fern (*Athyrium filix-femina*). As noted in Rocky Mountains ecosystems, Archibald et al. (1985) documented grizzly bears feeding on roots and leaves of skunk cabbage and stems of Douglas' water-hemlock (*Cicuta douglasii*) in low-elevation stream bottoms of the west slope in British Columbia. Both of these species occur on similar west slope sites in the North Cascades, but our scat analysis failed to identify them as local bear foods.

West slope habitats apparently provide the most significant differences in vegetal composition from other ecosystems south of Canada. Most noticeable is the addition of several species of fruiting shrubs: Alaska huckleberry (*Vaccinium alaskense*), Cascade huckleberry (*V. deliciosum*), evergreen huckleberry (*V. ovatum*), oval-leaf huckleberry (*V. ovalifolium*), red bilberry (*V. parvifolium*), high-bush cranberry (*Viburnum edule*), Pacific blackberry (*Rubus ursinus*), and salmonberry (*R. spectabilis*). The percent cover of *Vaccinium* spp. is high in many of the forested vegetation types.

Many east slope habitats in the North Cascades resemble vegetal components found in Montana and Wyoming, although the physiognomy and species composition of several plant communities differ. For example, huckleberry shrubfields do not usually occur as expansive understory vegetation classes on the east slope here. Instead, it seems that most fruit shrubs in the North Cascades occur in smaller communities of wider distribution.

Upper-elevation grass sidehill parks in other ecosystems often produce dense clumps of alpine hedysarum (*Hedysarum alpinum*) or biscuit-root. On similar sites on the North Cascades east slope, licorice-root (*Ligusticum* spp.) and Sitka valerian (*Valeriana sitchensis*) occur more commonly, often in association with American false hellebore (*Veratrum viride*).

Forested stands in the North Cascades likely provide seasonal feeding sites and denning habitat, as well as security cover for travel corridors and breeding sites (McLellan 1982, Almack 1985). Spring feeding sites probably exist in horsetail and sedge marshes of western red cedar (*Thuja plicata*)/ western hemlock stands. These stands also support dense patches of skunk cabbage.

We watched 2 black bears feed on clover (*Trifolium* spp.) and grasses (Graminoid spp.) in early June on the west slope. We viewed 4 black bears feeding in an avalanche chute on the leaves of angelica (*Angelica arguta*) and sitka valerian in late July along the Cascade crest. Also in late July, we observed a black bear family group feeding on fruits of western serviceberry and big huckleberry above the Methow River on the east slope. We watched several black bears feed on ants (*Camponotus* and *Formica* spp.) collected from logs, stumps, rocks, and ant hills throughout the ecosystem. On the east slope in August, we found a mule deer (*Odocoileus hemionus*) carcass that had been fed on by at least 1 black bear. We could not determine if the black bear had killed the deer, or fed on the carcass.

In other ecosystems, grizzly bears use certain plant and animal foods during specific seasons. Identification and conservation of these foods and the habitat components that support them is vital to the survival of the North Cascades grizzly bear population.

Spring habitats in other ecosystems often include low-elevation, wet meadows. As discussed earlier, few of these meadows exist in the North Cascades, but other analogous spring feeding sites are available. We would anticipate grasses, sedges, horsetail, skunk cabbage, ungulate carrion, and small mammals to be important spring foods in the NCGBE. Succulent shoots of false hellebore, lady fern, cow parsnip, and thistle (*Cirsium* spp.) are also probable spring foods here. In its distribution throughout the North Cascades in disturbed sites, coltsfoot (*Petasites frigidus*) may be analogous to cow parsnip. Coltsfoot is likely used by grizzly bears in coastal British Columbia (T. Hamilton, pers. commun. 1989) and is used by grizzly bears in southeast Alaska (J. Schoen, pers. commun. 1989). Roots and bulbs of plants like biscuit-root, glacier lily, avalanche lily (*Erythronium montanum*), western springbeauty (*Claytonia lanceolata*), Siberian miner's-lettuce (*Montia sibirica*), few-flowered shooting star (*Dodecatheon pauciflorum*), and yellow bell (*Fritillaria pudica*) probably are also important spring foods.

Winter-killed ungulates may provide an early spring supply of protein to grizzly bears in the North Cascades. To assess this food source, we digitized ungulate winter ranges on the east slope of the ecosystem (Table 11, Fig. 15). On the west side, areas below 670 m elevation were mapped as ungulate winter range. Small mammal grizzly bear foods in the North Cascades probably include hoary marmots, yellow-bellied marmots (*Marmota flaviventris*), Columbian ground squirrels (*Spermophilus columbianus*), Cascade golden-mantled ground squirrels (*S. saturatus*), meadow voles (*Microtus pennsylvanicus*), and deer mice (*Peromyscus maniculatus*). Some of these animals could be grizzly bear foods throughout the snow free season. Anadromous fishes are available to grizzly bears over a large portion of the North Cascades (Table 12, Fig. 16). Hydroelectric dams on some of the major rivers in Washington have severely decreased or, in some cases, completely blocked seasonal runs of anadromous fishes; this is especially true on the east side of the ecosystem.

Summer plant foods in other ecosystems often include forbs, grasses, sedges, horsetail, and bulbs. The most important summer forbs in the North

Cascades likely include angelica, licorice-root, cow parsnip, and Sitka valerian. Shrub fruits become available in late summer and in the North Cascades probably include all of the huckleberries, blackberry, western serviceberry, mountain-ash, high-bush cranberry, salmonberry, elderberry (*Sambucus* spp.), buckthorn (*Rhamnus alnifolia*), dogwood (*Cornus* spp.), cherry (*Prunus* spp.), honeysuckle (*Lonicera* spp.), thimbleberry (*Rubus parviflorus*), and red raspberry (*R. idaeus*).

As documented in other ecosystems, fall grizzly bear foods for the North Cascades are likely predominately shrub fruits. In some ecosystems, bears switch back to bulbs of glacier lily and biscuit-root in the fall. Grizzly bears may dig the roots of specific grasses, sedges, forbs, and shrubs, including pinegrass (*Calamagrostis rubescens*), bluebunch wheatgrass (*Agropyron spicatum*), beaked sedge (*Carex rostrata*), angelica, licorice-root, Sitka valerian, mountain sweet-cicely (*Osmorhiza chilensis*), coolwort foamflower (*Tiarella trifoliata*), queen's cup (*Clintonia uniflora*), and black elderberry (*Sambucus racemosa*) (Almack 1985). Nuts of whitebark pine (*Pinus albicaulis*) are an important fall food in the Yellowstone ecosystem (Knight and Blanchard 1983). Similarly, the North Cascades supports small stands of whitebark pine at higher elevations along the Cascade crest; these areas cover less than 1% of the ecosystem. We cannot document the value of pine nuts as an important local fall food in this area.

Of 426 scats collected during the evaluation, one scat was confirmed as grizzly bear by its association with confirmed grizzly bear tracks. This grizzly bear scat contained grass and forb vegetal parts, as well as ants. A subsample of 120 scats was analyzed to produce a general list of food items undifferentiated to bear species (Table 13, Fig. 17). These data indicate that many of the same species of grizzly bear foods identified in other ecosystems are also used by bears in the NCGBE. It is also apparent from our scat data that seasonal use of these foods is the same as noted by researchers in other study areas in the Rocky Mountains (Craighead et al. 1982) and coastal British Columbia (Archibald et al. 1985).

<u>Objective No. 5</u>. Collect information concerning the current level of human activities within the NCGBE, including human population centers, livestock allotments, and recreation sites.

The isolation of a grizzly bear ecosystem is a function of the type and amount of human activities that influence the overall effectiveness of required habitats and the security of individual grizzly bears (Craighead et al. 1982, McLellan and Shackleton 1988, Frederick 1991). Human settlement and resource use within the North Cascades have increased dramatically since historic grizzly bear population levels, but the area still provides a large tract of habitat to support a grizzly bear population.

There are 69 population centers, 258 campgrounds (excluding the backcountry camps in the NCNP), and 34 other sites (e.g. airstrips, ski areas) within the NCGBE. Assuming a zone of influence of 1,500 m around population centers and 500 m around each of the other sites, 43,800 ha (1.7% of the ecosystem) of habitat are affected. If the zones of influence are 2,000 m and 1,000 m for population centers and other sites, respectively, 110,765 ha (4.2% of the ecosystem) of habitat are affected.

<u>Roads</u>

Nine wilderness areas and NCNP comprise roughly 1,020,912 ha, or 39%, of the NCGBE (Table 14, Fig. 18). Our road density analysis showed that 68% of the ecosystem, including wilderness areas, has no open roads. Portions of currently roadless areas on national forest lands have been allocated to some level of commodity use in forest and resource management plans and may be managed for future resource extraction, with access by new road construction (U.S. Department of Agriculture 1989, 1990a, 1990b).

We identified 14,594 km of roads in the NCGBE (Table 15, Fig. 19). Road densities up to 1 km/km² occurred on 10% (243,927 ha) of the study area. Road densities from 1-3 km/km² occurred on 18% (469,855 ha) of the ecosystem, and densities exceeding 3 km/km² occurred on 4% (110,376 ha) of the area. While a relatively high proportion of the ecosystem had no open roads, the majority of the roads were found in low- to mid-elevation vegetation types that are seasonally important to grizzly bears. The distribution of open roads at lower elevations likely decreases the effectiveness of some frontcountry habitats.

Recreation

Recreation use in the ecosystem is expressed in Recreation Visitor Days (RVD's) on the national forests and Recreation Visits on the national park and recreation areas. Use is reported for three categories: developed recreation (use that occurs in developed sites), dispersed recreation (that which is not associated with developed sites), and backcountry (wilderness) use (Table 16, Fig. 20).

The majority of the trails in the NCGBE occur in wilderness and roadless areas (Fig. 21). Although our results may give the initial impression of a high-density trail system throughout the North Cascades, it is important to note that wilderness use is not equally distributed across the NCGBE. The Pasayten Wilderness Area in the northern part of the ecosystem, is 214,930 ha and receives 73,000 RVD's annually. The Alpine Lakes Wilderness Area, in the southern portion of the ecosystem, is 145,735 ha and receives greater than 300,000 RVD's. The NCNP has 114 designated backcountry sites where camping is restricted and assigned by permit to these areas. A significant amount of recreation occurs on lands managed by WDW and Washington Department of Natural Resources (WDNR); however, data for these areas was not available during our brief evaluation of this activity.

Timber Harvest

Timber harvest occurs on the national forests, lands managed by the WDNR, and private lands. Approximately 263 million board feet of timber are sold annually from federal and state lands (Table 17) (R. Klienfelder, E. Thomas, C. Vandemoer, W. Bidstrup, J. Beaster, L. Haselet, pers. commun. 1991). This total may change when final adjustments are made to meet habitat requirements for the northern spotted owl (*Strix occidentalis caurina*). There are additional areas on the national forests where timber harvest is restricted or not scheduled, e.g. allocated roadless areas and the North Cascades Scenic Highway. No data were available for timber harvest rates on private lands within the study area.

Livestock Grazing

Livestock grazing is permitted on the ONF, WNF, state land managed by WDNR, and private land. The allotments on national forests occur on approximately 477,749 ha (19% of the NCGBE), portions of which are in wilderness (Table 18, Fig. 22).

Sheep allotments on national forests allow 36,607 Animal Unit Months (AUM's) of annual sheep use; 1,200 of these AUM's are on the ONF and the remaining on the WNF. All of the sheep use on the ONF is by one permittee and two allotments are occupied in alternate years. Portions of the use on the ONF is within wilderness. Although some of the sheep allotments are within wilderness on the WNF, they are in no-use status.

Cattle grazing on the national forests is permitted on the ONF and WNF only. A total of 30,724 AUM's are permitted on the ONF and WMF, with 23,855 on the ONF and 6,869 on the WNF. No livestock use is permitted on the MBSNF.

We have unconfirmed evidence that some level of predator control has occurred on federally-permitted sheep allottments on the ONF and WNF. This control activity apparently has included grizzly bears, gray wolves, black bears, coyotes, golden eagles (*Aquila chrysaetos*), and hawks (*Accipiter* and *Buteo* spp.). Federal and state agency representatives have been notified of this information and a more intensive effort is now applied to educate the permittees and the herders about the protected status of some of these species and the need to coordinate control activities with the agencies, rather than dealing with it alone and, possibly, illegally.

Livestock use on private lands and lands managed by WDNR has not been quantified or categorized by livestock type or AUM's permitted. On private lands within the ecosystem, most of the grazing is by cattle, but horses, pigs, and sheep are all present. Horse operations are primarily for recreational use and use by commercial outfitters. Sheep, other than on the national forests, are restricted to small bands in confined locations within east side habitats.

No large volume hog (*Sus scrofa*) farms or poultry (*Gallus domesticus* and *Meleagris gallopavo*) operations are known within the ecosystem. Several commercial mink (*Mustela vison*) farms are located on private lands on the east slope of the ecosystem, near WNF lands. Commercial and private apiaries occur in virtually all agricultural areas of the North Cascades.

CONCLUSIONS

Objective No. 1. Collect, confirm and record data concerning reports of grizzly bear observations in the NCGBE.

We have documented the presence of a small, resident, widely-distributed, and reproducing grizzly bear population in the NCGBE. We ranked 21 observation reports from 1964 to 1991 as Class 1 grizzly bear observations. These Class 1 observations included verification of a video of 2 grizzly bears, identification of tracks, and verification of a food cache. No grizzly bears were radio-marked during our evaluation of the North Cascades.

No reliable method exists for censusing bear populations; therefore, population estimates for grizzly bears are often educated guesses. Based on our research experience in 5 of the 6 grizzly bear ecosystems south of Canada and the quality, quantity, and distribution of grizzly bear observations recorded for this ecosystem, we estimate that the North Cascades population consists of less than 50 grizzly bears and may be as low as 10 to 20 grizzly bears. Our evaluation also documented that grizzly bears existed

historically throughout the west slope of the Cascade Mountains and likely included the coastal regions of Washington and Oregon.

Objective No. 2. Evaluate the vegetal components of the NCGBE, documenting the suitability of the area to provide grizzly bear seasonal habitats.

We identified 50 vegetation and cover types on our Level 2 map of the NCGBE, and calculated the relative abundance of each type. These vegetation types and their abundance were summarized for each administrative unit, including wilderness areas. Approximately 39% of the ecosystem is within designated wilderness areas or the NCNP. No dens were confirmed within the ecosystem but we are confident that the North Cascades provides the physiographic characteristics that grizzly bears require for successful denning. Our analysis of snow free areas during an average snowfall year provides a general indication of areas available to grizzly bears upon den emergence. We suspect that many microsites above the snow free zone would be available to individual grizzly bears in early spring. Based upon the diversity, abundance, and distribution of vegetation types, we feel the NCGBE provides all of the seasonal habitats neccessary to support a viable population of grizzly bears.

Objective No. 3. Produce a map of general vegetation types with an accuracy level of 85%.

We conducted an accuracy assessment for our vegetation map generated from Landsat imagery. We attained 94.8% accuracy on the Level 1 map and 93.2% accuracy on the more detailed Level 2 map.

Objective No. 4. Produce a baseline list of probable grizzly bear foods identified in the NCGBE.

We reviewed literature from grizzly bear studies south of Alaska to compile a list of known grizzly bear foods. We identified 100 plant species from other studies that are present in the NCGBE. Additionally, there are species present in the NCGBE that are not identified from other studies but may be grizzly bear foods. We also assessed the abundance and diversity of these foods within each vegetation type and found a mean of 37 (range = 3-90) species in each vegetation type.

We analyzed the availability of winter mortality ungulate carcasses as a food source for grizzly bears by mapping the ungulate winter ranges in the ecosystem and the associated ungulate populations within each winter range. We also summarized available data on anadromous fish populations and important fruit-producing shrubs to analyze fall foods. Based on the species and distribution of local plant and animal foods identified here, we feel that adequate food resources are available to support a viable population of grizzly bears in the NCGBE.

Objective No. 5. Collect information concerning the current level of human activities within the NCGBE, including human population centers, livestock allotments and recreation sites.

We summarized vegetation information around identified human population centers, recreation areas (campgrounds, ski areas) and air strips. Zones of influence of 1,000 m and 2,000 m around recreation sites and population centers, respectively, affected 4.2% of the habitat. We also summarized road density data and concluded that 68% of the ecosystem has no open roads and only 4% of the NCGBE has road densities that are equal to or greater than 3 km/km^2. Recreation use on federal lands within the area was estimated to be 8 million RVD's annually. The majority of this use is associated with dispersed recreation, not with developed campgrounds or wilderness areas. Almost 1 million RVD's annually occur in wilderness areas. These are not equally distributed and some areas receive much higher recreation use than others. Cattle and sheep are present in the NCGBE and do graze in wilderness. AUM's of permitted grazing on the ONF and WNF total 30,724 for cattle and 36,607 for sheep. The reported average annual allowable timber sale quantity from the national forests and WDNR lands within the ecosystem is 263 million board feet. We feel that the current level of human activities within the NCGBE does not preclude the recovery of a viable population of grizzly bears.

ECOSYSTEM SUITABILITY

We also assessed the suitability of the NCGBE to support a viable population of grizzly bears (Almack 1986) by using the seven characteristics identified by Craighead et al. (1982) and Craighead et al. (1985). These ecosystem characteristics are space, isolation, sanitation, denning, safety, vegetation types, and food.

Space. Conservation biologists (Soulé 1985, Belovsky 1987, Shaffer 1987, Westman 1990) have discussed that most nature reserves are too small to maintain populations of large organisms for long periods of time. Even national parks, such as Yellowstone, are considered too small to maintain viable populations of certain bears and other upper trophic level carnivores (Soulé 1980, Salwasser et al. 1987). The NCGBE is 2,620,755 ha, the largest of the six ecosystems identified in the 1982 Grizzly Bear Recovery Plan (Table 19). Assuming the NCGBE has adequate quality and quantity of required habitats for grizzly bears, it appears that the area is large enough to support a viable population of grizzly bears. In addition, a significant amount of contiguous habitat (about 2.0 million ha) is present in British Columbia. This presents a tremendous opportunity to not only provide a large area for grizzly bears, but also to manage on an biogeographical ecosystem level.

Isolation. Craighead et al. (1982) described isolation as a refugium located away from human activities, such as timber management, recreation, and roads. Approximately 39% of the NCGBE is designated as wilderness or is in NCNP. Additionally, 68% of the ecosystem has no open roads. Human activities do not appear to be of a magnitude that would reduce the suitability of the NCGBE to a point that it could not support a viable population of grizzly bears.

Isolation can also relate to the potential of immigration or emigration in the given population. Wilcox (1980) described an island population as any discrete ecological unit that is insulated from other similar units. As a part of the southern extension of occupied grizzly bear range, the NCGBE is not a true island population; however, it may be functionally isolated from adjacent populations, as a result of low grizzly bear population levels in adjacent areas and the high level of human settlement between the ecosystems (Almack 1986; R. Forbes, pers. commun. 1992). An effectively isolated population has fewer than one individual per generation immigrating and successfully reproducing (Gilpin 1987, Lande and Barrowclough 1987). Although it may be appropriate to evaluate grizzly bear population support capabilities of linkage zones between the North Cascades and adjacent areas, in effect, the NCGBE should be managed as an island population.

Denning. No dens were confirmed in the ecosystem. Based on information from other ecosystems, grizzly bears prepare winter dens in excavated chambers or natural caves above 1,600 m on slopes with deep snow accumulation. The NCGBE is a large area with isolated, steep, snow-packed slopes and many natural caves, all present at high elevations. Many potential den sites also occur below 1,600 m; these sites are associated with specific local geological conditions, such as ridge systems stemming from major volcanic peaks on the west slope.

Safety. No human-induced mortality of grizzly bears was confirmed during this evaluation. Assuming no undocumented, human-caused deaths, current human-induced mortality is at an acceptable level for supporting a viable grizzly bear population. However, if our low estimate of 10 to 20 grizzly bears in the North Cascades is correct, this population likely cannot survive even an extremely small rate of human-caused mortality. Maintaining a zero human-induced mortality level is critical for the survival of the North Cascades grizzly bear population.

Each cooperating agency should review their regulations and policies to ensure that no agency activity leads to human-induced grizzly bear mortality. In other grizzly bear ecosystems, including the Selkirk Mountains of northeastern Washington, hunting regulations have been modified to minimize the potential for grizzly bear mortality. WDW regulations should be reviewed to identify potential conflicts with North Cascades grizzly bear conservation strategies. With public assistance, such regulations could be better tailored to allow for the continued support of grizzly bear conservation in the North Cascades, while providing the maximum recreational opportunity to the public.

Federal and state agencies have adopted the Interagency Grizzly Bear Guidelines (Interagency Grizzly Bear Committee 1986), which include a management strategy to minimize the potential for human-bear conflicts. The Forest Service Manual (FSM 2676.1) directs FS activities concerning conservation of the North Cascades grizzly bear population. These agency regulations should be implemented as soon as possible to promote the security of this population.

The NCNP Bear Management Plan addresses management issues related to nuisance bears and human-bear conflicts. This plan is being revised to incorporate more information specific to grizzly bears, including current guidelines for visitor etiquette designed to prevent management-related grizzly bear mortalities resulting from bear-human conflicts.

The IGBC has adopted an interagency nuisance grizzly bear plan (Interagency Grizzly Bear Committee 1989) for use in the northwest ecosystems. This plan should be reviewed for the North Cascades and tailored to current grizzly bear conservation goals. Federal and state relocation sites for nuisance bears must be identified throughout the ecosystem, prior to the need for their use.

Sanitation. Grizzly bears may become conditioned to human activities when the bears associate humans with a potential food source (Herrero 1979, Cottingham and Langshaw 1981, Craighead and Craighead 1970, Anon. 1984, Jope 1985, U.S. Fish and Wildlife Service 1982, 1990). We documented one human-bear conflict involving sanitation problems in the North Cascades.

This incident involved people baiting black bears into the Hannegan Pass area of Mount Baker Ranger District in the fall of 1989. Powdered, flavored gelatin was poured onto several large boulders in this open, subalpine area to draw black bears close enough for short-distance photography opportunities. During the time that gelatin was avaliable to bears in the area, a woman hiker was charged, thrown to the ground, and stripped of her backpack by an adult black bear. Although frightened, the woman was not injured in this incident. This situation was managed by stationing a backcountry ranger in the pass to instruct campers in bear country etiquette and to assist those who did not have rope to hang their storage items and those who did not know how to hang these items. Our review of human-bear conflicts in the Hannegan Pass area revealed that black bears raided improperly-stored human food caches and camping gear several times each year. Such incidents were common knowledge among FS district staff. Both the FS and NCNP have temporarily closed Hannegan Pass and nearby Boundary Camp to camping during times following less-aggressive human-bear conflicts in the Hannegan Pass area.

We documented only food-conditioned *black bears* in NCNP and FS campgrounds and administrative facilities. NCNP provides bear-resistent refuse containers in all of their frontcountry camps that are accessible by vehicle. Funding restrictions have precluded the development of suitable food storage systems for frontcountry camps accessed by foot or boat and for backcountry sites. Trees in many parts of the North Cascades backcountry are not present, too small, or not shaped properly to allow for proper hanging of food, cooking gear, garbage, and cosmetics, as described by IGBC literature. As funding and management priorities allow, NCNP plans to upgrade their backcountry sites in the near future to meet interagency bear standards. FS facilities generally lack correct bear sanitation facilities and literature. These bear management discrepancies should be corrected as soon as budgets allow to prevent human injury or death, or the unnecessary death of a grizzly bear or black bear.

Sanitation is a management issue that must be addressed (Herrero 1985) and could have severe implications to the survival and long-term management of the small population of grizzly bears in the NCGBE. The full implementation of the Interagency Grizzly Bear Guidelines (Interagency Grizzly Bear Committee 1986) and use of available public information and education materials (Appendix M) would greatly improve this situation.

Vegetation Types and Food. As discussed earlier, we conclude that the vegetal components and the plant and animal resources available in the NCGBE provide excellent habitat and foods to support a viable grizzly bear population.

LITERATURE CITED

Agee, J.K., and J. Kertis. 1986. Vegetation cover types of the North Cascades. National Park Service Cooperative Park Studies Unit, College of Forest Resources, Univ. of Washington, Seattle. 64 pp. + map.

Allendorf, F.W., F.B. Christiansen, T. Dobson, W.F. Eanes, and O. Frydenberg. 1979. Electrophoretic variation in large mammals. I: The polar bear, *Thalarctos maritimus*. Hereditas 91:19-22.

Almack, J. 1990. North Cascades grizzly bear investigations; 1987 and 1988 progress report. Washington Dept. of Wildlife, Olympia. 33 pp.

______. 1986. North Cascades grizzly bear project; annual report, 1986. Washington Dept. of Game, Olympia. 71 pp.

______. 1985. Evaluation of grizzly bear habitat in the Selkirk Mountains of north Idaho. M.S. Thesis. Univ. of Idaho, Moscow. 87 pp.

______. 1980. Examination of the Pillick Ridge grizzly bear travel corridor, Cabinet Mountains, Montana. Special Rpt. No. 53, Border Grizzly Project, Univ. of Montana, Missoula. 89 pp.

Anonymous. 1984. Guidelines for determining grizzly bear nuisance status and for controlling nuisance grizzly bears in northern Idaho and Washington. 1989 revision. Idaho Dept. of Fish and Game, Washington Dept. of Game, U.S. Fish and Wildlife Service, U.S. Forest Service, Border Grizzly Project. 9 pp + App.

Archibald, W.R., A.N. Hamilton, and E. Lofroth. 1985. Coastal grizzly research project. Progress Report - Year 3 - 1984; Working Plan - Year 4 - 1985. Wildlife Working Report No. WR-17, Wildlife Habitat Research Report No. WHR-22. Wildlife Branch, Ministry of Environment, Victoria, British Columbia. 62 pp.

Aune, K., T. Stivers, and M. Madel. 1984. Rocky Mountain Front grizzly bear monitoring and investigation. Montana Dept. of Fish, Wildlife and Parks, Helena. 239 pp.

______. and T. Stivers. 1982. Rocky Mountain Front grizzly bear monitoring and investigation. Cooperative report of the Montana Dept. of Fish, Wildlife and Parks, Helena. 143 pp.

Belovsky, G.E. 1987. Extinction models and mammalian persistence. Pages 35-57 *in* M. Soulé, ed. Viable Populations for Conservation. Cambridge University Press, New York.

Bjorklund, J. 1981. Species, subspecies, and distribution of mammals in the North Cascades. Misc. Research Paper NCT-14. USDI National Park Service, North Cascades National Park Service Complex, Sedro Woolley, Washignton. 19 pp.

______. 1980a. Historical and recent grizzly bear sightings in the North Cascades. Misc. Research Paper NCT-13. USDI National Park Service, North Cascades National Park Service Complex, Sedro Woolley, Washington. 10 pp.

______. 1980b. Habitat and vegetative characteristics of a remote backcountry area as related to reestablishment of a grizzly bear population in the North Cascades National Park Complex. Misc. Research Paper NCT-10. USDI National Park Service Complex, Sedro Woolley, Washington. 38 pp.

______. 1978. Preliminary investigation of the feasibility of reestablishing a grizzly bear population in the North Cascades National Park Complex. Misc. Research Paper NCT-8. USDI National Park Service Complex, Sedro Woolley, Washington. 35 pp.

Brown, W.C. 1968. Early Okanogan history. Ye Galleon Press, Fairfield, Washington. 27 pp.

Butterfield, B.R., D.L. Davis, and J.W. Unsworth. 1989. Stratified Landsat classification of north-central Idaho and adjacent Montana. Pages 263-266 *in* Proceedings-Land classification based on vegetation: applications for resource management. GTR INT-257.

______, and C.H. Key. 1986. Mapping grizzly bear habitat in Glacier National Park using a stratified Landsat classification. Pages 58-66 *in* G.P. Contreras, and K.E. Evans, eds. Proceedings-Grizzly bear habitat symposium. GTR INT-207.

______, and J.A. Almack. 1985. Evaluation of grizzly bear habitat in the Selway-Bitteroot Wilderness Area. Idaho Dept. of Fish and Game Project No. 04-78-719. Cooperative Wildlife Research Unit, Univ. of Idaho, Moscow. 66 pp.

Christensen, A.G., and M.J. Madel. 1982. Cumulative effects analysis process: grizzly habitat component mapping. USDA Forest Service publication. 38pp.

Collins, J.M. 1974. Valley of the spirits. University of Washington Press, Seattle. 267 pp.

Cottingham, D., and R. Langshaw. 1981. Grizzly bear and man in Canada's mountain parks. Summerthought Publication, Banff, Alberta. 60 pp.

Craighead, J.J., F.L. Craighead, and D.J. Craighead. 1985. Using satellites to evaluate ecosystems as grizzly bear habitat. Pages 101-112 *in* G.P. Contreras, and K.E. Evan, compilers. Proceedings - grizzly bear habitat symposium. Missoula, Montana, April 30-May2, 1985. USDA Forest Service, Intermountain Res. Sta., Ogden, Utah. 252 pp.

______, and J.A. Mitchell. 1983. Grizzly bear (*Ursus arctos*). Pages 515-556 *in* J.A. Chapman, and G.A. Feldhamer, eds. Wild mammals of North America; biology, management, and economics. The Johns Hopkins Univ. Press, Baltimore. 1147 pp.

______, J.S. Sumner, and G.B. Scaggs. 1982. A definitive system for analysis of grizzly bear habitat and other wilderness resources. Wildlife-Wildlands Institute Monogr. No. 1. UofM Foundation, Univ. of Montana, Missoula. 279 pp.

Craighead, F.C., Jr., and J.J. Craighead. 1972. Grizzly bear prehibernation and denning activities as determined by radiotracking. Wildl. Monogr. No. 32. 35 pp.

______, and J.J. Craighead. 1970. Radiotracking of grizzly bears in Yellowstone National Park, Wyoming, 1962. Pages 63-71 *in* P.H. Oehser, ed. National Geographic Society Research Reports, 1961-1962. Natl. Geogr. Soc., Washington, D.C.

00727

Dicks, S.E., and T.H. Lo. 1990. Evaluation of thematic map accuracy in a land-use and land-cover mapping program. Photogram. Eng. 56(9):1247-1252.

Franklin, J.F., and C.T. Dyrness. 1973. Natural vegetation of Oregon and Washington. Gen. Tech. Report PNW-8. USDA Forest Service, Pacific Northwest Forest and Range Exp. Stn., Portland. 417 pp.

_____, and J.M. Trappe. 1968. Plant communities of the Northern Cascade Range: a reconnaisance. Northwest Sci. 37(4):163-164 (abstract).

Frederick, G.P. 1991. Effects of forest roads on grizzly bears, elk, and gray wolves: a literature review. USDA Forest Service, Kootenai National Forest, Libby, Montana.

Garrison, G.A., and J.M. Skovlin. 1976. Northwest plant names and symbols for ecosystem inventory and analysis. USDA Forest Service Gen. Tech. Rep. PNW-46, PNW Forest and Range Exp. Sta., Portland, Oregon. 263 pp.

Gibbs, G. 1972. Indian tribes of Washington Territory. Ye Galleon Press, Fairfield, Washington. 56 pp.

Gilpin, M.E. 1987. Spacial structure and population vulnerability. Pages 124-139 *in* M. Soulé, ed. Viable populations for conservation. Cambridge University Press, Cambridge, New York.

Glenn, L.P., and L.H. Miller. 1980. Seasonal movements of an Alaskan Penisula brown bear population. Pages 307-312 *in* C.J. Martinka and K.L. McArthur, eds. Bears - their biology and management. Proc. 4th Int. Conf. on Bear Research and Management. Bear Biol. Assoc. Conf. Serv. No. 3.

Goodwin, E. 1984. Differentiation of brown bear and black bear scats: an evaluation of bile acid detection by thin layer chromatography. Big game studies: Vol. VI black bear and brown bear, Susitna hydroelectic project 1983 annual report. Document No. 2325:46-47. Alaska Dept. of Fish and Game, Juneau.

Hall, E.R., and K.R. Kelson. 1959. The mammals of North America. Vol. 2. The Ronald Press Company, New York. 1083 pp. + App.

Hamer, D., and S. Herrero, eds. 1983. Ecological studies of the grizzly bear in Banff National Park. Univ. of Calgary, Calgary, Alberta. 303 pp.

_____, and _____. 1980. Differentiating black and grizzly bear faeces. National Research Council of Canada, Grant No. A-6507. Univ. of Calgary, Calgary, Alberta. 8 pp.

Harris, A.G., and E. Tuttle. 1977. Geology of national parks. Kendall/Hunt Publishing Company, Dubuque, Iowa. 554 pp.

Henderson, J.A., and D. Peter. 1985. Preliminary plant associations and habitat types of the Mt. Baker Ranger District, Mt. Baker-Snoqualmie National Forest. USDA Forest Service, Pacific Northwest Region, Olympia, Washington. 74 pp. + app.

Herrero, S. 1985. Bear attacks: their causes and avoidance. Winchester Press, New Century Publishers, Inc., Piscataway, New Jersey.

_____. 1979. Human injury inflicted by grizzly bears. Science 170:593-598.

Hill, M.O., and H.G. Gauch, Jr. 1980. Detrended correspondence analysis, an improved technique. Vegetatio 42:47-58.

Hitchcock, C.L., and A. Cronquist. 1987. Flora of the Pacific Northwest. University of Washington Press, Seattle. 730 pp.

_____, _____, M. Ownbey, and J.W. Thompson. 1955-1969. Vascular plants of the Pacific Northwest. Volumes 1-5. University of Washington Press, Seattle.

Ingles, L.G. 1965. Mammals of the Pacific states. Stanford University Press, Stanford, California. 506 pp.

Interagency Grizzly Bear Committee. 1989. Guidelines for determining grizzly bear nuisance status and for controlling nuisance grizzly bears in northern Idaho and Washington. Revised from 1984. Interagency Grizzly Bear Committee, Denver, Colorado. 18 pp.

_____. 1986. Interagency grizzly bear guidelines. Adopted in 1987. Interagency Grizzly Bear Committee, Denver, Colorado.

Jonkel, C.J. 1982. Five year summary report. Special Report No. 60. Border Grizzly Project, School of Forestry, Univ. of Montana, Missoula. 277 pp.

Jope, K.L. 1985. Implications of grizzly bear habituation to hikers. Wildl. Soc. Bull. 13(1):323-334.

Kasworm, W. 1986. Cabinet Mountains grizzly bear study. 1985 Annual Progress Report. Montana Dept. of Fish, Wildlife and Parks, Helena. 81 pp.

Knight, R.R., D.J. Matson, and B.M. Blanchard. 1984. Movements and habitat use of the Yellowstone grizzly bear. Unpubl. report to the Interagency Grizzly Bear Committee. USDI National Park Service, Forestry Sciences Lab, Montana State Univ., Bozeman. 177 pp.

_____, and B.M. Blanchard. 1983. Yellowstone grizzly bear investigations. Report of the Interagency Study Team, 1982. USDI National Park Service. 45 pp.

Lande, R., and G.F. Barrowclough. 1987. Effective population size, genetic variation, and their use in population management. Pages 87-124 *in* M. Soulé, ed. Viable populations for conservation. Cambridge University Press, Cambridge, New York.

Leach, R. 1986. Grizzly bear habitat component mapping in the northern region. Pages 32-35 *in* G.P. Contreras, and K.E. Evans, eds. Proceedings - grizzly bear habitat symposium. Missoula, Montana, April 30 - May 2, 1985. GTR-INT-207.

Mace, R., T. Manley, and K. Aune. 1990. Use of systematically deployed remote cameras to monitor grizzly bears; 1989 report. Montana Dept. of Fish, Wildlife and Parks, Helena. 29 pp.

_____. 1984. Identification and evaluation of grizzly bear habitat in the Bob Marshall Wilderness Area, Montana. M.S. Thesis. Univ. of Montana, Missoula. 176 pp.

_____, and C.J. Jonkel. 1979. Seasonal food habitats of the grizzly bear (*Ursus arctos horribilis* Ord.) in northwestern Montana. *In* C. Jonkel, ed. Annual Report No. 5. Border Grizzly Project, School of Forestry, Univ. of Montana, Missoula. 222 pp.

Majors, H.M., ed. 1984. First crossing of the Picket Range 1859. Northwest Discovery, 5(22):90-116.

Mattson, D.J., and R.R. Knight. 1989. Evaluation of grizzly bear habitat using habitat type and cover type classifications. Pages 135-143 *in* Proceedings - Land classifications based on vegetation: applications for resource management. GTR-INT- 257.

McKee, B. 1972. Cascadia: the geologic evolution of the Pacific Northwest. McGraw-Hill Book Company, New York. 394 pp.

McLellan, B.N., and D.M. Shackleton. 1988. Grizzly bears and resource-extraction industries: effects of roads on behaviour, habitat use, and demography. J. Applied Ecol. 25:451-460.

______. 1982. Akamina-Kishinena grizzly project: progress report, 1980 (year 3). British Columbia Fish and Wildlife Branch, Cranbrook, British Columbia. 65 pp.

Miller, K.V., and M.J. Conroy. 1990. Spot satellite imagery for mapping Kirtland's warbler wintering habitat in the Bahamas. Wildl. Soc. Bull. 18:252-257.

Moore, T.D., L.E. Spence, and C.E. Dugnolle. 1974. Identification of the guard hairs of some mammals of Wyoming. Bull. No. 14, Wyoming Game and Fish Department, Cheyenne. 177 pp.

Morrison, P.H., D. Kloepfer, D.A. Leversee, C.A. Milner, and D.L. Ferber. 1990. Ancient forests on the Mt. Baker-Snoqualmie National Forest, analysis of conditions. The Wilderness Society, Washington, D.C. 19pp.

Mueller-Dombois, D., and H. Ellenberg. 1974. Aims and methods of vegetation ecology. John Wiley and Sons, New York. 547 pp.

Perry, J. 1978. Handling captured bears: capture, drugging, and radio-collaring. Border Grizzly Technical Committee, Working Paper No. 31. Border Grizzly Project, School of Forestry, Univ. of Montana, Missoula. 17 pp.

Picton, H.D. 1986. The chromatographic identification of bear scats. Unpubl. progress report for USDI Fish and Wildlife Service, Purchase Order 60; 181-05034-6. Montana State Univ., Bozeman.

Pierce, H.H. 1883. Report of an expedition from Fort Colville to Puget Sound, Washington Territory, by way of Lake Chelan and Skagit River, during the months of August and September, 1882. U.S. Government Printing Office, Washington, D.C. 25 pp.

Reynolds, H.V. 1980. North Slope grizzly bear studies. Job Progress Report; July 1, 1978, to June 30, 1979. Fed. Aid Wildl. Rest. Proj. W-17-11, Jobs 4.14 R and 4.15 R. Alaska Dept. of Fish and Game, Juneau. 65 pp.

Roe, J. 1980. The Northcascadians. Madrona Publishers, Seattle. 214 pp.

Rowe, R.C. 1974. Geology of our western national parks and monuments. Binfords and Mort, Portland, Oregon. 220 pp.

Ruby, R., and J. Brown. 1981. Indians of the Pacific Northwest: a history. University of Oklahoma Press, Norman. 294 pp.

Salwasser, H.C., C. Schonewald-Cox, and R. Baker. 1987. The role of interagency cooperation in managing for viable populations. Pages 159-174 *in* M. Soulé, ed. Viable Populations for Conservation. Cambridge University Press, New York.

Schneider, B. 1977. Where the grizzly walks. Mountain Press Publishing Company, Missoula, Montana. 191 pp.

Servheen, C. 1985. The grizzly bear. Pages 400-415 *in* R.L. DiSilvestro, ed. Audubon Wildlife Report 1985. The National Audubon Society, New York. 671 pp.

_____. 1983. Grizzly bear food habits, movements, and habitat selection in the Mission Mountains, Montana. J. Wildl. Manage. 47:1026-1035.

_____. 1981. Grizzly bear ecology and management in the Mission Mountains, Montana. Ph.D. Dissertation. Univ. of Montana, Missoula. 139 pp.

Shaffer, M. 1987. Minimum viable populations: coping with uncertainty. Pages 69-86 *in* M. Soulé, ed. Viable Populations for Conservation. Cambridge University Press, New York.

Sizemore, D. 1980. Foraging strategies of the grizzly bear as related to its ecological energetics. M.S. Thesis, Univ. of Montana, Missoula. 67 pp.

Soulé, M.E. 1985. What is conservation biology? BioScience 35(11).

_____. 1980. Thresholds for survival: maintaining fitness and evolutionary potential. Pages 151-170 *in* M. Soulé and B. Wilcox, eds. Conservation biology: an evolutionary- ecological perspective. Sinauer Associates, Inc. Sunderland, Massachusetts. 395 pp.

Staatz, M.H., R.W. Tabor, P.L. Weiss, J.F. Robertson, R.M. VanNoy, and E.C. Pattee. 1972. Geology and mineral resources of the northern part of North Cascades National Park, Washington. Geol. Surv. Bull. No. 1359. 139 pp.

Sullivan, P.T. 1983. A preliminary study of historic and recent reports of grizzly bears, *Ursus arctos*, in the North Cascades area of Washington. Unpubl. report of Washington Dept. of Game, Olympia. 37 pp.

Thompson, E.N. 1970. North Cascades N.P., Ross Lake N.R.A., and Lake Chelan N.R.A.: history basic data. Office of History and Historic Architecture, Eastern Service Center, USDI National Park Service, Washington, D.C. 301 pp.

Underhill, R. 1945. Indians of the Pacific Northwest. USDI Bureau of Indian Affairs, Washington, D.C. 232 pp.

U.S. Department of Agriculture. 1989. Land and Resource Management Plan: Okanogan National Forest. Final Environmental Impact Statement. Pacific Northwest Region, Portland, Oregon.

U.S. Department of Agriculture. 1990a. Land and Resource Management Plan: Wenatchee National Forest. Final Environmental Impact Statement. Pacific Northwest Region, Portland, Oregon.

_____. 1990b. Land and Resource Management Plan: Mount Baker-Snoqualmie National Forest. Final Environmental Impact Statement. Pacific Northwest Region, Portland, Oregon.

U.S. Fish and Wildlife Service. 1993. Grizzly bear recovery plan. Five-year revision draft. USDI Fish and Wildlife Service, Washington, D.C.

_____. 1982. Grizzly bear recovery plan. USDI Fish and Wildlife Service, Washington, D.C. 195 pp.

Westman, W.E. 1990. Managing for biodiversity. BioScience 40(1).

Wheeler, D.L. 1987. Computer analysis of ecological data, a user's manual for the Data General MV-series. USDA Forest Service, Siskyou National Forest.

Wilcox, B.A. 1980. Insular ecology and conservation. Pages 95-117 in M.E. Soulé, and B.A. Wilcox, eds. Conservation biology: an evolutionary-ecological perspective. Sinauer Associates, Inc. Sunderland, Massachusetts. 395 pp.

Williams, C.K., and B.G. Smith. 1990. Forested plant associations of the Wenatchee National Forest (Draft). USDA Forest Service.

______, and T.R. Lillybridge. 1983. Forested plant associations of the national forest. R6-ECOL-132B-1983. USDA Forest Service, Pacific Northwest Region, Portland, Oregon.

Wolfe, J.R. 1983. Electrophoretic differentiation between Alaskan brown and black bears. J. Wildl. Manage. 47(1):268-271.

Woolf, H.B., ed. 1992. Webster's new collegiate dictionary. G.C. Merriam Co., Springfield, Massachusetts. 1,532 pp.

Table 1. Area and portion of the North Cascades Grizzly Bear Ecosystem within each administrative unit or ownership.

ADMINISTRATIVE CLASS	AREA (ha)	PORTION OF ECOSYSTEM (%)
Private land (TOTAL)	263,394	10
State land (TOTAL)	217,206	8
Federal land (TOTAL)	2,140,155	82
Bureau of Land Management	(2,201)	(<1)
Okanogan National Forest	(599,617)	(23)
Wenatchee National Forest	(642,047)	(24)
Mount Baker-Snoqualmie NF	(620,847)	(24)
North Cascades National Park Service Complex	(275,443)	(11)
North Cascades Grizzly Bear Ecosystem Evaluation Area	2,620,755	100

Table 2. Class 1 (confirmed) grizzly bear observations (N = 22) reported during the 1986-1991 North Cascades Grizzly Bear Ecosystem evaluation. Observations in British Columbia were confirmed by British Columbia Wildlife Branch (BCWB).

No.	DATE	OBSERVATION	UTM LOCATION	LEGAL LOCATION	AREA OF OBSERVATION	OBSERVER
HISTORICAL						
1	19 Jun 1859	1 Adult (Killed)	5425400 mN 596500 mE	T 40N R 9E S 7	Mt Baker RD, MBSNF	Custer
CURRENT						
2	Fall 1964	1 Unaged (Killed)	5401300 mN 657500 mE	T 38N R 16E S 33	Winthrop RD, ONF	Ensley
3	10 Nov 1979	Tracks	5498000 mN 523000 mE	British Columbia	Upper Pitt, BC	Hahn
4	18 Sep 1980	1 Unaged	5497000 mN 607000 mE	British Columbia	Inkawathia Lake, BC	Keding
5	12 Jun 1982	1 Adult (Killed)	5538000 mN 477000 mE	British Columbia	Squamish Valley, BC	Unknown via BCWB
6	26 Sep 1982	1 Unaged (Killed)	5474500 mN 592300 mE	British Columbia	Slollicum Creek, BC	Unknown via BCWB
7	Sep 1983	3 Adults	5409200 mN 620200 mE	T 39N R 11E S 34	North Unit, NCNP	Hunger
8	Nov 1984	1 Adult	5385500 mN 692500 mE	T 36N R 20E S 19	Winthrop RD, ONF	Hunger
9	05 Oct 1986	1 Adult	5397700 mN 709300 mE	T 37N R 21E S 24	Winthrop RD, ONF	Cadman
10	21 Jun 1987	Tracks	5392500 mN 642300 mE	T 37N R 13E S 26	Ross Lake NRA, NCNP	Almack
11	Jul 1987	Skull	5368300 mN 643500 mE	T 35N R 14E S 36	South Unit, NCNP	Ohlstein
12	06 Jul 1988	2 Adults (Video)	5253300 mN 638700 mE	T 22N R 13E S 1	Cle Elum RD, WNF	Eagen
13	Apr 1989	Food Cache	5428500 mN 641700 mE	T 40N R 13E S 2	Ross Lake NRA, NCNP	Coss

Table 2. Continued.

No.	DATE	OBSERVATION	UTM LOCATION	LEGAL LOCATION	AREA OF OBSERVATION	OBSERVER
14	18 Oct 1989	Tracks	5389500 mN 605600 mE	T 37N R 9E S 36	Mt Baker RD, MBSNF	Bindseil
15a	17 Oct 1989	1 Adult	5243000 mN 657300 mE	T 21N R 15E S 11	Cle Elum RD, WNF	Harless
15b	27 Oct 1989	Tracks	5242400 mN 656500 mE	T 21N R 15E S 11	Confirmed 15a	Almack
16	26 May 1990	Track, Scat	5426900 mN 641000 mE	T 40N R 13E S 2	Ross Lake NRA, NCNP	Fitkin
17	Jul 1990	1 Unaged	5483400 mN 644800 mE	British Columbia	Jim Kelly Creek, BC	Reheis
18	20 Aug 1990	Tracks	5411300 mN 288800 mE	T 38N R 24E S 6	DNR, Okanogan County	Bedient
19	07 Jul 1991	Tracks	5259800 mN 631900 mE	T 23N R 13E S 17	Cle Elum RD, WNF	Keeler
20a	20 Jul 1991	1 Adult, 1 Cub	5345300 mN 678000 mE	T 32N R 18E S 28	Chelan RD, WNF	Worden
20b	23 Jul 1991	Tracks	5345300 mN 678000 mE	T 32N R 18E S 28	Confirmed 20a	Stream
21	Sep 1991	1 Unaged	5463200 mN 647500 mE	British Columbia	Paradise Valley, BC	Reheis
22	11 Sep 1991	Tracks	5266000 mN 677000 mE	T 23N R 17E S 1	Leavenworth RD, WNF	Strand

Table 3. Class 2 (high reliability) grizzly bear observations (N = 82) reported during the 1986-1991 North Cascades Grizzly Bear Ecosystem evaluation. Observations in British Columbia were evaluated by British Columbia Branch (BCWB).

No.	DATE	OBSERVATION	UTM LOCATION	LEGAL LOCATION	AREA OF OBSERVATION	OBSERVER
HISTORICAL						
1	20 Jun 1859	1 Adult, 3 Cubs	5425400 mN 596500 mE	T 40N R 9E S 7	Mt Baker RD, MBSNF	Custer
CURRENT						
2	1964	1 Adult	5378000 mN 713800 mE	T 35N R 22E S 17	Winthrop RD, OKNF	Holeman
3	06 Jul 1974	1 Adult	5248000 mN 637900 mE	T 22N R 13E S 26	Cle Elum RD, WNF	Dammarell
4	Aug 1975	1 Adult	5372100 mN 641900 mE	T 35N R 13E S 26	Mt Baker RD, MBSNF	Armey
5	1980	1 Adult, 2 Cubs	5410000 mN 590000 mE	T 40N R 8E	Mt Baker RD, MBSNF	Beard
6	Fall 1980	1 Adult, 2 Cubs	5250000 mN 650000 mE	T 23N R 15E	Cle Elum RD, WNF	Carello
7	1981	1 Unaged	5442000 mN 696000 mE	British Columbia	Ashnola River, BC	Unknown via Peatt
8	Jun 1981	1 Unaged	5420400 mN 693200 mE	T 39N R 20E S 4	Winthrop RD, OKNF	Stansberry
9	May 1982	2 Adults	5382200 mN 370600 mE	T 36N R 32E S 36	Republic RD, CNF	Minnich
10	1983	1 Unaged	5477000 mN 648000 mE	British Columbia	Dear Mountain, BC	Unknown via Peatt
11	Aug 1983	1 Unaged	5339800 mN 635000 mE	T 31N R 13E S 1	Darrington RD, MBSNF	Reece
12	08 Aug 1983	1 Adult	5399000 mN 639000 mE	T 38N R 13E S 33	North Unit, NCNP	Saunders-Ogg
13	Jul 1984	1 Adult	5299100 mN 642900 mE	T 27N R 14E S 14	Skykomish RD, MBSNF	Reed

Table 3. Continued.

No.	DATE	OBSERVATION	UTM LOCATION	LEGAL LOCATION	AREA OF OBSERVATION	OBSERVER
14	1985	1 Unaged	5442000 mN 696000 mE	British Columbia	Ashnola River, BC	Unknown via Peatt
15	Jul 1985	1 Unaged	5442300 mN 640200 mE	British Columbia	Shawatum Creek, BC	Bond
16	Aug 1985	1 Adult	5322600 mN 635700 mE	T 30N R 13E S 36	Darrington RD, MBSNF	Cox
17	Aug 1985	1 Adult, 2 Cubs	5306900 mN 629300 mE	T 28N R 12E S 21	Skykomish RD, MBSNF	Westling
18	Sep 1985	1 Adult	5383000 mN 675300 mE	T 36N R 18E S 32	Winthrop RD, ONF	Armey
19	Sep 1985	Tracks	5398000 mN 612500 mE	T 37N R 10E S 2	North Unit, NCNP	Johnston
20	1986	1 Adult	5230000 mN 660000 mE	T 20N R 16E	Cle Elum RD, WNF	Domico
21	Apr 1986	1 Adult, 2 Cubs	5403200 mN 607500 mE	T 38N R 10E S 20	North Unit, NCNP	Pitman
22	Jul 1986	1 Adult	5393400 mN 677700 mE	T 37N R 18E S 28	Winthrop RD, ONF	Johnson
23	Jul 1986	1 Adult	5417600 mN 666100 mE	T 39N R 17E S 10	Winthrop RD, ONF	Kitzel
24	19 Jul 1986	1 Adult	5383800 mN 662400 mE	T 36N R 16E S 25	Winthrop RD, ONF	Beazizo
25	Aug 1986	1 Adult	5361700 mN 643900 mE	T 34N R 13E S 36	Chelan RD, WNF	Gorham
26	Sep 1986	1 Adult	5409900 mN 652900 mE	T 39N R 15E S 36	Winthrop RD, ONF	Sorg
27	02 Sep 1986	1 Adult	5324800 mN 611700 mE	T 30N R 10E S 23	Darrington RD, MBSNF	Schirm

Table 3. Continued.

No.	DATE	OBSERVATION	UTM LOCATION		LEGAL LOCATION			AREA OF OBSERVATION	OBSERVER
28	11 Sep 1986	1 Adult	5430000 mN	707100 mE	T 40N	R 21E	S 10	Winthrop RD, ONF	Humes
29	18 Apr 1987	1 Adult	5369400 mN	632400 mE	T 34N	R 12E	S 2	Mt Baker RD, MBSNF	Bates
30	Summer 1987	1 Adult	5237100 mN	658500 mE	T 21N	R 15E	S 36	Kittitas County	Stanper
31	28 Jun 1987	2 Unaged	5418000 mN	645000 mE	T 40N	R 14E	S 31	Ross Lake NRA, NCNP	Unknown via Mason
32	Jul 1987	1 Adult	5399000 mN	658200 mE	T 37N	R 16E	S 10	Winthrop RD, ONF	Lawless
33	Aug 1987	1 Adult	5376600 mN	670000 mE	T 35N	R 17E	S 26	Twisp RD, ONF	Holeman
34	Sep 1987	1 Adult	5408500 mN	657800 mE	T 38N	R 16E	S 10	Winthrop RD, ONF	Calvert
35	27 Sep 1987	1 Adult	5421000 mN	588000 mE	T 40N	R 8E	S 20	Mt Baker RD, MBSNF	Wiens
36	Jul 1988	Tracks	5293200 mN	646000 mE	T 26N	R 14E	S 1	Lake Wenatchee RD, WNF	Reed
37	03 Jul 1988	1 Adult	5376600 mN	670000 mE	T 35N	R 17E	S 23	Twisp RD, ONF	Johnson
38	14 Aug 1988	1 Adult	5380000 mN	626500 mE	T 36N	R 12E	S 32	South Unit, NCNP	Weinstein
39	Sep 1988	1 Cub	5321000 mN	676100 mE	T 29N	R 18E	S 7	Entait RD, WNF	Van Slyke
40	Oct 1988	Digs	5367300 mN	689400 mE	T 34N	R 19E	S 23	Twisp RD, ONF	Kikendall
41	19 Oct 1988	1 Adult	5207000 mN	586000 mE	T 18N	R 7E	S 26	White River RD, MBSNF	Thune

Table 3. Continued.

No.	DATE	OBSERVATION	UTM LOCATION	LEGAL LOCATION	AREA OF OBSERVATION	OBSERVER
42	Apr 1989	2 Unaged	5370000 mN 700000 mE	T 35N R 21E	Winthrop RD, ONF	Nelson
43	Apr 1989	2 Adults	5403300 mN 643000 mE	T 38N R 13E S 23	Ross Lake NRA, NCNP	Showell
44	30 Apr 1989	Tracks	5422400 mN 641000 mE	T 40N R 13E S 23	Ross Lake NRA, NCNP	Almack
45	31 May 1989	1 Unaged	5311400 mN 685800 mE	T 28N R 18E S 13	Entiat RD, WNF	Heinle
46	Summer 1989	Digs	5368100 mN 691000 mE	T 34N R 19E S 13	Twisp RD, ONF	Kikendall
47	Jun 1989	1 Adult	5341300 mN 653300 mE	T 31N R 15E S 11	Chelan RD, WNF	Peterson
48	13 Jun 1989	1 Adult	5385200 mN 677900 mE	T 36N R 18E S 27	Winthrop RD, ONF	Sanders
49	17 Jun 1989	1 Adult	5113300 mN 577100 mE	T 8N R 6E S 24	St Helens RD, GPNF	DeLong
50	07 Jul 1989	1 Unaged	5386500 mN 693900 mE	T 36N R 20E S 20	Winthrop RD, ONF	Hayes
51	14 Jul 1989	1 Adult	5426200 mN 702400 mE	T 40N R 21E S 17	Winthrop RD, ONF	Prenti
52	22 Jul 1989	1 Adult	5288400 mN 640000 mE	T 26N R 13E S 16	Skykomish RD, MBSNF	Jack
53	Sep 1989	1 Adult	5260300 mN 627900 mE	T 23N R 12E S 14	Cle Elum RD, WNF	Brown
54	Sep 1989	1 Adult	5173400 mN 614400 mE	T 14N R 10E S 13	Packwood RD, GPNF	English
55	30 Apr 1990	1 Adult	5427800 mN 648200 mE	T 40N R 15E S 4	Winthrop RD, NCNP	Stickney

Table 3. Continued.

No.	DATE	OBSERVATION	UTM LOCATION		LEGAL LOCATION			AREA OF OBSERVATION	OBSERVER
56	11 May 1990	1 Adult	5368800 mN	289600 mE	T 34N	R 24E	S 20	Twisp RD, ONF	McCants
57	23 May 1990	1 Adult	5319000 mN	687300 mE	T 29N	R 19E	S 21	Entiat RD, WNF	Thatcher
58	Jun 1990	1 Adult	5255100 mN	635100 mE	T 23N	R 13E	S 33	Cle Elum RD, WNF	Stover
59	25 Jun 1990	1 Adult	5380000 mN	560000 mE	T 36N	R 5E	S 28	Whatcom County	Holroyd
60	27 Jun 1990	1 Adult	5382000 mN	658000 mE	T 35N	R 16E	S 4	South Unit, NCNP	Wendt
61	03 Aug 1990	1 Adult	5397100 mN	673300 mE	T 37N	R 18E	S 17	Winthrop RD, ONF	Mack
62	14 Aug 1990	1 Unaged	5416500 mN	696200 mE	T 39N	R 20E	S 15	Winthrop RD, ONF	Walker
63	Sep 1990	1 Adult	5254500 mN	634300 mE	T 22N	R 13E	S 4	Cle Elum RD, WNF	Nichols
64	08 Sep 1990	1 Adult	5409800 mN	683600 mE	T 38N	R 19E	S 5	Winthrop RD, ONF	Fitzgerald
65	10 Sep 1990	1 Adult	5345200 mN	660500 mE	T 32N	R 16E	S 27	Chelan RD, WNF	Reid
66	16 Sep 1990	1 Adult	5332500 mN	374200 mE	T 30N	R 33E	S 5	Colville IR	Linderoth
67	19 Sep 1990	1 Adult, 3 Cubs	5258900 mN	630800 mE	T 23N	R 13E	S 19	Cle Elum RD, WNF	Fannin
68	22 Sep 1990	1 Adult	5327400 mN	655900 mE	T 30N	R 15E	S 24	Lake Wenatchee RD, WNF	Smith
69	21 Oct 1990	1 Adult	5256900 mN	668900 mE	T 23N	R 17E	S 31	Leavenworth RD, WNF	Grant

Table 3. Continued.

No.	DATE	OBSERVATION	UTM LOCATION	LEGAL LOCATION	AREA OF OBSERVATION	OBSERVER
70	21 Oct 1990	1 Adult	5397000 mN 650000 mE	T 37N R 15E S 10	Ross Lake NRA, NCNP	Simmons
71	23 Oct 1990	1 Adult	5208800 mN 616300 mE	T 18N R 10E S 25	White River RD, MBSNF	Kinney
72	09 Nov 1990	1 Adult	5305000 mN 647300 mE	T 28N R 15E S 31	Lake Wenatchee RD, WNF	Yonke
73	04 May 1991	1 Unaged	5393000 mN 703300 mE	T 36N R 21E S 5	Winthrop RD, ONF	Vail
74	Jun 1991	1 Adult	5336100 mN 668500 mE	T 31N R 17E S 28	Chelan RD, WNF	Gaebler
75	02 Jul 1991	1 Adult	5336000 mN 668800 mE	T 31N R 17E S 28	Entiat RD, WNF	Jones
76	10 Jul 1991	1 Adult	5241300 mN 687100 mE	T 21N R 18E S 23	Cle Elum RD, WNF	Couron
77	16 Jul 1991	1 Adult	5376900 mN 667900 mE	T 35N R 17E S 22	Twisp RD, ONF	Etta
78	23 Jul 1991	1 Adult	5376300 mN 671300 mE	T 35N R 17E S 24	Twisp RD, ONF	Bollman
79	Sep 1991	1 Adult	5412800 mN 694500 mE	T 39N R 20E S 33	Winthrop RD, ONF	Ament
80	Sep 1991	1 Unaged	5464900 mN 639400 mE	British Columbia	Davis Mountain, BC	Unknown via Forbes
81	15 Sep 1991	1 Adult	5400400 mN 649200 mE	T 38N R 14E S 34	Winthrop RD, ONF	Williams
82	27 Sep 1991	1 Adult	5446000 mN 642800 mE	British Columbia	Silverdaisy Mtn. BC	Walder

Table 4. Class 3 (low reliability) grizzly bear observations (N = 102) reported during the 1986-1991 North Cascades Grizzly Bear Ecosystem evaluation. Observations in British Columbia were evaluated by British Columbia Wildlife Branch (BCWB).

No.	DATE	OBSERVATION	UTM LOCATION		LEGAL LOCATION			AREA OF OBSERVATION	OBSERVER
HISTORICAL									
1	1924	1 Adult	5327000 mN	679000 mE	T 30N	R 18E	S 28	Entiat RD, WNF	Roundy
2	1928	1 Unaged	5172100 mN	628900 mE	T 14N	R 12E	S 21	Naches RD, WNF	Truett
3	Fall 1938	1 Adult	5292400 mN	676800 mE	T 26N	R 18E	S 7	Lake Wenatchee RD, WNF	Willet
4	Aug 1940	1 Unaged	5252100 mN	646700 mE	T 22N	R 14E	S 14	Kittitas County	Waldron
5	Summer 1942	1 Adult	5242700 mN	664300 mE	T 21N	R 16E	S 10	Kittitas County	Ferguson
CURRENT									
6	1960	1 Adult	5396800 mN	287000 mE	T 37N	R 23E	S 24	Tonasket RD, ONF	Griswold
7	Aug 1962	2 Unaged	5414400 mN	608000 mE	T 39N	R 10E	S 17	Mt Baker RD, MBSNF	Slotemaker
8	1970	1 Unaged	5404700 mN	346300 mE	T 38N	R 30E	S 19	Tonasket RD, ONF	Griswold
9	1970	1 Unaged	5404700 mN	346300 mE	T 38N	R 30E	S 19	Tonasket RD, ONF	Griswold
10	1970	1 Unaged	5404700 mN	346300 mE	T 38N	R 30E	S 19	Tonasket RD, ONF	Griswold
11	1972	1 Adult	5385500 mN	613100 mE	T 36N	R 10E	S 11	Mt Baker RD, MBSNF	Ensley
12	Fall 1975	1 Unaged	5372100 mN	641900 mE	T 35N	R 13E	S 26	South Unit, NCNP	Latting
13	Jun 1977	1 Adult	5417900 mN	643100 mE	T 39N	R 13E	S 1	Ross Lake NRA, NCNP	Stockton

Table 4. Continued.

No.	DATE	OBSERVATION	UTM LOCATION	LEGAL LOCATION	AREA OF OBSERVATION	OBSERVER
14	Fall 1977	Digs, Scat	5404800 mN 600000 mE	T 38N R 9E S 9	North Unit, NCNP	Armey
15	1979	1 Unaged	Data Not Available	Data Not Available	Republic RD, CNF	Hamblin
16	Aug 1980	1 Adult	5334400 mN 650700 mE	T 31N R 15E S 34	Darrington RD, MBSNF	Reece
17	Jul 1981	1 Adult	5421900 mN 621500 mE	T 40N R 11E S 22	North Unit, NCNP	Clawson
18	10 Jul 1982	1 Adult	5428500 mN 642500 mE	T 40N R 13E S 2	Ross Lake NRA, NCNP	Mason
19	Oct 1983	1 Unaged	5405300 mN 583300 mE	T 38N R 7E S 1	Mt Baker RD, MBSNF	Hunger
20	Spring 1984	1 Adult	5372800 mN 639300 mE	T 35N R 13E S 28	South Unit, NCNP	Renner
21	31 May 1984	1 Adult, 2 Cubs	5564000 mN 498000 mE	British Columbia	Soo River, BC	Unknown via BCWB
22	15 Sep 1984	1 Adult	5411100 mN 651300 mE	T 39N R 15E S 26	Winthrop RD, ONF	Vandergriend
23	1985	1 Unaged (Killed)	Data Not Available	Data Not Available	Okanogan County	Unknown via Brackinridge
24	Nov 1985	Tracks	5226900 mN 604400 mE	T 20N R 9E S 26	North Bend RD, MBSNF	Schelper
25	Apr 1986	1 Unaged	5396900 mN 653300 mE	T 37N R 15E S 12	Ross Lake NRA, NCNP	Buchanan
26	Jul 1986	1 Unaged	5420300 mN 672400 mE	T 39N R 18E S 5	Winthrop RD, ONF	McGroder
27	09 Jul 1986	1 Adult, 2 Cubs	5417300 mN 665900 mE	T 39N R 17E S 9	Winthrop RD, ONF	Kitzel

Table 4. Continued.

No.	DATE	OBSERVATION	UTM LOCATION	LEGAL LOCATION	AREA OF OBSERVATION	OBSERVER
28	13 Aug 1986	1 Adult	5376500 mN 671000 mE	T 35N R 17E S 26	Twisp RD, ONF	Feldstein
29	Fall 1986	1 Adult	5386400 mN 617300 mE	T 36N R 1[illegible]E S 8	Mt Baker RD, MBSNF	Faddis
30	Sep 1986	1 Adult, 1 Cub	5379800 mN 627100 mE	T 36N R 12E S 32	South Unit, NCNP	Gary
31	May 1987	1 Unaged	5368600 mN 597000 mE	T 34N R 9E S 6	Mt Baker RD, MBSNF	O'Connor
32	30 May 1987	Claw Marks	5423100 mN 709800 mE	T 40N R 22E S 31	Winthrop RD, ONF	Barnett
33	Summer 1987	1 Adult	5361700 mN 643900 mE	T 34N R 13E S 36	Chelan RD, WNF	Layton
34	Jun 1987	1 Adult	5252600 mN 674100 mE	T 22N R 17E S 10	Leavenworth RD, WNF	Caldwell
35	Jul 1987	1 Unaged	5424000 mN 644000 mE	T 40N R 15E S 18	Ross Lake NRA, NCNP	Biesbock
36	Jul 1987	1 Unaged	5394500 mN 669200 mE	T 37N R 17E S 26	Winthrop RD, ONF	Manza
37	04 Jul 1987	1 Adult	5371400 mN 669000 mE	T 34N R 17E S 3	South Unit, NCNP	Clark
38	18 Jul 1987	1 Adult	5380000 mN 660000 mE	T 36N R 16E	Ross Lake NRA, NCNP	Putnam
39	05 Sep 1987	1 Unaged	5337300 mN 625700 mE	T 31N R 12E S 18	Darrington RD, MBSNF	Unknown via Hawkins
40	1988	1 Unaged	5180000 mN 620000 mE	T 16N R 12E	Naches RD, WNF	Schuman
41	10 Aug 1988	1 Adult	5249800 mN 662900 mE	T 22N R 16E S 21	Cle Elum RD, WNF	Houck

Table 4. Continued.

No.	DATE	OBSERVATION	UTM LOCATION		LEGAL LOCATION			AREA OF OBSERVATION	OBSERVER
42	Sep 1988	1 Adult, 3 Cubs	5338200 mN	583000 mE	T 31N	R 7E	S 10	Darrington RD, MBSNF	Blound
43	21 Sep 1988	Tracks	5353600 mN	662300 mE	T 33N	R 16E	S 36	Chelan RD, WNF	Reece
44	Oct 1988	1 Adult, 2 Cubs	5244400 mN	665000 mE	T 21N	R 16E	S 3	Kittitas County	George
45	20 Oct 1988	Tracks, Scat	5391000 mN	347000 mE	T 36N	R 30E	S 3	Tonasket RD, ONF	Platt
46	1989	1 Unaged	5323400 mN	668800 mE	T 29N	R 17E	S 4	Entiat RD, WNF	Nuesse
47	Spring 1989	1 Adult, 1 Cub	5220000 mN	670000 mE	T 20N	R 18E		Cle Elum RD, WNF	Hill
48	May 1989	1 Unaged	5243500 mN	652200 mE	T 21N	R 15E	S 8	Cle Elum RD, WNF	Unknown via Richards
49	30 May 1989	1 Adult	5242200 mN	658900 mE	T 21N	R 15E	S 13	Kittitas County	Taasevigen
50	Summer 1989	1 Unaged	5286700 mN	665100 mE	T 26N	R 16E	S 36	Leavenworth RD, WNF	Unknown via Murphy
51	Jul 1989	1 Adult	5325800 mN	704600 mE	T 30N	R 21E	S 31	Chelan RD, WNF	Gomez
52	Jul 1989	1 Unaged	5377400 mN	700400 mE	T 35N	R 20E	S 24	Okanogan County	McNeil
53	Jul 1989	Tracks	5200000 mN	630000 mE	T 18N	R 13E		Naches RD, WNF	Sims
54	23 Jul 1989	1 Adult	5422800 mN	657800 mE	T 40N	R 16E	S 27	Winthrop RD, ONF	Kenyon
55	Aug 1989	1 Unaged	5372700 mN	340000 mE	T 35N	R 29E	S 35	Tonasket RD, ONF	Unknown via Haines

Table 4. Continued.

No.	DATE	OBSERVATION	UTM LOCATION		LEGAL LOCATION			AREA OF OBSERVATION	OBSERVER
56	10 Sep 1989	1 Adult	5349100 mN	630000 mE	T 32N	R 12E	S 10	Darrington RD, MBSNF	Luther
57	Oct 1989	1 Adult	5385000 mN	676300 mE	T 36N	R 18E	S 28	Winthrop RD, ONF	Postlethwaite
58	01 Oct 1989	Unknown	5410000 mN	580000 mE	T 40N	R 7E		Mt Baker RD, MBSNF	Campa
59	31 Oct 1989	Prey Kill	5239800 mN	687700 mE	T 21N	R 18E	S 25	Cle Elum RD, WNF	McEwen
60	02 Nov 1989	Tracks	5375500 mN	667600 mE	T 35N	R 17E	S 28	Twisp RD, ONF	Parham
61	12 Nov 1989	1 Adult	5141200 mN	545200 mE	T 11N	R 3E	S 22	Lewis County	Anderson
62	13 Dec 1989	1 Unaged	5243700 mN	673600 mE	T 21N	R 17E	S 9	Cle Elum RD, WNF	Lang
63	05 Apr 1990	1 Adult	5238700 mN	646100 mE	T 21N	R 14E	S 27	Kittitas County	Christian
64	12 May 1990	1 Adult	5229000 mN	670300 mE	T 20N	R 17E	S 30	Kittitas County	Ruddell
65	13 May 1990	1 Adult	5301800 mN	657800 mE	T 27N	R 16E	S 7	Lake Wenatchee RD, WNF	Johnson
66	15 May 1990	1 Adult	5371400 mN	669100 mE	T 35N	R 17E	S 35	Twisp RD, ONF	Campion
67	27 May 1990	Tracks	5410100 mN	632100 mE	T 39N	R 12E	S 26	North Unit, NCNP	Moore
68	Summer 1990	1 Unaged	5124400 mN	605700 mE	T 9N	R 9E	S 13	Randle RD, GPNF	Wyss
69	Jun 1990	1 Adult	5320100 mN	616400 mE	T 29N	R 11E	S 6	Darrington RD, MBSNF	Bonano

Table 4. Continued.

No.	DATE	OBSERVATION	UTM LOCATION		LEGAL LOCATION			AREA OF OBSERVATION	OBSERVER
70	01 Jun 1990	1 Unaged	5236200 mN	635100 mE	T 21N	R 13E	S 33	Cle Elum RD, WNF	Johnson
71	20 Jun 1990	1 Adult	5248300 mN	670000 mE	T 22N	R 17E	S 30	Cle Elum RD, WNF	DeBusschere
72	Jul 1990	1 Adult	5369500 mN	670900 mE	T 34N	R 17E	S 14	Lake Chelan NRA, NCNP	Byeman
73	10 Jul 1990	1 Adult	5181500 mN	585000 mE	T 15N	R 7E	S 14	MRNP	Cordi
74	12 Jul 1990	1 Unaged	5376800 mN	614500 mE	T 35N	R 10E	S 12	Mt Baker RD, MBSNF	Traeger
75	14 Jul 1990	1 Adult	5286700 mN	665200 mE	T 26N	R 16E	S 36	Leavenworth RD, WNF	Miller
76	18 Jul 1990	1 Adult	5359500 mN	680900 mE	T 33N	R 18E	S 14	Lake Chelan NRA, NCNP	Caplan
77	30 Jul 1990	1 Adult	5249200 mN	638000 mE	T 22N	R 13E	S 23	Cle Elum RD, WNF	Day
78	Aug 1990	Tracks, Scat	5250000 mN	620000 mE	T 23N	R 12E	S 26	Cle Elum RD, WNF	Traufer
79	17 Aug 1990	1 Adult	5376500 mN	671000 mE	T 35N	R 17E	S 23	Twisp RD, ONF	Richter
80	29 Aug 1990	1 Adult	5317300 mN	641100 mE	T 29N	R 14E	S 21	Lake Wenatchee RD, WNF	Robison
81	Fall 1990	1 Unaged	Data Not Available		Data Not Available			Cle Elum RD, WNF	Unknown via Lertz
82	09 Sep 1990	1 Adult, 1 Cub	5400000 mN	360000 mE	T 38N	R 31E		Tonasket RD, ONF	Hawkins
83	Sep 1990	1 Unaged	5447200 mN	642400 mE	British Columbia			Vuich Creek, BC	Unknown via Forbes

Table 4. Continued.

No.	DATE	OBSERVATION	UTM LOCATION	LEGAL LOCATION	AREA OF OBSERVATION	OBSERVER
84	Sep 1990	2 Unaged	5459200 mN 647000 mE	British Columbia	Mount Snass, BC	Unknown via Forbes
85	09 Sep 1990	1 Adult	5426300 mN 609300 mE	T 40N R 10E S 4	North Unit, NCNP	Lamoreaux
86	09 Sep 1990	1 Adult	5230400 mN 618000 mE	T 20N R 11E S 18	King County	Merkuriaff
87	17 Sep 1990	2 Adults	5254800 mN 628200 mE	T 23N R 12E S 35	Cle Elum RD, WNF	Davis
88	22 Sep 1990	1 Adult, 1 Cub	5256600 mN 628300 mE	T 23N R 12E S 26	Cle Elum RD, WNF	Calvisky
89	14 Apr 1991	1 Adult	5232500 mN 660100 mE	T 20N R 16E S 18	Cle Elum RD, WNF	Classin
90	11 May 1991	Tracks, Scat	5337600 mN 621700 mE	T 31N R 11E S 15	Darrington RD, MBSNF	Ferber
91	Summer 1991	1 Unaged	5270000 mN 640000 mE	T 25N R 15E	Leavenworth RD, WNF	Hein
92	Summer 1991	1 Unaged	5414000 mN 694100 mE	T 39N R 20E S 28	Winthrop RD, ONF	Porter
93	05 Jun 1991	1 Adult	5360800 mN 692400 mE	T 33N R 20E S 18	Twisp RD, ONF	Kuhn
94	08 Jun 1991	1 Unaged	5370000 mN 710000 mE	T 34N R 22E	Okanogan County	Lieberman
95	Jul 1991	1 Adult, 1 Cub	5259500 mN 651300 mE	T 23N R 15E S 20	Cle Elum RD, WNF	Riz
96	08 Jul 1991	1 Adult	5180100 mN 597900 mE	T 15N R 9E S 30	MRNP	Justice
97	11 Jul 1991	1 Adult	5243200 mN 620500 mE	T 21N R 11E S 4	Cle Elum RD, WNF	Noyes

Table 4. Continued.

No.	DATE	OBSERVATION	UTM LOCATION		LEGAL LOCATION			AREA OF OBSERVATION	OBSERVER
98	21 Jul 1991	Tracks	5365800 mN	673400 mE	T 34N	R 18E	S 30	Lake Chelan NRA, NCNP	Cline
99	27 Aug 1991	1 Unaged	5342100 mN	696100 mE	T 31N	R 20E	S 8	Chelan RD, WNF	Unknown via Smythe
100	27 Aug 1991	1 Unaged	5258300 mN	634900 mE	T 23N	R 13E	S 21	Kittitas County	Upshaw
101	Oct 1991	1 Adult	5370000 mN	610000 mE	T 35N	R 11E		Mt Baker RD, MBSNF	Meyer
102	22 Nov 1991	Tracks	5387700 mN	623600 mE	T 36N	R 11E	S 1	Ross Lake NRA, NCNP	Beamer

Table 5. Animal species identified at self-activated camera stations from 1989-1991 during the North Cascades Grizzly Bear Ecosystem evaluation.

SCIENTIFIC NAME	COMMON NAME	NO. OF STATIONS SPECIES OBSERVED 1989	1990	1991
Aquila chrysaetos	golden eagle	1	0	0
Bonasa umbellus	ruffed grouse	0	1	1
Bos sp.	domestic cattle	3	0	1
Canis familiaris	domestic dog	2	0	2
Canis latrans	coyote	11	5	6
Canis lupus	gray wolf	0	0	2
Cathartes aura	turkey vulture	1	0	1
Cervus elaphus	elk	2	1	0
Colaptes auratus	northern flicker	0	1	0
Corvus corax	common raven	6	3	1
Cyanocitta stelleri	Steller's jay	1	0	0
Dendragapus obscurus	blue grouse	0	1	0
Erethizon dorsatum	porcupine	1	0	0
Eutamias amoenus	yellow pine chipmunk	0	2	1
Felis concolor	mountain lion	1	3	1
Felis familiaris	domestic cat	0	0	1
Felis lynx	lynx	1	0	0
Felis rufus	bobcat	2	1	0
Homo sapiens	human	8	3	1
Lepus americanus	snowshoe hare	2	6	5
Martes americana	marten	5	0	0
Mustela erminea	ermine	1	0	0
Odocoileus hemionus	mule deer	8	8	8
Odocoileus virginianus	white-tailed deer	1	0	1
Perisoreus canadensis	gray jay	5	0	0
Peromyscus manfulatus	deer mouse	0	1	0
Pica pica	black-billed magpie	1	0	0
Spermophilus saturatus	golden-mantled ground squirrel	0	1	0
Sphyrapicus ruber	red-breasted sapsucker	1	0	0
Spilogale putorius	spotted skunk	0	0	1
Tamiasciurus douglasii	Douglas squirrel	1	0	2
Tamiasciurus hudsonicus	red squirrel	1	6	0
Turdus migratorius	American robin	0	1	0
Ursus americanus	black bear	25	11	3

Table 6. Area and portion of Level 2 vegetation and other cover types on private, state, and federal lands within the North Cascades Grizzly Bear Ecosystem.

	PORTION OF ECOSYSTEM					
	PRIVATE		STATE		FEDERAL	
VEGETATION/COVER TYPE	AREA (ha)	%	ha	%	ha	%
Water	2,523	0.96	301	0.14	26,410	1.23
PIPO	15,026	5.71	6,680	3.19	34,746	1.62
PIPO-PSME	21,007	7.98	20,589	9.84	116,835	5.46
PSME-mixed conifer-east	19,400	7.37	21,216	10.14	168,440	7.87
PSME-mixed conifer-west	2,503	0.95	1,961	0.94	1,641	0.08
ABLA2-PIEN-PICO-east	16,097	6.12	34,024	16.27	322,913	15.08
ABLA2-PIEN-PICO-west	9	0.00	0	0.00	2,046	0.10
PIEN riparian	447	0.17	635	0.30	11,879	0.55
Young PSME-managed (MBS only)	279	0.11	98	0.05	28,264	1.32
TSHE-east	1,216	0.46	0	0.00	7,713	0.36
TSHE-west	33,835	12.86	22,852	10.92	73,071	3.41
ABAM-east	7,213	2.74	0	0.00	75,574	3.53
ABAM-west	14,832	5.64	12,205	5.83	215,294	10.06
TSME-east	921	0.35	0	0.00	45,773	2.14
TSME-west	2,842	1.08	3,514	1.68	235,307	10.99
PIAL	129	0.05	396	0.19	11,147	0.52
LALY	210	0.08	370	0.18	19,317	0.90
Shrub steppe-herbaceous	24,770	9.41	20,911	10.00	29,949	1.40
Shrub steppe-PUTR	9,246	3.51	8,057	3.85	8,422	0.39
Shrub steppe_ARTR	3,527	1.34	2,763	1.32	2,350	0.11
Southeast shrubby shrub steppe	1,994	.76	13,370	6.39	1,872	0.09
Alpine meadow-east	219	0.06	122	0.05	11,369	0.53
Alpine meadow-west	19	0.01	0	0.00	9,913	0.46
Subalpine lush meadow-east	624	0.24	93	0.04	25,816	1.21
Subalpine lush meadow-west	2,013	0.76	601	0.29	60,890	2.84
Subalpine meadow(mesic/dry)-east	990	0.38	1,300	0.62	35,695	1.67
Subalpine meadow(mesic/dry)-west	551	0.21	138	0.07	17,919	0.84
Subalpine heather-VADE meadow	1,459	0.55	1,150	0.55	54,948	2.57
Subalpine-alpine VASC-VACA meadow	134	0.05	903	0.43	38,398	1.79
Subalpine mosaic-east	557	0.21	833	0.40	6,251	0.29
Subalpine mosaic-west	74	0.03	79	0.04	3,150	0.15
Montane mosaic-east	825	0.31	3,779	1.81	12,441	0.58
Montane mosaic-west	53	0.02	8	0.00	3,282	0.15
Montane herbaceous-east	6,043	2.30	5,985	2.86	47,239	2.21
Montane herbaceous-west	7,073	2.69	3,155	1.51	27,197	1.27
Montane shrub-east	5,635	2.14	235	0.11	31,027	1.45
Montane shrub-west	12,275	4.66	4,188	2.00	49,223	2.30
Lush shrub (ALSI, etc)-east	771	0.29	21	0.01	5,553	0.26
Lush shrub (ALSI, etc)-west	748	0.28	336	0.16	7,785	0.36
Lush low elev. herbaceous-east	397	0.15	125	0.06	291	0.01
Low elevation herbaceous-west	3,166	1.20	694	0.33	250	0.01
Lush low elev. shrub-east	130	0.05	58	0.03	5	0.00
Riparian deciduous forest-east	1,467	0.56	192	0.09	2,880	0.13
Riparian deciduous forest-west	4,176	1.59	661	0.32	2,105	0.10
Non-riparian decid forest-east	4,960	1.88	795	0.38	26,146	1.22
Non-riparian decid forest-west	15,516	5.90	7,954	3.80	13,459	0.63
Barren, snow, unclassified	7,656	2.91	5,272	2.52	205,553	9.60
Ag.-fallow and dry pasture	1,999	0.76	434	0.21	28	0.00
Ag. orchard and crops	5,465	2.08	115	0.06	0	0.00

Table 7. Area and portion of Level 2 vegetation and other cover types in Wilderness Areas, National Parks, and National Recreation Areas in the North Cascades Grizzly Bear Ecosystem.

VEGETATION/COVER TYPE	PORTION OF ECOSYSTEM AREA (ha)	%	CUMMULATIVE (%)
Water	10,891	1.05	1.30
PIPO	4,597	0.44	1.74
PIPO-PSME	6,252	0.60	2.35
PSME-mixed conifer-east	24,577	2.36	4.71
PSME-mixed conifer-west	1,618	0.16	4.87
ABLA2-PIEN-PICO-east	136,404	13.12	17.99
ABLA2-PIEN-PICO-west	984	0.09	18.08
PIEN riparian	5,917	0.57	18.65
Young PSME-managed (MBSNF only)	529	0.05	18.71
TSHE-east	2,972	0.29	18.99
TSHE-west	26,482	2.55	21.54
ABAM-east	50,426	4.85	26.39
ABAM-west	103,837	9.99	36.38
TSME-east	38,999	3.75	40.13
TSME-west	159,925	15.39	55.52
PIAL	7,857	0.76	56.28
LALY	14,451	1.39	57.67
Shrub steppe-herbaceous	4,336	0.42	58.08
Shrub steppe-PUTR	587	0.06	58.14
Shrub steppe_ARTR	116	0.01	58.15
Southeast shrubby shrub steppe	10	0.00	58.15
Alpine meadow-east	8,949	0.86	59.01
Alpine meadow-west	7,335	0.71	59.72
Subalpine lush meadow-east	23,292	2.24	61.96
Subalpine lush meadow-west	44,513	4.28	66.24
Subalpine meadow(mesic/dry)-east	24,687	2.38	68.62
Subalpine meadow(mesic/dry)-west	14,755	1.42	70.04
Subalpine heather-VADE meadow	42,479	4.09	74.12
Subalpine mosaic-east	2,955	0.28	74.41
Subalpine mosaic-west	2,269	0.22	74.63
Montane mosaic-east	1,775	0.17	74.80
Montane mosaic-west	102	0.01	74.81
Montane herbaceous-east	7,278	0.70	75.51
Montane herbaceous-west	7,269	0.70	76.21
Montane shrub-east	16,343	1.57	77.78
Montane shrub-west	14,375	1.38	79.16
Lush shrub (ALSI,etc)-east	3,989	0.38	79.55
Lush shrub (ALSI,etc)-west	5,103	0.49	80.04
Lush low elev. herbaceous-east	16	0.00	80.04
Low elevation herbaceous-west	178	0.02	80.06
Lush low elev. shrub-east	2	0.00	80.06
Riparian deciduous forest-east	1,127	0.11	80.17
Riparian deciduous forest-west	766	0.07	80.24
Non-riparian decid forest-east	8,638	0.83	81.07
Non-riparian decid forest-west	2,814	0.27	81.34
Barren, snow, unclassified	169,433	16.30	97.64
Subalpine-alpine VASC-VACA	24,473	2.35	100.00

Table 8. Results of the accuracy assessment for the Level 1 and Level 2 vegetation and other cover types mapped within the North Cascade Grizzly Bear Ecosystem.

VEGETATION AND COVER TYPES	N	ACCURACY LEVEL (% mapped correctly)
LEVEL 1		
Water	80	100.0
Conifer 70%+	575	95.0
Conifer 50-70%	211	93.8
Conifer 30-50%	84	90.5
Herbaceous	186	91.9
Shrub	66	98.5
Clearcut	63	100.0
Deciduous forest	37	91.9
Shrub-steppe	98	93.9
Barren	64	92.2
Agricultural	15	100.0
Snow	53	100.0
Overall Accuracy of Level 1	1,532	94.8
LEVEL 2		
PIPO	18	81.8
PIPO-PSME	79	89.9
PSME-mixed conifer	63	90.6
ABLA2-PIEN-PICO	172	95.9
Young PSME-managed	19	100.0
TSHE	35	88.6
ABAM	147	98.6
TSME	57	91.2
PIAL	3	33.3
LALY	6	100.0
Shrub steppe-herbaceous	64	94.4
Shrub steppe-shrub	34	91.2
Alpine meadow	4	100.0
Subalpine lush meadow	6	83.3
Subalp meadow (mesic/dry)	11	100.0
Subalp heather-VADE meadow	29	86.2
Subalpine mosaic	2	0.0
Montane mosaic	20	90.0
Montane herbaceous	50	96.0
Montane shrub	45	91.1
Lush shrub (ALSI,etc)	6	100.0
Lush low elev. herb-shrub	5	100.0
Overall Accuracy of Level 2	875	93.2

Table 9. Plant species identified as grizzly bear foods in other ecosystems, excluding Alaska and the northern provinces of Canada.

SCIENTIFIC NAME	COMMON NAME
Trees	
Crataegus douglasii	black hawthorn
Crataegus spp.	howthorn
Pinus albicaulis	whitebark pine
Pinus monticola	western white pine
Prunus domestica	cultivated plum
Pyrus communis	cultivated pear
Malus spp.	cultivated apple
Prunus spp.	cultvated cherry
Shrubs	
Amalanchier alnifolia	western serviceberry
Arctostaphylos uva-ursi	bearberry
Berberis repens	creeping Oregongrape
Chimaphila umbellata	prince's-pine
Cornus canadensis	bunchberry dogwood
Cornus nutallii	Pacific dogwood
Cornus sericea	dogwood
Cornus stolonifera	creek dogwood
Lonicera ciliosa	trumpet honeysuckle
Lonicera involucrata	bearberry honeysuckle
Lonicera utahensis	Utah honeysuckle
Oplopanax horridum	devil's club
Prunus emarginata	bittercherry
Prunus virginiana	common chokecherry
Ribes bracteosum	stink currant
Ribes lacustre	swamp currant
Ribes viscosissimum	sticky currant
Rosa acicularis	prickly rose
Rosa gymnocarpa	baldhip rose
Rosa spp.	rose
Rubus idaeus	red raspberry
Rubus parviflorus	thimbleberry
Rubus pedatus	fiveleaved bramble
Rubus spectabilis	salmonberry
Rubus spp.	raspberry
Salix spp.	willow
Sambucus cerulea	blue elderberry
Sambucus racemosa	black elderberry
Shepherdia canadensis	buffalo-berry
Sorbus scopulina	Cascade mountain-ash
Sorbus sitchensis	Sitka mountain-ash
Symphoricarpos alba	common snowberry
Vaccinium caespitosum	dwarf bilberry
Vaccinium globulare	globe huckleberry
Vaccinium membranaceum	thin-leaved blueberry
Vaccinium myrtillus	dwarf bilberry
Vaccinium ovalifolium	early blueberry
Vaccinium ovatum	evergreen blueberry
Vaccinium parvifolium	red bilberry
Vaccinium scoparium	grouseberry
Vaccinium spp.	bilberry

Table 9. Continued.

SCIENTIFIC NAME	COMMON NAME
Forbs/Ferns/Fern Allies/Grasses/Grasslikes	
Agropyron spicatum	bluebunch wheatgrass
Agropyron spp.	wheatgrass
Agrostis alba	redtop
Allium schoenoprasum	chives
Angelica arguta	Lyall's arguta
Angelica genuflexa	kneeling angelica
Astragalus robbinsii	Robbins' milk-vetch
Boykinia richardsonii	boykinia
Bromus sp.	brome
Calamagrostis canadensis	bluejoint reedgrass
Calamagrostis rubescens	pinegrass
Carex athrostachya	slender-beaked sedge
Carex concinnoides	northewst sedge
Carex geyeri	elk sedge
Carex macrochaeta	large-awn sedge
Carex nigricans	black alpine sedge
Carex rostrata	beaked sedge
Carex sitchensis	Sitka sedge
Carex spp.	sedge
Castilleja spp.	paintbrush
Cicuta douglasii	Douglas' water-hemlock
Cirsium edule	Indian thistle
Cirsium scariosum	elk thistle
Cirsium spp.	thistle
Claytonia lanceolata	western springbeauty
Claytonia megarhiza	alpine springbeauty
Clintonia uniflora	beadlily
Danthonia unispicata	onespike danthonia
Deschampsia cespitosa	tufted hairgrass
Disporum sp.	fairy-bell
Empetrum nigrum	crowberry
Epilobium angustifolium	fireweed
Equisetum arvense	common horsetail
Equisetum hymale	common scouring-rush
Equisetum spp.	horsetail
Eriophorum vaginatum	cotton-grass
Erythronium grandiflorum	pale fawn-lily
Erythronium montanum	alpine fawn-lily
Festuca idahoensis	blue bunchgrass
Festuca scabrella	buffalo bunchgrass
Fragaria vesca	woods strawberry
Fragaria virginiana	blueleaf strawberry
Fritillaria pudica	yellow bell
Graminae spp.	grasses
Gymnocarpium dryopteris	oak-fern
Hedysarum alpinum	American hedysarum
Hedysarum occidentale	western hedysarum
Hedysarum spp.	hedysarum
Hedysarum sulphurescens	yellow hedysarum
Heracleum lanatum	cow-parsnip
Heracleum sphondylium	cow-parsnip
Hieracium gracile	slender hawkweed
Hieracium spp.	hawkweed
Hordeum brachyantherum	meadow barley

Table 9. Continued.

SCIENTIFIC NAME	COMMON NAME
Juncus filiformis	thread rush
Juncus parryi	Parry's rush
Juncus spp.	rush
Ligusticum canbyi	Canby's lovage
Ligusticum spp.	lovage
Ligusticum verticillatum	verticillate-umbel lovage
Lomatium cous	cous biscuit-root
Lomatium dissectum	fern-leaved lomatium
Lomatium spp.	biscuit-root
Lupinus nootkatensis	lupine
Luzula hitchcockii	smooth woodrush
Luzula spp.	woodrush
Lysichitum americanum	skunk cabbage
Melica spectabilis	showy onion
Mertensia sp.	lungwort
Mitella brewerii	Brewer's mitrewort
Mitella sp.	mitrewort
Osmorhiza chilensis	mountain sweet-root
Osmorhiza depauperata	blunt-fruited sweet-root
Osmorhiza occidentalis	western sweet-root
Osmorhiza spp.	sweet-root
Oxyria digyna	mountain sorrel
Oxytropis spp.	crazyweed
Perideridia gairdneri	Gairdner's yampah
Petasites sp.	coltsfoot
Phleum alpinum	alpine timothy
Phleum pratense	common timothy
Poa alpina	alpine bluegrass
Poa pratensis	Kentucky bluegrass
Poa spp.	bleugrass
Polygonum bistortoides	American bistort
Polygonum viviparum	European bistort
Polygonum spp.	doorweed
Polypodiaceae spp.	common fern family
Pteridium aquilinium	braken
Ranunculus spp.	buttercup
Rumex spp.	dock
Scirpus microcarpus	small-friuted bulrush
Senecio triangularis	groundsel
Smilacina racemosa	western Solomon-plume
Smilacina stellata	starry Solomon-plume
Streptopus amplexifolius	clasping-leaved twisted-stalk
Streptopus roseus	rosy twisted-stalk
Taraxacum officinale	common dandelion
Taraxacum spp.	dandelion
Tiarella ovatum	coolwort
Tiarella spp.	coolwort
Tiarella trifoliata	coolwort
Trifolium pratense	red clover
Trifolium repens	white clover
Trifolium spp.	clover
Trillium ovatum	white trillium
Veratrum sp.	false hellebore
Veratrum viride	American false hellebore
Viburnum edule	moosewood viburnum
Viola glabella	stream violet

Table 9. Continued.

SCIENTIFIC NAME	COMMON NAME
Viola spp.	violet
Xerophyllum tenax	beargrass
Commercial hay (various spp.)	hay
Medicago sativa	alfalfa

Table 10. The number of plant species that are probable grizzly bear foods within each vegetation type in the North Cascades Grizzly Bear Ecosystem.

VEGETATION TYPE	NUMBER OF SPECIES OF PROBABLE GRIZZLY BEAR FOODS TREES	SHRUBS	HERBS	TOTAL
PIPO	0	6	16	22
PIPO-PSME	1	16	15	32
PSME-mixed conifer-east	2	32	33	67
PSME-mixed conifer-west	2	19	14	35
ABLA2-PIEN-PICO-east	2	32	56	90
ABLA2-PIEN-PICO-west	2	19	43	64
PIEN riparian	1	21	33	55
TSHE-east	1	6	8	15
TSHE-west	2	29	24	55
ABAM-east	2	21	26	49
ABAM-west	1	25	40	66
TSME-east	2	18	33	53
TSME-west	2	18	43	63
PIAL	2	4	8	14
LALY	1	3	12	16
Shrub steppe-herbaceous	---	9	25	34
Shrub steppe-PUTR	---	5	9	14
Shrub steppe-ARTR	1	3	15	19
Alpine meadow-east	1	8	19	28
Alpine meadow-west	---	5	16	21
Subalpine lush meadow-east	1	17	46	64
Subalpine lush meadow-west	1	20	44	65
Subalp meadow(mesic/dry)-east	2	17	47	66
Subalp meadow(mesic/dry)-west	2	7	27	36
Subalpine heather-VADE meadow	2	12	31	45
Subalpine mosaic-east	1	10	13	24
Subalpine mosaic-west	---	2	9	11
Montane mosaic-east	---	3	2	5
Montane mosaic-west	1	2	---	3
Montane herbaceous-east	---	9	23	32
Montane herbaceous-west	---	2	6	8
Montane shrub-east	2	36	48	86
Montane shrub-west	2	31	34	67
Lush shrub (ALSI,etc)-east	1	18	22	41
Lush shrub (ALSI,etc)-west	---	17	24	41
Lush low elev. herb-east	---	6	22	28
Low elevation herb-west	---	2	1	3
Lush low elev. shrub	---	19	24	43
Rip deciduous forest-east	---	6	11	17
Rip deciduous forest-west	1	11	9	21
Non-rip decid forest-east	---	13	16	29
Non-rip decid forest-west	---	9	9	18
Subalp-alp VASC-VACA	1	7	19	27

Table 11. Population estimates and area of winter range for ungulates on national forest lands within the North Cascades Grizzly Bear Ecosystem (W. Myers, pers. commun. 1991; C. Vandemoer, pers. commun. 1991).

SPECIES	ESTIMATED POPULATION	AREA OF WINTER RANGE (ha)
Deer	38,090	556,467
Elk	5,750	44,154
Mountain Goats	1,780	NOT AVAILABLE
Bighorn Sheep	200	NOT AVAILABLE

Table 12. Population estimates of salmon species in eight major streams within the North Cascades Grizzly Bear Ecosystem (U.S. Department of Agriculture 1990ab; W. Somes, pers. commun. 1991).

RIVER SYSTEM	CHINOOK	PINK	CHUM	SOCKEYE	COHO
Nooksack	3,460	15,192	18,800	0	650
Skagit	6,170	132,210	17,100	0	8,100
NF Stillaguamish	430	18,000	2,140	0	3,930
SF Stillaguamish	500	26,460	2,440	0	4,475
Skykomish	550	28,440	790	0	8,560
Wenatchee	6,220	0	0	31,785	0
Entiat	860	0	0	0	0
Methow	1,875	0	0	0	0
TOTALS	20,065	220,302	41,270	31,785	25,715

Table 13. Preliminary list of North Cascades bear foods identified from analysis of bear scats (N = 120) undifferentiated to bear species.

PLANT OR ANIMAL SPECIES	STRUCTURES IDENTIFIED
NATURAL FOODS	
Plants	
Amalanchier alnifolia	Fruits, leaves, seeds
Angelica arguta	Flowers, fruit, leaves
Arctostaphylos uva-ursi	Fruits, leaves, seeds
Carex spp.	Flowers, leaves
Equisetum arvense	Cones, sheaths, stems
Equisetum sp.	Sheaths, stems
Graminae spp.	Leaves, roots, stems
Ligusticum sp.	Flowers, leaves, stems
Oplopanax horridum	Fruit, seeds
Osmorhiza spp.	Leaves, stems
Pinus sp.	Fruit
Trifolium sp.	Flowers, leaves, stems
Animals	
Camponotus sp. ants	Entire body
Canis latrans	Hair
Formica sp. ants	Entire body
Mephitis mephitis	Foot, hair
Odocoileus hemionus columbianus	Entire body
Oreamnos americanus	Hair, hooves, horns
Spermophilus saturatus	Feet, hair, teeth
Unknown sp. termite	Thorax, wings
Ursus americanus	Hair
ARTIFICIAL FOODS	
Human food from campsite	
Human garbage	

Table 14. Area and portion of the North Cascades Grizzly Bear Ecosystem within each Wilderness Area.

ADMINISTRATIVE CLASS	AREA (ha)	PORTION OF ECOSYSTEM (%)
Okanogan National Forest		
Pasayten Wilderness	214,975	8
Lake Chelan-Sawtooth Wilderness	38,776	1
Wenatchee National Forest		
Lake Chelan-Sawtooth Wilderness	22,891	1
Glacier Peak Wilderness	115,255	4
Henry M. Jackson Wilderness	10,910	1
Alpine Lakes Wilderness	86,870	3
Mt. Baker-Snoqualmie National Forest		
Mt. Baker Wilderness	48,013	2
Noisy Diobsud Wilderness	5,664	1
Glacier Peak Wilderness	111,448	4
Boulder River Wilderness	19,662	1
Henry M. Jackson Wilderness	30,564	1
Alpine Lakes Wilderness	58,865	2
North Cascades National Park		
S.P. Mather Wilderness	257,019	10
TOTALS	1,020,912	39

Table 15. Kilometers of roads in each administrative unit within the North Cascades Grizzly Bear Ecosystem.

ROAD TYPE	PRIVATE	STATE WDW	STATE DNR	OTHER FED BLM	OTHER FED NCNP	NATIONAL FOREST ONF	NATIONAL FOREST WNF	NATIONAL FOREST MBSNF
Primary highway	285	1	27	0	45	70	94	71
Secondary paved	556	6	48	2	5	159	174	151
Improved gravel	296	43	105	0	24	936	347	1,847
Improved dirt	893	148	514	17	44	733	849	650
Unimproved	1,227	133	642	14	44	853	1,871	370
TOTALS	3,257	331	1,336	33	162	2,751	3,335	3,089
Total Paved	841	7	75	2	50	229	268	222
Total Unpaved	2,416	324	1,261	31	112	2,522	3,067	2,867
Gated Road*	94	11	21	0	0	605	217	19
Blocked Road*	67	2	19	0	0	573	255	225

BLM = Bureau of Land Management
DNR = Department of Natural Resources
MBSNF = Mount Baker- Snoqualmie National Forest
NCNP = North Cascades National Park
ONF = Okanogan National Forest
WDW = Washington Department of Wildlife
WNF = Wenatchee National Forest
* Gated Roads and Blocked Roads are subsets of the Total roads.

Table 16. Average annual reported Recreation Visitor Days or Visits in the North Cascades Grizzly Bear Ecosystem by administrative unit and type of use (D. Yenko, pers. commun. 1991; C. Vandemoer, pers. commun. 1991; E. Thomas, pers. commun. 1991; R. Kuntz, pers. commun. 1991).

ADMINISTRATIVE UNIT	RECREATION VISITOR DAYS or VISITS		
	DEVELOPED	DISPERSED	WILDERNESS
Okanogan NF	178,200	482,500	109,700
Wenatchee NF	1,200,000	2,400,000	400,000
Mt. Baker-Snoq. NF	348,840	1,823,240	390,150
North Cascades NP	NOT AVAILABLE	624,933	25,918
TOTALS	1,727,040	5,330,673	925,768

Table 17. Reported average annual Allowable Timber Sale Quantity (ASQ) from the Okanogan, Wenatchee, and Mount Baker-Snoqualmie national forests, and lands managed by the Washington Department of Natural Resources in the North Cascades Grizzly Bear Ecosystem.

ADMINISTRATIVE UNIT		ASQ (million board feet)
Okanogan NF		40
Wenatchee NF		75
Mount Baker-Snoqualmie NF		91
Washington Dept of Natural Resources		
Northeast Region		17
Northwest Region		30
Southeast Region		10
	TOTAL	263

Table 18. Area and portion of the North Cascades Grizzly Bear Ecosystem within permitted livestock range allotments on national forest lands.

ADMINISTRATIVE UNIT	ALLOTMENT TYPE	AREA (ha) IN ALLOTMENTS	PORTION (%) OF ECOSYSTEM	PORTION (%) IN FEDERAL AND STATE
Okanogan NF	Cattle	275,248	11	12
Okanogan NF	Sheep	70,000	3	3
Wenatchee NF	Cattle	46,376	2	2
Wenatchee NF	Sheep	86,125	3	4
		TOTALS	19	21

Table 19. Size comparison of the six Grizzly Bear Ecosystems (U.S. Fish and Wildlife Service 1990).

ECOSYSTEM	AREA ha	AREA km^2	AREA mi^2
North Cascades	2,620,755	26,207	10,119
Northern Continental Divide	2,480,000	24,800	9,575
Greater Yellowstone	2,333,000	23,330	9,008
Bitterroot	1,403,221	14,032	5,418
Cabinet/Yaak	510,000	5,100	1,969
Selkirk Mountains	507,000	5,070	1,958

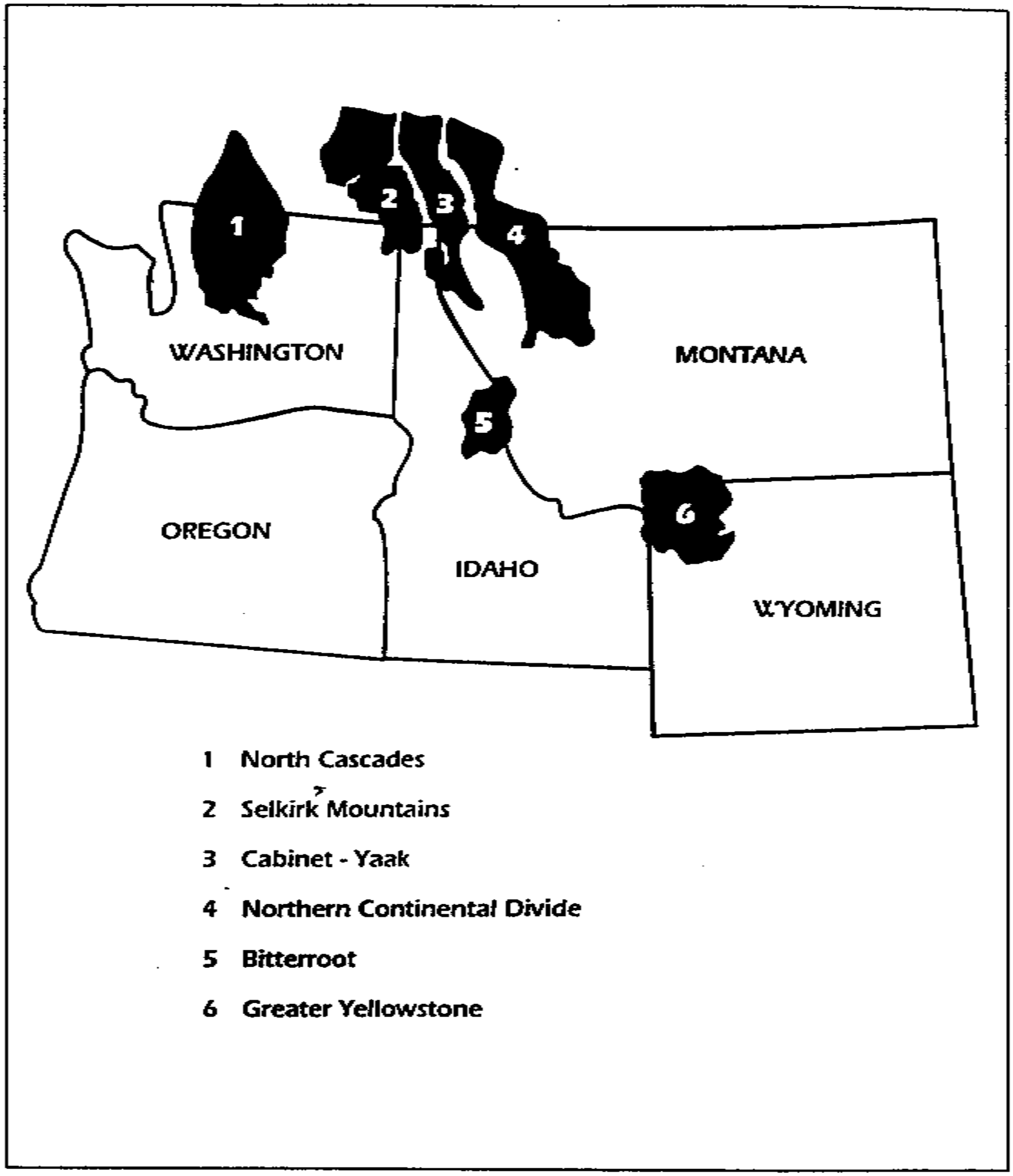


Figure 1. Grizzly Bear Ecosystems identified in the Grizzly Bear Recovery Plan (U.S. Fish and Wildlife Service 1993).

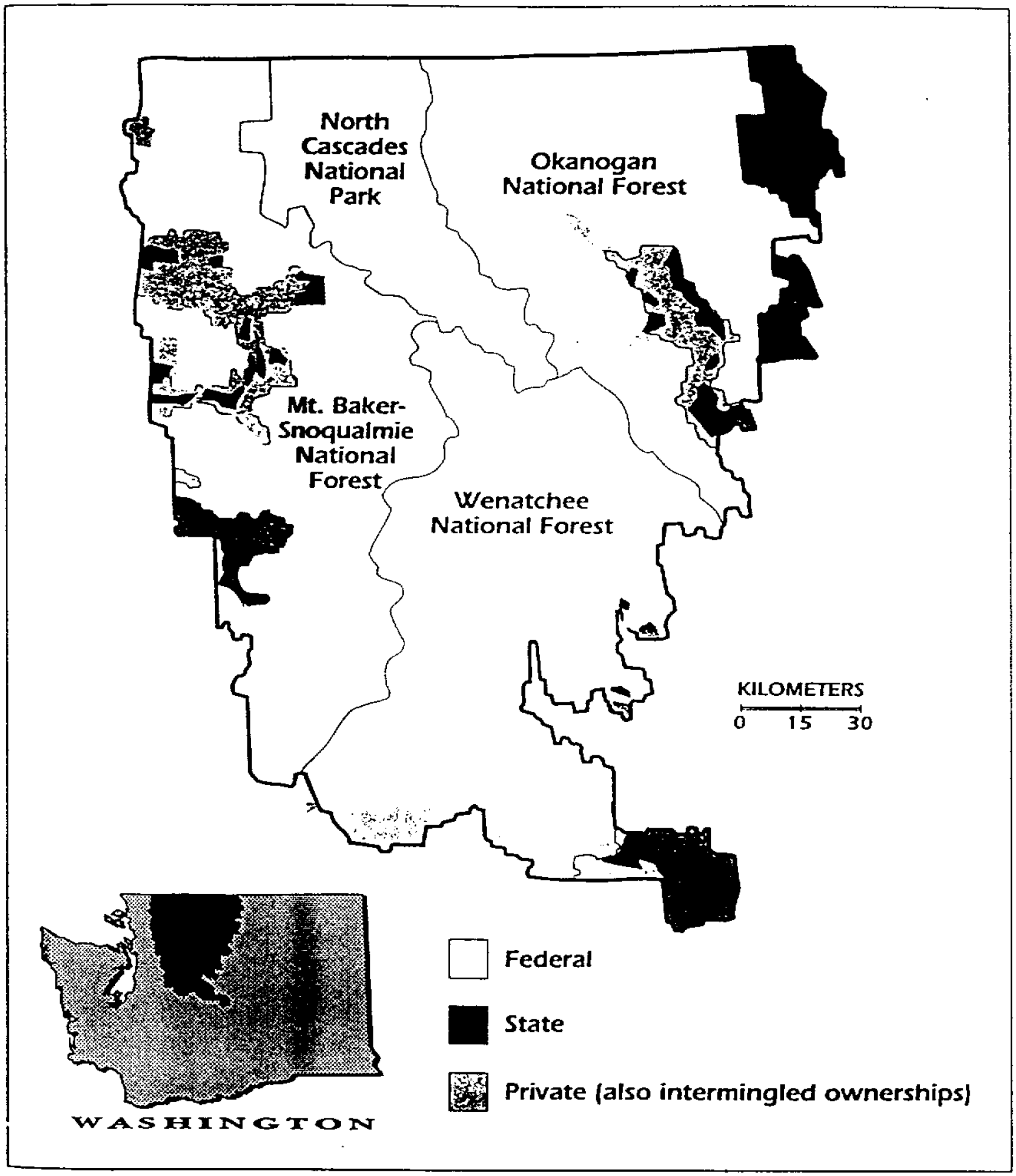
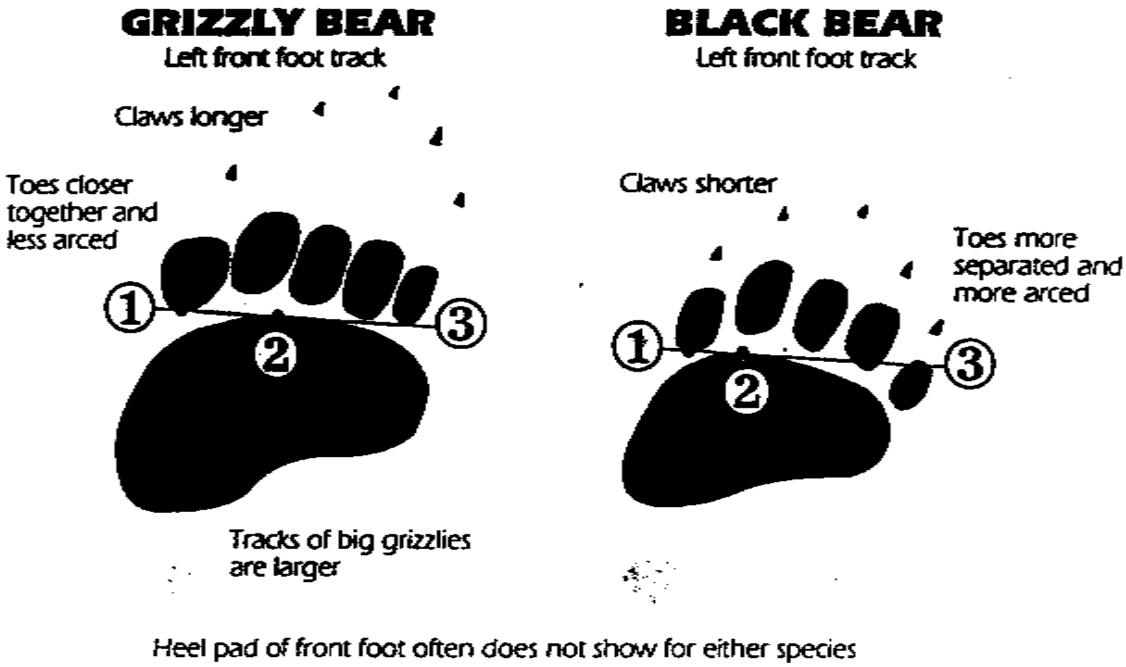


Figure 3. North Cascades Grizzly Bear Ecosystem Evaluation Area. General administrative ownerships are shown.



① Lowest point of outside (largest) toe.

② Highest point on front edge of palm pad.

Connect points 1 and 2; extend this line to inside edge of track

③ If more than 50% of the inside (smallest) toe is above the line, the track is from a grizzly bear

If more than 50% of the inside (smallest) toe is below the line, the track is from a black bear

If the line bisects the inside toe, claw marks, shape of the palm pad, spacing between toes, and other sign must be used to aid in species differentiation.

Figure 4. The Palmisciano Line Method for differentiating between grizzly bear and black bear tracks (drawing was adapted from Herrero (1985), by permission of the author).

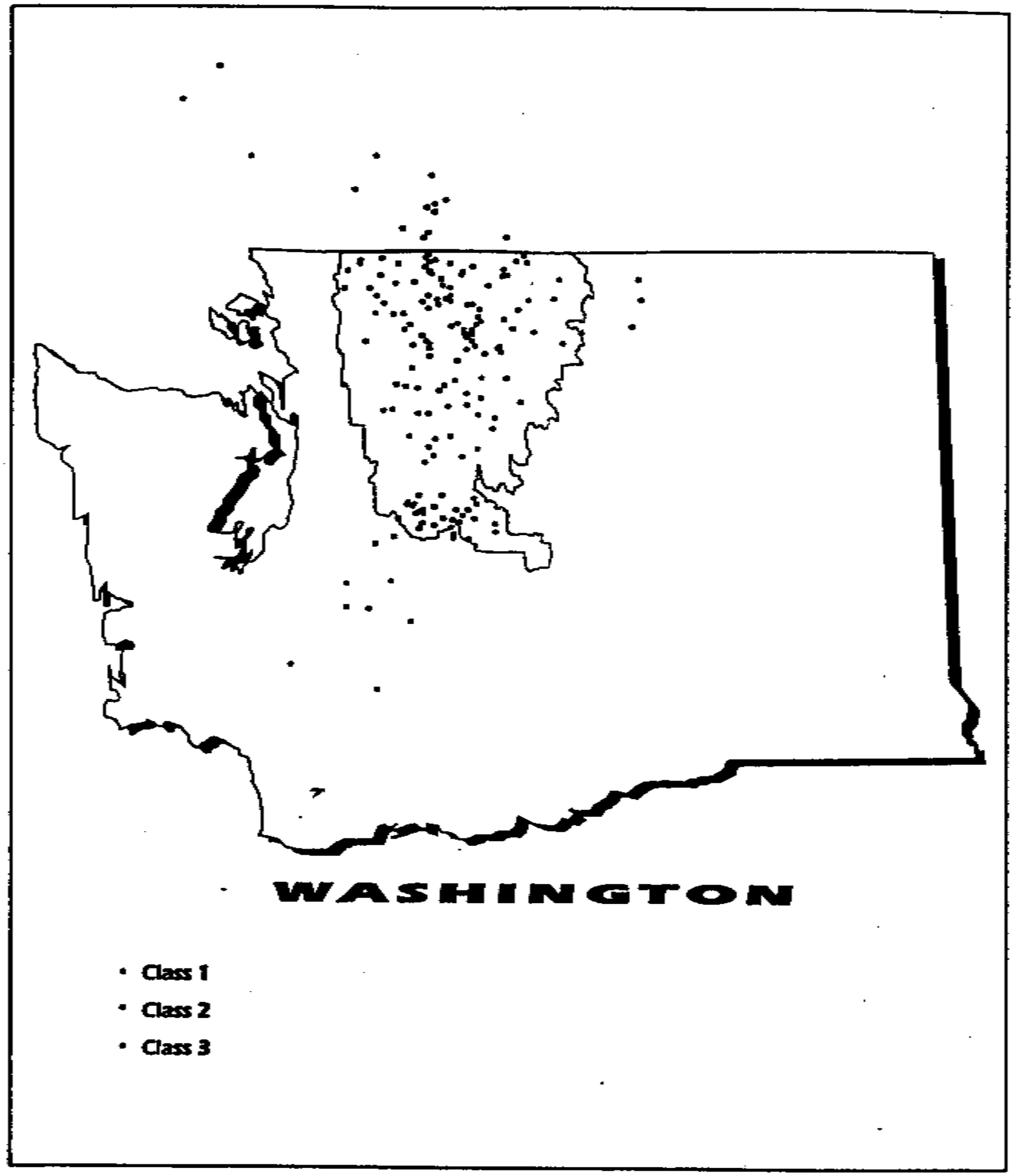


Figure 5. General locations of all grizzly bear observations (N = 238) documented during the 1986-1991 North Cascades Grizzly Bear Ecosystem evaluation.

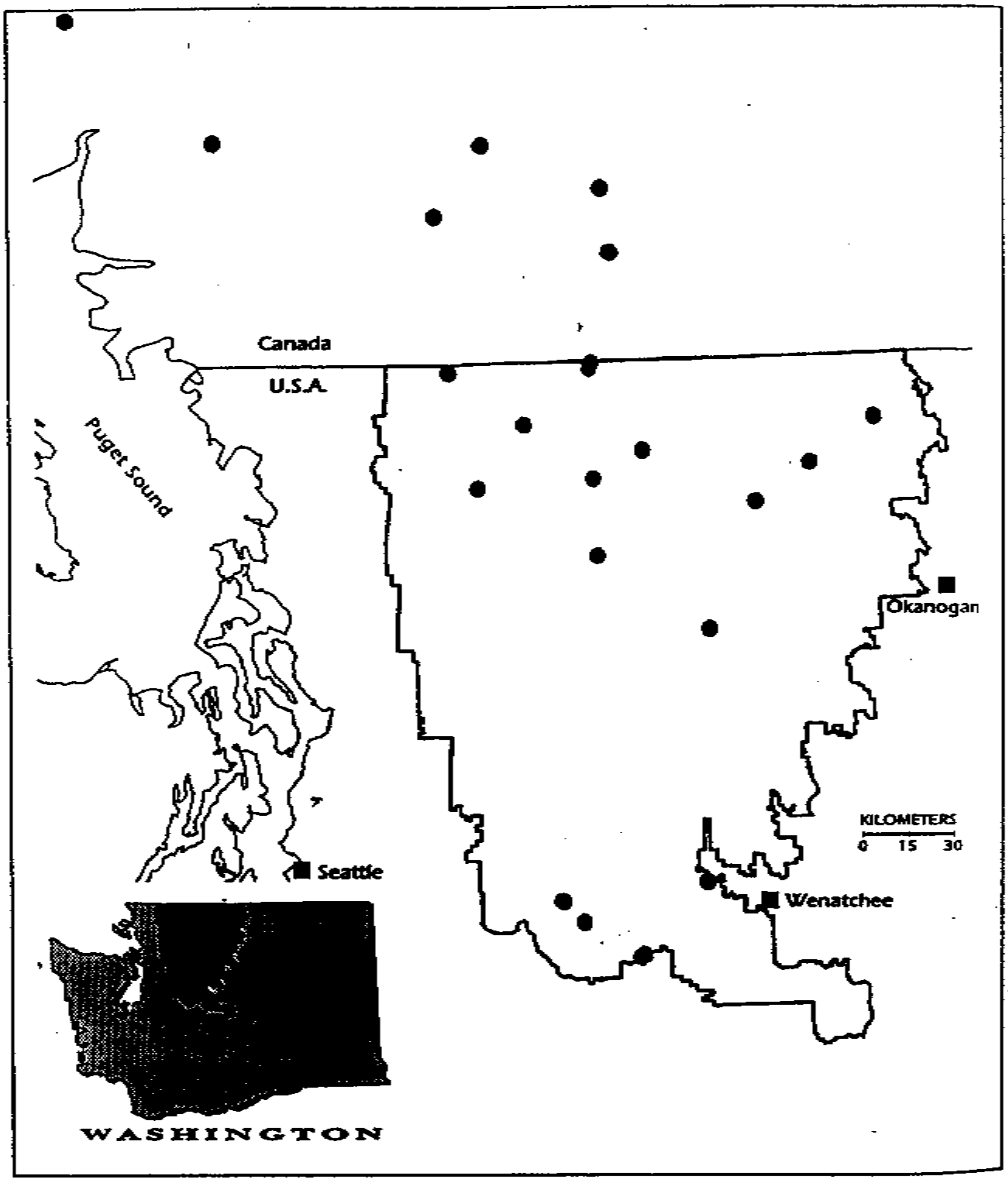


Figure 6. General locations of Class 1 (confirmed) grizzly bear observations (N = 22) documented during the 1986-1991 North Cascades Grizzly Bear Ecosystem evaluation.

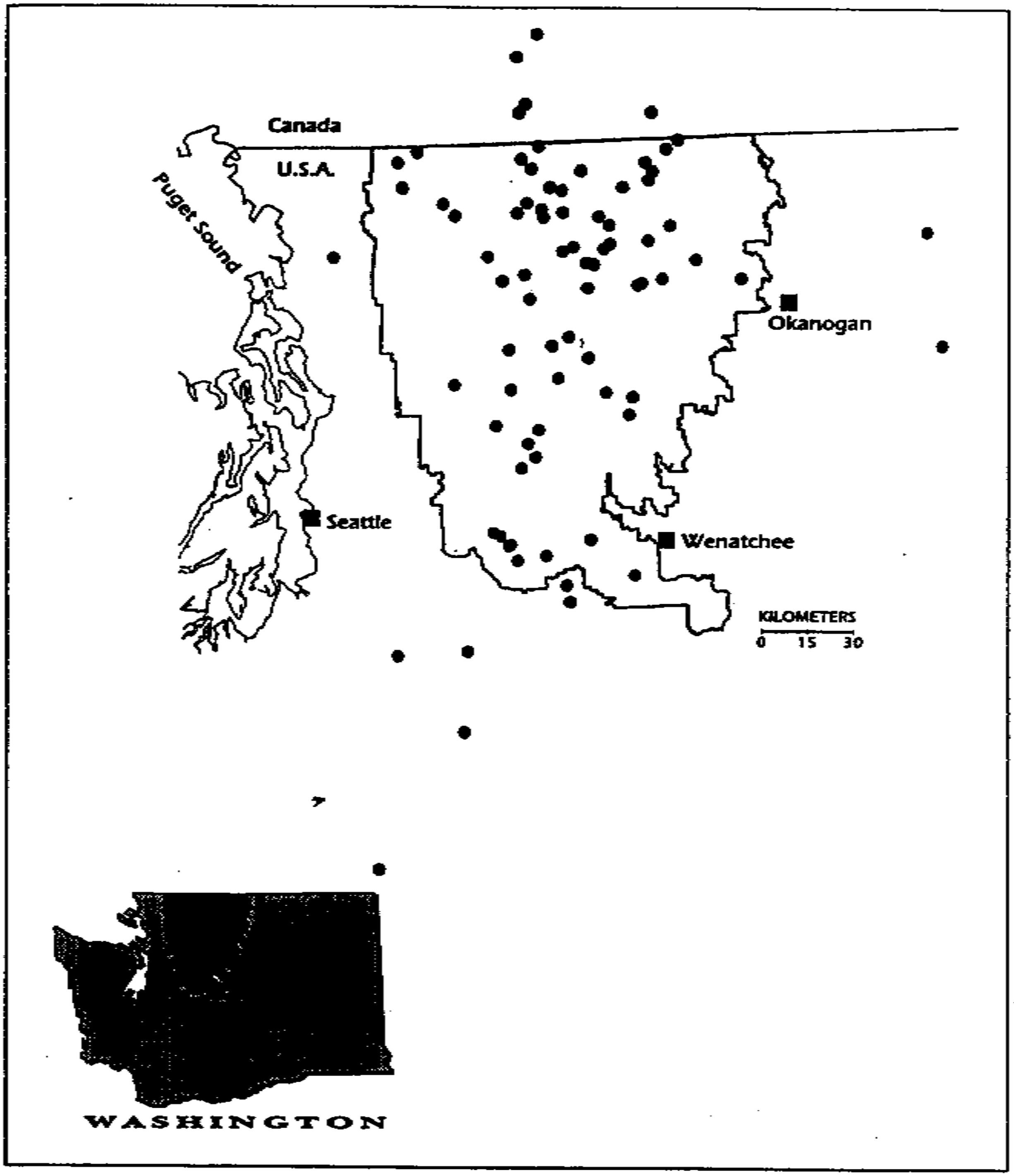


Figure 7. General locations of Class 2 (high reliability) grizzly bear observations (N = 82) documented during the 1986-1991 North Cascades Grizzly Bear Ecosystem evaluation.

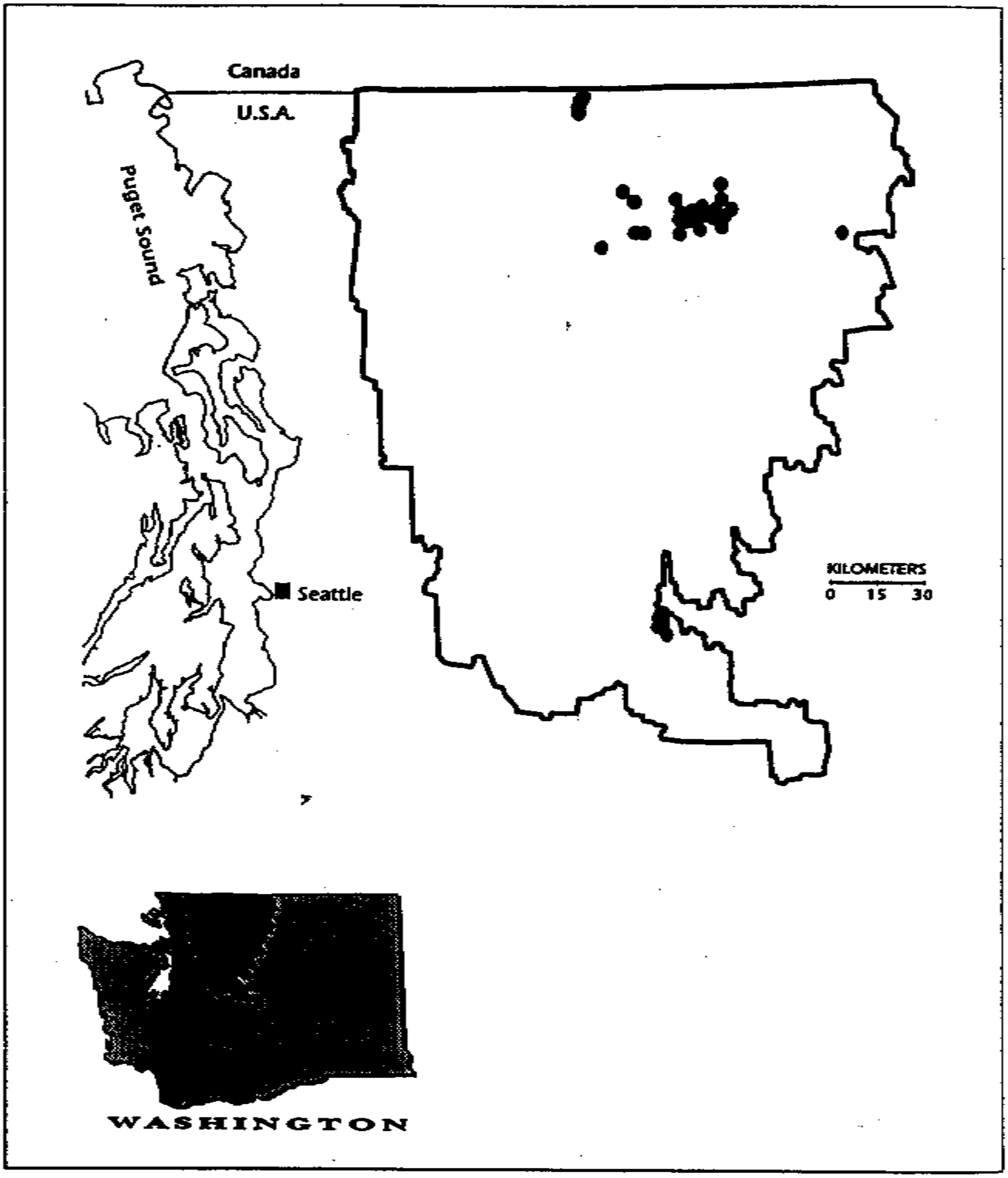


Figure 8. General locations of grizzly bear trap sites (N = 36) used during the 1986-1991 North Cascades Grizzly Bear Ecosystem evaluation.

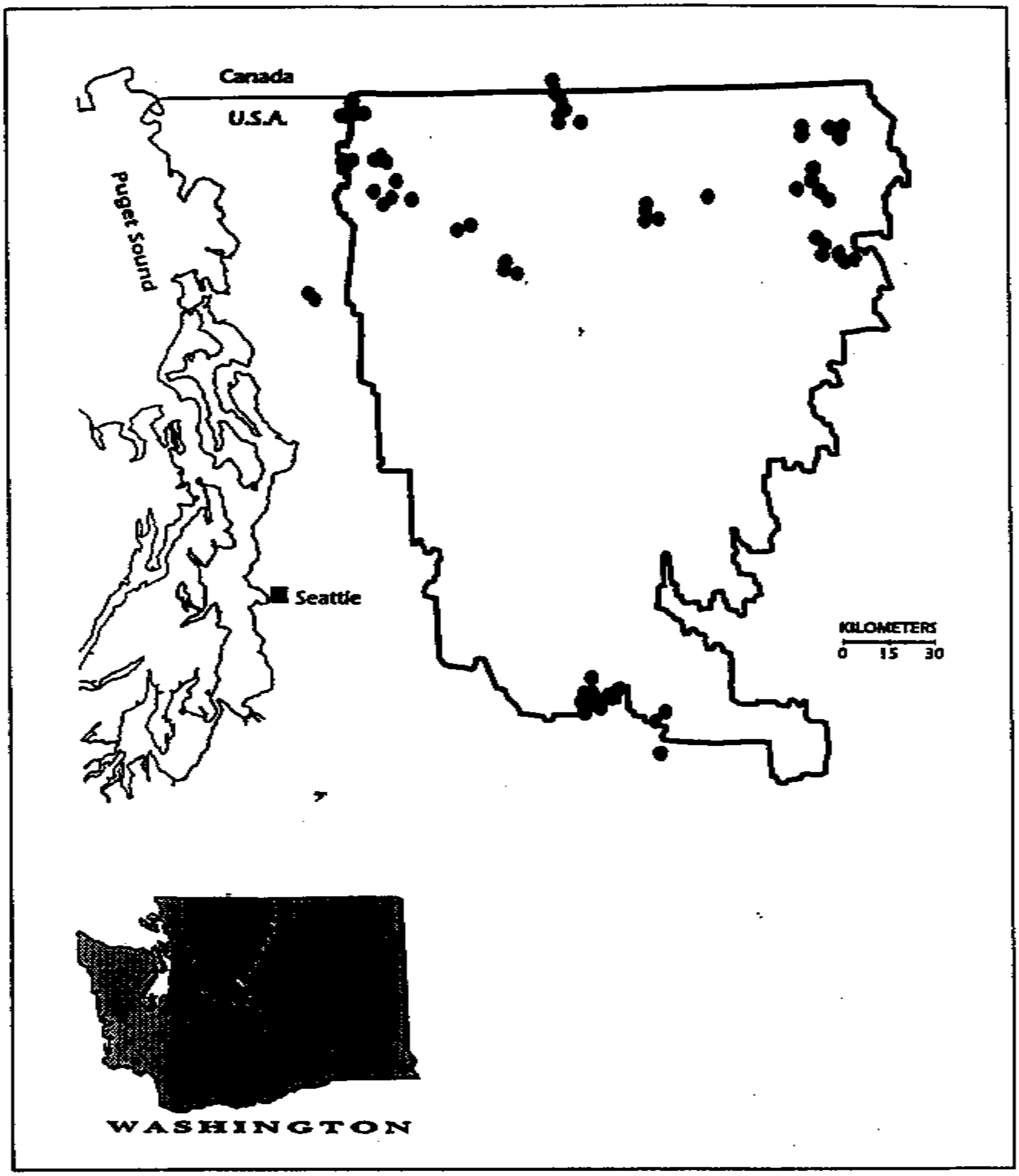


Figure 9. General locations of grizzly bear self-activated camera sites (N = 71) used during the 1986-1991 North Cascades Grizzly Bear Ecosystem evaluation.

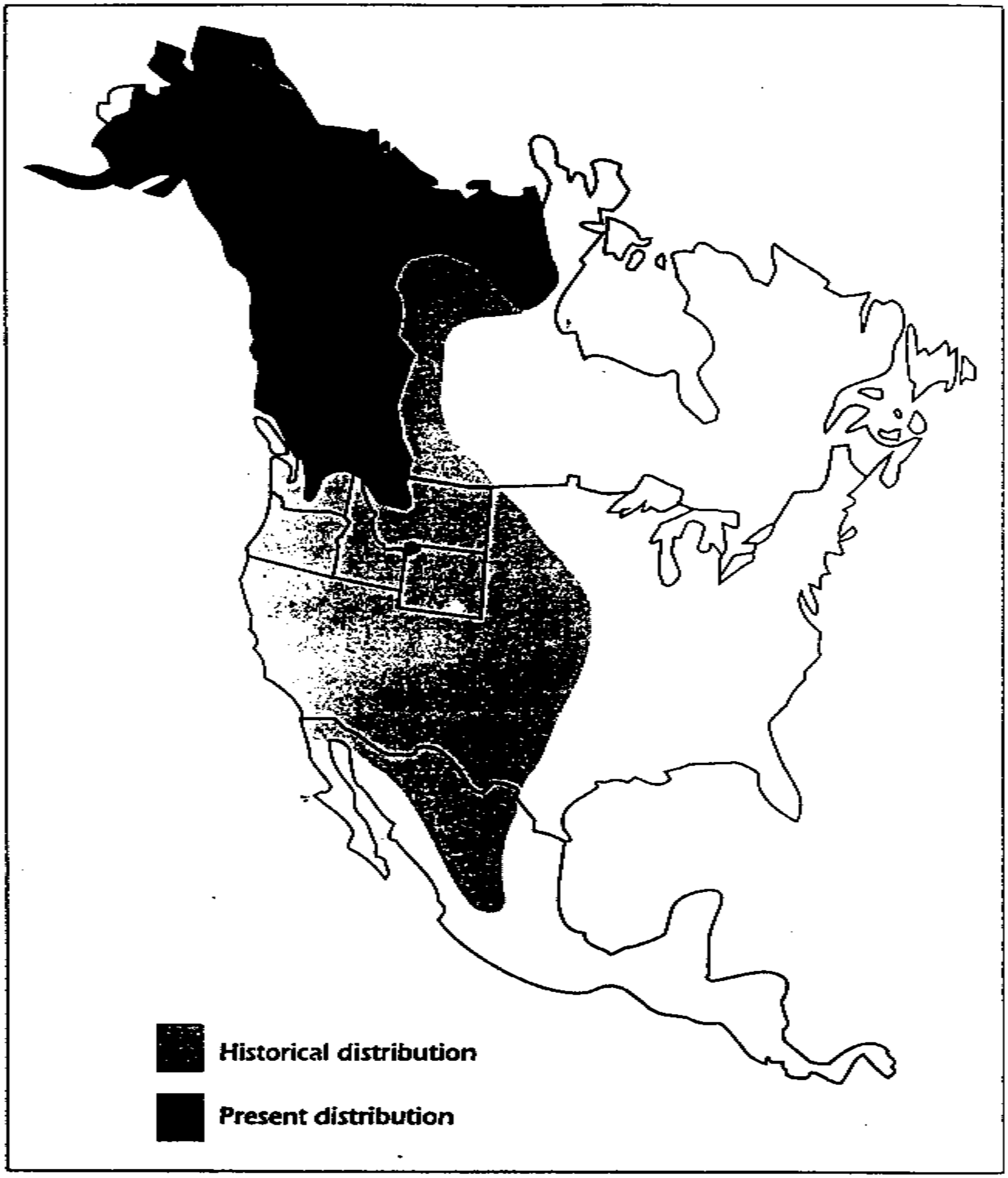


Figure 10. Corrected historical and current grizzly bear ranges, as depicted by incidental grizzly bear observations documented during the 1986-1991 North Cascades Grizzly Bear Ecosystem evaluation.

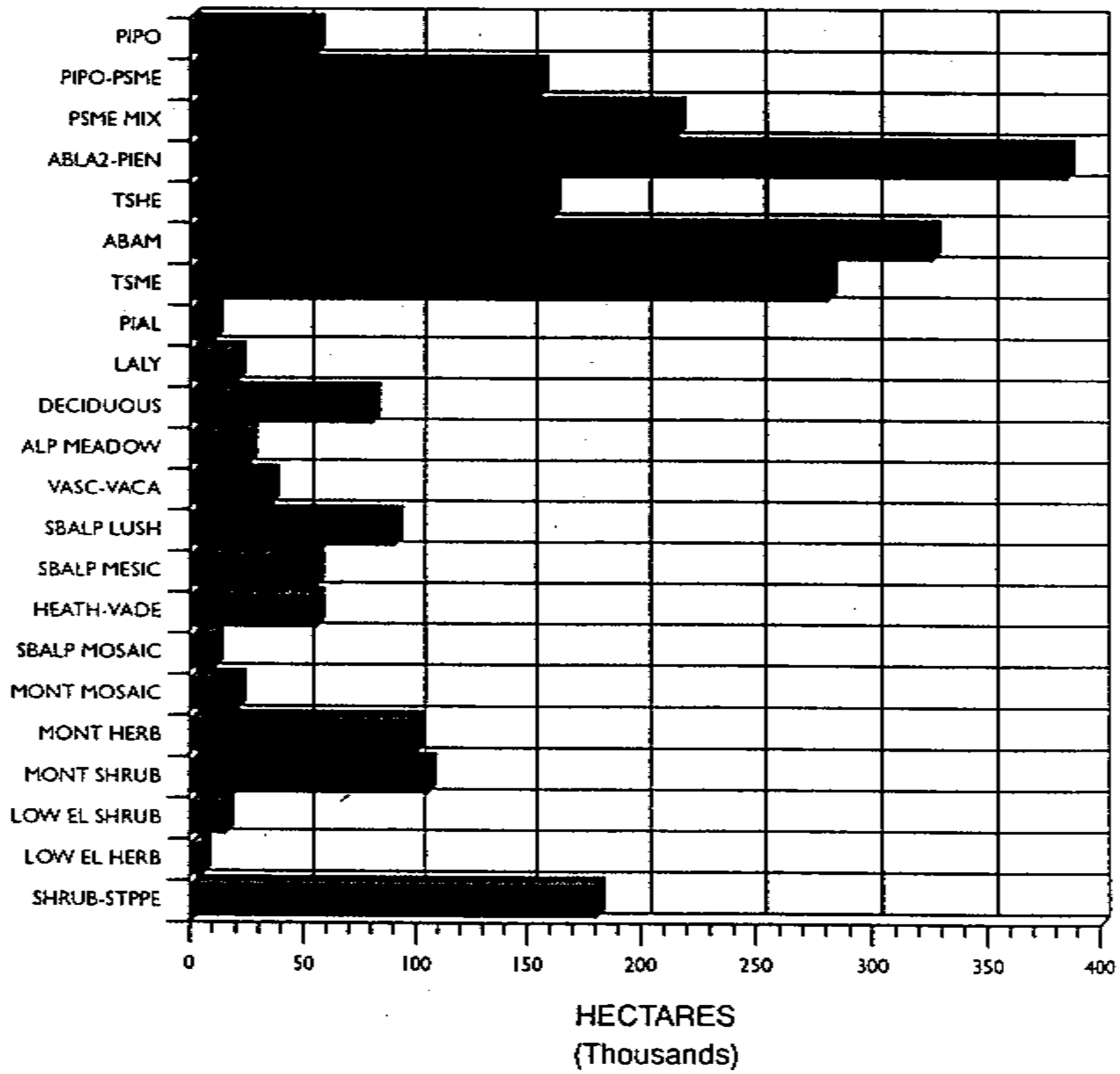


Figure 11. The relative abundance of Level 2 vegetation types within the North Cascades Grizzly Bear Ecosystem.

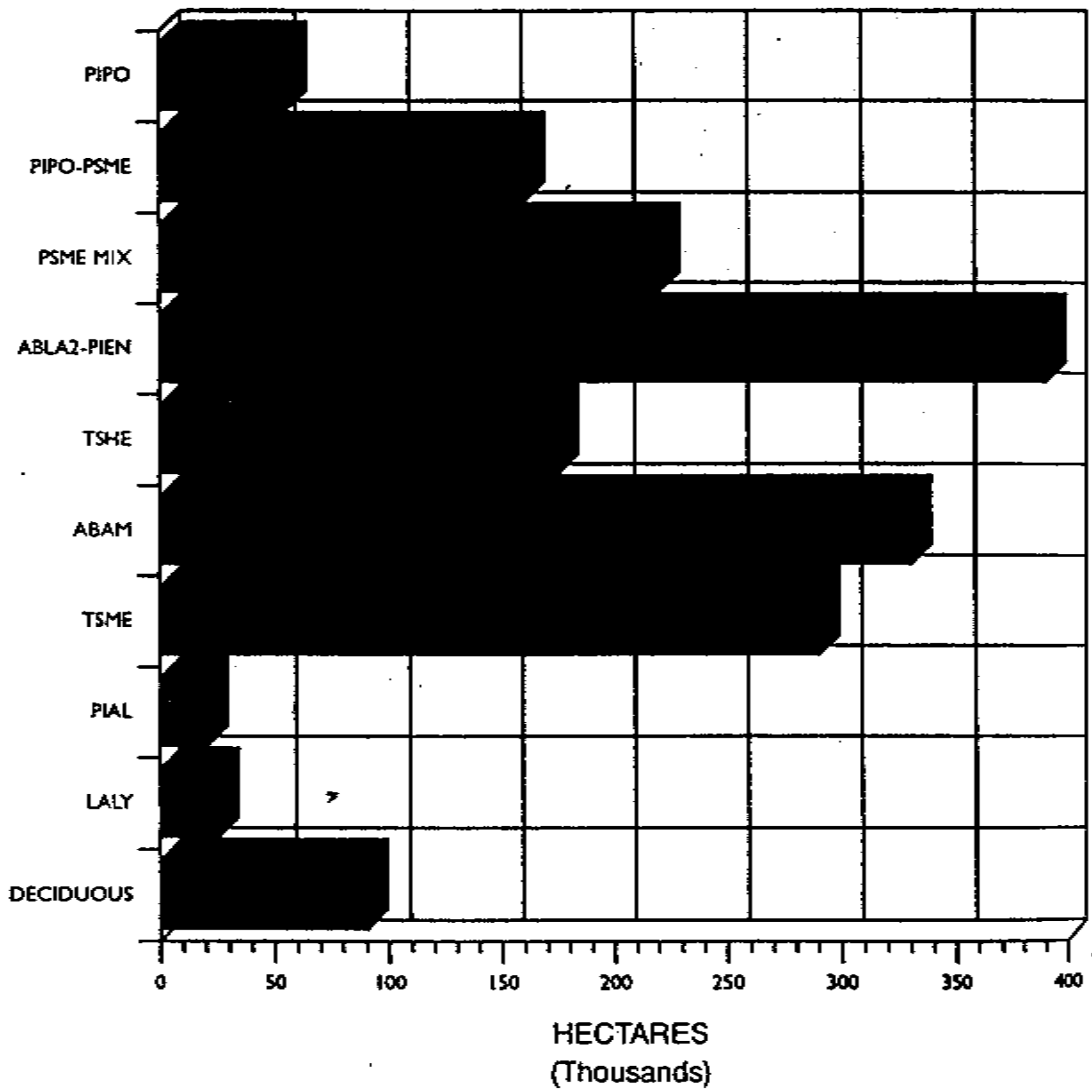


Figure 12. The relative abundance of Level 2 forested vegetation types within the North Cascades Grizzly Bear Ecosystem.

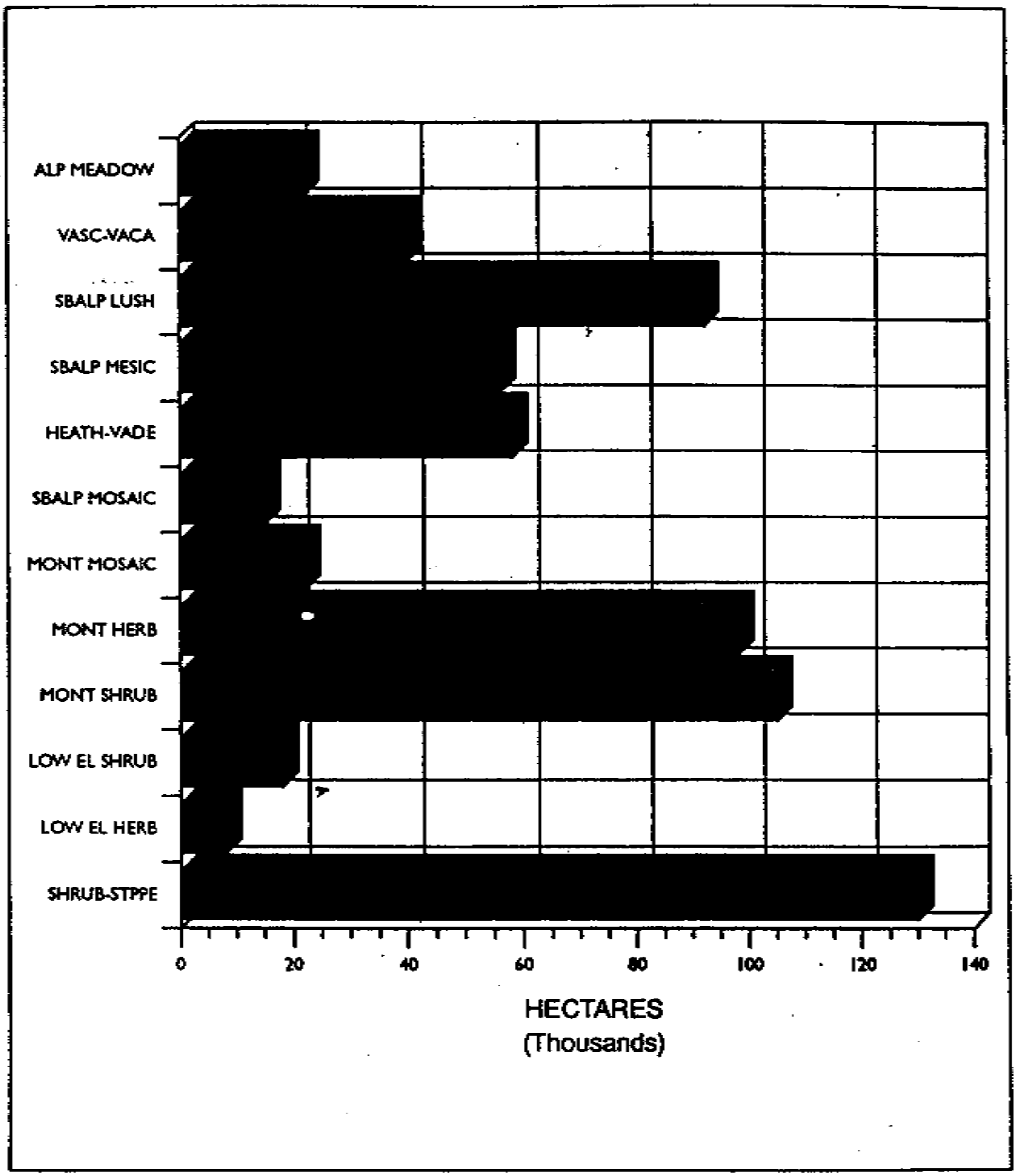


Figure 13. The relative abundance of Level 2 non-forested vegetation types within the North Cascades Grizzly Bear Ecosystem.

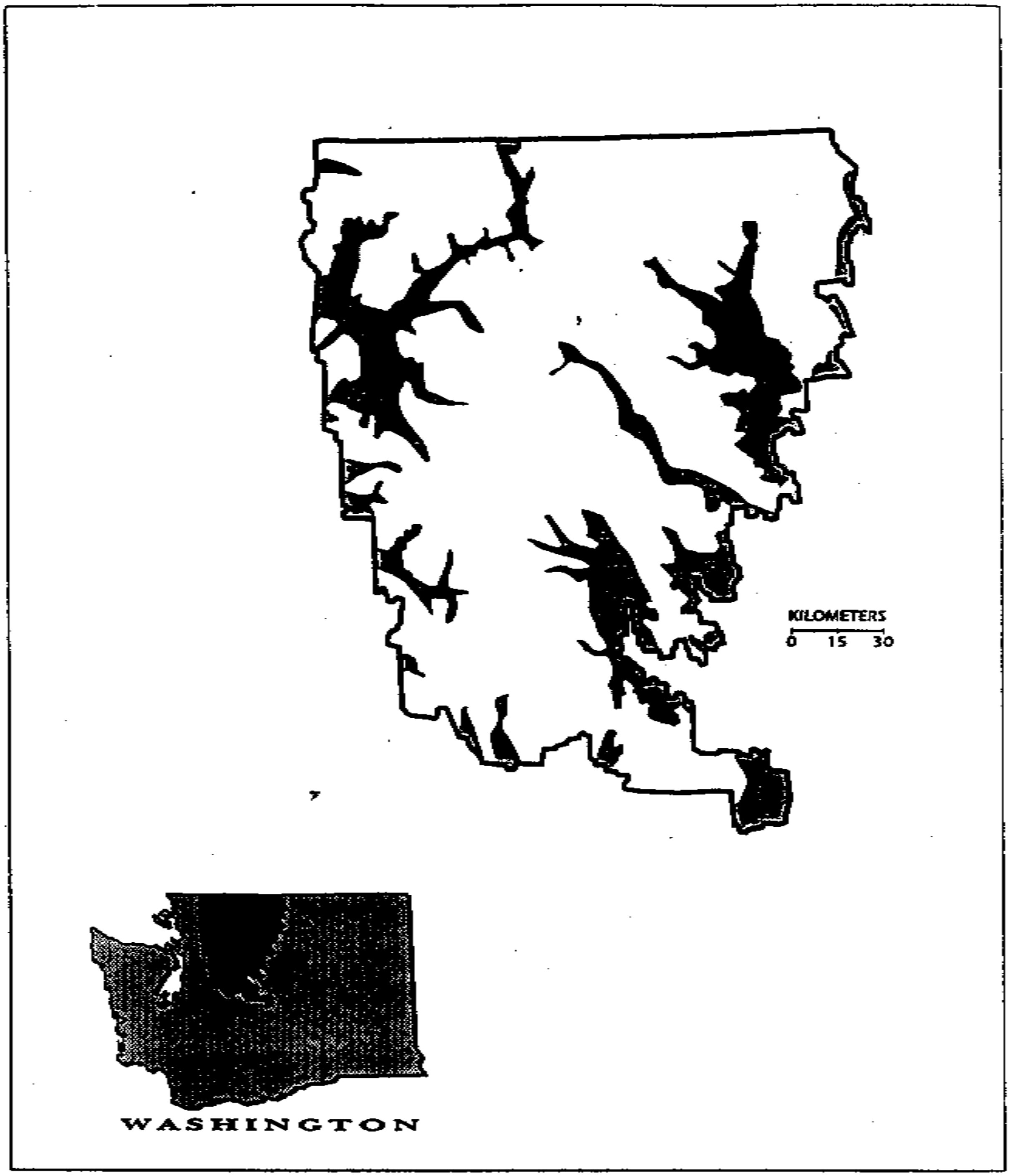


Figure 14. Map showing the distribution of snow-free areas (dark shading) modeled for the North Cascades Grizzly Bear Ecosystem (1 April 1975 data).

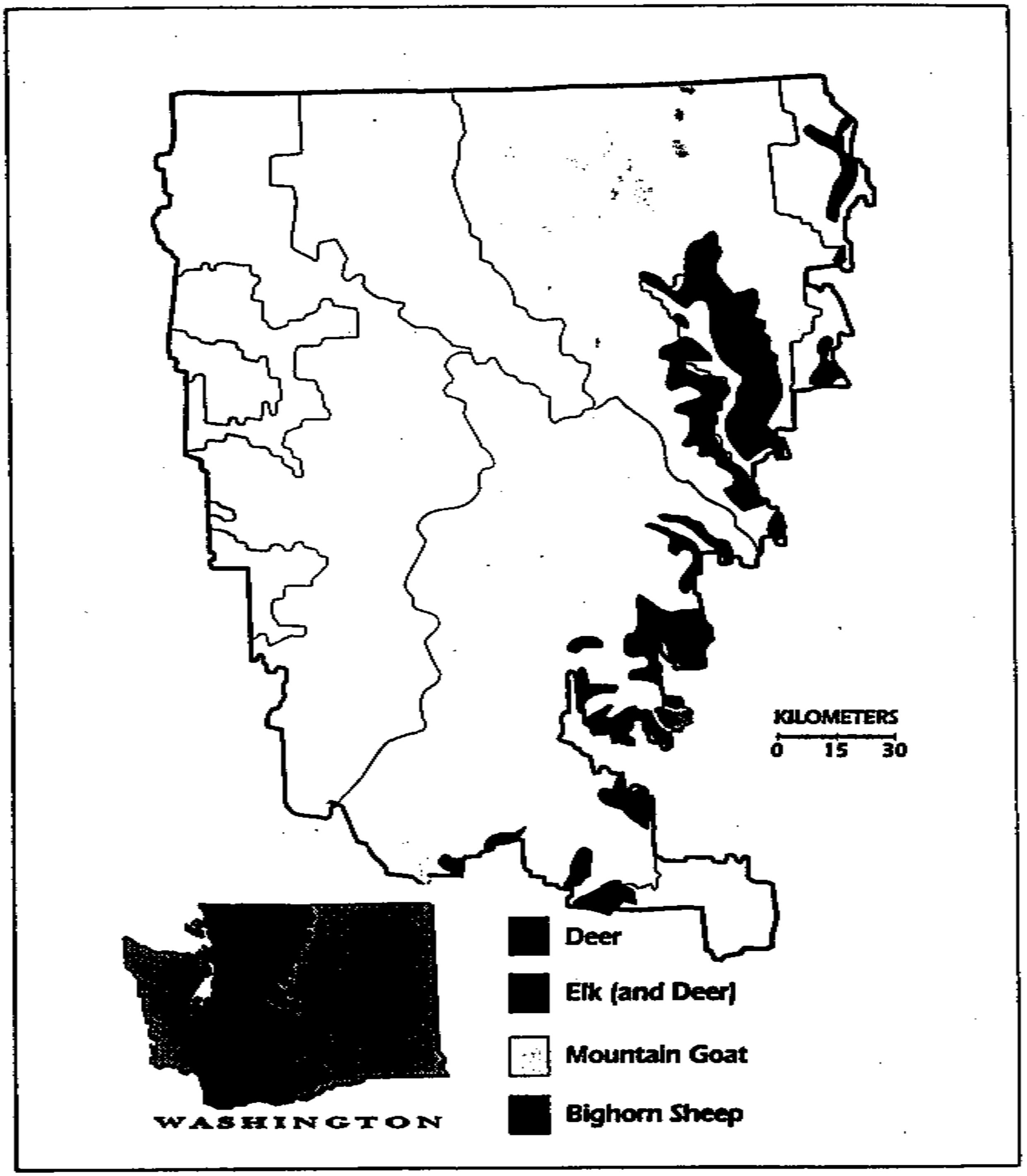


Figure 15. Map showing the ungulate winter ranges on the east slope of the North Cascades Grizzly Bear Ecosystem.

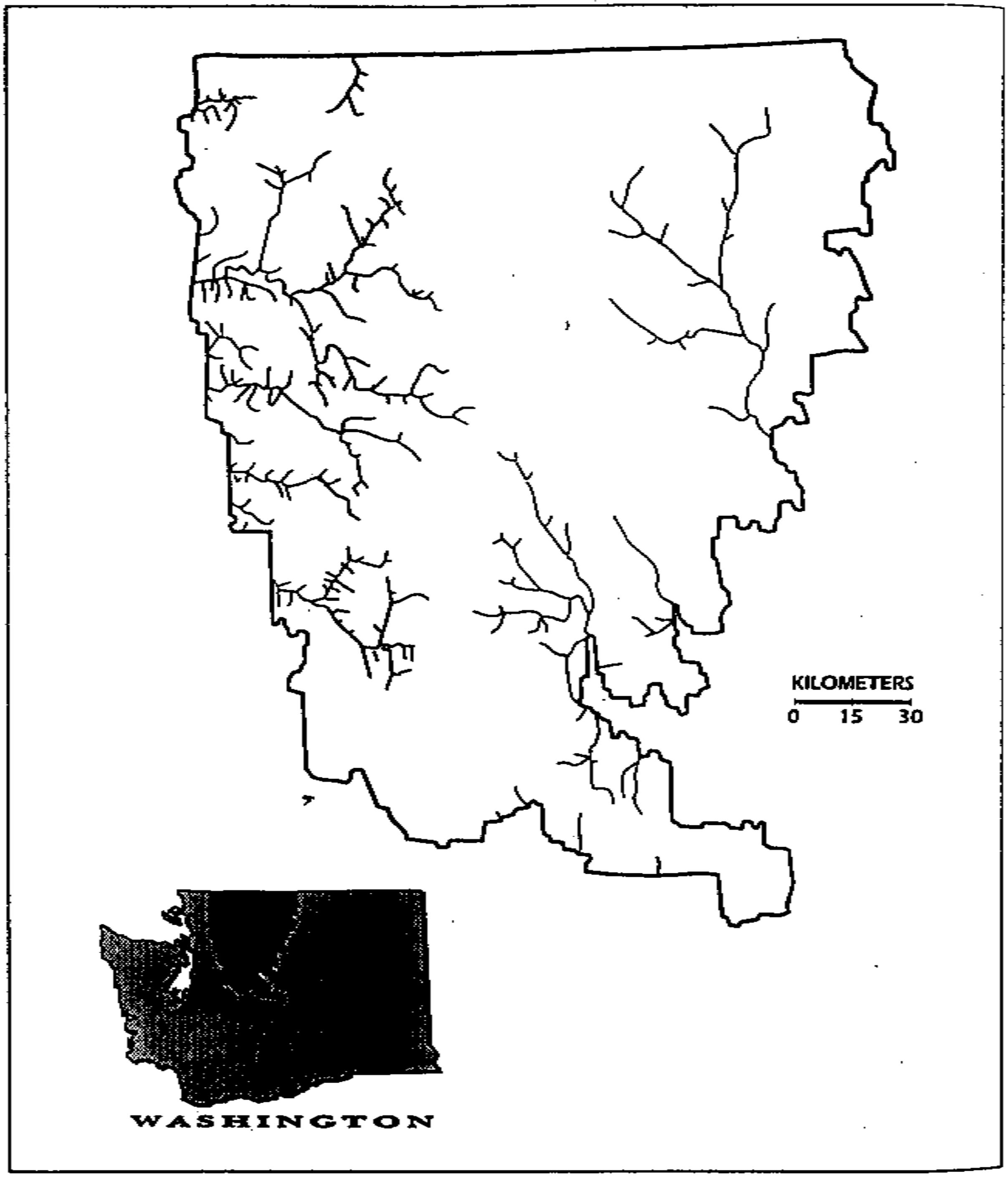


Figure 16. Map showing the anadromous fish reaches within the North Cascades Grizzly Bear Ecosystem.

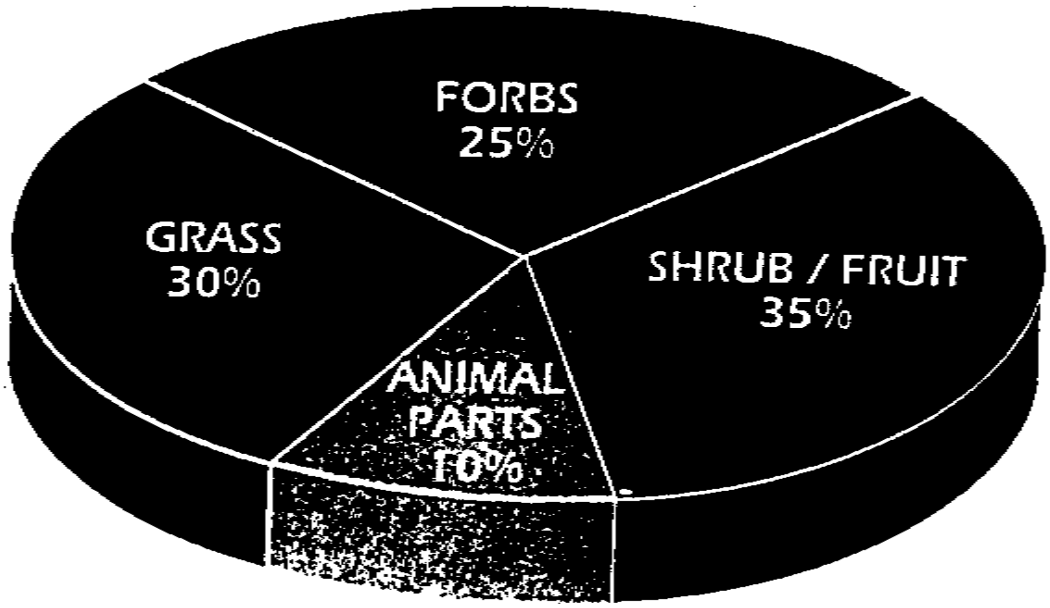


Figure 17. Distribution of major bear food groups identified in the North Cascades Grizzly Bear Ecosystem from the analysis of bear scats (N = 120) undifferentiated to bear species.

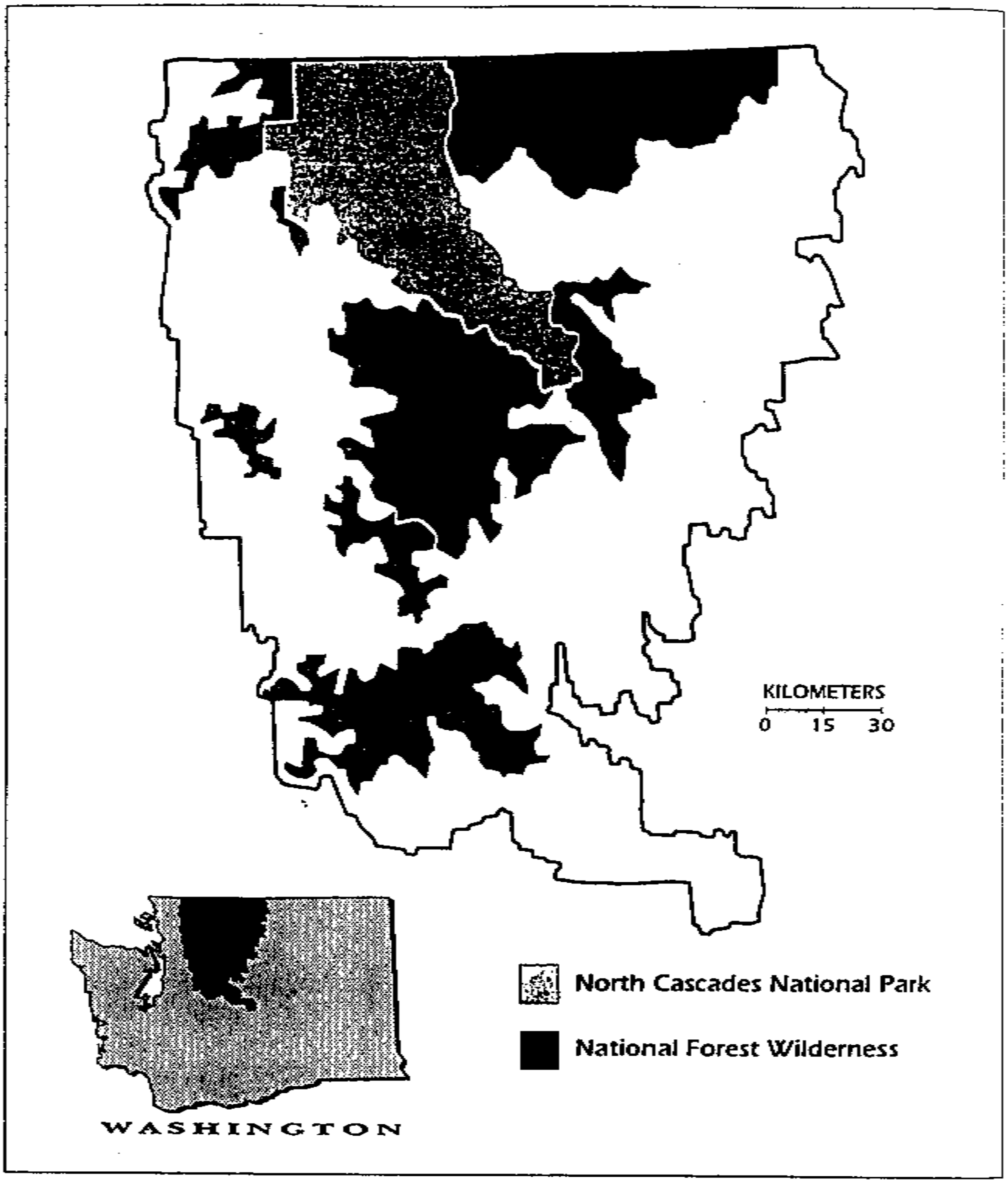


Figure 18. Distribution of wilderness areas and national park lands within the North Cascades Grizzly Bear Ecosystem.

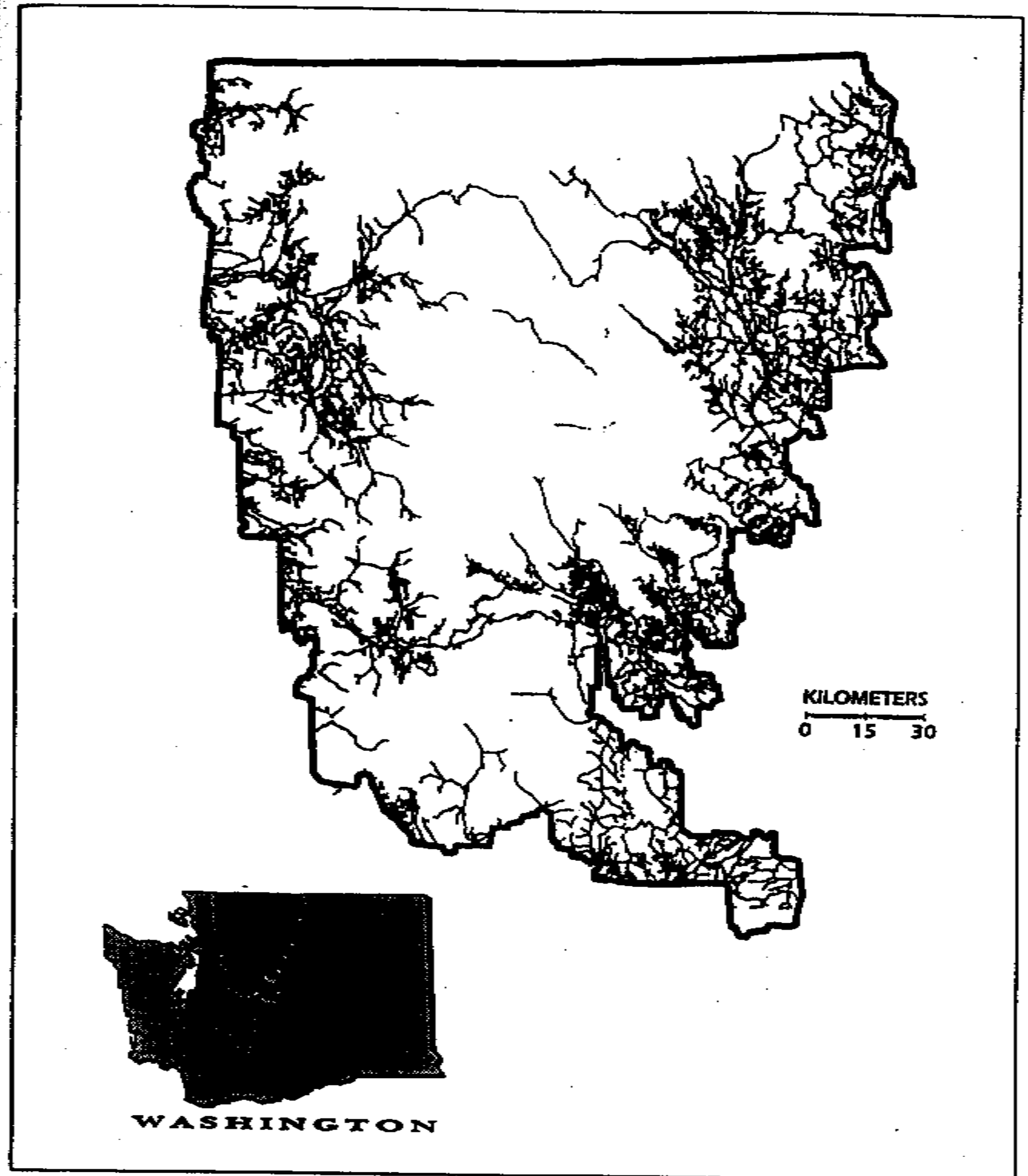


Figure 19. Distribution of roads within the North Cascades Grizzly Bear Ecosystem.

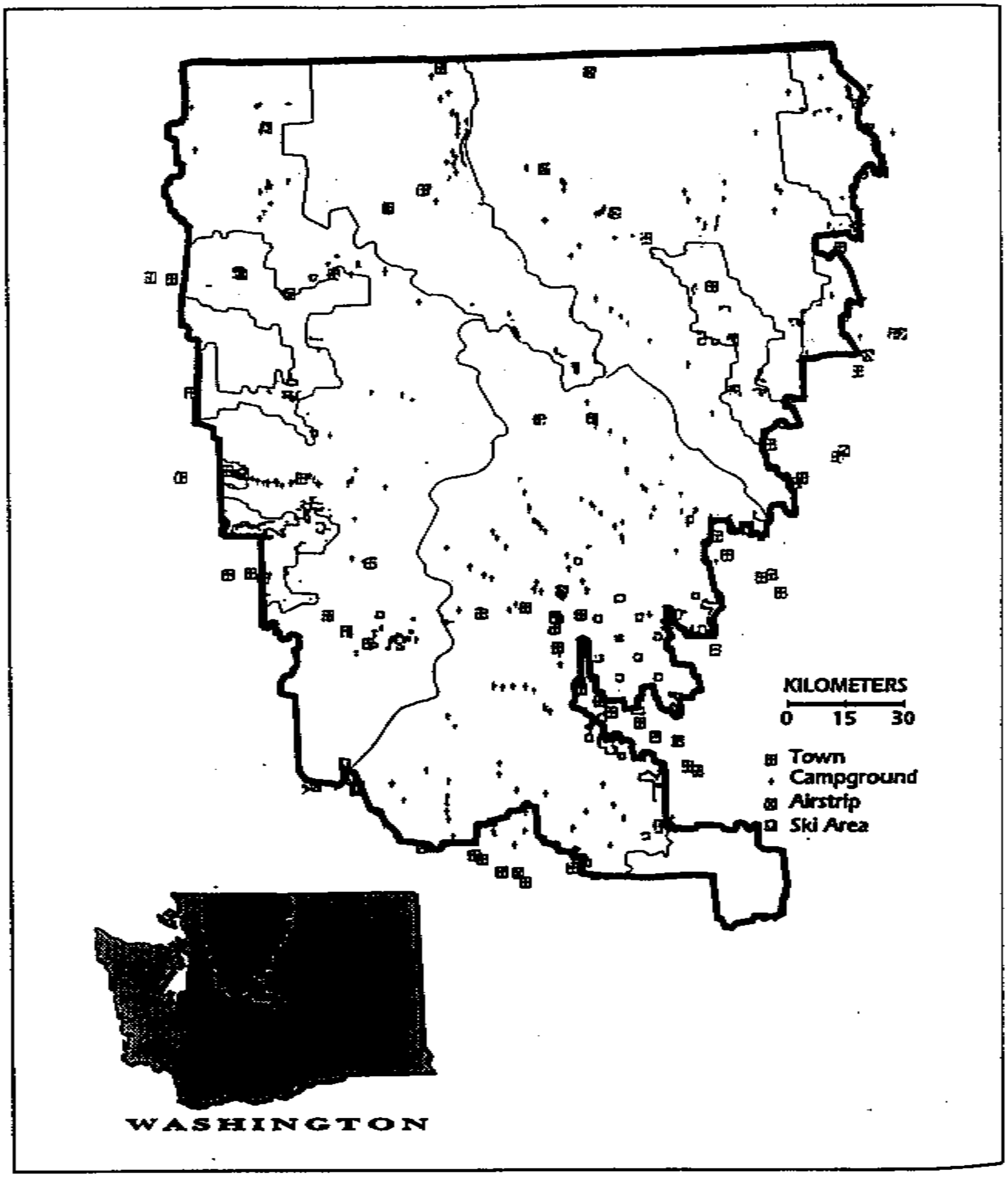


Figure 20. Distribution of campgrounds, ski areas, air strips, and population centers within and adjacent to the North Cascades Grizzly Bear Ecosystem.

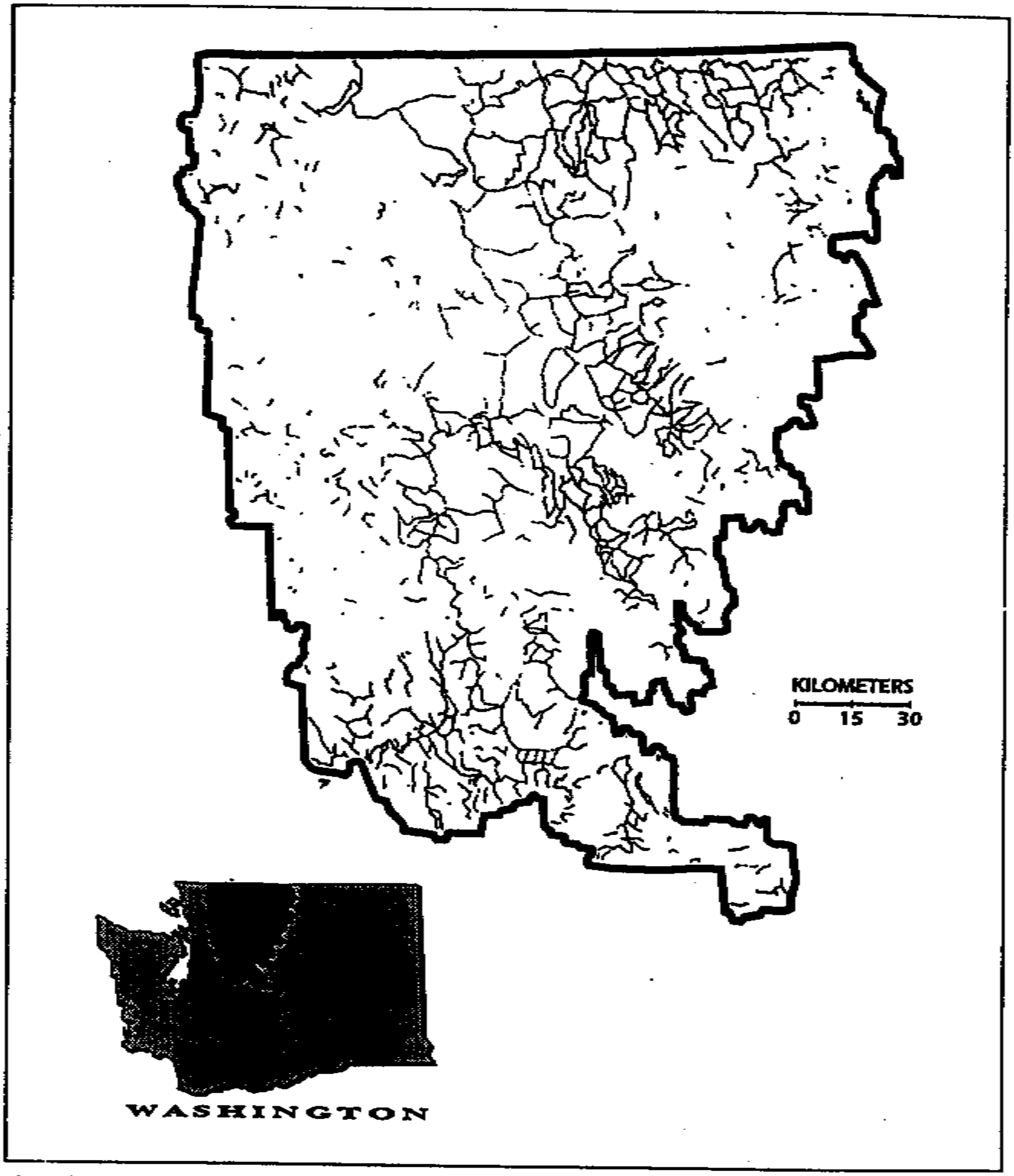


Figure 21. Distribution of trails within the North Cascades Grizzly Bear Ecosystem.

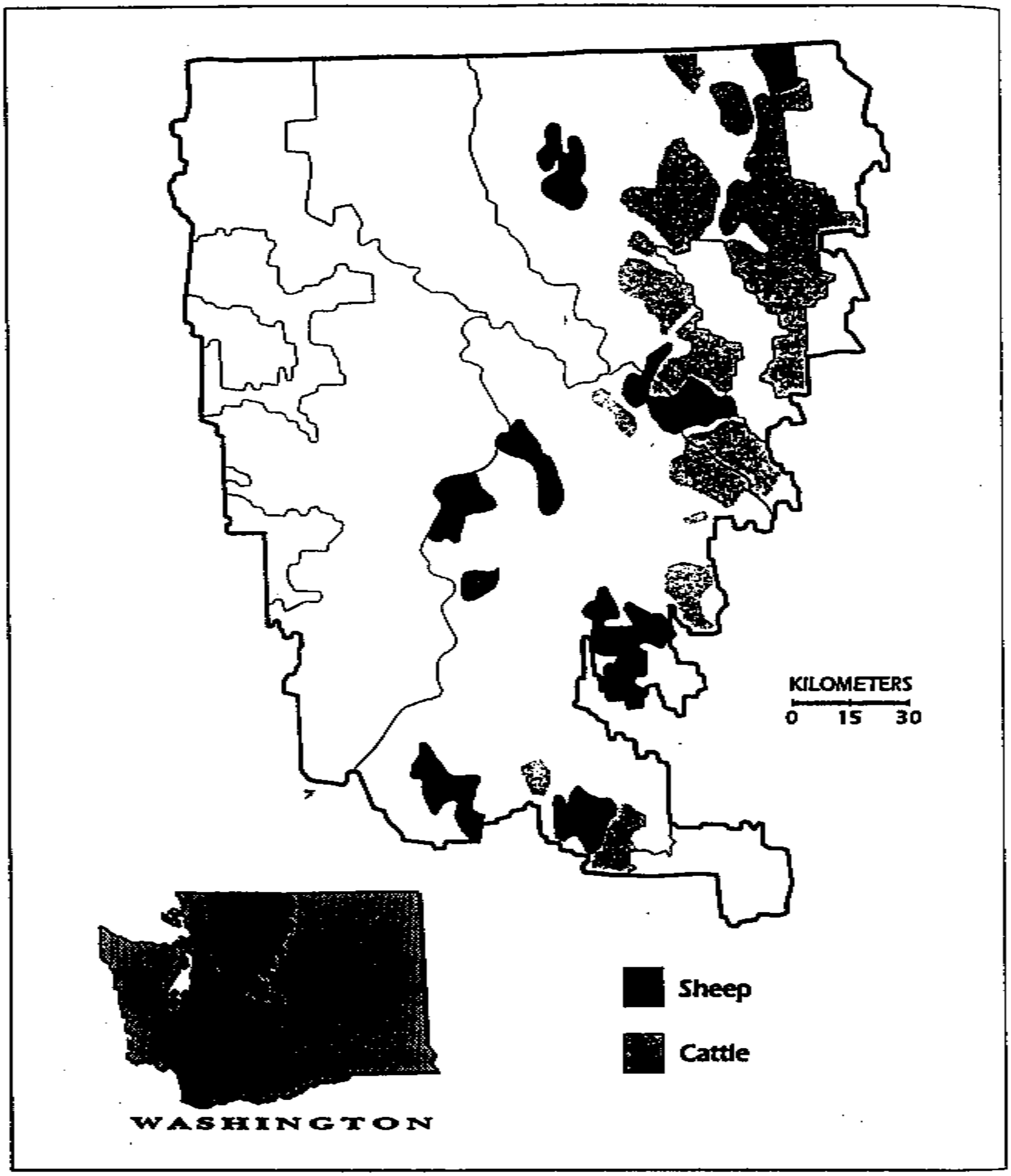


Figure 22. Livestock allotments on national forest lands within the North Cascades Grizzly Bear Ecosystem.

Appendix A. Selected vegetation studies previously conducted in the North Cascades Ecosystem.

Agee, J.K., and J. Kertis. 1986. Vegetation cover types of the North Cascades. National Park Service Cooperative Park Studies Unit, College of Forest Resources, Univ. of Washington, Seattle. 64 pp. + map.

Agee, J.K., and S.G. Pickford. 1985. Vegetation and fuel mapping of North Cascades National Park Service Complex. Final Report. NPS Contract CX-9000-3-E029. National Park Service Copperative Park Studies Unit, Univ. of Washington, Seattle. 111 pp. + app. and map.

Briggs, D.G., D.S. DeBall, and W.A. Atkinson. 1978. Utilization and management of alder. Proc. of Symp. at Ocean Shores, Washington. April 25-27, 1977. USDA Forest Service Tech. Rep. PNW-70. Pacific Northwest For. and Range Exp. Sta., Portland. 379 pp.

Comulada, A.B. 1981. A botanical reconnaissance of the Chilliwack River in North Cascades National Park, Washington. M.S. Thesis. Western Washington Univ., Bellingham. 53 pp.

Cushman, M.J. 1976. Vegetation composition as a predictor of major avalanche cycles, North Cascades, Washington. M.S. Thesis. Univ. of Washington, Seattle.

Douglas, G.W. 1970. A vegetation study in the subalpine zone of the western North Cascades, Washington. M.S. Thesis. Univ. of Washington, Seattle. 293 pp.

_____. 1969. A preliminary biological survey of the North Cascades National Park and the Ross Lake and Lake Chelan national recreation areas. National Park Service, Seattle. 195 pp.

_____, and T.M. Ballard. 1971. The effect of fire on alpine plant communities in the North Cascades. Ecology 52: 1058-1064.

_____, and L.C. Bliss. 1977. Alpine and high subalpine plant communities of the North Cascades Range, Washington, and British Columbia. Ecol. Monogr. 47: 113-150.

Franklin, J.F., and C.T. Dyrness. 1973. Natural vegetation of Oregon and Washington. USDA Forest Service Gen. Tech. Rep. PNW-8. Pacific Northwest Region, Portland. 417 pp.

Franklin, J.F., and J.M. Trappe. 1963. Plant communities of the northern Cascade range: a reconnaissance. Northwest Sci. 37: 163-164.

Hammett, J. 1983. Recreational horse grazing impacts on subalpine vegetation and soils in the Lake Juanita area. Misc. Res. Paper NCT-20. North Cascades National Park Service Complex, Sedro Woolley, Washington. 16 pp.

Henderson, J.A., and D. Peter. 1985. Preliminary plant associations and habitat types of the Mt. Baker Ranger District, Mt. Baker-Snoqualmie National Forest. USDA Forest Service, Pacific Northwest Region, Olympia, Washington. 74 pp. + app.

_____, and _____. 1984. Preliminary plant associations and habitat types of the Darrington Ranger District, Mt. Baker-Snoqualmie National Forest. USDA Forest Service, Pacific Northwest Region, Olympia, Washington. 69 pp. + app.

Hitchcock, C.L., and A. Cronquist. 1973. Flora of the Pacific Northwest. University of Washington Press, Seattle. 730 pp.

Kenady, R., and M. Kenady. 1969. Plants in the North Cascades National Park. Univ. of Washington Arboretum Bull. 32: 76-80.

Larrison, E.J., G.W. Patrick, W.H. Baker, and J.A. Yaich. 1974. Washington wildflowers. The Seattle Audubon Society, Seattle. 376 pp.

Larson, J.W. 1972. Ecological role of lodgepole pine in the upper Skagit River valley, Washington. M.S. Thesis. Univ. of Washington, Seattle. 77 pp.

Lyons, C.P. 1967. Trees, shrubs and flowers to know in Washington. J.M. Dent and Sons, Ltd., Toronto, Ontario, Canada. 211 pp.

Miller, J.M., and M.M. Miller. 1974. Succession after wildfire in the North Cascades National Park Complex. Proc. Tall Timbers Fire Ecol. Conf. 15: 71-83.

_____, and _____. 1972. A preliminary ecological survey of Big Beaver Valley, North Cascades National Park Complex. North Cascades National Park Service Complex, Sedro Woolley, Washington. 83 pp.

Naas, R., and D. Naas. 1978. A checklist of the vascular plants of the North Cascades National Park Service Complex. North Cascades National Park Service Complex, Sedro Woolley, Washington. 64 pp.

Oliver, C.D., A.B. Adams, J. Dragavon, R.J. Zasoski, and K. Bardo. 1977. Nooksack Cirque natural history; preliminary report. Contract No. CX-9000-6-0148. Univ. of Washington, SEattle. 75 pp.

Schubert, J. 1977. Fisher Pass: a report on the Fisher Creek approach and conditions of recreational impact. North Cascades National Park Service Complex, Sedro Woolley, Washington. 10 pp.

Scott, E.R.M., H. Barber, and J. Long. 1971. Plant community study of the Ross Lake Basin. Appendix D in R.D. Taber, ed. Biotic Survey of Ross Lake Basin. Univ. of Washington, Seattle. 35 pp.

Smith, V., and M.G. Anderson. 1921. A preliminary biological survey of the Skagit and Stillaguamish rivers. Publisher unknown. 76 pp.

Taber, R.D., and K. Raedeke. 1976. Biotic survey of Ross Lake Basin. Report for Julty 1, 1975 - June 30, 1976. College of Forest Resources, Univ. of Washington, Seattle. 46 pp.

Taylor, R.J., and G.W. Douglas. 1975. Mountain wildflowers of the Pacific Northwest. Benford and Mort, Portland, Oregon. 176 pp.

Taylor, R.L., and B. MacBryde. 1977. Vascular plants of British Columbia; a descriptive resource inventory. The Botanical Garden Tech. Bull. No. 4. Univ. of British Columbia, Vancouver. 754 pp.

Thornburgh, D.A. 1976. Permanent vegetational monitoring system for Whatcom Pass, North Cascades National Park. Humboldt State Univ., Arcata, California. 128 pp.

_____. 1970. Survey of recreational impact and management recommendations for the subalpine vegetation communities at Cascade Pass, North Cascades National Park. Humboldt State College, Arcata, California. 42 pp.

Trappe, J.M., J.F. Franklin, R.F. Tarrant, and G.M. Hansen. 1968. Biology of alder. Proc. of Symp. held at Northwest Scientific Assoc., 40th annual mtg. April 14-15, 1967, Pullman, Washington. USDA Forest Service, Pacific Northwest Region, Portland. 292 pp.

Tunison, T. 1979. Plant succession following wildfire on Bear Mountain, North Cascades National Park Complex - baseline report. North Cascades National Park Service Complex, Sedro Woolley, Washingtin. 30 pp.

Whitney, S.R. 1983. A field guide to the Cascades and Olympics. The Mountaineers, Seattle. 288 pp.

Williams, C.K., and T.R. Lillybridge. 1983. Forested plant associations of the Okanogan National Forest. USDA Forest Service, Pacific Northwest Region, Portland. 116 pp.

Appendix B. Grizzly bear observation form.

GRIZZLY BEAR OBSERVATION REPORT Obs.No. ________

NORTH CASCADES GRIZZLY BEAR ECOSYSTEM

Date of Observation __________ Reliability Rating (see back) ________

Recorder ____________________

Observer

Name ____________________

Address ____________________

City ____________________

State ____________ Zip Code ________

Telephone Area Code ______ Number __________ Home

Area Code ______ Number __________ Other

Observation Location UTM ______________ N ______________ E

T ________ R ________ S ________ 1/4 S ______ 1/4 of 1/4 ______

General Location (Attach map if possible) ____________________

____

____

Number of grizzly bears observed ____ Adults ____ Cubs ____ Unknown ____

Description Hump? Y N Front Claws? Y N Facial Profile? Y N

____

____

____

Sign Photo? Y N Carcass? Y N Tracks? Y N Hair? Y N

Den? Y N Bed? Y N Digs? Y N Scat? Y N

Distance ________ Weather ____________________

Time of Day ______ Binoc/Scope? Y N Aspect ______ Elevation ______

Habitat (Explain in detail on back if necessary)

______	Closed-canopy forest	______	Avalanche Chute
______	Open-canopy forest	______	Talus/Scree/Rock
______	Grass/Forb (wet)	______	Stream/Marsh
______	Grass/Forb (dry)	______	Agricultural Land
______	Shrubfield (Species? ________)	______	Other ____________

Description of Behavior (Explain in detail on back if necessary)

____

____

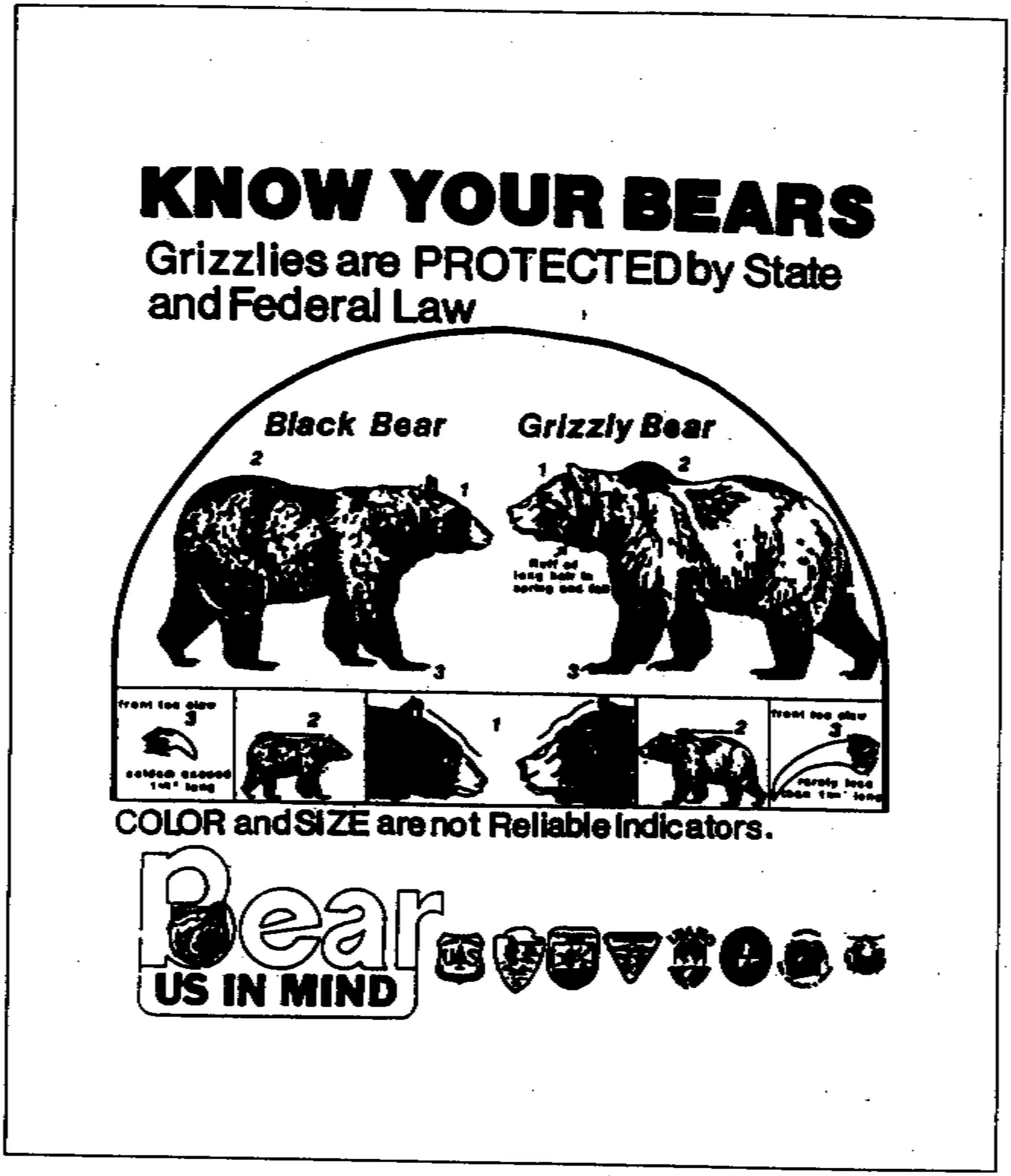
Seen grizzly bears before? Y N Where? Wild Zoo Photo T.V. Movie

Knows physical characteristics? Y N Location ____________

When? ____________

Other observers present? Y N (List names, address, phone on back)

Appendix C. "Know Your Bears" poster.



Appendix D. "Warning" sign.

Appendix E. "Danger" sign.

DANGER

TRAPS SET IN THIS AREA FOR BEARS

- DO NOT ENTER -

Appendix F. Capture form.

GRIZZLY BEAR CAPTURE FORM Bear Name____________ #_______
WASHINGTON DEPT OF WILDLIFE Sex: F M Age__________
Date: Dy___ Mo___ Yr___ Crew ______________________
Capture Site _______________ Method_______ Bait______
Arrive Time______ Depart Time______ Capture Duration______
Est Body Weight___lbs Nuisance? Y N Recapture? Y N
ANESTHESIA Initial_____ Full______ Immob Time______

Time	Drug	Admin	Volume	Concentrat	Dosage	Delivery
___	___	IM IV	___cc	___mg/cc	___mg	___
___	___	IM IV	___cc	___mg/cc	___mg	___
___	___	IM IV	___cc	___mg/cc	___mg	___
___	___	IM IV	___cc	___mg/cc	___mg	___
___	___	IM IV	___cc	___mg/cc	___mg	___

Recovery: Initial ____ Full____ R Time_____ Down Time_____
VITAL SIGNS Stick in Mouth? Y N Stick Removed? Y

Time	R Temp °F	Pulse/min	Resp/min	Injuries
___	___	___	___	___
___	___	___	___	___
___	___	___	___	___
___	___	___	___	___

Part Snared__________
IDENTIFICATION Collar: Frequency________MHz Color_____
Magnet Removed? Y Pulse: Reg___/min Act___ /min Mort___/min
Spacer? Y N Transmitter: Company________ Serial #_______
LT Ear Tag #_____Color: #______ Tag______ Lip Tattoo #_____
RT Ear Tag #_____Color: #______ Tag______ Tattoo Color_____
PHYSICAL EXAMINATION (cm)
Zygoma Breadth__________ Chest circumference__________
Neck Circumference__________ Genitals______________
Collar Diameter__________ Teats: Color_____ Nursed? Y N
Pelage Color______________ Total Body Length______________
______________________ Skull Length (Nose-occip)______
Facies______________________ Skull Circum (ant to ears)______
______________________ Tail Length____ Fat Index 1 2 3
Body Weight: ____lbs ____kg Other Bears? Y N ____________
Front Pad RT: L___ W___ #3 Claw___ LT: L___ W___ #3 Claw___
Rear Pad RT: L___ W___ #3 Claw___ LT: L___ W___ #3 Claw___
Blood Samples: Red Hep____ Red Non-Hep____ Violet Hep____
Parasites?:______________ Sample? Y N Urine Sample? Y N
Scat Sample? Y N Photos? Y N Foot Cast? Y N Video? Y N
Premolar? Y N RT LT Up Low Nose Print? Y N (on back)
Tattoo Test: Remarks? Y N (on back)

Appendix G. Ecology plot form.

PLOT
QUADNO
QNAME
NHAP
USDA
LSAT
MAP PATH
CLASS
ELEV
ASPECT
SLOPE
CANOPY:EST
SERAL
PARMAT
GEOL
BRGD
GRAVEL
ROCK
BDROCK
LITTER
MOSS
ROCKLICH
SOILLICH
WATER
ZIP ONLY:
DECID OVER
CONIF OVER
DECID UNDR
CONIF UNDR
SHRUB TOTL
HERB TOTAL

HABCOVTYP COMM/ASSOC
OBSV (INITIALS) DATE TIME
LOCATION:

REMARKS:

STAND EXTENT (PIXELS)
ADJ. VEG.
NO. AGE CLASSES
AGES
VEG PATCHINESS(1-5)
NO. CANOPY LAYERS
DISTURBANCES (FREQ,MAG 1-5)
SELECTIVE(CLEARCUT<1ac)
PARTIAL(EVEN)
CLEARCUT>1ac THINNING
WINDTHROW INSECT
DISEASE FIRE
AVALANCHE LANDSLIDE
FLOODING EROSION
OTHER:

% OF 10M STEMS IN DIA. CLASSES

0'-1'	1'-2'	2'-3'	3'-4'	>4'

DENSIOMETER: DARK LIGHT
(CUT 50, 20: READ 3,5,10)

PLOT1	PLOT2	PLOT3	PLOT4	PLOT5
)				

SNAGS, LOGS(S,L / ac: LRG> 20" X 6')
NONE
0-1 SML 2-6 SML >6 SML
0-1 LRG 2-6 LRG >6 LRG

OVERSTORY			TREE COVER	UNDERSTORY		
ALPHA	% COV	HT(FT)	SPECIES NAME	% COV	0-1M	1-10M

PLOT #

SHRUBS		
ALPHA	COVER	SPECIES NAME
REMS		Remaining shrubs not ID'd
		HERBACEOUS
REMH		Remaining herbs not ID'd

HERBACEOUS		
ALPHA	COVER	SPECIES NAME

Appendix H. Plant species identification codes, scientific names, and common names for all species identified during the North Cascades Grizzly Bear Ecosystem evlauation.

SPECIES IDENTIFICATION CODE	SCIENTIFIC NAME	COMMON NAME
TREES		
ABAM	Abies amabilis	Pacific Silver fir
ABLA	Abronia latifolia	Yellow Sand Verbena
ABLA2	Abies lasiocarpa	Subalpine fir
ABGR	Abies grandis	Grand fir
ABIES	Abies spp.	True fir
ACMA	Acer macrophyllum	Bigleaf maple
ALIN	Alnus incana	Mountain alder
ALRH	Alnus rhombifolia	White alder
ALRU	Alnus rubra	Red alder
BEOC	Betula occidentalis	Western birch
BEPA	Betula papyrifera	Paper birch
BEPI2	Betula x piperi	Hybrid paper birch
CHNO	Chamaecyparis nootkatensis	Alaska yellow-cedar
CONU	Cornus nuttallii	Pacific dogwood
LALY	Larix lyalli	Alpine Larch
LAOC	Larix occidentalis	Western Larch
PIAL	Pinus albicaulis	Whitebark Pine
PICO	Pinus contorta	Lodgepole Pine
PIEN	Picea engelmannii	Engelmann Spruce
PIMO	Pinus monticola	Western White Pine
PIPO	Pinus ponderosa	Ponderosa Pine
POTR	Populus tremuloides	Quaking Aspen
POTR2	Populus trichocarpa	Black Cottonwood
PSME	Psuedotsuga menziesii	Douglas Fir
RHPU	Rhamnus purshiana	Cascara
SAAM2	Salix amygdaloides	Peach-Leaf Willow
SALA2	Salix lasiandra	Whiplash Willow
SASC	Salix scouleriana	Scouler Willow
THPL	Thuja plicata	Western Red-Cedar
TSHE	Tsuga heterophylla	Western Hemlock
TSME	Tsuga mertensiana	mountain hemlock

SPECIES IDENTIFICATION CODE	SCIENTIFIC NAME	COMMON NAME
SHRUBS		
ACCI	Acer circinatum	Vine Maple
ACGL	Acer glabrum	Bigleaf Maple
ALNUS	Alnus spp.	Alder
ALSI	Alnus sinuata	Sitka Alder
AMAL	Amelanchier alnifolia	Western Serviceberry
ARCA	Artemisia cana	Silver Sagebrush
ARDR	Artemisia dracunculus	Tarragon
ARLU	Artemisia ludoviciana	Western Mugwort
ARNE	Arctostaphylos nevadensis	Pinemat Manzanita
ARRI	Artemisia rigida	Stiff Sagebrush
ARTEM	Artemisia spp.	Sagebrush
ARTR	Artemisia tridentata	Big Sagebrush
ARTR2	Artemisia tripartita	Threetip Sagebrush
ARUV	Arctostaphylos uva-ursi	Bearberry
ASCA3	Asarum caudatum	Wild Ginger
BEAQ	Berberis aquifolium	Oregon Grape
BEGL	Betula glandulosa	Birch
BENE	Berberis nervosa	Cascade Oregon Grape
CAME	Cassiope mertensiana	Merten's Mountain heather
CAST5	Cassiope stelleriana	Alaska Moss-Heather
CATE2	Cassiope tetragona	Four-Angled Mountain Heat
CESA	Ceanothus sanguineus	Redstem Ceanothus
CEVE	Ceanothus velutinus	Snowbrush Ceanothus
CHME	Chimaphila menziesii	Little Prince's Pine
CHNA	Chrysothamnus nauseosus	Grey Rabbitbrush
CHRYS	Chrysanthemum spp.	Rabbitbrush
CHUM	Chimaphila umbellata	Prince's Pine
CHVI	Chrysothamnus viscidiflorus	Green Rabbitbrush
CLCO	Clematis columbiana	Columbia Clematis
CLLI	Clematis ligusticifolia	Western Clematis
CLPY	Cladothamnus pyrolaeflorus	Copper Bush
COCA	Cornus canadensis	Bunchberry
COCO2	Corylus cornuta	California Hazelnut
CONU	Cornus nuttallii	Pacific Dogwood
COST	Cornus stolonifera	Red-Osier Dogwood
CRDO	Crataegus douglasii	Black Hawthorn
CYSC	Cytisus scoparius	Scot's Broom
GAHU	Gaultheria humifusa	Alpine Wintergreen
GAMU	Galium multiflorum	Shrubby Bedstraw
GAOV	Gaultheria ovatifolia	Slender Wintergreen
GASH	Gaultheria shallon	Salal
GAULT	Gaultheria spp.	Wintergreen
HABL	Haplopappus bloomeri	Rabbitbrush Goldenweed
HAST2	Haplopappus stenophyllus	Narrowleaf Goldenweed
HODI	Holodiscus discolor	Oceanspray
JUCO4	Juniperus communis	Common Juniper

Appendix H. Continued.

SPECIES IDENTIFICATION CODE	SCIENTIFIC NAME	COMMON NAME
SHRUBS CONTINUED		
JUSC	Juniperus scopulorum	Rocky Mountain Juniper
KAMI	Kalmia microphylla	Alpine Laurel
LEGL	Ledum glandulosum	Labrador Tea
LIBO2	Linnaea borealis	Western Twinflower
LOCI	Lonicera ciliosa	Trumpet Honeysuckle
LOIN	Lonicera involucrata	Bearberry Honeysuckle
LONIC	Lonicera spp.	Honeysuckle
LOUT2	Lonicera utahensis	Utah Honeysuckle
MEFE	Menziesia ferruginea	Rusty Menziesia
MOOD	Monardella odoratissima	Mountain Monardella
OECE	Oemleria cerasiformis	Indian Plum
OPHO	Oplopanax horridum	Devil's Club
PAMY	Pachistima myrsinites	Oregon Boxwood
PEDA	Penstemon davidsonii	Davidson's Penstemon
PEFR3	Penstemon fruticosis	Shrubby Penstemon
PEPR	Penstemon procerus	Tiny Bloom Penstemon
PERY	Penstemon rydbergii	Rhydberg's Penstemon
PHDI	Phlox diffusa	Spreading Phlox
PHEM	Phyllodoce empetriformis	Red Mountain-Heather
PHGL	Phyllodoce glanduliflora	Yellow Mountain-Heather
PHLE2	Philadelphus lewisii	Mock Orange
PHLI	Phacelia linearis	Threadleaf Phacelia
POFR	Potentilla fruticosa	Shrubby Cinquefoil
POMU	Polystichum munitum	Common Swordfern
PREM	Prunus emarginata	Bittercherry
PRUNU	Prunus spp.	Cherry
PRVI	Prunus virginiana	Chokecherry
PUTR	Purshia tridentata	Bitterbrush
PYAS	Pyrola asarifolia	Alpine Pyrola
PYCH	Pyrola chlorantha	Greenish Wintergreen
PYMA	Pyrus malus	Apple
PYPI	Pyrola picta	White-Vein Pyrola
PYROL	Pyrola spp.	Pyrola
PYSE	Pyrola secunda	Sidebells Pyrola
RHAL	Rhododendron albiflorum	Cascades Azalea
RHAL2	Rhamnus alnifolia	Alder Buckthorn
RHGL	Rhus glabra	Smooth Sumac
RHPU	Rhamnus purshiana	Cascara
RHRA	Rhus radicans	Poison Ivy
RIBES	Ribes spp.	Currant
RIBR	Ribes bracteosum	Stink Currant
RICE	Ribes cereum	Wax Currant
RIHO	Ribes howellii	Mapleleaf Currant
RIHU	Ribes hudsonianum	Stinking Currant
RIIN	Ribes inerme	Whitestem Gooseberry

Appendix H. Continued.

SPECIES IDENTIFICATION CODE	SCIENTIFIC NAME	COMMON NAME
SHRUBS CONTINUED		
RILA	Ribes lacustre	Gooseberry
RISA	Ribes sanguineum	Red Currant
RIVI	Ribes viscosissimum	Sticky Currant
RIWA	Ribes watsonianum	Watson Gooseberry
ROGY	Rosa gymnocarpa	Baldhip Rose
RONU	Rosa nutkana	Nootka Rose
ROSA	Rosa spp.	Rose
ROWO	Rosa woodsii	Wood's Rose
RUBUS	Rubus spp.	Bramble
RUID	Rubus idaeus	Red Raspberry
RULA	Rubus lasiococcus	Dwarf Bramble
RULE	Rubus leucodermis	Black Raspberry
RUPA	Rubus parviflorus	Thimbleberry
RUPE	Rubus pedatus	Strawberry Bramble
RUSP	Rubus spectabilis	Salmonberry
RUUR	Rubus ursinus	Pacific Blackberry
SABA	Salix barclayi	Barclay's Willow
SACA6	Salix cascadensis	Cascade Willow
SACE	Sambucus cerulea	Blue Elderberry
SACO2	Salix commutata	Undergreen Willow
SADO2	Salvia dorrii	Grey-Ball Sage
SAEX	Salix exigua	Riverbank Willow
SALIX	Salix spp.	Willow
SAMBU	Sambucus spp.	Elderberry
SAMO2	Salix monticola	Mountain Willow
SAMY	Salix myrtillifolia	Blueberry Willow
SANI	Salix nivalis	Snow Willow
SAPH	Salix phylicifolia	Tea-Leaved Willow
SARA	Sambucus racemosa	Black Elderberry
SASC	Salix scouleriana	Scouler's Willow
SASI2	Salix sitchensis	Sitka Willow
SHCA	Shepherdia canadensis	Buffaloberry
SORBU	Sorbus spp.	Mountain Ash
SOSC2	Sorbus scopulina	Mountain Ash
SOSI	Sorbus sitchensis	Sitka Mountain Ash
SPBE	Spiraea betulifolia	Birch-Leaf Spirea
SPDE	Spiraea densiflora	Subalpine Spirea
SPDO	Spiraea douglasii	Douglas' Spirea
SPIRA	Spiraea spp.	Spirea
SPPY	Spiraea pyramidata	Pyramid Spirea
SYAL	Symphoricarpos albus	Snowberry
SYOR	Symphoricarpos oreophilus	Mountain Snowberry
TABR	Taxus brevifolia	Western Yew
VAAL	Vaccinium alaskaense	Alaska Blueberry
VACA	Vaccinium caespitosum	Dwarf Huckleberry

Appendix H. Continued.

SPECIES IDENTIFICATION CODE	SCIENTIFIC NAME	COMMON NAME
SHRUBS CONTINUED		
VACCI	Vaccinium spp.	Huckleberry
VADE	Vaccinium deliciosum	Cascade Blueberry
VAME	Vaccinium membranaceum	Big Huckleberry
VAMY	Vaccinium myrtillus	Dwarf Bilberry
VAOV	Vaccinium ovalifolium	Early Blueberry
VAPA	Vaccinium parvifolium	Red Bilberry
VASC	Vaccinium scoparium	Grouseberry
VIED	Viburnum edule	Highbush Cranberry

Appendix H. Continued.

SPECIES IDENTIFICATION CODE	SCIENTIFIC NAME	COMMON NAME
HERBS		
ACMI	Achillea millefolium	Yarrow
ACRU	Actaea rubra	Western Red Baneberry
ACTR	Achlys triphylla	Vanillaleaf
ADBI	Adenocaulon bicolor	Pathfinder
AGCR	Agropyron cristatum	Crested Wheatgrass
AGEX	Agrostis exarata	Spike Bentgrass
AGGLD	Agoseris glauca dasycephala	Pale Agoseris
AGIN2	Agropyron intermedium	Intermediate Wheatgrass
AGRE	Agropyron repens	Quack Grass
AGROS	Agrostis spp.	Bentgrass
AGSP	Agropyron spicatum	Bluebunch Wheatgrass
AGTH	Agrostis thurberiana	Thurber Bentgrass
ALMA	Allium macrum	Rock Onion
ANAR2	Angelica arguta	Sharptooth Angelica
ANLA	Antennaria lanata	Wooly Pussy Toes
ANMA	Anaphalis margaritacea	Common Pearly Everlasting
ANOC	Anemone occidentalis	Western Pasqueflower
ANRA	Antennaria racemosa	Raceme Pussyflower
APAN	Apocynum androsaemifolium	Spreading Dogbane
AQFO	Aquilegia formosa	Red Columbine
ARCA2	Arenaria capillaris	Mountain Sandwort
ARCO	Arnica cordifolia	Heartleaf Arnica
ARLA	Arnica latifolia	Mountain Arnica
ARLU	Artemisia ludoviciana	Western Mugwort
ARMA3	Arenaria macrophylla	Bigleaf Sandwort
ARNO	Artemesia norvegica	Boreal Wormwood
AROB	Arenaria obtusiloba	Arctic Sandwort
ARPA3	Arnica parryi	Parry's Arnica
ASEN	Aster engelmannii	Engelmann's Aster
ASFO	Aster foliaceus	Leafy Aster
ASTER	Aster spp.	Aster
ATDI	Athyrium distentifolium	Alpine Lady Fern
ATFI	Athyrium filix-femina	Lady Fern
BAHO	Balsamorhiza hookeri	Hooker's Balsamroot
BASA	Balsamorhiza sagittata	Arrowleaf Balsamroot
BLSP	Blechnum spicant	Deer Fern
BRCA	Bromus carinatus	California Brome
BRCA3	Brodiaea capitata	Brodiaea
BROMU	Bromus spp.	Brome Grass
BRTE	Bromus tectorum	Cheat Grass
BRVU	Bromus vulgaris	Columbia Brome
CAAQ	Carex aquatilis	Water Sedge
CABI	Caltha biflora	White Marshmerigold
CACA	Calamagrostis canadensis	Bluejoint Reedgrass
CACO	Carex concinnoides	Northwest Sedge
CADR2	Cardaria draba	Hoary Pepperwort

SPECIES IDENTIFICATION CODE	SCIENTIFIC NAME	COMMON NAME
HERBS CONTINUED		
CAFI	Carex filifolia	Thread-Leaved Sedge
CAFL	Carex flava	Yellow Sedge
CAGE	Carex geyeri	Elk Sedge
CAIL	Carex illota	Sheep Sedge
CALAM	Calamagrostis spp.	Reedgrass
CALE2	Caltha leptosepala	Elkslip
CAME2	Carex mertensii	Merten's Sedge
CANI2	Carex nigricans	Black Alpine Sedge
CAOB	Carex obnupta	Slough Sedge
CAPA	Carex pachystachya	Thick Headed Sedge
CAREX	Carex spp.	Sedge
CARO	Carex rossii	Ross Sedge
CARO2	Carex rostrata	Beaked Sedge
CARU	Calamagrostis rubescens	Pinegrass
CASC3	Carex scirpoidea	Sedge
CASC5	Carex scopulorum	Holm's Sedge
CASI3	Carex sitchensis	Sitka Sedge
CASP	Carex spectabilis	Showy Sedge
CASTI	Castilleja spp.	Indian Paintbrush
CEDI	Centaurea diffusa	Diffuse knapweed
CHTE	Chorispora tenella	Blue Mustard
CIAL	Circaea alpina	Enchanter's Nightshade
CLUN	Clintonia uniflora	Queen's Cup
COCA	Cornus canadensis	Bunchberry
COCO	Cotula coronopifolia	Brass Buttons
DAIN	Danthonia intermedia	Timber Oatgrass
DEAT	Deschampsia atropurpurea	Mountain Hairgrass
DIHO	Disporum hookeri	Hooker Fairy Bell
DROC	Dryas octopetala	White Dryad
ELGL	Elymus glaucus	Blue wildrye
ELPA2	Eleocharis pausiflora	Few-Flowered Spikerush
EPAN	Epilobium angustifolium	Fireweed
EPGL2	Epilobium glandulosum	Common Willow Weed
EQAR	Equisetum arvense	Common Horsetail
EQHY	Equisetum hyemale	Common Scouring Rush
EQTE	Equisetum telmateia	Giant Horsetail
ERCI	Erodium cicutarium	Alfilaria
ERDO	Eriogonum douglasii	Douglas' Buckwheat
ERGR	Erythronium grandiflorum	Pale Fawnlily
ERIGE	Erigeron spp.	Daisy
ERIOG	Erigonum spp.	Buckwheat
ERIOP	Eriophorum spp.	Cotton-grass
ERLI	Erigeron linearis	Desert Yellow Daisy
ERPE	Erigeron peregrinus	Subalpine Daisy
ERTH	Eriogonum thymoides	Thyme-Leaved Buckwheat

SPECIES IDENTIFICATION CODE	SCIENTIFIC NAME	COMMON NAME
HERBS CONTINUED		
ERUM	Erigonum umbellatum	Sulfur flower
FEBR	Festuca bromoides	Barren Fescue
FEID	Festuca idahoensis	Idaho Fescue
FERN	Polypodiaceae	Unidentified Fern
FESC	Festuca scabrella	Rough Fescue
FESTU	Festuca spp.	Fescue
FEVI	Festuca viridula	Green Fescue
FRAGA	Frageria spp.	Strawberry
FRVI	Fragaria virginiana	Broadpetal Strawberry
GAAP	Galium aparine	Cleavers
GABO	Galium boreale	Northern Bedstraw
GADI	Gayophytum diffusum	Spreading Groundsmoke
GECA	Gentiana calycosa	Explorers Gentian
GRASS	Graminae	Unidentified Grass
GYDR	Gymnocarpium dryopteris	Oak Fern
HADI2	Habenaria dilatata	White Bog Orchid
HEDO	Helianthella douglasii	Rocky Mnt. Helianthella
HELA	Heracleum lanatum	Cow Parsnip
HIMO	Hippuris montana	Mountain Mare's-Tail
HYFE	Hydrophyllum fendleri	Fendler's Waterleaf
HYFO	Hypericum formosum	Western St. John's-Wort
JUNCU	Juncus spp.	Rush
JUPA	Juncus parryi	Parry's Rush
LAMU	Lactuca muralis	Wall Lettuce
LANE	Lathyrus nevadensis	Sierran Pea
LICA2	Ligusticum canbyi	Canby's Lovage
LIGR	Ligusticum grayi	Gray's Lovage
LIGUS	Ligusticum spp.	Lovage
LOAM	Lomatium ambiguum	Swale Desert-Parsley
LOBR	Lomatium brandegei	Brandegee's Lomatium
LODI2	Lomatium dissectum	Fernleaf Lomatium
LOMAT	Lomatium spp.	Biscuit Root
LUHI	Luzula hitchcockii	Smooth Woodrush
LULA	Lupinus latifolius	Broadleaf Lupine
LULE2	Lupinus lepidus	Prarie Lupine
LUNA	Lupinus nanus	Silver Crown Lupina
LUNA2	Luina nardosmia	Luina
LUPE	Luetkea pectinata	Partridgefoot
LUPIN	Lupinus spp.	Lupine
LUPO	Lupinus polyphyllus	Bigleaf Lupine
LUSE	Lupinus sericeus	Silky Lupine
LUZUL	Luzula spp.	Woodrush
LYAM	Lysichitum americanum	Skunk Cabbage
LYCOP	Lycopodium spp.	Clubmoss
LYSI	Lycopodium sitchense	Alaska Clubmoss

Appendix H. Continued.

SPECIES IDENTIFICATION CODE	SCIENTIFIC NAME	COMMON NAME
HERBS CONTINUED		
MADI	Madia dissitiflora	Slender Tarweed
MADI2	Maianthemum dilatatum	Beadruby
MAMI	Madia minima	Small-Head Tarweed
MEAR3	Mentha arvensis	Field Mint
MEPA	Mertensia paniculata	Tall Bluebells
MERTE	Mertensia spp.	Lungwort
MESA	Medicago sativa	Alfalfa
MIPE	Mitella pentandra	Alpine Mitrewort
MITEL	Mitella spp.	Mitrewort
MOSI	Montia sibirica	Western Springbeauty
NEBR	Nemophila breviflora	Great Basin Nemophila
OSMOR	Osmorhiza spp.	Sweetroot
OSOC	Osmorhiza occidentalis	Western Sweetroot
OXDI	Oxyria digyna	Mountain Sorrel
PEBR	Pedicularis bracteosa	Bracted Lousewort
PEFRP	Petasites frigidus palmatus	Sweet Coltsfoot
PEGR	Pedicularis groenlandica	Elephant's Head
PEOR5	Pedicularis ornithorhyncha	Bird's Beak Lousewort
PERA	Pedicularis racemosa	Leafy Lousewort
PHAL	Phleum alpinum	Alpine Timothy
PLPA	Plantago patagonica	Indian Wheat
POA	Poa spp.	Bluegrass
POBI	Polygonum bistortoides	American Bistort
POBR	Potentilla brevifolia	Short-Leaved Cinquefoil
POBU	Poa bulbosa	Bulbous Bluegrass
POCO	Poa compressa	Canada Bluegrass
PODI	Potentilla diversifolia	Diverse Leaf Cinquefoil
POFL2	Potentilla flabellifolia	Fanleaf Cinquefoil
POPR	Poa pratensis	Kentucky Bluegrass
POSE	Poa secunda	Sandberg's Bluegrass
POTEN	Potentilla spp.	Cinquefoil
PTAQ	Pteridium aquilinum	Bracken Fern
RUCR	Rumex crispus	Curly Dock
SASI	Sanquisorba sitchensis	Sitka Burnet
SCCE2	Scirpus cespitosus	Tufted Clubrush
SECE	Secale cereale	Cultivated Rye
SECY2	Senecio cymbalarioides	Alpine Meadow Butterweed
SEST2	Senecio streptanthifolius	Rocky Mountain Butterweed
SETR	Senecio triangularis	Arrowleaf Groundsel
SIAL	Sisymbrium altissimum	Jim Hill Mustard
SILO	Sisymbrium loeselii	Loesl Tumblemustard
SMST	Smilacina stellata	Starry Solomon-Plume
SOCA	Solidago canadensis	Meadow Goldenrod
STCO2	Stipa comata	Needle-and-Thread
STIPA	Stipa spp.	Needlegrass

Appendix H. Continued.

SPECIES IDENTIFICATION CODE	SCIENTIFIC NAME	COMMON NAME
HERBS CONTINUED		
STOC	Stipa occidentalis	Western Needlegrass
STRO	Streptopus roseus	Rosy Twisted Stalk
THOC	Thalictrum occidentale	Western Meadowrue
TITR	Tiarella trifoliata	Trefoil Foamflower
TIUN	Tiarella unifoliata	Coolwort Foamflower
TOME	Tolmiea menziesii	Pig-a-Back Plant
TRLA2	Trientalis latifolia	Western Starflower
TRLA4	Trollius laxus	American Globeflower
URDI	Urtica dioica	Stinging Nettle
VASI	Valeriana sitchensis	Mountain Heliotrope
VECU	Veronica cusickii	Cusick's Speedwell
VETH	Verbascum thapsus	Mullein
VEVI	Veratrum viride	American False Hellebore
VICIA	Vicia spp.	Vetch
VIGL	Viola glabella	Stream Violet
VIOLA	Viola spp.	Violet
XETE	Xerophyllum tenax	Indian Basket Grass

Appendix I. List and description of vegetation and cover types mapped in the North Cascades Grizzly Bear Ecosystem.

LEVEL 1 VEGETATION AND COVER TYPES

1. WATER

2. CONIFER 70%+
Conifer forest of trees over 10 feet tall with greater than 70% canopy closure. In the upper ecological zone this class is restricted to stands greater than 50 years old.

3. CONIFER 50 - 70%
Conifer forest of trees over 10 feet tall with 50 to 70% canopy closure. In the upper ecological zones all forests with this canopy closure are included. In the PSME and PIPO zones only those forests with 50 to 70% conifer canopy cover and total tree and shrub and herb cover less than 130% are included.

4. CONIFER 30 - 50%
Conifer forest of trees over 10 feet tall with 30 to 50% canopy closure. Herbaceous or shrubby vegetation may be greater than tree cover.

5. YOUNG CLOSED CANOPY UPPER ELEVATION FOREST
Forest with over 70% conifer cover in the upper ecological zone.

6. CONIFER FOREST 50 - 70% IN PSME AND PIPO ZONES
Conifer forests with 50 to 70% canopy closure and lush shrub and/or herbaceous occurring in PIPO or PSME zones. Total tree plus shrub plus herbaceous vegetation must be greater than 130%.

7. SHRUB-STEPPE
Shrub steppe vegetation with shrubby and herbaceous vegetation greater than 30%.

8. HERBACEOUS VEGETATION
Broad ctegory that includes lush to dry areas dominated by herbaceous vegetation at all elevations. It may include cut over lands, burns and native meadows. Heather meadows and sparsely vegetated areas with mixtures of trees, shrubs and herbs are included.

9. DECIDUOUS FOREST - RIPARIAN
Forest within 467 feet of a stream, river or wetland composed primarily of deciduous species.

10. DECIDUOUS FOREST - NON-RIPARIAN
Composed of primarily deciduous species not in a riparian zone. Usually POTR dominated forests.

11. SHURBS
Lush shrubby vegetation dominates.

12. SHRUBS - RIPARIAN
Same as 11 except in riparian zone.

Appendix I. Continued.

13. RIPARIAN CONIFER OVER 70% CANOPY COVER.
Same as 2 and 5 except in riparian zone.

14. RIPARIAN CONIFER 50 - 70% CANOPY CLOSURE
Same as 3 and 6 except in riparain zone.

15. RIPARIAN CONIFER 30 - 50% CANOPY CLOSURE
Same as 4 except in riparian zone.

16. BARE
Areas with less than 20% vegetation. Includes rock, talus, bareground, etc. and wet ground and gravel

17. SNOW AND ICE
This is self explanatory.

18. AGRICULTURAL LANDS
Includes fallow fields, pastures, cropland and orchards

LEVEL 2 VEGETATION AND COVER TYPES

1. WATER
This is self explanatory.

2. PIPO
Conifers over 10 feet tall cover greater than or equal to 30% of the total tree cover. Ponderosa pine and Douglas fir are equal to or greater than one half the total tree cover, and ponderosa pine cover more area than Douglas fir.

3. PIPO-PSME
Same as 2 except pondersosa pine cover is less than or equal to the Douglas fir cover, and the ponderosa pine composes more than or equal to 5% of the total tree cover.

4. PSME-MIXED CONIFER-EAST
Same as 3 except that the amount of ponderosa pine cover is less than 5% of the total tree cover, and it is located on the east side of the ecosystem.

5. PSME-MIXED CONIFER-WEST
Same as 4 except that it is located on the west side of the ecosystem.

6. ABLA2-PIEN-PICO-EAST
The total cover of ponderosa pine and Douglas fir are less than or equal to half of the total tree cover. Whitebark pine is not dominant and Engelmann spruce cover is less than 10%. These areas do not occur within 467 feet of a stream, river, or wetland.

7. ABLA2-PIEN-PICO-WEST
Same as 6 except it is located on the wet side of the ecosystem.

Appendix I. Continued.

8. PIEN RIPARIAN
Ponderosa pine and Douglas fir cover is less than half or equal to half of the total tree cover. Whitebark pine is not dominant and Engelmann spruce cover is greater than or equal to 10% of the total cover. These areas are located within 467 feet of a stream, river, or wetland.

9. YOUNG PSME IN MANAGED AREA ON MBS ONLY
This is self explanatory.

10. TSHE-EAST
Hemlock composes greater than 10% of the total tree cover. Ponderosa pine and Douglas fir make up less than or equal to half of the total tree cover. These areas are located on the east side of the ecosystem.

11. TSHE-WEST
Same as 10 except that it is located on the west side of the ecosystem.

12. ABAM-EAST
Pacific silver fir cover is greater than or equal to 10% of the total tree cover. Ponderosa pine and Douglas fir cover is less than or equal to half of the total tree cover. Whitebark pine or western larch are not dominant. These areas are located on the east side of the ecosystem.

13. ABAM-WEST
Same as 12 except located on the west side of the ecosystem.

14. TSME-EAST
The amount of hemlock tree cover is greater than or equal to 10% of the total tree cover. Ponderosa pine and Douglas fir compose less than or equal to half of the total tree cover. Whitebark pine or western larch are not dominant. These areas are located on the east side of the ecosystem.

15. TSME-WEST
Same as 14 except that it is located on the west side of the ecosystem.

16. PIAL
White bark pine is the dominant tree cover.

17. LALY
Western larch is the dominant tree cover.

18. SHRUB-STEPPE-HERBACEOUS
These areas are composed of bitterbrush, sagebrush, balsam root, bunchgrasses, phlox, etc. In this class the herbaceous plants are dominant.

19. SHRUB-STEPPE-PUTR
Same as 18 except that bitterbrush is dominant.

20. SHRUB-STEPPE-ARTR
Same as 19 except that sagebrush is dominant.

Appendix I. Continued.

21. SOUTHEAST SHRUBB STEPPE
Composed of bitterbrush, sagebrush, balsam root, bunchgrasses, phlox, etc. Shrubs are dominant and these areas are located in the lower Wenatchee Valley.

22. ALPINE MEADOW-EAST
Herbaceous vegetation is dominant. Composed of alpine meadows usually above 7000 feet. Located on hte east side of the ecosystem.

23. ALPINE MEADOW-WEST
Same as 22 except located on the west side of the ecosystem.

25. SUBALPINE LUSH MEADOW-EAST
These are located in the subalpine zone and are composed of lush subalpine meadow vegetation on the east side of the ecosystem.

26. SUBALPINE LUSH MEADOW-WEST
Same as 25 except located on the west side of the ecosystem.

27. SUBALPINE MESIC TO DRY MEADOW-EAST
These areas are located inthe subalpine zone. They are composed of mesic to dry meadows on the east side of the ecosystem.

28. SUBALPINE MESIC TO DRY MEADOW-WEST
Same as 27 except located on the west side of the ecosystem.

29. SUBALPINE HEATHER WITH VADE
Subalpine shrubs and meadow with hunckleberry (Vaccinium deliciosum).

30. SUBALPINE MOSAIC-EAST
A mixture of shrubs, trees, herbs, and bare ground with no clear dominant. Located in the subalpine zone on the east side of the ecosystem.

31. SUBALPINE MOSAIC-WEST
Same as 30 except located on the west side of the ecosystem.

32. MONTANE MOSAIC-EAST
A mixture ofshrubs, trees, herbs, and bare ground with no clear dominant. Composed of montane vegetation in the montane zone on the east side of the ecosystem.

33. MONTANE MOSAIC-WEST
Same as 32 except located on the west side of the ecosystem.

34. MONTANE HERBACEOUS-EAST
Dominated by herbaceous vegetation. Located in the montane zone on the east side of the ecosystem.

35. MONTANE HERACEOUS-WEST
Same as 34 except located on the west side of the ecosystem.

Appendix I. Continued.

36. MONTANE SHRUB-EAST
A variety of montane and subalpine shrubfields that differ from vegetation types 29,38,39,41,42 and 54. Located on the east side of the ecosystem.

37. MONTANE SHRUB-WEST
Same as 36 except located on the west side of the ecosystem.

38. LUSH SHRUB-EAST
Shrub cover is greater than 74%. Composed of lush alder and vine maple fields on the east side of the ecosystem.

39. LUSH SHRUB-WEST
Same as 38 except located on the west side of the ecosystem.

40. LUSH LOW ELEVATION HERBACEOUS-EAST
Composed of lush low elevation herbaceous plants that are below the subalpine zone on the east side of the ecosystem.

41. LUSH LOW ELEVATION HERBACEOUS-WEST
Same as 40 except it is located on the west side of the ecosytem.

42. LUSH LOW ELEVATION SHRUB-EAST
Composed of lush low elevation shrubs below the montane zone on the east side of the ecosystem only.

44. RIPARIAN DECIDUOUS FOREST-EAST
The deciduous forest cover is greater than or equal to 50% cover, or is greater than other forest types. These areas are located within 467 feet of a stream, river, or wetland, and are on the east side of the ecosystem.

45. RIPARIAN DECIDUOUS FOREST-WEST
Same as 44 except located on the west side of the ecosystem.

46. NONRIPARIAN DECIDUOUS FOREST-EAST
Same as 44 except these areas are greater than 467 feet from a stream, river or wetland. Located on the east side of the ecosystem.

47. NONRIPARIAN DECIDUOUS FOREST-WEST
Same as 46 except it is located on the west side of the ecosystem.

48. BARE GROUND, SNOW, UNCLASSIFIED
This is self explanatory.

52. AGRICULTURE-FALLOW
These are composed of dry pasture, fallow fields, and dryland crops.

53. AGRICULTURE-ORCHARD,CROPS
These are composed of orchards, lush pastures, and lush crop fields.

54. SUBALPINE TO ALPINE VASC,VACA
Subalpine shrubs and meadows with hunckleberry (Vaccinium caespitosum, Vaccinium scoparium) present.

Appendix I. Continued.

56. DECIDUOUS LUSH SHRUB IN MANAGED AREA
These areas are composed of deciduous shrubs that have developed in areas following timber harvest.

Appendix J. List of quadrangle maps that were used in the accuracy assessment in each portion of the North Cascades Grizzly Bear Ecosystem.

Northeast Quarter
- Billy Goat Mountain
- Horseshoe Basin
- Enterprise
- Tiffany Mountain
- Thompson Ridge
- Buck Mountain

Southeast Quarter:
- Mount David
- Manson
- Plain
- Chiwaukum Mountains
- Kachess Lake
- Swauk Prairie
- Liberty

West Half:
- Mount Spickard
- Damnation Peak
- Forbidden Peak
- Fortson
- Mallardy Ridge
- Sloan Peak
- Skykomish
- Big Snow Mountain

Appendix K. List of road types and status of roads, as used in the G.I.S. database.

ROAD TYPE	ROAD STATUS
1-Primary highway	0-open
2-Other paved	1-gate
3-Improved-gravel	2-blocked
4-Improved-dirt	
5-Unimproved	
6-Trail-motorized	
7-Trail-nonmotorized	

Appendix L. Mean and constancy for trees, shrubs, and herbs in each Level 2 vegetation type (MEAN = Average percent cover in plots, CONS = Constancy = percent of plots in which species occured).

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
PIPO	ABLA2	0.2	4	AMAL	* 0.7	26	AGSP	* 3.5	26
23 PLOTS	PIPO	40.7	100	CEVE	1.5	9	ARCO	0.8	26
	PSME	9.1	87	HODI	0.3	17	ERGR	* 0.0	4
	BEOC	0.2	4	PAMY	0.9	9	PTAQ	* 0.4	13
	POTR	0.1	9	SYAL	* 5.2	43	ACMI	0.5	35
	POTR2	0.5	9	BEAQ	0.7	30	CARU	* 6.6	43
	PICO	0.2	4	RUPA	* 0.1	9	ERIGE	0.4	9
	ABGR	1.7	13	SARA	* 0.1	4	ERPE	0.1	4
	SASC	1.0	13	PEFR3	0.2	4	GRASS	* 3.1	17
	LAOC	0.3	4	ALSI	0.2	9	LOMAT	* 0.0	4
	ALIN	0.2	4	ARNE	* 0.3	4	LULA	0.0	4
				SPBE	1.3	17	BASA	3.2	26
				RICE	0.6	22	COCO	* 0.1	4
				COST	* 0.7	4	LUNA2	0.1	4
				ROSA	* 0.3	9	LUPIN	2.6	30
				PUTR	3.1	39	ERIOG	0.1	4
				CESA	0.1	13	VASI	0.0	4
				ARTR2	1.5	4	CAREX	* 0.7	9
				CHNA	0.1	4	ANMA	0.1	4
				HABL	0.0	4	FESTU	0.2	4
							BRTE	* 0.1	9
							LUSE	1.5	9
							VICIA	0.0	4
							POBU	* 0.7	4
							POA	* 0.7	9
							CEDI	0.9	9
							MERTE	* 0.1	4
							TOME	0.2	4
							POSE	* 0.1	9
							ERTH	1.5	9
							CHTE	0.0	4
							FEBR	* 0.7	4
							AGEX	* 0.7	9
							STCO2	* 0.9	9
PIPO-PSME	ABLA2	0.4	10	ACGL	1.0	21	AGSP	1.3	17
29 PLOTS	PIPO	13.2	100	AMAL	* 0.7	24	LOBR	* 0.1	3
	PSME	36.5	100	CEVE	4.5	34	ADBI	0.1	7
	POTR	0.2	14	HODI	0.7	24	ARCO	0.4	17
	POTR2	0.4	17	PAMY	4.7	38	PTAQ	* 0.4	7
	PIEN	0.2	3	PHLE2	0.0	3	ACMI	0.6	24
	PICO	2.6	21	PREM	* 0.4	17	ARMA3	0.1	10
	ABGR	3.6	24	SYAL	* 2.9	31	ASTER	0.1	10
	PIMO	* 0.3	7	BEAQ	1.2	38	CARU	* 9.9	52
	THPL	0.2	10	LOIN	* 0.0	3	FEVI	* 0.1	3
	ACMA	0.2	7	RUPA	* 0.0	3	GRASS	* 0.4	14
	SASC	1.7	52	PEFR3	0.2	7	LULA	0.2	3

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
PIPO-PSME	LAOC	0.7	21	PRVI	* 0.1	3	BASA	0.7	10
	ALIN	0.7	3	ALSI	0.1	3	CACO	* 0.1	10
	ABIES	0.4	3	ARNE	* 2.3	24	LUNA2	0.1	7
				SPBE	2.4	45	EPAN	* 0.1	3
				SASC	0.1	7	APAN	0.4	14
				SOSC2	* 0.1	3	CAREX	* 0.5	14
				CHUM	* 0.5	3	FRVI	* 0.1	3
				SALIX	* 0.6	7	EQAR	* 0.0	3
				VASC	* 0.0	3	FESTU	0.1	3
				SHCA	* 0.2	3	LUSE	0.1	3
				RULE	* 0.0	3	POA	* 0.4	10
				LIBO2	0.1	10	SIAL	0.1	3
				ARUV	* 0.4	10	CIAL	0.0	3
				ACCI	0.2	3	LYSI	0.1	3
				COST	* 0.2	3	CAGE	* 0.0	3
				ROSA	* 0.4	24	TOME	0.1	3
				PUTR	0.3	10	ERTH	0.1	3
							AGEX	* 0.4	10
							CAFI	* 0.1	3
							ALMA	0.0	3
PSME-MIX CON (E)	ABLA2	7.0	41	ACGL	0.4	16	AGSP	* 0.1	4
69 PLOTS	PIPO	0.7	28	AMAL	* 0.6	16	LOBR	* 0.0	1
	PSME	37.2	100	CEVE	0.3	17	ADBI	0.1	4
	POTR	0.8	7	HODI	0.1	7	ARCO	1.0	17
	POTR2	0.4	9	PAMY	4.9	41	DIHO	* 0.0	1
	PIAL	* 0.6	9	PHLE2	0.1	3	ERGR	* 0.0	1
	PIEN	2.2	28	PREM	* 0.1	4	PTAQ	* 1.0	13
	PICO	4.9	42	SYAL	* 1.4	13	SMST	* 0.2	6
	TSME	0.4	10	SYOR	0.9	1	THOC	0.1	4
	ABGR	11.1	36	BEAQ	0.4	12	VIGL	* 0.0	3
	PIMO	* 1.6	20	LOIN	* 0.1	1	ACMI	0.1	4
	THPL	4.0	22	PYAS	0.0	1	ANAR2	* 0.0	3
	TSHE	2.1	14	PYSE	0.2	17	ARMA3	0.3	13
	ACMA	0.0	3	RUPA	* 0.5	16	ASTER	0.7	10
	ABAM	0.7	16	SOSI	* 0.0	1	BROMU	* 0.3	1
	SASC	1.5	23	PERF3	0.1	4	CARU	* 6.0	43
	ALRU	0.1	1	PRVI	* 0.0	1	GRASS	* 0.3	4
	LAOC	0.8	19	ALSI	1.3	16	LULA	0.6	6
	SALA2	0.0	1	ARNE	* 2.9	17	BASA	0.1	3
	ALIN	0.0	1	JUCO4	0.1	6	CACO	* 0.1	7
				PHDI	0.0	1	LUNA2	0.7	12
				RIBES	0.0	1	ARCA2	0.1	4
				SPBE	1.4	29	PERA	0.1	6
				RICE	0.0	1	ANRA	0.1	4
				SASC	0.3	7	CARO	* 0.1	3
				SOSC2	* 0.1	6	EPAN	* 0.2	4
				CHUM	* 1.3	26	APAN	0.1	4
				SALIX	* 0.3	6	CAREX	* 0.0	1
				VASC	* 0.2	3	ARLA	0.5	7
				RHAL	0.0	3	FRVI	* 0.0	3
				SHCA	* 0.5	6	ANMA	0.0	1

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
ABLA2-PIEN-PICO(W)							TRLA4	0.2	9
							VEVI *	0.9	38
							MITEL *	0.1	3
							ARLA	1.4	38
							SETR *	0.4	12
							VIOLA *	0.0	3
							JUNCU *	0.0	3
							FRVI *	0.1	6
							PEGR	0.1	3
							HELA *	0.2	18
							CANI2 *	1.1	18
							LUPE	0.8	18
							POFL2	0.7	24
							MIPE *	0.3	3
							EQAR *	0.1	3
							ELGL *	0.1	6
							DEAT *	0.1	3
							TIUN *	0.4	3
							CLUN *	0.2	6
							GYDR *	0.2	6
							STRO *	0.1	3
							ASFO	0.1	6
							POBI *	0.0	3
							CASP *	0.2	9
							LYSI	0.1	6
							CASC5 *	0.1	3
							LIGR *	0.2	18
							LUPO	1.1	18
							AGGLD	0.8	18
							CAIL *	0.7	24
							ARNO	0.3	3
							CAGE *	0.1	3
							LAMU	0.1	6
							CASI3 *	0.1	3
							XETE *	0.4	3
							LANE	0.2	6
							NEBR	0.2	6
							GAAP	0.1	3
							CARO2 *	0.1	6
							ERDO	0.0	3
							MANI	0.2	9
PIEN RIPARIAN	ABLA2	32.2	90	ACGL	0.2	20	ARCO	0.5	20
10 PLOTS	PIPO	0.1	10	AMAL *	0.1	10	DIHO *	1.3	20
	PSME	3.1	50	PAMY	1.2	30	PTAQ *	1.5	20
	BEOC	0.2	10	SYAL *	0.4	10	SMST *	0.2	10
	PIEN	42.0	100	BEAQ	0.4	10	THOC	0.9	20
	LALY	1.1	20	LOIN *	1.2	40	VIGL *	0.1	10
	PICO	4.3	30	PYAS	0.9	40	ANAR2 *	0.1	10
	TSME	0.5	20	PYSE	1.2	60	ASTER *	0.4	20
	PIMO *	0.5	10	RUPA *	0.8	30	BROMU *	0.1	10
	THPL	0.1	10	SARA *	0.2	10	ERPE	0.1	10

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
PIEN RIPARIAN	ABAM	1.0	20	SOSI *	0.3	20	GRASS *	0.8	30
	SASC	0.1	10	ALSI	5.8	60	LICA2 *	0.6	10
				RIBES	0.3	20	LULA	0.4	20
				LOUT2 *	0.3	10	CACO *	0.1	10
				SOSC2 *	0.1	10	PERA	0.1	10
				CHUM *	0.2	20	EPAN *	0.2	20
				SALIX *	7.3	30	AQFO	0.1	10
				VASC *	1.2	20	ANLA	0.2	10
				RHAL	10.1	40	VASI	1.5	30
				VAME *	10.8	60	CAREX *	1.3	10
				VAMY *	0.5	10	TRLA4	0.5	10
				LIBO2	0.4	10	VEVI *	1.5	30
				PHEM	3.4	20	CABI	0.1	10
				LEGL	0.3	20	ERIOP	0.2	10
				RILA *	1.2	60	ARLA	0.8	30
				GAHU	0.2	10	SETR *	0.5	20
				ROGY *	0.1	10	GECA	0.3	10
				RUPE *	1.5	20	HELA *	0.1	10
				VAAL *	0.1	10	CANI2 *	0.3	10
				OPHO *	0.1	10	POFL2	0.2	10
				COST *	0.3	30	MIPE *	0.2	10
				ROSA *	0.1	10	EQAR *	3.1	40
				MEFE	3.7	20	CALAM *	0.2	10
				RULA *	0.2	10	TIUN *	2.0	30
				SPDO	0.5	20	ATFI *	1.0	20
				LONIC	0.2	10	COCA *	1.0	10
				RIHO	0.2	10	CLUN *	1.5	10
				PYCH	0.1	10	GYDR *	1.1	30
							LYCOP	0.3	10
							STRO *	0.7	30
							ASFO	0.3	20
							CASP *	0.5	10
							BRCA *	0.3	10
							LIGR *	0.1	10
							LUPO	0.3	10
							CAIL *	0.2	10
							ARNO	0.2	10
							CAGE *	3.1	40
							ACTR	0.2	10
							XETE *	2.0	30
							SCCE2	1.0	20
							BRVU *	1.0	10
							LANE	1.5	10
							NEBR	1.1	30
							LOAM *	0.3	10
							GAAP	0.7	30
							CARO2 *	0.3	20
TSHE-EAST	ABLA2	11.0	67	ACGL	1.0	67	ADBI	1.0	33
3 PLOTS	PIPO	1.3	67	CEVE	1.7	33	PTAQ *	6.7	33
	PSME	5.0	100	PAMY	1.7	67	SMST *	0.3	33
	POTR2	3.0	33	PREM *	3.3	33	ASTER	0.3	33

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
TSHE-EAST	PIEN	5.3	100	PYSE	1.0	67	CARU *	5.0	33
	PIMO *	8.7	100	RUPA *	8.7	67	GRASS*	0.3	33
	THPL	24.3	100	ALSI	3.7	67	PERA	0.3	33
				RIBES	0.3	33	ELGL *	0.7	33
				SPBE	0.3	33	TIUN *	0.3	33
				CHUM *	2.3	67	CLUN *	1.7	33
				RHAL	0.7	33	LAMU	0.7	33
				VAME *	3.0	100	XETE *	0.3	33
				LIBO2	5.7	67	LANE	1.7	33
				ROGY *	0.3	33			
				COCA *	8.3	33			
				PYPI	0.3	33			
TSHE-WEST	ABLA2	0.1	4	ACGL	0.2	5	ADBI	0.0	1
77 PLOTS	PSME	22.5	77	AMAL *	0.0	3	DIHO *	0.0	1
	BEOC	0.0	1	HODI	0.1	3	PTAQ *	2.2	23
	POTR2	0.2	4	PAMY	1.2	16	SMST *	0.1	4
	PIEN	0.2	6	SYAL *	0.0	1	GRASS*	0.0	1
	PICO	1.9	10	BEAQ	0.4	9	PERA	0.1	4
	TSME	0.1	4	PYAS	0.1	4	EPAN	0.9	6
	ABGR	1.2	9	PYSE	0.0	1	MITEL*	0.0	1
	PIMO *	0.5	6	RUPA *	0.5	9	ANMA	0.1	5
	CHNO	0.6	5	SARA *	0.1	5	TRLA2	0.1	6
	THPL	20.7	87	SOSI *	0.3	1	EQAR*	0.0	1
	TSHE	51.4	94	PRVI *	0.0	1	ELGL *	0.0	1
	ACMA	1.5	25	ALSI	0.1	4	TIUN *	0.0	3
	ABAM	1.0	21	ARNE *	0.0	3	AFTI *	1.1	26
	SASC	0.6	12	SOSC2*	0.0	3	COCA *	0.1	3
	BEPA	0.7	6	CHUM *	0.3	16	CLUN *	0.3	18
	BEP12	0.1	3	SALIX*	0.3	1	GYDR *	0.0	3
	ALRU	2.4	29	SHCA *	0.2	3	LYCOP	0.0	1
	ABIES	0.1	3	VAME *	1.4	12	STRO *	0.0	1
	CONU *	0.0	1	VAMY *	0.0	1	TITR *	0.3	9
	RHPU	0.0	1	RULE *	0.0	1	BLSP *	0.4	9
				LIBO2	2.0	32	MADI	0.2	1
				RILA *	0.3	8	MADI2		
				ROGY *	0.0	3	CIAL	0.2	5
				RUPE *	0.1	6	MERTE*	0.1	5
				VAAL *	1.2	17	MEPA *	0.1	6
				ACCI	4.2	34	CAGE *	0.0	1
				ASCA3	0.0	1	LAMU	0.0	1
				OPHO *	1.1	17	XETE *	0.0	3
				POMU *	4.8	35	SCCE2*	1.1	26
				TABR	0.1	5	BRVU *	0.1	3
				COCO2	0.2	4	LANE	0.3	18
				COST *	0.1	1	NEBR	0.0	18
				ROSA *	0.0	1	LOAM *	0.0	1
				BENE	2.5	31	GAAP	0.0	1
				MEFE	0.1	5	GABO	0.3	9
				RULA *	0.1	4	PEFRP*	0.4	9
				RUSP *	1.1	12	HYPO	0.2	1
				COCA *	0.3	14	STIPA*	0.1	4

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
TSHE-WEST				LOCI	* 0.0	1	ALMA	0.2	5
				RUUR	* 0.2	5			
				VAPA	* 0.4	17			
				GAOV	0.9	8			
				GASH	4.1	17			
				VAOV	* 0.0	1			
ABAM-EAST	ABLA2	5.1	36	AMAL	* 0.2	6	ARCO	0.0	3
36 PLOTS	PSME	11.5	72	PAMY	1.5	28	DIHO	* 0.1	6
	PIAL	* 0.1	8	PYAS	0.2	14	PTAQ	* 3.9	33
	PIEN	1.8	17	PYSE	0.4	19	SMST	* 0.1	8
	PICO	1.0	6	RUPA	* 0.7	22	THOC	0.1	3
	TSME	1.5	33	SOSI	* 0.2	14	VIGL	* 0.1	3
	PIMO	* 3.4	42	ALSI	0.6	22	BROMU	* 0.1	6
	CHNO	1.3	17	ARNE	* 0.6	11	ERIGE	0.0	3
	THPL	6.1	50	SOSC2	* 0.2	8	ERPE	0.0	3
	TSHE	19.4	58	CHUM	* 0.8	19	FEVI	* 0.1	3
	ABAM	42.3	100	SALIX	* 0.4	8	GRASS	0.1	3
	SASC	0,2	8	VASC	* 0.1	3	ACRU	0.0	3
				RHAL	1.0	11	PERA	0.1	6
				VAME	*14.0	67	EPAN	* 0.1	3
				LIBO2	1.3	17	LUPIN	2.4	6
				RILA	* 0.1	6	JUPA	* 0.0	3
				VADE	* 1.2	8	VASI	0.4	8
				ROGY	* 0.1	3	MITEL	* 0.0	3
				RUPE	* 1.3	19	ARLA	0.4	11
				VAAL	* 2.5	8	VIOLA	* 0.1	8
				ACCI	1.2	14	ANMA	0.1	8
				OPHO	* 2.1	14	POFL2	0.1	3
				POMU	* 0.1	6	FESTU	0.1	3
				TABR	0.2	3	DEAT	* 0.0	3
				ROSA	* 0.0	3	TIUN	* 0.6	14
				BENE	1.3	22	ATFI	* 1.2	17
				MEFE	0.3	8	COCA	* 0.2	6
				RULA	* 1.9	31	CLUN	* 1.8	44
				RUSP	* 0.5	8	GYDR	* 1.3	6
				LONIC	0.0	3	STRO	* 0.4	8
				COCA	* 0.3	8	ASEN	0.0	3
				GAOV	1.9	22	TITR	* 0.2	11
				GASH	0.0	3	POBI	* 0.0	3
				RIBR	* 0.1	3	CASP	* 0.1	3
				CHME	0.4	6	MERTE	* 0.1	8
				PYROL	0.1	3	CAIL	* 0.1	3
							TOMB	0.1	3
							CASI3	* 0.0	3
							XETE	* 0.6	14
							SCCE2	1.2	17
							BRVU	* 0.2	6
							LANE	1.8	44
							NEBR	1.3	6
							GAAP	0.4	8
							SASI	0.0	3

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
ABAM-EAST							GABO	0.2	11
							ERDO	0.0	3
							MAMI	0.1	3
ABAM-WEST	ABLA2	2.1	7	ACGL	0.1	3	DIHO	* 0.1	4
76 PLOTS	PSME	5.4	30	AMAL	* 0.0	3	PTAQ	* 0.5	9
	POTR2	0.1	5	HODI	0.0	1	SMST	* 0.1	4
	PIEN	1.1	12	PAMY	0.4	17	THOC	0.0	3
	TSME	0.7	18	PYAS	0.1	4	VIGL	* 0.1	5
	PIMO	* 0.1	8	PYSE	0.5	26	BROMU	* 0.0	1
	CHNO	2.1	16	RUPA	* 0.4	11	GRASS	* 0.0	3
	THPL	5.3	41	SARA	* 0.3	13	LULA	0.0	1
	TSHE	36.5	79	SOSI	* 0.2	5	OSOC	* 0.0	1
	ACMA	0.2	4	PRVI	* 0.0	1	LUHI	* 0.0	3
	ABAM	46.2	100	ALSI	0.3	5	CARO	* 0.0	1
	SASC	0.3	7	RIBES	0.0	4	EPAN	* 2.0	13
	ALRU	0.9	11	SPBE	0.0	1	VASI	0.2	9
				SOSC2	* 0.1	4	VEVI	* 0.0	1
				CHUM	* 0.2	12	CABI	0.2	3
				SALIX	* 0.1	4	MITEL	* 0.1	4
				VASC	* 0.1	5	ARLA	0.3	9
				RHAL	1.4	8	VIOLA	* 0.0	4
				VAME	* 7.7	46	ANMA	0.5	8
				VAMY	* 0.0	1	HELA	* 0.0	1
				LIBO2	0.8	13	EQAR	* 0.0	1
				PHEM	0.2	4	FESTU	0.0	1
				RILA	* 0.1	5	ELGL	* 0.0	1
				CAME	0.1	1	OSMOR	* 0.0	1
				VADE	* 0.8	3	TIUN	* 0.7	21
				ROGY	* 0.1	3	ATFI	1.4	25
				RUPE	* 4.8	42	SOCA	0.0	1
				VAAL	* 8.8	45	COCA	* 0.3	3
				SACO2	* 0.1	1	CLUN	* 1.4	34
				ACCI	0.4	3	GYDR	* 0.3	9
				OPHO	* 1.5	22	LYCOP	0.0	1
				POMU	* 0.8	9	STRO	* 0.4	17
				TABR	0.1	4	MOSI	0.0	1
				BENE	0.3	7	ASFO	0.0	1
				MEFE	0.4	14	TITR	* 0.2	9
				RULA	* 0.9	21	BLSP	* 0.8	21
				SPDE	0.3	1	LYAM	* 0.1	1
				RUSP	* 2.6	24	MADI2	0.6	11
				SASI2	* 0.0	1	CASP	* 0.0	1
				COCA	* 0.5	17	MERTE	* 0.5	8
				RUUR	* 0.5	4	LIGR	* 0.0	1
				VAPA	* 0.3	4	CAGE	* 0.0	1
				RHPU	0.0	1	TOME	0.0	1
				GAOV	0.2	3	LAMU	0.0	1
				GASH	0.3	3	CAPA	* 0.0	1
				RIHU	0.0	1	XETE	* 0.7	21
							SCCE2	1.4	25
							EQHY	* 0.0	1

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
ABAM-WEST							BRVU *	0.3	3
							LANE	1.4	34
							NEBR	0.3	9
							LOAM *	0.0	1
							GAAP	0.4	17
							CASC3 *	0.0	1
							CARO2 *	0.0	1
							GABO	0.2	9
							PEFRP *	0.8	21
							POCO *	0.1	1
							STIPA *	0.6	11
							MAMI	0.0	1
TSME-EAST	ABLA2	8.3	68	ACGL	0.0	2	LOBR *	0.2	2
56 PLOTS	PSME	1.3	14	AMAL *	0.0	2	PTAQ *	0.3	2
	PIAL *	0.4	12	PAMY	0.4	7	ACMI	0.0	2
	PIEN	0.6	16	PYAS	0.0	2	ERIGE	0.1	1
	LALY	0.4	5	PYSE	0.1	7	ERPE	0.2	9
	PICO	0.4	4	SOSI *	1.9	20	FEVI *	0.3	11
	TSME	24.3	100	ALSI	0.5	9	GRASS *	0.1	4
	ABGR	1.0	4	ARNE *	0.2	2	LULA	0.2	29
	PIMO *	0.3	11	JUCO4	0.0	2	ARCA2	0.0	4
	CHNO	4.6	48	PHDI	0.1	5	PERA	0.1	7
	TSHE	0.9	7	CHUM *	0.1	7	LUHI *	0.4	14
	ABAM	27.8	84	SALIX *	0.0	2	CARO *	0.0	2
	SASC	0.2	2	VASC *	0.2	2	JUPA *	0.2	7
	LAOC	0.0	2	RHAL	8.1	38	ANLA	0.0	2
				VAME *	18.3	64	VASI	1.6	23
				PEDA	0.1	4	ANOC	0.1	2
				PHEM	5.3	43	CAREX *	1.2	11
				RILA *	0.0	4	PEBR	0.0	2
				CAME	2.1	14	VEVI *	0.2	9
				VADE *	10.6	41	MITEL *	0.0	2
				RUPE *	0.3	7	ARLA	0.4	18
				VAAL *	1.4	5	SETR *	0.0	2
				ARUV *	0.7	2	VIOLA *	0.0	2
				POMU *	0.0	2	HELA *	0.1	4
				MEFE	0.6	14	CANI2 *	0.2	11
				RULA *	1.1	38	LUPE	1.7	27
				SPDE	0.2	5	POFL2	0.5	9
				RUSP *	0.0	2	EQAR *	0.0	2
				SPDO	0.0	2	DEAT *	0.3	12
				RIHO	0.0	4	TIUN *	0.0	2
				SASI2 *	0.3	2	AFTI *	0.0	2
				COCA *	0.0	2	CLUN *	0.7	5
				GAOV	0.1	4	GYDR *	0.1	2
				CAST5	0.0	2	LYCOP	0.0	2
				RIBR *	0.0	2	CACA *	0.0	2
							LUSE	0.0	2
							TITR *	0.0	2
							BLSP *	0.0	2
							POBI *	0.0	2

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
TSME-EAST							CASP	* 0.3	9
							LIGR	* 0.1	4
							LUPO	0.2	11
							AGGLD	1.7	27
							CAIL	* 0.5	9
							CAGE	* 0.0	2
							CASI3	* 0.3	12
							XETE	* 0.0	2
							SCCE2	0.0	2
							LANE	0.7	5
							NEBR	0.1	2
							LOAM	* 0.0	2
							AGCR	* 0.0	2
							ERTH	0.0	2
							GABO	0.0	2
							PEFRP	* 0.0	2
							ERDO	0.0	2
							MAMI	0.3	9
TSME-WEST	ABLA2	5.1	32	AMAL	* 0.0	1	PTAQ	* 0.2	7
107 PLOTS	PSME	0.3	6	PAMY	0.4	4	SMST	* 0.1	2
	PIAL	* 0.0	2	BEAQ	0.1	1	THOC	0.0	1
	PIEN	0.2	5	PYSE	0.1	4	ASTER	0.1	2
	TSME	35.0	100	RUPA	* 0.2	5	BROMU	* 0.0	1
	ABGR	0.0	1	SOSI	* 1.2	23	ERPE	0.2	8
	PIMO	* 0.1	3	ALSI	0.1	2	FEVI	* 0.0	1
	CHNO	8.1	59	ARNE	* 0.1	2	HYFE	0.0	1
	THPL	0.8	4	RIBES	0.4	3	LULA	0.7	6
	TSHE	0.9	6	SOSC2	* 0.0	1	ARCA2	0.0	1
	ABAM	20.7	74	CHUM	* 0.0	1	PERA	0.1	3
				SALIX	* 0.0	2	LUHI	* 0.2	10
				VASC	* 0.1	4	EPAN	* 0.1	5
				RHAL	2.3	18	LUPIN	0.2	2
				VAME	*10.2	45	JUPA	* 0.0	1
				LIBO2	0.1	1	ANLA	0.0	1
				PHEM	10.1	51	PHAL	* 0.0	1
				CAME	3.2	24	VASI	1.0	13
				VADE	*10.3	47	ANOC	0.0	2
				RUPE	* 2.5	26	CAREX	* 0.6	7
				VAAL	* 3.1	25	PEBR	0.0	1
				ACCI	0.2	3	VEVI	* 0.7	17
				OPHO	* 0.1	1	CABI	0.7	9
				COCO2	0.0	1	MITEL	* 0.0	1
				MEFE	1.1	12	ARLA	0.5	11
				RULA	* 1.1	19	SETR	* 0.1	5
				SPDE	0.2	5	VIOLA	* 0.0	4
				RUSP	* 0.2	5	JUNCU	* 0.0	2
				RIHO	0.0	1	GECA	0.0	1
				SASI2	* 0.0	1	HELA	* 0.0	1
				COCA	* 0.2	4	CANI2	* 0.4	9
				VAPA	* 0.0	1	LUPE	2.3	28
				RISA	0.0	1	POFL2	0.1	4

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
TSME-WEST				CLPY	1.7	5	EQAR	* 0.0	1
				GAOV	0.0	1	ELGL	* 0.0	2
				CAST5	0.0	1	DEAT	* 0.2	9
				GAULT	0.1	1	DAIN	* 0.0	1
							TIUN	* 0.1	6
							ATFI	* 0.3	7
							CLUN	* 0.3	8
							PEOR5	0.0	2
							GYDR	* 0.0	1
							LYCOP	0.0	1
							STRO	* 0.2	6
							ASFO	0.0	2
							LUSE	0.0	1
							TITR	* 0.0	3
							BLSP	* 0.1	4
							LYAM	* 0.0	1
							MADI2	0.1	2
							POBI	* 0.1	7
							CASP	* 0.3	14
							BRCA	* 0.0	1
							LIGR	* 0.0	1
							LUPO	0.4	9
							AGGLD	2.3	28
							CAIL	* 0.1	4
							CAGE	* 0.0	1
							LAMU	0.0	2
							CASI3	* 0.2	9
							ATDI	* 0.0	1
							XETE	* 0.1	6
							SCCE2	0.3	7
							LANE	0.3	8
							FEID	* 0.0	2
							NEBR	0.0	1
							LOAM	* 0.0	1
							GAAP	0.2	6
							CARO2	* 0.0	2
							ERTH	0.0	1
							GABO	0.0	3
							PEFRP	* 0.1	4
							POCO	* 0.0	1
							STIPA	* 0.1	2
							ERDO	0.1	7
							MAMI	0.3	14
PIAL	ABLA2	12.8	89	PAMY	1.3	56	LOBR	* 0.1	11
9 PLOTS	PIAL	*28.7	100	ARNE	* 3.3	11	ARCO	0.4	33
	PIEN	* 2.7	100	JUCO4	1.0	56	ACMI	0.8	33
	LALY	1.4	56	PHDI	1.4	33	ERPE	0.6	33
	PICO	1.7	11	VASC	*11.3	67	ERUM	0.7	22
	PIMO	* 0.1	11	VAME	* 0.9	22	FEVI	* 4.6	33
	ABAM	0.1	11	PEDA	0.4	33	LULA	3.4	56
				PERY	0.3	11	CACO	* 0.1	11
				VACA	* 0.3	11	ARCA2	1.3	56

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
PIAL				POFR	0.1	11	PERA	0.1	11
							LUHI	* 2.9	56
							CARO	* 0.7	22
							JUPA	* 0.6	33
							VECU	0.1	11
							ANLA	0.1	11
							ARPA3	0.9	11
							PEBR	0.1	11
							LUPE	2.8	11
							LUZUL	* 0.2	11
							AGGLD	2.8	11
							AGTH	* 0.2	11
LALY	ABLA2	6.9	68	VASC	*14.1	88	CASTI	* 0.1	12
8 PLOTS	PIAL	* 3.0	100	PHEM	6.4	88	ERPE	0.4	12
	PIEN	2.9	75	CAME	11.9	75	FEVI	* 0.1	12
	LALY	36.0	100	GAHU	0.3	12	GRASS	* 0.5	25
	TSME	0.3	12	KAMI	0.1	12	ARCA2	0.5	25
				PHGL	0.3	12	LUHI	* 6.0	88
				SACA6	* 0.1	12	JUPA	* 0.6	25
				VADE	* 3.9	50	VECU	1.3	75
							ANLA	0.3	25
							VASI	0.4	25
							CAREX	* 2.6	75
							TRLA4	0.1	12
							CABI	0.3	12
							ARLA	0.3	25
							SETR	* 0.1	12
							JUNCU	* 0.1	12
							CANI2	* 2.0	25
							LUPE	8.3	75
							POFL2	1.6	38
							DEAT	* 0.3	25
							LUPO	2.0	25
							AGGLD	8.3	75
							CAIL	* 1.6	38
							CASI3	* 0.3	25
SHRUB-STEPPE-HERB	PIPO	1.2	36	ACGL	0.2	9	AGSP	* 20.0	67
69 PLOTS	PSME	0.5	10	AMAL	* 1.2	20	LODI2	* 0.4	14
	POTR	0.5	9	CEVE	0.1	1	ACMI	0.4	23
	POTR2	0.0	1	HODI	0.1	6	BROMU	* 0.0	1
	SAAM2	0.0	1	PHLE2	0.1	4	CARU	* 0.1	3
	SASC	0.0	1	PREM	* 0.1	7	CASTI	* 0.0	1
	ALRH	0.1	1	SYAL	* 0.1	6	ERUM	0.0	3
				PRVI	* 0.3	10	GRASS	* 0.6	7
				RICE	0.2	12	BASA	6.8	57
				SALIX	* 0.0	1	LUPIN	0.2	9
				ROSA	* 0.0	1	ERIOG	0.1	4
				ARTR	3.2	28	FESTU	0.7	4
				RONU	* 0.0	1	BRTE	* 10.1	59

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
SHRUB-STEPPE HERB				PUTR	6.6	54	LUSE	0.4	12
				SAMBU	0.0	1	VICIA	0.0	1
				CRDO *	0.0	1	ERLI	0.2	6
				HAST2	0.1	1	POBU *	4.0	25
				HOOD	0.0	3	ARLU	0.0	1
				RHGL	0.0	4	CADR2	0.1	3
				SADO2	0.0	3	POA *	0.3	6
				ARCA	0.5	13	STOC *	1.1	7
				RHRA	0.0	1	VETH	0.0	1
				SAEX *	0.0	1	HEDO	0.1	1
				ARTR2	0.7	9	AGRE *	0.0	1
				CLLI	0.0	1	CEDI	2.4	12
				PHLI	0.0	1	RUCR *	0.4	1
				CHNA	0.0	1	SIAL	0.2	3
				ARRI	0.0	3	SILO	0.0	1
				ARDR	0.1	4	MESA *	0.0	1
				ARTEM	0.0	1	TOME	0.7	4
							POSE *	10.1	59
							ERTH	0.4	12
							CHTE	0.0	1
							SECE *	0.2	6
							FEBR *	4.0	25
							FESC *	0.0	1
							ERCI	0.1	3
							AGEX *	0.3	6
							POBR	1.1	7
							CAOB *	0.0	1
							CAAQ *	0.1	1
							CAFL	0.0	1
							STCO2 *	2.4	12
							PLPA	0.4	1
							CAFI *	0.2	3
							AGIN2 *	0.0	1
							POPR *	0.0	1
SHRUB-STEPPE-PUTR	PIPO	1.4	50	AMAL *	0.7	30	AGSP *	5.9	60
10 PLOTS	PSME	0.6	20	PREM *	0.1	10	LODI2 *	1.3	20
				SYAL *	0.1	10	ACMI	0.1	10
				PRVI *	0.8	30	LOMAT *	0.3	10
				LOUT2 *	0.2	20	BASA	3.1	40
				RICE	0.2	10	ERIOG	2.5	10
				ARTR	0.3	10	BRTE *	3.6	70
				PUTR	29.5	100	LUSE	0.9	20
							POBU *	0.4	10
							STOC *	0.1	10
							HEDO	0.5	10
							POSE *	3.6	70
							ERTH	0.9	20
							FEBR *	0.4	10
							POBR	0.1	10
							CAAQ *	0.5	10

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
SHRUB-STEPPE-ARTR	ABLA2	0.1	5	CEVE	2.2	15	AGSP *	4.8	40
20 PLOTS	PIPO	1.4	55	HODI	0.1	5	THOC	0.1	5
	PSME	1.1	35	PAMY	0.1	5	LODI2 *	0.1	5
	POTR	0.3	10	SYAL *	0.3	10	ACMI	0.8	40
	PIAL *	0.2	10	SYOR	0.2	5	BROMU *	0.1	5
				PEFR3	0.1	5	CARU *	0.3	5
				PRVI *	0.1	5	CASTI *	0.3	5
				SPBE	0.1	5	ERIGE	0.2	15
				RICE	0.5	20	ERPE	0.2	5
				ARTR	40.4	100	ERUM	0.8	25
				PUTR	0.6	20	FEVI *	0.6	5
				CRDO *	0.3	10	GRASS *	4.3	10
				ARTR2	0.3	10	LOMAT *	0.1	5
				CHNA	0.1	5	LULA	0.4	5
				ARRI	0.3	5	BASA	1.1	30
				CHYRS	0.1	5	LUNA2	0.2	5
				CHVI	0.1	5	LUPIN	0.9	25
							CAREX *	1.6	10
							FESTU	0.8	10
							BRTE *	2.2	20
							LUSE	0.1	5
							ERLI	0.4	5
							POBU *	0.9	20
							CEDI	0.1	5
							TOME	0.8	10
							POSE *	2.2	20
							ERTH	0.1	5
							SECE *	0.4	5
							FEBR *	0.9	20
							STCO2 *	0.1	5
ALPINE MEADOW (E)	ABLA2	0.6	31	ARNE *	0.1	6	ACMI	0.5	19
16 PLOTS	PIAL *	1.9	38	JUCO4	0.8	44	CASTI *	0.4	19
	PIEN	1.4	44	PHDI	0.8	19	ERIGE	0.1	6
	LALY	0.9	38	SALIX *	1.4	25	ERPE	0.7	19
				VASC *	0.5	12	ERUM	0.1	12
				VAME *	0.6	6	FEVI *	3.8	19
				PEDA	0.1	6	GRASS *	3.1	38
				PHEM	2.5	50	LULA	0.1	6
				VACA *	1.4	19	POTEN	1.8	31
				CAME	1.8	25	ARCA2	0.9	25
				KAMI	1.0	31	LUHI *	0.6	12
				SANI *	0.1	6	JUPA *	0.4	12
				CATE2	0.1	6	VECU	0.2	12
				PHGL	0.3	19	ERIOG	0.2	12
				VADE *	0.6	12	ANLA	3.2	44
				ARUV *	0.3	6	PHAL *	0.3	12
				POFR	0.4	6	PODI	1.1	25
							VASI	0.1	6
							CAREX *	9.1	62
							TRLA4	0.1	6

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
ALPINE MEADOW (E)							CALE2	0.3	6
							GECA	0.9	31
							AROB	0.8	19
							LULE2	0.8	12
							DROC	1.1	25
							CANI2 *	16.6	44
							LUPE	0.4	6
							POFL2	0.9	19
							DEAT *	0.1	6
							LUZUL *	0.1	6
							DAIN *	0.3	12
							PEOR5	0.4	12
							CASP *	0.1	6
							MEAR3	0.3	6
							BRCA *	0.9	31
							LIGUS *	0.8	19
							FERN	0.8	12
							SECY	1.1	25
							LUPO	16.6	44
							AGGLD	0.4	6
							CAIL *	0.9	19
							CASI3 *	0.1	6
							AGTH *	0.1	6
							ATDI *	0.3	12
							FEID *	0.4	12
							MAMI	0.1	6
ALPINE MEADOW (W) 5 PLOTS	ABLA2	1.4	60	SOSI *	0.2	20	ERGR *	0.2	10
	PIEN	0.2	20	SALIX *	1.2	20	CASTI *	0.4	20
	TSME	1.2	20	VASC *	0.2	20	ERPE	2.4	20
	CHNO	0.6	20	PHEM	4.8	80	GRASS *	1.0	20
	TSHE	0.6	20	VACA *	2.0	20	LULA	0.8	20
	ABAM	0.4	20	CAME	2.6	60	PERA	0.2	20
				KAMI	0.4	20	LUHI *	0.2	20
				PHGL	0.4	20	VECU	1.2	60
				VADE *	3.6	80	ANLA	0.6	40
				SPDE	2.0	20	PHAL *	0.2	20
							PODI	0.2	20
							VASI	0.4	20
							ANOC	0.2	20
							CAREX *	1.6	20
							PEBR	0.2	20
							TRLA4	0.2	20
							VEVI *	0.2	20
							CABI	3.6	40
							ARLA	0.2	20
							PEGR	0.2	20
							GECA	0.2	20
							CANI2 *	28.0	100
							LUPE	10.8	80
							POFL2	2.0	20
							EQAR *	2.2.	40

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
ALPINE MEADOW (W)							DEAT *	1.2	40
							CASP *	1.2	40
							CASC5 *	0.2	20
							BRCA *	0.2	20
							LUPO	28.0	100
							AGGLD	10.8	80
							CAIL *	2.0	20
							CAGE *	2.2	40
							CASI3 *	1.2	40
							MAMI	1.2	40
SUBALPINE LUSH MEADOW-EAST	ABLA2	3.6	72	AMAL *	0.1	2	ARCO	0.1	2
40 PLOTS	PSME	0.1	5	PAMY	0.2	5	ERGR *	0.6	12
	PIAL *	0.6	30	LOIN *	0.1	2	PTAQ *	0.4	2
	PIEN	2.5	45	PYAS	0.1	2	THOC	4.8	38
	LALY	0.4	20	SARA *	0.2	10	VIGL *	0.1	8
	PICO	0.5	10	SOSI *	0.0	2	ACMI	1.1	32
	TSME	0.4	5	ALSI	0.6	8	ANAR2 *	1.1	12
	CHNO	0.1	5	ARNE *	0.1	2	ARMA3	0.0	2
	ABAM	0.4	5	JUCO4	0.1	2	ASTER	1.0	12
	SASC	0.6	5	PHDI	0.3	18	BROMU *	0.2	12
				RIBES	0.3	12	CARU *	0.4	2
				SOSC2 *	0.9	5	CASTI *	0.5	25
				SALIX *	1.3	32	ERIGE	0.4	8
				VASC *	1.1	35	ERPE	1.7	32
				RHAL	0.1	10	ERUM	0.1	8
				VAME *	0.2	8	FEVI *	4.3	40
				PERY	0.1	2	GRASS *	3.2	30
				PHEM	1.0	42	HYFE	0.1	2
				LEGL	0.4	12	LICA2 *	0.9	28
				RILA *	0.1	8	LOMAT *	0.2	2
				SAMO2 *	0.1	2	LULA	1.8	30
				VACA *	0.6	5	OSOC *	0.3	8
				CAME	0.2	12	POTEN	0.6	18
				GAHU	0.0	2	ARCA2	0.2	12
				KAMI	0.1	5	PERA	0.2	10
				SANI *	0.1	2	LUHI *	1.1	28
				PHGL	0.0	2	CARO *	0.1	2
				VADE *	0.8	20	EPAN *	0.2	12
				VAAL *	0.1	2	LUPIN	0.5	10
				SACO2 *	0.5	15	FRAGA	0.1	5
				PEPR	0.0	2	JUPA *	0.5	18
				POFR	0.0	2	VECU	0.5	22
				SPDE	0.1	5	AQFO	0.0	2
				SASI2 *	0.5	2	ANLA	0.6	22
							ARPA3	0.2	10
							PHAL *	0.7	32
							PODI	0.2	8
							VASI	2.5	40
							ANOC	0.7	22
							CAREX *	7.6	48
							HADI2	0.6	18

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS		MEAN	CONS
SUBALPINE LUSH MEADOW-EAST							OXDI	*	0.1	2
							PEBR		0.3	15
							TRLA4		1.1	25
							VEVI	*	5.4	55
							CABI		1.4	18
							ERIOP		0.8	8
							MITEL	*	0.2	8
							ARLA		0.2	10
							SETR	*	0.2	12
							VIOLA	*	0.1	5
							JUNCU	*	0.3	8
							FRVI	*	0.6	12
							PEGR		0.4	12
							ANMA		0.2	5
							TRLA2		0.4	2
							CALE2		1.2	8
							GECA		0.3	20
							HELA	*	1.5	18
							URDI		0.0	2
							CANI2	*	0.7	15
							LUPE		1.8	15
							POFL2		2.8	32
							EQAR	*	0.1	5
							FESTU		0.1	2
							CALAM	*	0.3	2
							ELGL	*	0.4	12
							OSMOR	*	0.2	10
							DAIN	*	1.0	2
							CLUN	*	0.1	2
							STRO	*	0.1	2
							ASFO		0.2	8
							ASEN		2.8	12
							POBI	*	0.1	2
							CASP	*	2.9	20
							LYSI		0.6	12
							CASC5	*	0.4	12
							MERTE	*	0.2	5
							MEPA	*	0.4	2
							MEAR3		1.2	8
							BRCA	*	0.3	20
							LIGR	*	1.5	18
							GADI		0.0	2
							LUPO		0.7	15
							AGGLD		1.8	15
							CAIL	*	2.8	32
							CAGE	*	0.1	5
							TOME		0.1	2
							ACTR		0.3	2
							LAMU		0.4	12
							CAPA	*	0.2	10
							ATDI	*	1.0	2
							LANE		0.2	2
							GAAP		0.1	2

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
SUBALPINE LUSH							CARO2	* 0.2	8
MEADOW-EAST							SASI	2.8	12
							ERDO	0.1	2
							MAMI	2.9	20
SUBALPINE LUSH	ABLA2	3.1	62	AMAL	* 0.0	4	DIHO	* 0.1	2
MEADOW-WEST	PIAL	* 0.1	8	PAMY	0.2	10	ERGR	* 0.4	21
48 PLOTS	PIEN	0.2	8	PREM	* 0.3	4	PTAQ	* 3.1	8
	LALY	0.0	2	SYAL	* 0.0	2	SMST	* 0.4	8
	PICO	0.1	4	RUPA	* 0.0	2	THOC	3.4	29
	TSME	1.8	48	SARA	* 0.0	2	VIGL	* 0.0	2
	CHNO	1.4	27	SOSI	* 1.0	29	ACMI	0.4	15
	ABAM	0.3	19	ALSI	0.2	2	ANAR2	* 0.3	12
				ARNE	* 0.0	2	ARMA3	0.5	10
				JUCO4	0.0	2	ASTER	0.6	10
				PHDI	0.3	15	BROMU	* 0.2	4
				RIBES	0.4	8	CARU	* 0.1	2
				SOSC2	* 0.2	8	CASTI	* 0.1	12
				SALIX	* 0.1	2	ERPE	0.9	23
				VASC	* 0.1	6	ERUM	0.1	4
				RHAL	0.2	8	FEVI	* 2.8	27
				VAME	* 2.4	25	GRASS	* 0.8	15
				PHEM	1.9	40	HYFE	0.2	6
				VACA	* 0.2	6	LULA	3.8	58
				CAME	0.5	12	POTEN	0.1	4
				GAHU	0.0	2	ARCA2	0.1	10
				KAMI	0.2	6	PERA	0.3	10
				VADE	* 8.6	60	LUHI	* 0.4	15
				RUPE	* 0.0	2	CARO	* 0.2	10
				VAAL	* 0.2	4	EPAN	* 2.8	35
				SACO2	* 0.1	4	LUPIN	0.0	2
				POFR	0.0	2	JUPA	* 0.3	6
				RULA	* 0.0	2	VECU	0.1	8
				SABA	* 0.2	4	AQFO	0.1	6
				SPDE	1.4	17	ANLA	0.1	8
				RUSP	* 0.1	2	ARPA3	0.0	4
				SPIRA	0.1	2	PHAL	* 0.4	12
				SPDO	0.4	2	PODI	0.1	4
				RIHO	0.1	6	VASI	13.5	77
				RONU	* 0.0	2	ANOC	0.3	10
							CAREX	* 2.1	25
							HADI2	0.0	2
							PEBR	0.7	29
							TRLA4	0.6	8
							VEVI	* 5.5	56
							CABI	0.9	12
							MITEL	* 0.0	2
							ARLA	2.2	44
							SETR	* 0.2	10
							VIOLA	* 0.2	6
							JUNCU	* 0.0	4
							FRVI	* 0.2	4

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
SUBALPINE LUSH							PEGR	0.2	6
MEADOW-WEST							ANMA	0.0	2
							HELA	* 1.0	17
							CANI2	* 0.4	15
							LUPE	0.8	19
							POFL2	1.8	44
							EQAR	* 0.1	4
							ELGL	* 1.1	17
							OSMOR	* 0.0	2
							DEAT	* 0.4	19
							DAIN	* 0.3	2
							SOCA	0.5	6
							PEOR5	0.0	2
							ELPA2	0.5	6
							ASFO	0.1	8
							ASEN	0.9	8
							VICIA	0.1	2
							POBI	* 4.0	27
							CASP	* 8.5	35
							LYSI	0.2	4
							CASC5	* 0.2	6
							MERTE	* 0.0	2
							LIGR	* 1.0	17
							LUPO	0.4	15
							AGGLD	0.8	19
							CAIL	* 1.8	44
							CAGE	* 0.1	4
							LAMU	1.1	17
							CAPA	* 0.0	2
							CASI3	* 0.4	19
							ATDI	* 0.3	2
							EQHY	* 0.5	6
							FEID	* 0.0	2
							CAME2	* 0.5	6
							CARO2	* 0.1	8
							SASI	0.9	8
							CHTE	0.1	2
							ERDO	4.0	27
							MAMI	8.5	35
SUBALPINE MESIC-	ABLA2	3.2	65	ACGL	0.0	1	LOBR	* 0.4	12
DRY MEADOW (E)	PIPO	0.0	1	AMAL	* 0.0	3	ARCO	0.2	5
75 PLOTS	PSME	0.1	4	CEVE	0.2	4	ERGR	* 0.4	19
	POTR	0.3	1	PAMY	1.0	15	PTAQ	* 0.1	1
	PIAL	* 0.5	55	LOIN	* 0.0	1	THOC	0.2	7
	PIEN	0.6	28	RUPA	* 0.0	1	ACMI	1.2	45
	LALY	1.4	27	SARA	* 0.0	1	ANAR2	* 0.0	1
	PICO	0.6	5	SOSI	* 0.1	5	ASTER	0.4	9
	TSME	0.3	7	PEFR3	0.1	3	BROMU	* 0.1	7
	PIMO	* 0.1	3	ALSI	0.3	4	CARU	* 1.1	9
	CHNO	0.1	3	ARNE	* 0.2	4	CASTI	* 0.3	16

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
SUBALPINE MESIC-DRY MEADOW (E)	SASC	0.4	7	JUCO4	0.3	11	ERIGE	0.2	5
				PHDI	1.8	41	ERPE	1.1	33
				SPBE	0.0	1	ERUM	0.6	21
				LOUT2 *	0.0	1	FEVI *	15.0	69
				RICE	0.0	1	GRASS *	1.1	25
				SASC	0.0	1	LICA2 *	0.9	21
				SOSC2 *	0.2	7	LOMAT *	0.1	3
				SALIX *	0.8	9	LULA	1.9	39
				VASC *	3.1	32	POTEN	0.1	4
				VAME *	0.9	9	CACO *	0.0	4
				PERY	0.0	3	ARCA2	1.6	49
				PHEM	1.8	28	PERA	0.1	7
				LEGL	0.1	4	LUHI *	1.5	32
				CLCO	0.0	1	ANRA	0.0	1
				VACA *	1.8	19	CARO *	0.1	4
				CAME	1.1	15	EPAN *	0.1	9
				KAMI	0.0	1	LUPIN	0.2	5
				PHGL	0.1	5	FRAGA	0.0	3
				VADE *	1.3	16	JUPA *	2.2	40
				ROGY *	0.0	1	VECU	0.7	24
				PEPR	0.0	1	AQFO	0.0	1
				SABA *	0.1	1	ERIOG	0.0	1
				SPDE	0.0	1	ANLA	3.4	37
				SPDO	0.1	3	ARPA3	0.2	9
				RIHO	0.0	1	PHAL *	0.4	16
				ARTR	0.0	1	PODI	0.4	11
				ARLU	0.1	1	VASI	0.3	12
				SASI2 *	0.0	1	ANOC	0.2	12
				SAMY *	0.1	1	CAREX *	4.4	33
				RIWA	0.0	1	PEBR	0.1	7
							TRLA4	0.3	9
							VEVI *	0.2	9
							CABI	0.0	3
							ARLA	0.1	5
							SETR *	0.0	4
							JUNCU *	0.0	3
							FRVI *	0.4	9
							PEGR	0.1	7
							ANMA	0.2	9
							GECA	0.1	7
							CANI2 *	0.2	7
							LUPE	1.3	13
							POFL2	1.1	24
							EQAR *	0.0	1
							CALAM *	0.1	4
							ELGL *	0.0	3
							OSMOR *	0.0	1
							SEST2	0.2	3
							DEAT *	0.1	4
							LUZUL *	0.0	1
							DAIN *	0.3	3
							ASFO	0.3	1
							ASEN	0.5	7

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
SUBALPINE MESIC-							CACA *	0.1	
DRY MEADOW (E)							ARLU	0.1	3
							POA *	0.0	1
							POBI *	0.1	3
							CASP *	0.1	3
							LYSI	0.4	9
							CASC5	0.1	7
							MERTE *	0.2	9
							BRCA *	0.1	7
							LUPO	0.2	7
							AGGLD	1.3	13
							CAIL *	1.1	24
							CAGE *	0.0	1
							ACTR	0.1	4
							LAMU	0.0	3
							CAPA *	0.0	1
							HIMO	0.2	3
							CASI3 *	0.1	4
							AGTH *	0.0	1
							ATDI *	0.3	3
							CARO2 *	0.3	1
							SASI	0.5	4
							AGCR *	0.0	1
							FESC *	0.1	3
							AGEX *	0.0	1
							ERDO	0.1	3
							MAMI	0.1	3
SUBALPINE MESIC-	ABLA2	5.8	30	PAMY	0.4	26	LOBR *	0.3	15
DRY MEADOW (W)	PIAL *	0.4	19	SOSI *	0.6	7	ERGR *	0.3	26
27 PLOTS	PIEN	0.4	15	PHDI	3.9	63	PTAQ *	1.1	4
	LALY	0.1	7	RIBES	0.0	4	THOC	0.3	11
	TSME	0.5	11	SALIX *	0.1	7	ACMI	0.3	11
	PIMO *	0.0	4	VASC *	2.4	41	ASTER	0.3	15
	CHNO	0.5	11	RHAL	0.0	4	BROMU *	0.1	4
				VAME *	2.0	26	CASTI *	0.5	19
				PEDA	0.1	4	ERPE	2.6	59
				PHEM	2.5	41	ERUM	0.3	11
				VACA *	1.1	7	FEVI *	10.2	78
				CAME	0.8	15	GRASS *	0.8	15
				VADE *	6.6	56	LICA2 *	0.3	7
				SABA *	0.0	4	LOMAT *	0.0	4
							LULA	3.9	52
							POTEN	0.0	4
							ARCA2	2.8	56
							PERA	0.1	4
							LUHI *	1.2	44
							CARO *	0.1	7
							EPAN *	0.1	4
							LUPIN	0.6	11
							JUPA *	2.5	48
							VECU	1.0	44

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
SUBALPINE MESIC-							AQFO	0.0	4
DRY MEADOW (W)							ANLA	4.4	52
							ARPA3	0.1	7
							PHAL *	0.3	19
							PODI	0.4	15
							VASI	0.7	30
							ANOC	2.0	56
							CAREX *	3.6	44
							PEBR	0.3	26
							TRLA4	0.1	7
							VEVI *	0.4	30
							ARLA	2.2	33
							SETR *	0.0	4
							VIOLA *	0.0	4
							PEGR	0.0	4
							GECA	0.1	7
							CANI2 *	0.4	15
							LUPE	1.5	41
							POFL2	2.4	37
							DEAT *	0.2	7
							ASFO	0.1	4
							ASEN	0.6	4
							POBI *	0.6	11
							CASP *	0.0	4
							CASC5 *	0.0	4
							BRCA *	0.1	7
							LUPO	0.4	15
							AGGLD	1.5	41
							CAIL *	2.4	37
							CASI3 *	0.2	7
							CARO2 *	0.1	4
							SASI	0.6	4
							ERDO	0.6	11
SUBALPINE HEATHER	ABLA2	3.0	71	SOSI	* 1.9	29	ERGR *	0.3	6
WITH VADE	PIAL	* 0.4	32	ALSI	0.6	6	PTAQ *	0.3	6
31 PLOTS	PIEN	0.2	13	PHDI	0.3	13	THOC	0.1	3
	LALY	1.1	32	VASC	* 0.4	6	ACMI	0.1	3
	TSME	4.5	55	VAME	* 2.8	16	ASTER	0.4	10
	CHNO	0.3	13	PEDA	0.0	3	CASTI *	0.1	3
	TSHE	0.2	3	PHEM	24.7	87	ERIGE	0.1	6
	ABAM	0.8	23	VACA	* 0.5	10	ERPE	0.2	6
				CAME	8.2	61	FEVI *	0.5	13
				PHGL	0.7	6	GRASS *	0.1	3
				VADE	*21.2	90	LOMAT *	0.1	10
				SPDE	0.3	3	LULA	0.6	19
				SPDO	1.0	13	POTEN	0.1	3
				RIHO	0.1	6	ARCA2	0.1	10
							LUHI *	0.6	32
							CARO *	0.1	10
							EPAN *	0.0	3
							JUPA *	0.2	10

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
SUBALPINE HEATHER WITH VADE							VECU	0.3	19
							ANLA	1.0	26
							PHAL	* 0.0	3
							PODI	0.0	3
							VASI	1.4	26
							ANOC	0.4	13
							CAREX	* 0.2	13
							TRLA4	0.0	3
							VEVI	* 1.3	6
							ARLA	0.1	6
							JUNCU	* 0.0	3
							PEGR	0.1	6
							GECA	0.1	10
							CANI2	* 1.6	45
							LUPE	5.5	74
							POFL2	0.7	23
							DEAT	* 0.2	16
							POBI	* 0.4	23
							CASP	* 1.5	42
							CASC5	* 0.1	6
							BRCA	* 0.1	10
							LUPO	1.6	45
							AGGLD	5.5	74
							CAIL	* 0.7	3
							CASI3	* 0.2	16
							ERDO	0.4	23
							MAMI	1.5	42
SUBALPINE HEATHER WITH VADE (W)	ABLA2	1.2	38	PAMY	0.1	2	ERGR	* 0.0	2
80 PLOTS	PIAL	* 0.0	2	SOSI	* 0.9	19	PTAQ	* 0.0	1
	PIEN	0.1	2	JUCO4	0.7	4	ANAR2	* 0.0	1
	LALY	0.4	10	PHDI	0.2	5	ARMA3	0.0	1
	TSME	7.4	79	RIBES	0.0	1	ASTER	0.0	2
	PIMO	* 0.0	2	SOSC2	* 0.0	1	CASTI	* 0.1	5
	CHNO	1.3	34	SALIX	* 0.0	1	ERIGE	0.1	1
	ABAM	0.6	21	VASC	* 0.2	1	ERPE	0.8	22
				RHAL	0.4	9	FEVI	* 0.2	6
				VAME	* 1.3	9	GRASS	* 0.1	6
				PHEM	27.7	92	LICA2	* 0.0	1
				VACA	* 0.9	6	LULA	0.9	11
				CAME	12.8	60	PERA	0.1	4
				KAMI	0.0	1	LUHI	* 0.5	16
				PHGL	0.1	2	EPAN	* 0.2	5
				VADE	*18.9	85	JUPA	* 0.1	5
				RUPE	* 0.1	2	VECU	0.1	9
				VAAL	* 0.0	1	ERIOG	0.1	1
				SACO2	* 0.0	1	ANLA	1.1	15
				MEFE	0.0	2	VASI	1.6	31
				SABA	* 0.0	1	ANOC	0.2	10
				SPDE	0.3	2	CAREX	* 0.7	14
				RIHO	0.0	2	HADI2	0.0	1
				SASI2	* 0.0	2	PEBR	0.2	5

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
SUBALPINE HEATHER							TRLA4	0.0	1
WITH VADE							VEVI	* 0.3	12
							CABI	0.3	8
							ARLA	0.7	20
							SETR	* 0.0	2
							PEGR	0.0	1
							ANMA	0.0	1
							CALE2	0.1	2
							GECA	0.1	6
							CANI2	* 4.3	50
							LUPE	4.5	70
							POFL2	0.3	12
							ELGL	* 0.0	1
							DEAT	* 0.3	15
							LUZUL	* 0.0	1
							PEOR5	0.2	5
							ASFO	0.0	2
							POBI	* 0.8	10
							CASP	* 1.0	29
							CASC5	* 0.0	1
							MERTE	* 0.0	1
							MEAR3	0.1	2
							BRCA	* 0.1	6
							LUPO	4.3	50
							AGGLD	4.5	70
							CAIL	* 0.3	12
							LAMU	0.0	1
							CASI3	* 0.3	15
							AGTH	* 0.0	1
							FEID	* 0.2	5
							CARO2	* 0.0	2
							ERDO	0.8	10
							MAMI	1.0	29
SUBALPINE MOSAIC	ABLA2	4.8	73	PAMY	0.2	13	LOBR	* 0.1	7
-EAST	POTR	0.1	7	SARA	* 0.1	7	ERGR	* 0.1	7
15 PLOTS	PIAL	* 3.1	47	ARNE	* 1.1	13	ACMI	0.1	7
	PIEN	0.5	27	JUCO4	2.0	40	CASTI	* 0.1	7
	LALY	1.5	40	PHDI	0.2	13	ERIGE	0.1	7
	PICO	2.0	13	SOSC2	0.1	7	ERPE	0.1	7
	TSME	1.3	33	VASC	* 1.9	13	FEVI	* 1.8	47
	CHNO	0.3	7	VAME	* 0.6	20	GRASS	* 0.4	13
				PEDA	0.6	40	LOMAT	* 0.1	7
				RULE	* 0.3	7	POTEN	0.1	7
				PHEM	2.0	40	ARCA2	0.3	20
				LEGL	0.1	7	LUHI	* 0.2	13
				VACA	* 0.1	7	LUPIN	0.7	13
				CAME	1.1	27	APAN	0.1	7
				GAHU	0.1	7	JUPA	* 0.3	20
				KAMI	0.1	13	AQFO	0.4	7
				SANI	* 0.3	7	ERIOG	0.1	7
				PHGL	1.2	27	ANLA	0.1	13

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
SUBALPINE MOSAIC				VADE *	2.6	27	VASI	0.1	7
-EAST				ARUV *	0.1	7	CAREX *	0.2	20
				SPDE	0.1	7	AROB	0.3	7
							LULE2	1.0	7
							DROC	0.3	7
							CANI2 *	0.7	40
							LUPE	1.3	27
							POFL2	0.1	7
							CASP *	0.1	7
							LIGUS *	0.3	7
							FERN	1.0	7
							SECY2	0.3	7
							LUPO	0.7	40
							AGGLD	1.3	27
							CAIL *	0.1	7
							MAMI	0.1	7
SUBALPINE MOSAIC	ABLA2	0.6	29	PAMY	0.1	7	ACMI	0.1	7
-WEST	TSME	5.4	79	ALSI	0.3	14	ERPE	0.1	14
14 PLOTS	CHNO	0.4	21	JUCO4	0.4	7	EPAN *	0.1	7
	ABAM	0.7	29	PHDI	0.4	7	JUPA *	0.2	7
				VAME *	0.1	7	CAREX *	0.1	7
				PHEM	10.2	93	CABI	0.4	7
				CAME	5.7	71	CANI2 *	3.9	50
				VADE *	3.4	71	LUPE	5.1	71
				POFR	0.1	7	DEAT *	0.1	7
				SPDE	0.1	7	PEOR5	0.1	14
							ASPO	0.1	7
							CASP *	0.7	21
							LUPO	3.9	50
							AGGLD	5.1	71
							CASI3 *	0.1	7
							FEID *	0.1	14
							CARO2 *	0.1	7
							MAMI	0.7	21
MONTANE MOSAIC	PSME	7.0	67	AMAL *	1.3	33	AGSP *	1.3	33
-EAST	POTR	9.0	33	PAMY	3.3	33	LODI2 *	0.7	33
3 PLOTS				PHLE2	0.7	33			
				PREM *	0.3	33			
				GAMU	0.3	33			
				PERF3	1.3	33			
				PRVI *	0.3	33			
				ARTR	2.7	33			
				ARTR2	0.3	33			
				ARDR	0.3	33			
MONTANE MOSAIC	PSME	13.0	50	PAMY	2.5	50			
-WEST	TSME	0.5	50	PHLE2	0.5	10			
2 PLOTS	PIMO *	0.5	50	SARA *	1.0	50			

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
MONTANE MOSAIC				PHEM	5.0	50			
-WEST				ACCI	7.5	50			
				SPDE	4.0	50			
				RUSP	* 3.0	50			
MONTANE HERB	PIPO	1.8	42	ACGL	0.3	17	AGSP	* 0.2	8
-EAST	PSME	2.9	33	AMAL	* 0.3	8	DIHO	* 0.2	8
12 PLOTS	ACMA	1.1	8	HODI	1.4	17	PTAQ	* 2.5	8
	SASC	7.2	17	PREM	* 0.2	8	LODI2	* 0.2	8
				SYAL	* 0.6	17	ACMI	0.6	33
				SYOR	0.1	8	ASTER	0.3	8
				RUPA	* 0.1	8	BROMU	* 1.3	8
				SARA	* 0.2	8	CARU	* 0.4	8
				ALSI	0.9	17	GRASS	* 0.1	8
				ARNE	* 0.1	8	LULA	0.5	8
				SALIX	* 2.5	8	BASA	2.7	17
				ROSA	* 0.7	8	CACO	* 0.1	8
				SACE	* 0.3	8	LUNA2	0.1	8
				PUTR	0.2	8	ACRU	0.1	8
				HAST2	1.0	8	CARO	* 0.2	8
				ARTR2	1.0	8	CAREX	* 5.1	8
							VEVI	* 0.1	8
							SETR	* 0.1	8
							VIOLA	* 0.2	8
							ELGL	* 0.1	8
							ATFI	* 0.4	8
							AGROS	* 1.7	8
							BRTE	* 0.9	25
							ERLI	0.1	8
							POA	* 1.0	8
							RUCR	* 1.7	8
							SIAL	0.7	8
							LAMU	0.1	8
							SCCE2	0.4	8
							BAHO	1.7	8
							POSE	* 0.9	25
							SECE	* 0.1	8
							AGEX	* 1.0	8
							PLPA	1.7	8
							CAFI	* 0.7	8
MONTANE HERB	ABLA2	0.4	20	SOSI	* 0.2	20	ASTER	6.0	60
-WEST	TSME	6.6	60	PHEM	2.2	40	ERPE	4.4	60
5 PLOTS	CHNO	4.4	60	VADE	* 3.6	60	GRASS	* 1.0	20
	ABAM	0.8	40	SPDE	1.6	40	APAN	2.0	20
				SPDO	2.0	20	CAREX	* 24.0	80
							CABI	1.2	40
							EQAR	* 1.6	60
							CACA	* 2.2	40
							CAGE	* 1.6	60
							AGCR	* 2.2	40

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
MONTANE SHRUB	ABLA2	2.9	43	ACGL	2.2	20	AGSP	* 0.5	8
-EAST	PIPO	0.6	6	AMAL	* 2.6	29	LOBR	* 0.1	6
49 PLOTS	PSME	1.7	35	CEVE	3.2	20	DIHO	* 0.1	2
	POTR	3.4	14	HODI	0.9	8	ERGR	* 1.0	2
	POTR2	0.3	4	PAMY	5.0	39	PTAQ	3.5	14
	PIAL	* 0.3	10	PHLE2	0.1	4	THOC	1.5	15
	PIEN	1.0	22	PREM	* 3.6	20	VIGL	* 0.0	2
	LALY	0.1	6	SYAL	* 1.5	20	LODI2	* 0.1	2
	PICO	0.2	8	SYOR	0.0	2	ACMI	0.2	18
	TSME	0.4	14	BEAQ	0.1	4	ANAR2	* 0.0	2
	PIMO	* 0.0	4	LOIN	* 0.2	6	ARMA3	0.1	6
	CHNO	0.4	8	PYAS	0.1	2	ASTER	0.2	8
	THPL	0.0	2	RUPA	* 0.8	18	BROMU	* 0.2	4
	ABAM	0.9	24	SARA	* 0.2	8	CARU	* 1.7	12
	SASC	5.0	31	SOSI	* 0.5	10	CASTI	* 0.1	6
				PEFR3	0.2	10	ERIGE	0.0	2
				PRVI	* 0.0	2	ERPE	0.0	2
				ALSI	5.3	27	ERUM	0.0	2
				ARNE	* 0.1	4	FEVI	* 0.4	2
				PHDI	0.0	4	GRASS	* 0.7	12
				RIBES	0.1	4	HYFE	0.4	4
				SPBE	0.4	10	LICA2	* 0.0	4
				SASC	0.5	4	LOMAT	* 0.0	2
				SOSC2	* 2.6	20	LULA	0.1	6
				SALIX	* 4.9	20	OSOC	* 0.2	8
				VASC	* 0.2	4	POTEN	0.1	4
				RHAL	0.4	2	CACO	* 0.0	2
				SHCA	* 0.0	2	LUNA2	0.0	2
				VAME	* 5.4	24	ARCA2	0.1	2
				PEDA	0.1	2	PERA	0.0	2
				RULE	* 0.1	6	LUHI	* 0.1	2
				RILA	* 0.1	8	CARO	* 0.2	10
				RIVI	* 0.1	6	EPAN	* 1.1	29
				RUID	* 0.0	2	APAN	0.1	2
				VADE	* 0.1	4	JUPA	* 0.0	2
				RUPE	* 0.0	2	VASI	0.3	10
				VAAL	* 0.2	2	CAREX	* 0.6	10
				SACO2	* 1.3	4	TRLA4	0.0	2
				ARUV	* 0.0	2	VEVI	* 0.7	10
				POFR	0.1	2	CABI	0.2	4
				ACCI	2.1	14	MITEL	* 0.1	2
				OPHO	* 0.1	2	ARLA	0.2	6
				COST	* 1.8	2	SETR	* 0.0	2
				ROSA	* 0.1	6	FRVI	* 0.1	4
				RULA	* 0.4	10	ANMA	0.5	12
				SABA	* 0.8	4	GECA	0.0	2
				SPDE	0.9	6	HELA	* 0.2	8
				RUSP	* 0.7	10	URDI	0.1	4
				BEGL	1.2	4	LUPE	0.1	2
				SPDO	1.6	12	POFL2	0.6	4
				VACCI	* 0.1	2	EQAR	* 0.0	4
				RIHO	0.1	2	CALAM	* 0.3	6

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
MONTANE SHRUB				ARLU	0.1	2	ELGL *	1.3	10
-EAST				SASI2 *	2.3	6	DAIN *	0.1	2
				COCA *	0.1	4	ATFI *	0.7	4
				SACE *	0.0	4	SOCA	0.1	4
				RUBUS *	0.0	2	CLUN *	0.0	2
				PUTR	0.1	2	ASFO	0.6	8
				RHPU	0.0	2	ASEN	0.2	8
				RIWA	0.1	2	AGROS *	0.0	2
				SAPH *	1.4	2	CACA *	0.2	4
				ALNUS	0.5	4	ARLU	0.0	2
				PRUNU *	0.1	2	LYAM *	0.1	4
							CASP *	0.8	4
							LYSI	0.1	4
							MERTE *	0.5	12
							BRCA *	0.0	2
							LIGR *	0.2	8
							GADI	0.1	4
							AGGLD	0.1	2
							CAIL *	0.6	4
							CAGE *	0.0	4
							ACTR	0.3	6
							LAMU	1.3	10
							ATDI *	0.1	2
							SCCE2	0.7	4
							EQHY *	0.1	4
							LANE	0.0	2
							CARO2 *	0.6	8
							SASI	0.2	8
							BAHO	0.0	2
							AGCR *	0.2	4
							FESC *	0.0	2
							POCO *	0.1	4
							MAMI	0.8	4
MONTANE SHRUB	ABLA2	2.0	30	ACGL	1.1	12	ARCO	0.0	3
-WEST	PSME	0.7	24	AMAL *	0.8	15	PTAQ *	1.6	12
33 PLOTS	POTR	0.3	3	CEVE	0.3	6	SMST *	0.2	3
	POTR2	0.9	6	HODI	0.3	9	THOC	0.1	6
	PIAL *	0.0	3	PAMY	2.9	21	VIGL *	0.2	9
	PIEN	0.1	3	PREM *	0.1	3	ACMI	0.1	6
	PICO	0.1	3	SYAL *	0.4	6	ANAR2 *	0.1	6
	TSME	0.8	21	BEAQ	0.1	3	ARMA3	0.1	6
	PIMO *	0.1	9	LOIN *	0.2	3	ASTER	0.6	6
	CHNO	0.5	21	ROWO *	0.1	3	CARU *	0.2	3
	THPL	0.4	15	RUPA *	1.5	24	CASTI *	0.0	3
	TSHE	1.0	30	SARA *	0.8	12	ERPE	0.0	3
	ACMA	1.2	12	SOSI *	0.9	15	FEVI *	0.1	3
	ABAM	1.6	27	ALSI	4.5	30	GRASS *	0.5	15
	SASC	1.4	12	JUCO4	1.0	9	LULA	0.8	18
	ALRU	2.7	15	RIBES	0.0	3	OSOC *	0.1	3
				SPBE	0.1	3	ACRU	0.1	6
				SASC	0.2	3	ARCA2	0.0	3

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
MONTANE SHRUB				SOSC2	* 0.3	15	PERA	0.1	3
-WEST				SALIX	* 0.5	9	LUHI	* 0.2	6
				VASC	* 0.6	9	CARO	* 0.2	6
				RHAL	1.2	6	EPAN	* 4.2	36
				VAME	* 6.7	15	ANLA	0.1	6
				RULE	* 0.1	6	VASI	2.2	18
				LIBO2	0.2	3	CAREX	* 0.4	9
				RILA	* 0.3	12	PEBR	0.4	9
				VACA	* 0.1	6	VEVI	* 0.4	15
				VADE	* 0.1	3	MITEL	* 0.1	3
				ROGY	* 0.2	3	ARLA	0.6	6
				RUPE	* 0.3	9	VIOLA	* 0.0	3
				VAAL	* 6.8	15	FRVI	* 0.1	3
				SACO2	* 0.9	3	ANMA	0.4	18
				ARUV	* 0.6	3	TRLA2	0.1	6
				ACCI	5.0	21	HELA	* 0.3	3
				OPHO	* 1.3	9	URDI	0.2	9
				POMU	* 0.0	3	CANI2	* 0.0	3
				TABR	0.0	3	ELGL	* 0.2	3
				COCO2	0.2	3	OSMOR	* 0.1	3
				RHAL2	0.1	3	TIUN	* 0.2	6
				COST	* 2.7	12	ATFI	* 4.0	21
				BENE	0.C	3	SOCA	0.0	3
				RULA	* 1.2	15	CLUN	* 0.3	6
				RUSP	* 6.6	21	GYDR	* 0.3	6
				SPDO	0.3	3	MOSI	0.0	3
				VACCI	* 1.5	3	VICIA	0.3	3
				RIHO	0.4	6	BLSP	* 0.0	3
				SASI2	* 0.0	3	CIAL	0.2	6
				COCA	* 0.1	6	LYSI	0.1	3
				RONU	* 0.6	3	MERTE	* 0.4	18
				LOCI	* 0.0	3	MEPA	* 0.1	6
				CLPY	1.5	3	LIGR	* 0.3	3
				GAOV	0.0	3	GADI	0.2	9
							LUPO	0.0	3
							LAMU	0.2	3
							CAPA	* 0.1	3
							XETE	* 0.2	6
							SCCE2	4.0	21
							EQHY	* 0.0	3
							LANE	0.3	6
							NEBR	0.3	6
							CASC3	* 0.0	3
							CHTE	0.3	3
							PEFRP	* 0.0	3
							ALMA	0.2	6
LUSH SHRUB-EAST	ABLA2	1.2	35	ACGL	2.2	22	DIHO	* 0.4	9
23 PLOTS	PSME	0.5	26	AMAL	* 0.2	4	PTAQ	* 12.9	59
	BEOC	0.1	4	PAMY	4.9	35	SMST	* 1.7	17
	POTR	0.1	4	PHLE2	0.1	4	THOC	1.6	22
	POTR2	0.9	17	PREM	* 0.5	9	VIGL	* 1.0	13

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
LUSH SHRUB-EAST	PIEN	0.3	17	SYAL	* 0.2	9	ANAR2	* 0.0	4
	PICO	0.0	4	BEAQ	0.1	9	BROMU	* 0.0	4
	TSME	1.1	22	RUPA	* 1.6	30	CASTI	* 0.0	4
	ABGR	0.0	4	SARA	* 2.0	30	GRASS	* 0.1	4
	PIMO	* 0.1	4	SOSI	* 0.3	9	HYFE	0.1	4
	CHNO	0.9	13	PRVI	* 0.0	4	OSOC	* 0.0	4
	TSHE	0.2	9	ALSI	53.9	74	ACRU	1.7	4
	ACMA	0.1	4	RIBES	0.1	4	EPAN	* 0.2	9
	SASC	1.7	2	RICE	0.1	4	VIOLA	* 0.2	4
				SASC	0.1	4	HELA	* 0.3	9
				SOSC2	* 7.2	35	URDI	0.2	9
				SALIX	* 1.7	9	CALAM	* 0.0	4
				RHAL	0.2	9	ELGL	* 0.4	9
				VAME	* 0.4	13	ATFI	* 3.2	17
				RILA	* 0.1	4	SOCA	0.2	4
				RUID	* 0.1	4	CLUN	* 0.5	9
				ACCI	15.4	22	GYDR	* 0.1	4
				POMU	* 0.0	4	STRO	* 0.2	9
				MEFE	0.0	4	MOSI	0.3	9
				RULA	* 0.4	4	TITR	* 0.0	4
				RUSP	* 0.9	4	LIGR	* 0.3	9
				COCA	* 0.3	4	GADI	0.2	9
				RUBUS	* 0.7	13	ACTR	0.0	4
				SORBU	0.2	4	LAMU	0.4	9
							SCCE2	3.2	17
							EQHY	* 0.2	4
							LANE	0.5	9
							NEBR	0.1	4
							GAAP	0.2	9
							CASC3	* 0.3	9
							GABO	0.0	4
LUSH SHRUB-WEST	ABLA2	0.7	14	ACGL	6.0	24	PTAQ	* 3.3	10
21 PLOTS	PSME	0.6	19	AMAL	* 0.0	5	SMST	* 1.1	29
	PIEN	0.2	5	PAMY	0.8	10	THOC	1.4	19
	TSME	0.2	10	SYAL	* 0.1	5	VIGL	* 0.8	14
	CHNO	1.0	24	RUPA	* 1.1	19	ACMI	0.0	5
	THPL	0.5	14	SARA	* 1.3	38	ANAR2	* 0.1	5
	TSHE	0.7	10	SOSI	* 4.6	24	ASTER	0.1	5
	ACMA	1.2	14	ALSI	50.7	81	BROMU	* 0.2	5
	ABAM	1.0	19	PHDI	0.1	5	ERIGE	0.1	5
	SASC	1.7	10	LOUT2	* 0.0	5	FEVI	* 0.0	5
	ALRU	0.7	10	SOSC2	* 0.8	10	HYFE	0.2	10
	RHPU	0.4	5	SALIX	* 3.5	24	LOMAT	* 0.0	5
				VAME	* 2.5	14	ACRU	0.1	10
				RILA	* 0.1	5	LUHI	* 0.0	5
				SACO2	* 0.0	5	EPAN	* 1.9	33
				ARUV	* 0.1	5	JUPA	* 0.0	5
				ACCI	13.3	29	AQFO	0.1	5
				OPHO	* 0.4	14	ARPA3	0.1	5
				POMU	* 0.1	5	PODI	0.1	5
				COST	* 1.5	10	VASI	1.6	24

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
LUSH SHRUB-WEST				MEFE	1.2	5	VEVI	* 2.5	33
				RULA	* 0.1	5	MITEL	* 0.9	14
				SPDE	0.0	5	VIOLA	* 0.7	10
				RUSP	* 5.2	48	FRVI	* 0.1	5
				RIHO	0.5	14	HELA	* 0.1	5
							URDI	2.1	24
							CALAM	* 0.1	5
							ELGL	* 0.7	14
							TIUN	* 0.0	5
							ATFI	* 12.1	48
							GYDR	* 0.2	5
							STRO	* 0.5	5
							MOSI	0.8	19
							ASEN	0.1	5
							CIAL	0.6	10
							LYSI	0.1	5
							LIGR	* 0.1	5
							GADI	2.1	24
							ACTR	0.1	5
							LAMU	0.7	14
							XETE	* 0.0	5
							SCCE2	12.1	48
							NEBR	0.2	5
							GAAP	0.5	5
							CASC3	* 0.8	19
							SASI	0.1	5
							ALMA	0.6	10
LUSH LOW ELEV	ABLA2	0.4	6	AMAL	* 0.6	17	AGSP	* 0.8	11
HERB-EAST	PIPO	1.4	11	HODI	0.1	6	THOC	0.2	6
18 PLOTS	PSME	0.3	11	PAMY	0.3	6	ACHI	0.7	22
	BEOC	0.1	6	PHLE2	0.1	6	CARU	* 0.2	6
	POTR	0.5	11	SYAL	* 1.6	17	ERUM	0.1	6
	POTR2	0.6	6	PRVI	* 0.2	11	FEVI	* 0.3	6
	SASC	0.2	6	RICE	0.2	11	LULA	0.1	6
	ALIN	0.1	6	VACA	* 0.1	6	POTEN	0.3	6
				ROSA	* 0.1	6	CACO	* 0.4	6
				SPDO	0.3	6	LUPIN	0.3	6
				ARTR	0.6	17	CAREX	* 0.4	11
				PUTR	0.6	17	FRVI	* 0.3	6
				PYMA	* 3.3	6	POFL2	0.1	6
				SPPY	1.4	6	BRTE	* 0.6	11
				ARTR2	0.8	11	POBU	* 1.0	6
				CLLI	0.1	6	ARLU	1.0	6
				CHNA	0.1	6	CADR2	0.9	11
				ARRI	0.1	6	POA	* 0.2	6
							STOC	* 0.2	11
							VETH	1.7	6
							AGRE	* 3.4	11
							CEDI	0.3	1
							SIAL	0.8	22
							SILO	0.6	6

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
LUSH LOW ELEV							MESA	* 1.8	11
HERB-EAST							LYSI	0.3	6
							CAIL	* 0.1	6
							POSE	* 0.6	1
							FEBR	* 1.0	6
							FESC	* 1.0	6
							ERCI	0.9	1
							AGEX	* 0.2	6
							POBR	0.2	11
							CAOB	* 1.7	6
							CAFL	3.4	11
							STCO2	* 0.3	1
							CAFI	* 0.8	22
							AGIN2	* 0.6	6
							POPR	* 1.8	11
LUSH LOW ELEV	PSME	3.0	100	SYAL	* 1.0	100	PTAQ	* 60.0	100
HERB-WEST	BEOC	1.0	100	RUUR	* 2.0	100			
1 PLOT	TSHE	1.0	100	GASH	10.0	100			
	ACMA	1.0	100	CYSC	1.0	100			
	ALRU	3.0	100						
LUSH LOW ELEV	ABLA2	1.8	20	AMAL	* 0.2	20	DIHO	* 0.2	20
SHRUB-EAST	PIPO	1.6	20	PREM	* 0.4	20	PTAQ	* 3.0	20
5 PLOTS	PSME	0.2	20	SYAL	* 0.8	40	SMST	* 1.4	40
	POTR	0.2	20	SYOR	0.2	20	THOC	0.4	20
	POTR2	6.0	60	LOIN	* 1.4	40	GRASS	* 2.2	40
	PIEN	0.6	20	RUPA	* 1.0	40	EPAN	* 0.8	40
	THPL	0.2	20	SARA	* 0.4	20	EQAR	* 0.4	20
	SASC	15.6	60	ALSI	0.4	20	CALAM	* 0.4	20
	ALIN	1.4	20	SOSC2	* 2.4	40	ELGL	* 0.2	20
				SALIX	* 1.6	20	SOCA	0.2	20
				ACCI	9.2	40	CLUN	* 1.2	20
				COST	* 5.0	20	AGROS	* 0.2	20
				SPIRA	6.0	20	CACA	* 0.2	20
				SPDO	4.0	20	AGRE	* 0.2	20
				PUTR	3.0	20	CAGE	* 0.4	20
				CRDO	* 3.0	20	ACTR	0.4	20
							LAMU	0.2	20
							EQHY	* 0.2	20
							LANE	1.2	20
							BAHO	0.2	20
							AGCR	* 0.2	20
							CAFL	0.2	20
LUSH LOW ELEV	PSME	2.1	12	SYAL	* 0.4	12	PTAQ	* 1.4	25
SHRUB-WEST	POTR2	1.6	38	LOIN	* 1.3	12	GRASS	* 0.1	12
18 PLOTS	THPL	4.1	62	RUPA	* 1.6	25	CAREX	* 0.6	12
	TSHE	2.4	50	SARA	* 0.6	12	URDI	1.5	38
	ACMA	6.6	50	SOSI	* 0.3	12	ATFI	* 3.3	38

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
LUSH LOW ELEV	ABAM	0.1	12	SALIX	* 0.6	12	GYDR	* 0.1	12
SHRUB-WEST	ALRU	15.6	50	RULE	* 0.3	12	LYCOP	0.3	12
				LIBO2	0.3	25	TITR	* 1.0	12
				ACCI	7.5	38	BLSP	* 1.5	12
				OPHO	* 1.9	12	LYAM	* 0.4	38
				POMU	* 5.6	50	CIAL	0.4	25
				COST	* 0.3	12	GADI	1.5	38
				BENE	3.8	12	SCCE2	3.3	38
				RUSP	*17.5	62	NEBR	0.1	12
				SPDO	0.1	12	LOAM	* 0.3	12
				SASI2	* 8.8	12	GABO	1.0	12
				COCA	* 0.3	12	PEFRP	* 1.5	12
				VAPA	* 0.4	12	POCO	* 0.4	38
				RHPU	0.1	12	ALMA	0.4	25
				GASH	0.1	12			
				CONU	* 0.5	12			
				OECE	0.3	12			
RIPARIAN DECID.	ABLA2	1.0	50	AMAL	* 6.7	50	PTAQ	* 3.0	33
FOREST-EAST	PIPO	4.5	17	SYAL	* 8.7	33	SMST	* 1.3	33
6 PLOTS	PSME	1.2	50	ROWO	* 0.8	17	THOC	5.2	50
	POTR	43.8	83	RUPA	* 3.0	33	ACMI	0.2	17
	POTR2	2.5	17	SOSC2	* 2.5	33	ASTER	0.3	17
	PICO	1.2	17	ACCI	1.0	17	CARU	* 0.5	17
	CHNO	0.2	17	COST	* 2.2	33	GRASS	* 0.2	17
	THPL	0.2	17	SPIRA	0.7	17	FRVI	* 1.0	17
	SASC	24.2	83	SPDO	5.0	33	HELA	* 0.5	33
				RHPU	0.2	17	ELGL	* 0.2	17
				CLLI	0.3	17	OSMOR	* 2.0	17
							SOCA	0.5	17
							LYSI	1.0	17
							LIGR	* 0.5	33
							LAMU	0.2	17
							CAPA	* 2.0	17
							EQHY	* 0.5	17
RIPARIAN DECID	PSME	5.7	33	AMAL	* 0.1	7	PTAQ	* 0.2	7
FOREST-WEST	POTR2	11.6	40	HODI	0.3	7	GRASS	* 0.1	7
15 PLOTS	PICO	0.1	7	SYAL	* 0.5	13	URDI	4.3	27
	PIMO	* 0.1	13	PYAS	0.1	7	ELGL	* 0.2	7
	THPL	5.5	100	RUPA	* 0.7	7	TIUN	* 0.3	7
	TSHE	10.9	87	SARA	* 0.6	27	ATFI	* 1.8	27
	ACMA	19.7	100	CHUM	* 0.1	7	MOSI	1.5	13
	BEPA	0.7	7	ACCI	9.7	33	TITR	* 0.3	13
	BEPI2	0.1	7	OPHO	* 2.1	33	MADI2	0.1	13
	ALRU	43.1	87	POMU	*14.3	73	CIAL	0.3	7
	ABIES	0.1	7	COST	* 0.1	7	GADI	4.3	27
	RHPU	0.1	7	RUSP	* 9.3	80	LAMU	0.2	7
				LOCI	* 0.1	7	XETE	* 0.3	7
				RUUR	* 2.1	20	SCCE2	1.8	27
				OECE	0.1	7	CASC3	* 1.5	13

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
RIPARIAN DECID							GABO	0.3	13
FOREST-WEST							STIPA	* 0.1	13
							ALMA	0.3	7
NON-RIPAR. DECID	ABLA2	0.4	20	ACGL	0.5	20	ADBI	2.0	10
FOREST-EAST	PIPO	0.1	10	AMAL	* 0.9	30	ARCO	0.1	10
10 PLOTS	PSME	2.6	20	CEVE	0.1	10	DIHO	* 1.7	20
	BEOC	13.4	50	HODI	0.2	10	ERGR	* 0.2	10
	POTR	24.6	60	PAMY	14.7	40	PTAQ	* 4.8	30
	POTR2	13.5	30	PREM	* 0.8	20	SMST	* 0.5	20
	SAAM2	3.5	10	SYAL	*10.6	60	THOC	1.3	40
	PIEN	1.2	30	BEAQ	0.5	20	VIGL	* 0.5	20
	ABGR	0.2	20	PYAS	1.8	20	ACMI	0.2	10
	THPL	0.5	10	PYAS	1.8	20	ARMA3	0.1	10
	ACMA	0.2	10	PYSE	0.2	10	ASTER	1.2	20
	SASC	15.3	30	ROWO	* 0.2	10	BROMU	* 0.1	10
	ALIN	8.8	40	RUPA	* 3.6	40	CARU	* 0.7	10
				SARA	* 0.3	20	GRASS	* 5.1	30
				SOSI	* 0.2	10	LULA	0.1	10
				SPBE	0.1	10	CAREX	* 0.9	30
				SALIX	* 0.1	10	FRVI	* 0.2	10
				RULE	* 0.1	10	URDI	1.2	10
				ACCI	0.4	10	EQAR	* 0.3	10
				COST	*13.3	50	ATFI	* 3.1	20
				ROSA	* 0.2	20	CACA	* 0.2	10
				CRDO	* 0.2	20	LYSI	0.2	10
				RIIN	1.0	30	GADI	1.2	10
				ALSI	0.3	10	CAGE	* 0.3	10
							SCCE2	3.1	20
							AGCR	* 0.2	10
NON-RIPAR. DECID	PSME	8.0	44	PAMY	0.6	11	PTAQ	* 3.6	22
FOREST-WEST	BEOC	13.3	11	RUPA	* 1.1	11	SMST	* 0.2	11
9 PLOTS	POTR2	2.2	33	SARA	* 0.3	22	CAREX	* 0.6	11
	PICO	0.6	11	ALSI	1.1	11	HELA	* 0.1	11
	TSME	0.2	11	RILA	* 0.7	33	URDI	1.1	22
	ABGR	0.1	11	RUPE	* 0.2	11	POFL2	0.2	11
	CHNO	0.9	11	ACCI	10.6	44	ATFI	* 1.1	22
	THPL	11.9	67	OPHO	* 3.1	33	MOSI	0.7	33
	TSHE	5.2	56	POMU	* 5.0	56	MADI2	0.1	11
	ACMA	12.0	56	COST	* 4.9	22	CIAL	2.8	22
	ABAM	1.4	11	BENE	0.2	33	SCCE2	1.1	22
	SASC	8.3	11	RUSP	* 5.8	44	GADI	1.1	22
	BEPA	6.7	11	SAMBU	1.1	22	CAIL	* 0.3	11
	ALRU	28.7	67	RUUR	* 0.6	11	SCCE2	1.1	22
	ABIES	0.2	11	RISA	0.1	11	CASC3	* 0.7	33
				RHPU	0.1	11	STIPA	* 0.1	11
				GASH	3.9	22	ALMA	2.8	22
				OBCE	1.1	11			

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS	MEAN	CONS
BARE GROUND&ROCK	ABLA2	0.5	25	AMAL	* 0.3	25	AGSP	* 0.3	25
5 PLOTS	PIPO	0.5	25	HODI	0.5	50	GRASS	* 0.3	25
	PSME	0.8	25	PAMY	0.3	25	ANLA	0.3	25
	PIAL	* 0.3	25	PREM	* 0.3	25	AROB	0.3	25
	PIEN	0.3	25	PEFR3	0.3	25	CANI2	* 0.5	25
	LALY	0.5	50	JUCO4	0.3	25	LUPE	0.3	25
				PHEM	0.5	25	LIGUS	* 0.3	25
				CAME	0.5	25	LUPO	0.5	25
				PHGL	0.3	25	AGGLD	0.3	25
				PUTR	0.3	25			
AGRICUL.-FALLOW -EAST							JUNCO	* 0.5	50
2 PLOTS							CASP	* 1.0	50
							MAMI	1.0	50
AGRICUL.-FALLOW -WEST	POTR2	1.5	100	SASI2	* 2.0	100			
2 PLOTS	ALRU	1.5	100						
SUBALPINE-ALPINE VASC-VACA MEAD.	ABLA2	4.5	83	PAMY	3.3	67	LOBR	* 0.8	33
6 PLOTS	PSME	1.5	33	LOIM	* 0.3	17	ARCO	0.7	50
	PIAL	* 3.8	100	ARNE	* 2.2	33	THOC	0.5	17
	PIEN	0.5	50	JUCO4	0.5	50	ACMI	0.5	33
	LALY	1.0	17	PHDI	0.5	17	ANAR2	* 0.5	17
	PICO	2.0	50	SALIX	* 0.2	17	ASTER	0.3	17
				VASC	*40.5	100	CARU	* 0.5	33
				RHAL	0.3	17	CASTI	* 0.7	33
				VAME	* 0.8	33	ERIGE	0.2	17
				PEDA	0.5	17	ERPE	2.3	33
				LEGL	1.5	33	FEVI	* 2.5	50
				SAMO2	* 6.7	17	GRASS	* 0.5	33
				VACA	* 1.3	17	LICA2	* 0.3	17
							LULU	2.5	50
							CACO	* 0.3	17
							ARCA2	2.5	67
							PERA	0.3	17
							LUHI	* 0.7	33
							CARO	* 0.5	33
							EPAN	* 0.8	67
							LUPIN	0.3	17
							JUPA	* 0.5	17
							VECU	0.2	17
							ANLA	0.2	17
							PODI	0.3	17
							VASI	1.2	33
							ANOC	0.2	17
							CAREX	* 4.5	33
							HADI2	0.7	17
							PEBR	0.7	33
							TRLA4	0.5	17

00849

VEGETATION TYPE	TREES	MEAN	CONS	SHRUBS	MEAN	CONS	HERBS		MEAN	CONS
SUBALPINE-ALPINE							VEVI	*	0.2	17
VASC-VACA MEAD.							CABI		1.7	17
							MITEL	*	0.5	17
							ARLA		0.7	33
							SETR	*	0.3	17
							FRVI	*	0.8	17
							CANI2	*	0.5	17
							LUPE		0.3	17
							POFL2		0.2	17
							LYSI		0.8	17
							LUPO		0.5	17
							AGGLD		0.3	17
							CAIL	*	0.2	17

Appendix M. "Camping in Bear Country" poster.

Tips For Camping in Bear Country

FOOD AND ODORS ATTRACT BEARS!

Black Bear *Grizzly Bear*

Food Storage	Keep a clean camp. Store food, garbage, cooking gear, and cosmetics properly at all times. Lock these items in your car trunk if available. Otherwise, place in a bag, backpack, or pannier and hang from a tree branch. The storage container should hang at least 10 feet above the ground and at least 4 feet out from the tree trunk. Do not use stuff sacks from sleeping bags or tents for storing these items. Never store any of these items in your tent.
Garbage	Deposit garbage in bear proof containers where available. Otherwise, pack it out. Never bury or burn garbage.
Cooking	Design your camp to keep sleeping area, tent, sleeping bags, and personal gear at least 100 yards uphill from the cooking area. Store all food, garbage, cooking gear, and cosmetics properly at the cooking area. Never cook in your tent. Keep sleeping bags and personal gear free of food odors. Do not sleep in the clothing you wore while cooking.
Hunting & Fishing	Where hunting is permitted, store game meat the same as food. Dispose of fish entrails by puncturing the air bladder and dropping in deep water to allow natural decomposition.
Horses	Store horse pellets the same as food.
Camping	Choose another camping area if you see bears, dead animals, or bear sign, such as tracks, droppings, or diggings. Be alert!
Dogs	Dogs may disturb a bear and lead it back to you. If dogs are permitted in the area, don't allow your dog to run free.
Bear Sightings	If you have an encounter with a bear, or if you see a grizzly bear, report the information to agency biologists at 206-856-5700, or the nearest ranger station.

Appendix N. List of acronyms used in the North Cascades Grizzly Bear Ecosystem evaluation final report.

ACRONYM	REPRESENTS
BCP	British Columbia Parks
BCWB	British Columbia Wildlife Branch
FS	U.S. Forest Service
FWS	U.S. Fish and Wildlife Service
GIS	Geographic Information System
IGBC	Interagency Grizzly Bear Committee
MBSNF	Mount Baker-Snoqualmie National Forest
MSS	Multispectral Scanner
NCGBE	North Cascades Grizzly Bear Ecosystem
NCNP	North Cascades National Park Service Complex
NCWG	North Cascades Working Group
NPS	National Park Service
ONF	Okanogan National Forest
RVD	Recreation Visitor Day
UTM	Universal Transverse Mercator
WDNR	Washington Department of Natural Resources
WDW	Washington Department of Wildlife
WNF	Wenatchee National Forest

*GPO 589-672-93