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THE BITTERROOT GRIZZLY BEAR EVALUATION AREA

A Report to the Bitterroot Technical Review Team

by

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ABSTRACT

This report culminates a 5 year evaluation of a 1.4 million hectare area in the Bitterroot Mountains of Idaho and Montana, known as the Bitterroot Evaluation Area. The objectives of the evaluation were to (1) determine the present status of the grizzly bear population and (2) determine the space and habitat necessary to support a viable grizzly bear population in the Bitterroot Evaluation Area. We constructed a geographic information system containing 13 map layers: (1) evaluation area boundary, (2) Forest Service administrative units, (3) wilderness areas, (4) land ownership, (5) roads, (6) trails, (7) hydrology, (8) elevation, (9) aspect, (10) slope, (11) watershed basins, (12) potential spring habitat and (13) land cover. We discussed the suitability of the Bitterroot Evaluation Area for grizzly bears based on 7 characteristics of required grizzly bear habitat: (1) space, (2) isolation, (3) sanitation, (4) food, (5) denning, (6) vegetation types and (7) safety. We concluded that biological factors related to space, isolation, denning, vegetation types, and food are adequate. Grizzly bear recovery in the Bitterroot Evaluation Area will depend, however, on addressing potential human-caused mortality through education, enforcement and regulatory changes..

ACKNOWLEDGEMENTS

Cooperation among agencies and individuals has been a hallmark of this project from its inception. The U. S. Forest Service, U. S. Fish and Wildlife Service and Idaho Fish and Game can be proud of this project as a model for cooperative and partnership efforts.

A few individuals have stood out as deserving special mention. Rodd Richardson and John Weaver of the Forest Service Region 1 office, Chris Servheen of the Fish and Wildlife Service and Wayne Melquist of Idaho Fish and Game were instrumental in the initial phases of the project and in obtaining funding. Steve Blair, John Ormiston and Mike Hillis provided support and guidance from their respective forests. Steve Weaver helped with key logistical support in field operations. Dr. E. O. Garton provided expert technical advice.

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INTRODUCTION

The Grizzly Bear Recovery Plan (U.S.D.I. 1982) identified an undelineated area centered on the Selway-Bitterroot Wilderness Area as a potential grizzly bear recovery area. While noting that grizzly bears once occupied the area, the plan stated that little was known about the present status of grizzly bears in the area, nor of the current habitat suitability for grizzly bear recovery.

The recovery plan established the need for further evaluation of the Bitterroot area to ascertain its suitability as a grizzly bear recovery area. The plan specified two objectives: (1) determine the present status of the grizzly bear population, and (2) determine the space and habitat necessary to support a viable population of grizzly bears. Under the guidance of the Bitterroot Grizzly Bear Working Group, we have been building and analyzing a database to evaluate the suitability of the Bitterroot area for grizzly bear recovery.

This report culminates our efforts. We have not included extensive discussion of grizzly bear biology. Instead, we assume the reader is familiar with issues in grizzly bear recovery and present pertinent results from our project, as well as supporting information from past studies of the area. This report was written for and intended for use by the Bitterroot Technical Review Team in its task to make a recommendation to the Interagency Grizzly Bear Committee regarding the suitability of the Bitterroot area for grizzly bear recovery.

STUDY AREA

Located west of Missoula, Montana and east of Grangeville, Idaho, the Bitterroot Evaluation Area (BEA) straddles the Montana-Idaho state line (Fig. 1). The core of the BEA is the Selway Bitterroot Wilderness Area (Fig. 2). Roadless areas and the Frank Church River of No Return Wilderness south of the Selway Bitterroot Wilderness Area to the Salmon River were included in the evaluation area. Additional, largely roadless, areas north of the Selway Bitterroot Wilderness Area to the crest of the Mallard Larkins were also included. The eastern edge of the evaluation area was formed by the eastern boundary of the Selway Bitterroot Wilderness Area and the Fish Creek Road on the Lolo National Forest. The western boundary of the evaluation area was transcribed along the transition of roaded to roadless areas on the Clearwater and Nezperce National Forests. The entire BEA encompasses 1,403,221 hectares.

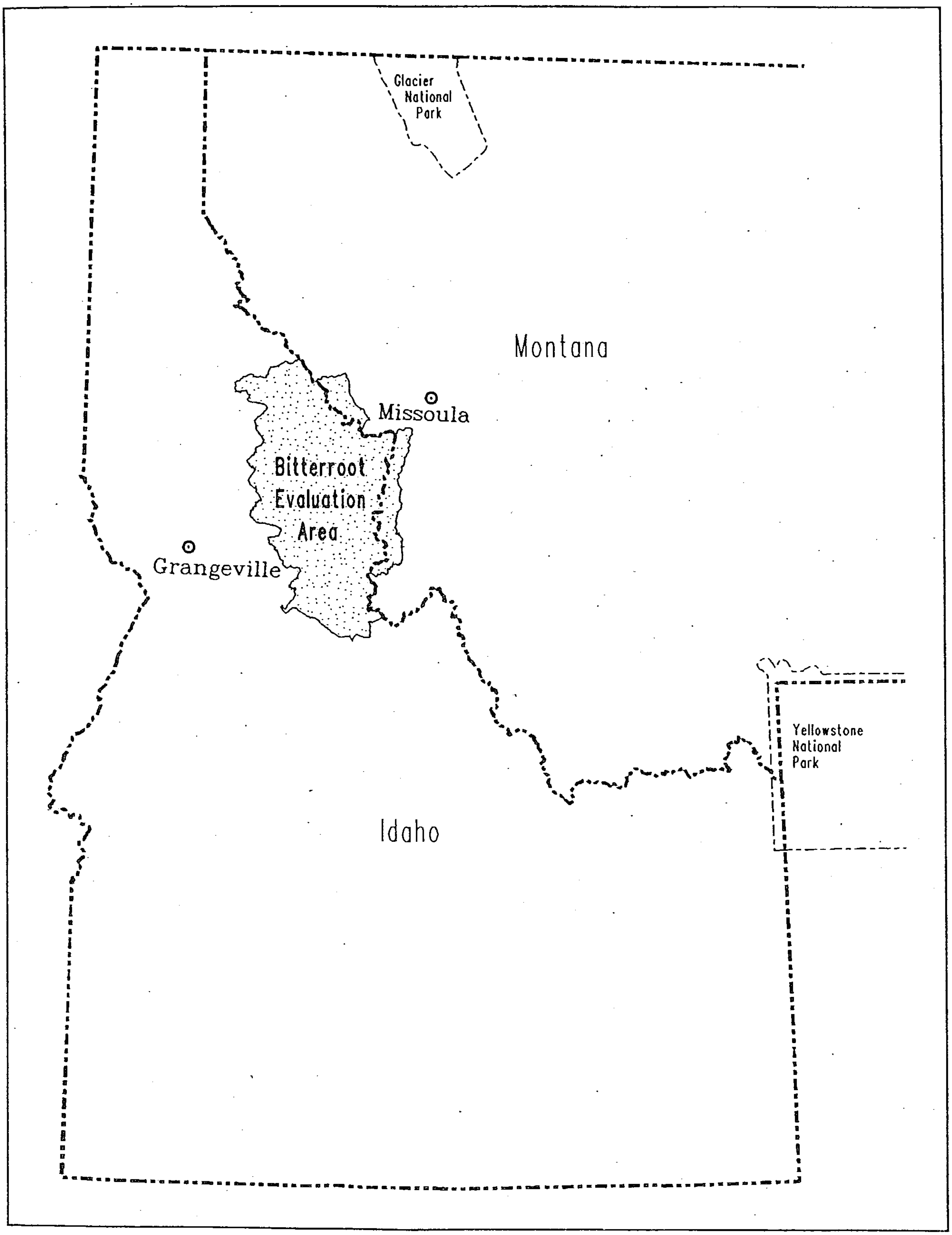

Figure 1. Location of Bitterroot Evaluation Area.

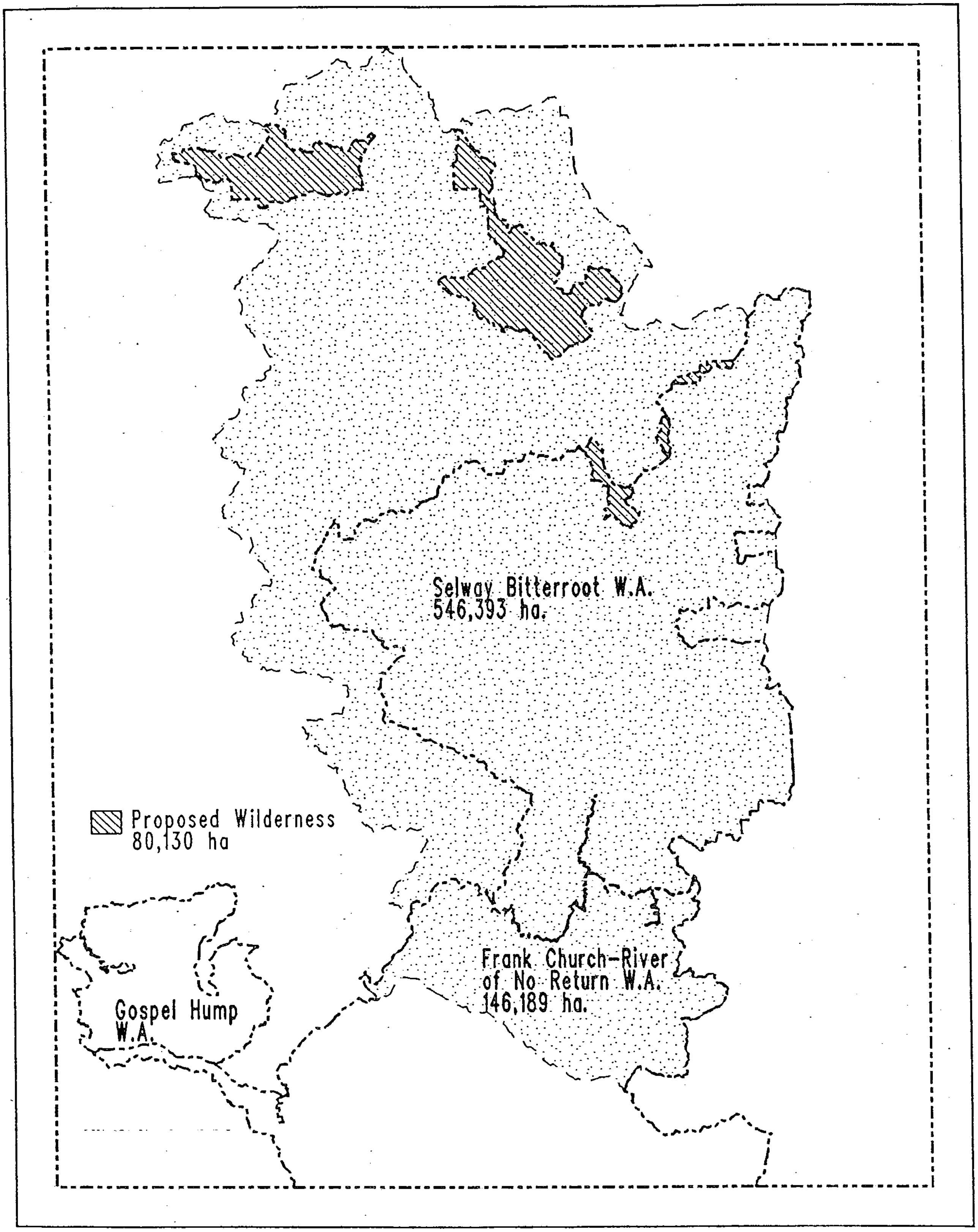

Figure 2. Area of each wilderness area within the Bitterroot Evaluation Area. Total land area in the BEA is 1,403,221 hectares.

The area is mountainous, with the granitic Bitterroot Mountains forming a central core. The east side of the Bitterroot Mountains rises abruptly from 1,100 m (3,600 ft) in the Bitterroot Valley to 3,048 m (10,000 ft) at the highest peaks. The Clearwater Mountains, Selway Crags, and Salmon River Mountains lie to the west of the Bitterroot Mountains inside the BEA. Steep-sided, glacial-cut valleys dissect the main mountain masses. Two major river systems, the Selway and the Lochsa, drain the central portion of the BEA (Fig. 3). The confluence of these two rivers forms the western most point of the BEA, and, at 540 m (1500 ft), also its lowest elevation. The North Fork of the Clearwater River drains the northern portion of the BEA and the South Fork of the Clearwater drains the southern portion. The Salmon River skirts the southern boundary.

Pacific maritime air masses dominate the climate of the BEA. It's influence is greatest in the northern portion, and is gradually reduced to the south. Springs are generally wet, summers are dry with periods of intense thunderstorms. Winters bring heavy snowfall to the higher elevations, which may remain well into late summer.

The vegetation is characterized by coniferous forests. Western hemlock (*Tsuga heterophylla*) reaches its southern range limit in the northern portion of the BEA. Western redcedar (*Thuja plicata*) and grand fir (*Abies grandis*) are dominant in the lower elevations. Western redcedar reaches its southern range limit just south of the Selway River. Douglas Fir (*Pseudotsuga menziesii*) and Ponderosa Pine (*Pinus ponderosa*) occupy only southern exposures in the northern portion of the BEA, but increases in distribution to the south. Subalpine fir (*Abies lasiocarpa*) occurs above approximately 1,500 m (5,000 ft) in the north and 1,980 m (6,500 ft) in the south. Engleman spruce (*Picea englemannii*), whitebark pine (*Pinus albicaulis*) and lodgepole pine (*Pinus contorta*) are often associated with subalpine fir. Subalpine larch (*Larix lyallii*) occurs only along the highest ridges in the Bitterroot Mountains. Cooper et al. (1987) provide a complete description of forest types in the BEA.

The forest cover is broken by numerous seral and disclimax vegetation types. The highest ridge tops in the Bitterroot Mountains are often rocky and support little tree cover. Beargrass (*Xerophyllum tenax*) and various shrubs usually occur there. Snow chutes break the forest cover along the ridge sides throughout the BEA. Wet meadows occur in glacial cirques and along streams. Fire has played a significant role in the formation of the vegetation in the BEA (Habeck 1972, Habeck and Mutch 1973, Leiberg 1900). Millions of acres in the BEA burned in wildfires in the early 1900's and now support extensive shrub fields (Habeck 1972). The Forest Service maintains a fire policy within the

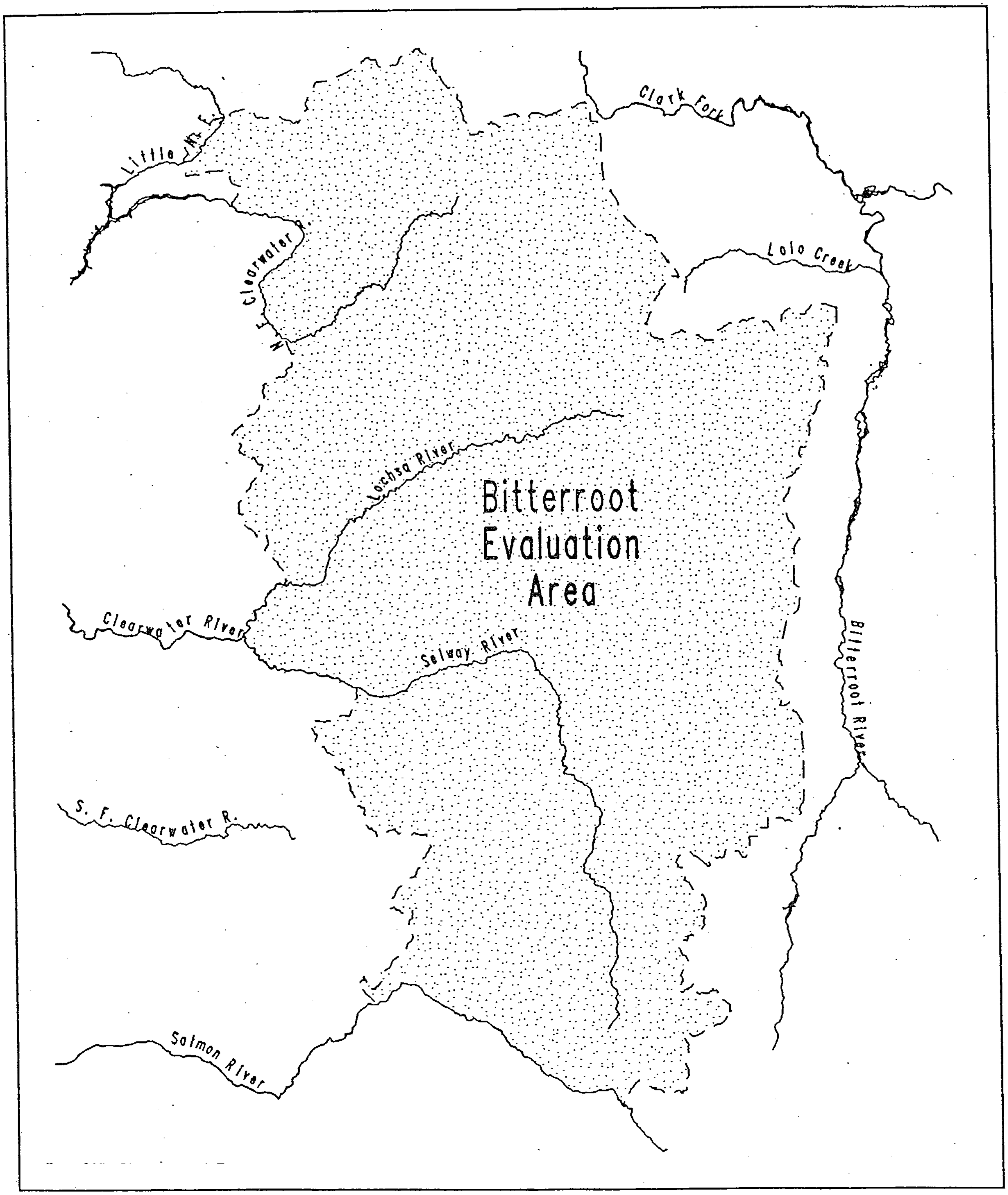

Figure 3. Major rivers draining the Bitterroot Evaluation Area.

Selway Bitterroot Wilderness Area, that assures that fire will continue to play an important ecological role in the BEA.

Six national forests occupy substantial amounts of the BEA: St. Joe, Clearwater, Nezperce, Lolo, Bitterroot and Salmon (Fig. 4). The central and southern portions of the BEA fall within the Selway Bitterroot and Frank Church River of No Return Wilderness Areas (Fig. 2). The northern portion of the BEA, mostly on the Clearwater National Forest, is largely unroaded with two large proposed wilderness areas. Small amounts of private timber lands occur in a checkerboard pattern on the Clearwater National Forest (Fig. 5).

METHODS

The results and discussion for the first objective, to determine the present status of the grizzly bear population, were taken largely from existing reports and survey efforts. Melquist (1985) surveyed the Clearwater National Forest and evaluated past grizzly bear reports. Idaho Fish and Game conducted remote camera surveys over bait stations during 1990 and 1991 (Servheen et al. 1990, Kunkel et al. 1991). Each year, grizzly bear sightings are reported by visitors or agency personnel. Every effort is made to confirm these reports. An education program including identification posters and talks to civic groups has contributed greatly to this effort.

The second objective, to determine the space and habitat necessary to support a viable grizzly bear population, required some sort of vegetation mapping effort. We determined that standard aerial-photo interpretation and ground mapping was not practical for such a large, inaccessible area. Landsat satellite imagery provided complete coverage, was receiving increased acceptance as a data source for mapping wildland vegetation, and could be readily combined with other mappable data themes into a geographic information system (GIS). The bulk of our project has been spent on developing a GIS for objective two. We won't explain every processing step in this report, but will provide only the major points. Details can be obtained from the junior author.

The GIS consists of 13 major data layers: (1) evaluation area boundary, (2) Forest Service administrative units, (3) wilderness areas, (4) land ownership, (5) roads, (6) trails, (7) hydrology, (8) elevation, (9) aspect, (10) slope, (11) watershed basins, (12) potential spring habitat and (13) land cover. A variety of minor data layers also exist as ancillary information or as temporary, intermediate steps. Most data layers were initially developed in

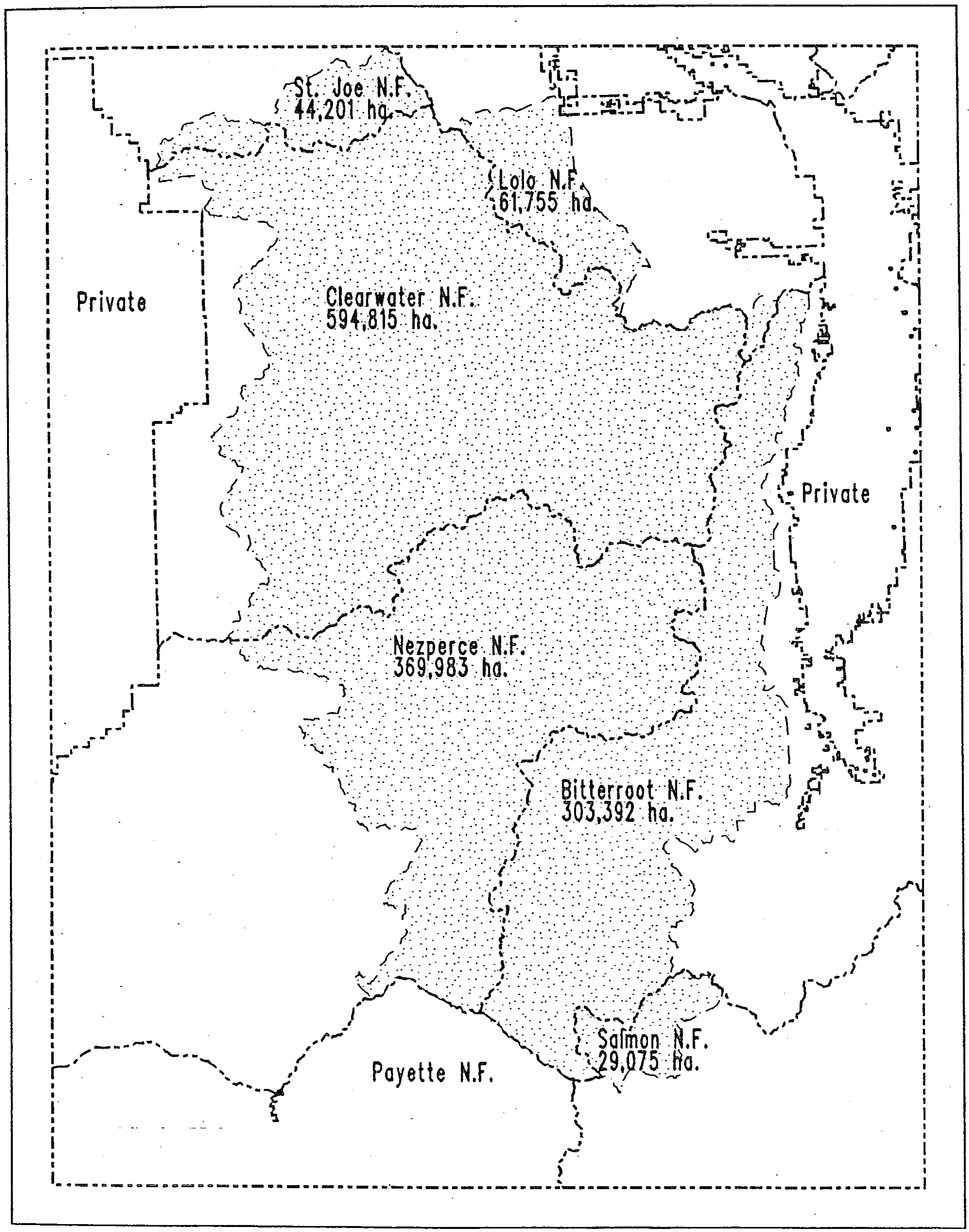

Figure 4. Area of each national forest within the Bitterroot Evaluation Area. Total land area of the BEA is 1,403,221 hectares.

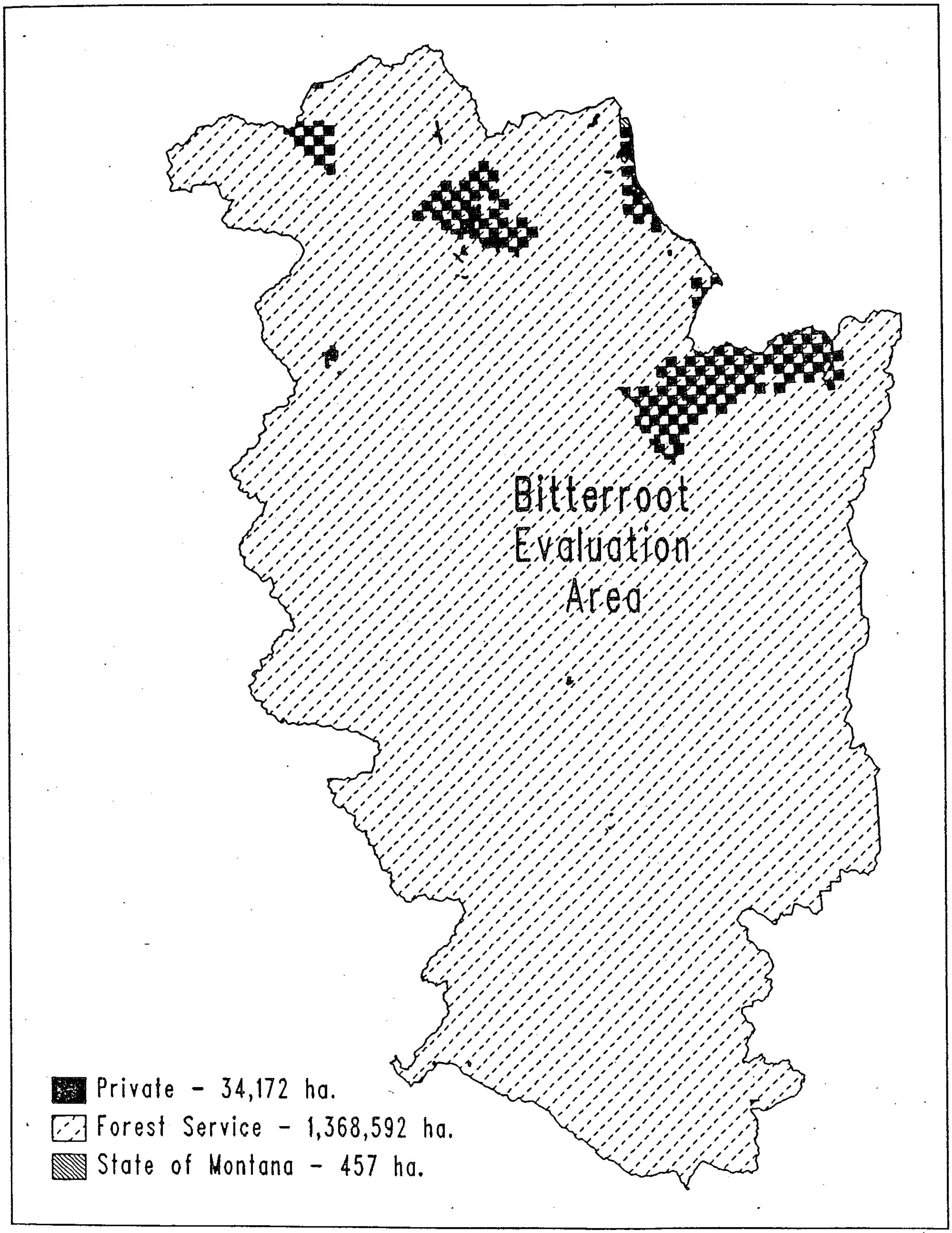

Figure 5. Land ownership in the Bitterroot Evaluation Area.

Arc/Info, a vector based GIS software. The Landsat and topographic data were the only exceptions. In order to be compatible with the latter, all data sets were transferred to GRASS, a raster based GIS software, but were maintained in the Arc/Info environment.

The BEA boundary, national forest boundaries, ranger district boundaries, and wilderness area boundaries were drafted onto 1:24,000 scale (7.5 minute) United States Geologic Survey (USGS) topographic maps. The entire set was digitized, imported into Arc/Info, edited, and labeled.

Land ownership in Idaho was obtained in digital format from Idaho Department of Water Resources. The source maps were the 1:100,000 series USGS-Bureau of Land Management Surface Management Status maps. Land ownership was identified as major federal agency, state or private. We digitized land ownership in the Montana portion of the BEA from the same map series.

USGS 1:100,000 scale Digital Line Graph transportation data was obtained from Idaho Department of Water Resources and directly from USGS. The attribute information that accompanied the data were interpreted, and edited where necessary, to identify highways, roads and trails. In addition, individual highways were labeled. Unimproved roads were not classified further regarding restrictions or size. It was our feeling that the presence of a road may provide opportunity for access, whether it be legal or illegal, and represents a potential disturbance to grizzly bears. This interpretation represents the most restrictive analysis of grizzly bear habitat.

Environmental Protection Agency 1:100,000 scale stream reach data was obtained from Idaho Department of Water Resources and Army Corp of Engineers in Walla Walla, Washington. This data included stream centers, streams banks of large rivers, and lake shores. The attribute information was not edited or updated and was not further classified.

Defense Mapping Agency 1:250,000 scale elevation data was obtained from the USGS. The elevation data was rescaled into 40 foot intervals. Aspect and slope map layers were derived from the raw elevation data by a program in GRASS. Aspect was scaled into 24 categories, each 15 degrees in range, plus flat ground. Slope was scaled into 1 degree increments, from 0 to 90 degrees.

We developed a model of potential grizzly bear spring habitat in order to consider potential distribution of grizzly bears during early spring. Although grizzly bears are not restricted to snow-free zones during early spring, such areas represent important sources of food and potential human contact during early spring. We obtained black and white color prints of a Landsat scene taken April 14, 1985. The scene was divided into 9 major watersheds. Within each watershed the evident snow line was traced onto 1:100,000 scale topographic maps. Then for each watershed, the average elevation of the snow line on each of 8 aspect categories (N, NE, E, SE, S, SW, W and NW) was determined and recorded. This data was used in conjunction with the elevation and aspect GIS layers and the 11 digit USGS hydrologic unit (watersheds) map layer to produce a spring snow-free zone map layer. In recent years, the area has suffered low snowfall winters, but, based on our personal history and recollection, snowfall was nearly average in 1985. In addition, by choosing an early season scene, our model represents a restrictive spring range model.

We obtained a Landsat MSS scene taken on July 24, 1985 that covered approximately 95% of the BEA. Later, we purchased a second scene, dated July 19, 1989, to obtain complete coverage of the BEA. The two scenes were statistically classified into 150 spectral classes using a hybrid supervised approach.

Forest Service ecodata plots were collected during the summers of 1987, 1988, and 1989. Due to the inaccessibility of the area, field personnel were sent to small sampling areas which were intensively sampled. These areas were scattered across the BEA in order to capture a large range of the regional environmental variation (Fig. 6). Plot locations were established from the Landsat imagery and spread among the relative mix of spectral classes in each area. Each plot location was marked and labeled on 1:24,000 scale ortho-photo quads, USGS topographic maps and Forest Service aerial photographs. Field personnel used all three sources to find plot locations in the field. All sampled plot locations were subsequently entered into the GIS.

Using the ocular method outlined in the Ecosystem Classification Handbook (FSH 12/87 R-1 SUPP 1), 1/10 acre plots were located in the field. General information on location, environmental features and vegetation structure were collected. Key data fields included Landsat spectral class, habitat type, ground cover, basal area of trees, mean diameter breast height of trees, seral structure of the stand, and percent cover of various size categories of trees, shrubs, forbs, and graminoids. A complete plant species list with percent cover was completed for each plot.

The ecodata plot data was entered into a computer database. The environmental and structural data were statistically summarized as well as viewed in various graph forms. Based on this evaluation, each Landsat spectral class was correlated to a structural and canopy cover category (Table 1). Where a spectral class appeared to occur in more than one structural or canopy category, it was often

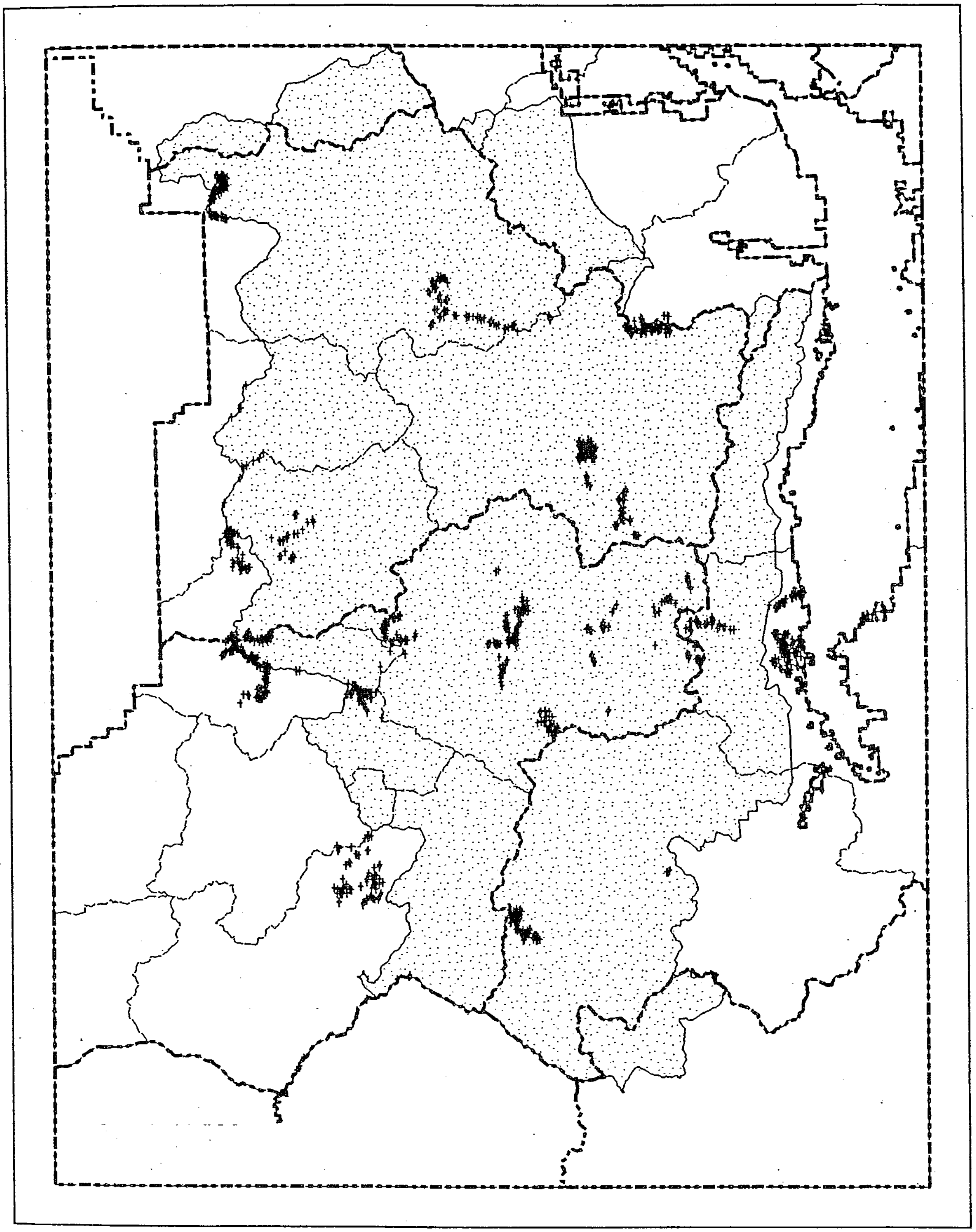

Figure 6. Distribution of ecodata plots collected for interpretation of the Landsat MSS spectral classification.

Table 1. General vegetation structure and canopy categories used in structural land cover classes in the Bitterroot Evaluation Area.

Canopy Cover Categories	
Closed	60%-100% closure
Open	20%-60% closure
Non-Timbered	0-20% closure
Structure Categories	
Non-Vegetated	less than 10% tree, shrub or herb foliar canopy cover.
Grass/Forb	less than 10% canopy cover trees and less than 10% canopy cover shrubs.
Shrub	greater than 10% canopy cover shrubs and less than 10% canopy cover trees.
Shrub/Sapling	greater than 10% canopy cover sapling trees and less than 10% canopy cover of pole and larger sized trees.
Pole Timber	greater than 10% canopy cover pole sized trees; about 50 to 100 year old trees.
Mature Timber	greater than 10% canopy cover mature and larger trees; about 100+ year old trees.

possible to split the spectral class based on its elevation, aspect, and slope. The result was a set of rules for classifying the 150 Landsat spectral classes into 15 structural land cover classes (Table 2).

The ecodata plot data were further analyzed to develop a community based classification. The probability of each habitat type series (*sensu* Cooper et al. 1987) recorded on the data forms occurring on a given elevation and aspect in a given national forest and ranger district was determined with a categorical step-wise logistic regression (PROC CATMOD in SAS). Habitat type series with a probability-of-occurrence less than 0.20 were dropped from further analysis. These results were used to identify three major ecological zones characterized by dominant habitat types (Table 3). The three ecological zones were determined based on our ability to differentiate major habitat type series through our statistical analysis of the ecodata plot data and major shifts in understory composition in characteristic habitat types. The ecological zones were modeled by the GIS using Forest Service administrative units, elevation, and aspect map layers. Eleven of the 15 structural land cover classes were split among the 3 ecological zones, resulting in 37 ecological land cover classes (Table 4). Four of the 15 structural land cover classes were not subdivided: snow fields, bare ground, water, and land/water interface.

RESULTS AND DISCUSSION

POPULATION STATUS

Historical perspective

Historical information indicates that grizzly bears were once common in the Bitterroot area. Members of the Lewis and Clark expedition killed six grizzly bears in the Clearwater Valley near present-day Kamiah in 1806 (Burroughs 1961). Wright (1909), a skilled hunter and naturalist, found grizzly bears to be relatively common in the Clearwater area in the 1890's. He reported killing five grizzly bears on the Clearwater during one episode. On another occasion, late in the fall of 1891, Wright and two other hunters killed 13 grizzly bears during a single hunt in the "Bitterroot region".

Merriam (1922) described the boundaries of grizzly bear range in Idaho and described the habitat there as one of the grizzly bears' last strongholds. He wrote that grizzly bears were "fairly plentiful" in extreme northern Idaho, but were confined to the Bitterroot, Clearwater, Lolo, and Salmon River Mountains in the Bitterroot Range. Moore (1984), a trapper and retired Forest Service employee, reported encounters with grizzly bears in 1930 and 1931. He also

Table 2. Fifteen structural land cover classes in the Bitterroot Evaluation Area identified with Landsat MSS and Defense Mapping Agency digital elevation data.

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1. Snow Fields

   Permanent snow fields

2. Bare Ground

   Less than 20% vegetative cover. Surface of rock, gravel, sand, or soil.

3. Water

   Standing or running water.

4. Land/Water Interface

   Shoreline areas consisting partially of water bodies and partially vegetated or unvegetated land.

5. Riparian Meadow

   Wet meadows associated with streams or water bodies and dominated by sedges with little or no shrub cover.

6. Riparian Shrub

   Wet meadows associated with streams or water bodies and dominated by sedges with a major component of wet-site shrubs of low stature.

7. Grass/Forb

   Dry, upland sites with no tree cover and dominated by herbaceous plants, often sparsely vegetated.

8. Dense Shrub

   Dense cover of moist site shrubs, typically alder or willow.

9. Shrub

   Moderate to dense cover of shrubs, ranging from moist-site to dry-site species.

10. Shrub/Sapling

    Shrub stands with significant sapling stage conifer regeneration.

(continued)

Table 2, continued.

11.	Open Mature Conifer (grass/forb understory)
	Open-canopied (20-60%), pole to oldgrowth stage stands of conifer without a dominant shrub understory.
12.	Open Pole Conifer (grass/forb understory)
	Open-canopied (20-60%), sapling to mature stage stands of conifer without a dominant shrub understory.
13.	Open Mature Conifer (shrub understory)
	Open-canopied (20-60%), pole to oldgrowth stage stands of conifer with a dominant shrub understory.
14.	Open Pole Conifer (shrub understory)
	Open-canopied (20-60%), sapling to mature stage stands of conifer with a dominant shrub understory.
15.	Closed Mature Conifer
	Closed-canopied (60-100%), pole to oldgrowth stage stands of conifer.

Table 3. Major ecological zones used as strata in the Bitterroot Evaluation Area land cover classification and characteristic habitat types of each zone.

Ecological Zone	Dominant Habitat Types
Lower Montane	Pseudotsuga menziesii/Agropyron spicatum
	Pseudotsuga menziesii/Festuca idahoensis
	Pseudotsuga menziesii/Vaccinium caespitosum
	Pseudotsuga menziesii/Physocarpus malvaceus
	Pseudotsuga menziesii/Symphorocarpos albus
	Pseudotsuga menziesii/Carex geyeri
	Pseudotsuga menziesii/Arctostaphylos uva-ursi
	Pseudotsuga menziesii/Juniperus communis
Mid to Upper Montane	
	Abies grandis/Physocarpos malvaceus
	Abies grandis/Xerophyllum tenax
	Abies grandis/Asarum caudatum
	Abies grandis/Clintonia uniflora
	Abies grandis/Linnaea borealis
	Thuja plicata/Clintonia uniflora
	Thuja plicata/Athyrium filix-femina
	Thuja plicata/Asarum caudatum
	Thuja plicata/Adiantum pedatum
Subalpine	
	Abies lasiocarpa/Clintonia uniflora
	Abies lasiocarpa/Menziesia ferruginea
	Abies lasiocarpa/Xerophyllum tenax
	Abies lasiocarpa/Vaccinium scoparium
	Abies lasiocarpa/Luzula hitchcockii
	Pinus albicaulis-Abies lasiocarpa
	Larix lyallii-Abies lasiocarpa

Table 4. Thrity-seven ecological land cover classes in the Bitterroot Evaluation Area identified with Landsat MSS and Defense Mapping Agency elevation data. Refer to tables 2 and 3 for descriptions of each.

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1. Snow Fields
2. Bare Ground
3. Water
4. Land/Water Interface

Lower Montane

5. Riparian Meadow
6. Riparian Shrub
7. Grass/Forb
8. Dense Shrub
9. Shrub
10. Shrub/Sapling
11. Open Mature Conifer (grass/forb understory)
12. Open Pole Conifer (grass/forb understory)
13. Open Mature Conifer (shrub understory)
14. Open Pole Conifer (shrub understory)
15. Closed Mature Conifer

Mid to Upper Montane

16. Riparian Meadow
17. Riparian Shrub
18. Grass/Forb
19. Dense Shrub
20. Shrub
21. Shrub/Sapling
22. Open Mature Conifer (grass/forb understory)
23. Open Pole Conifer (grass/forb understory)
24. Open Mature Conifer (shrub understory)
25. Open Pole Conifer (shrub understory)
26. Closed Mature Conifer

Subalpine

27. Riparian Meadow
28. Riparian Shrub
29. Grass/Forb
30. Dense Shrub
31. Shrub
32. Shrub/Sapling
33. Open Mature Conifer (grass/forb understory)
34. Open Pole Conifer (grass/forb understory)
35. Open Mature Conifer (shrub understory)
36. Open Pole Conifer (shrub understory)
37. Closed Mature Conifer

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described earlier reports of grizzly bears being trapped and shot by others. According to Moore, the last documented sign of grizzly bears in the region was recorded in the mid-1940's by a Forest Service ranger on the Selway. The last known grizzly bear killed in the Bitterroots was taken in the upper Lochsa River Valley by a Forest Service District Ranger in 1956.

Current Status

Melquist (1985) found no observations or sign of grizzly bears on the Clearwater National Forest during a one summer survey. He also evaluated 88 reports of grizzly bears. Since the last confirmed killing in 1956, 14 reports were considered probable and 37 reports as highly possible. No reports have been confirmed since 1956. Melquist concluded that a few grizzly bears may occupy the area, at least temporarily, however, the question of permanent residency and reproduction remain unanswered.

Remote-camera bait stations were maintained in the North Fork of the Clearwater River drainage by Idaho Department of Fish and Game during the summers of 1990 and 1991 (Servheen et al. 1990, Kunkel et al. 1991). In 759 'camera-days', 1,349 photographs were taken, none of grizzly bears. Kunkel et al. (1991) concluded that if grizzly bears occupy this area their numbers are very low. However, they also concluded that their effort was relatively small, due to low funding, and indicated that a greater effort would increase the probability of photographing a grizzly bear.

HABITAT EVALUATION

A number of studies have described occupied grizzly bear habitat from several ecosystems (Craighead et al. 1982, Jonkel 1982, McLellan 1982, Hamer and Herrero 1983, Servheen 1983, Aune et al. 1984, Knight et al. 1984, Mace 1984, Almack 1985, Hamilton and Archibald 1985, Kasworm 1986). There exists, however, no quantitative or definitive criteria for evaluation of grizzly bear habitat. When confronted with currently unoccupied habitat, and not having bears from which to obtain area-specific habitat-use data, habitat evaluation becomes even more problematic.

We have collected an extensive quantitative database on the BEA. We see our role in the Bitterroot decision-making process as one of presenting the collective data in summary form to the Bitterroot Technical Review Team, consisting of a panel of wildlife biologists, each an established expert in grizzly bear biology. This panel will make an authoritative recommendation regarding the suitability of the BEA for grizzly bear recovery to the Interagency Grizzly Bear Committee.

Craighead et al. (1982) described 7 habitat characteristics essential to the maintenance of a grizzly bear population: (1) space, (2) isolation, (3) sanitation, (4) food, (5) denning, (6) vegetation types, and (7) safety. Although these characteristics arise primarily from Craighead's work on grizzly bears in the Yellowstone Ecosystem, they appear to us to have broad applicability to other ecosystems. This scheme has previously been used in the Northern Continental Divide Ecosystem (Craighead et al. 1982), the Selway Bitterroot Wilderness Area (Butterfield and Almack 1985), and the North Cascades Ecosystem (Almack 1986). We adopt them here as a standardized base for discussion of the habitat suitability of the BEA.

Space

The total area of the BEA is 14,032 km^2. The 4 grizzly bear ecosystems identified in the Grizzly Bear Recovery Plan that contain confirmed populations of grizzly bears range in size from the 2,590 km^2 Selkirk Mountains Ecosystem (Almack 1985) to the 23,067 km^2 Northern Continental Divide Ecosystem (U.S.D.I. 1982). The BEA falls well within the space requirements for grizzly bears when compared to other ecosystems with known grizzly bear populations south of Canada.

Isolation

Fifty-one percent of the BEA consists of established wilderness areas. All of the 546,393 ha Selway Bitterroot Wilderness Area and 146,189 ha of the much larger Frank Church River of No Return Wilderness Area is inside the BEA (Fig. 2). These wilderness areas receive relatively light recreational use compared to other wilderness areas and other grizzly bear ecosystems, particularly compared to Yellowstone National Park and Glacier National Park, which form the cores of the Yellowstone and Northern Continental Divide Ecosystems, respectively. Recreational use in the BEA is primarily low intensity backcountry hiking and camping. An exception, is a great influx of hunters during the fall elk and deer seasons. The potential role of hunters in grizzly bear recovery in the BEA is discussed in detail in a following section on safety.

The bulk of non-wilderness in the BEA lies to the north of the Selway Bitterroot Wilderness Area on the Clearwater and Lolo National Forests (Fig. 4). Much of this area is in *de facto* wilderness and is classified as roadless in the respective forest plans (Forest Plan: Clearwater National Forest 1987). Two significant areas on this portion of the BEA have been proposed as new wilderness areas: the Mallard Larkins on the Clearwater and St. Joe National Forests and the Great Burn on the Clearwater and Lolo National Forests (Fig. 2) (Forest Plan: Clearwater National Forest 1987).

U.S. Highway 12 is the only highway inside the BEA (Fig. 7). The only significantly roaded areas in the BEA are associated with logging activities on private timber lands, and to a lesser extent Forest Service lands, within the Clearwater and Lolo National Forests (Fig. 8). The private timber lands occur in alternating square mile sections of land (Fig. 5). Most of the Clearwater and Nezperce National Forests and all of the other national forest lands inside the BEA are managed as roadless areas by the respective forest plans. Extensive roading exists outside the BEA boundary on all sides (Fig. 9). A well developed trail system is present throughout the BEA (Fig. 10).

Logging in the BEA occurs only on the Clearwater, Nezperce and Lolo National Forests. The Clearwater National Forest plans to log 70 million board feet annually from its roadless areas, most of which is in the BEA, over the next 10 years (Forest Plan: Clearwater National Forest 1987). All new logging roads on the Clearwater will be closed to public motorized travel.

Killing associated with livestock operations was a major source of mortality on grizzly bears in the Bitterroots in the early 1900's (Davis et al. 1985). Presently, however, no cattle or sheep grazing occurs within the BEA.

Grizzly bears in mountainous ecosystems typically use low elevations during early spring, although they are not restricted to them. These areas are generally snow free and provide fresh vegetation or winter-killed ungulates as valuable food supplies (Houston 1978, Mealey 1980). As mentioned above in the section on historical perspective, there is evidence that grizzly bears in the Bitterroot Mountains once used low elevations during the spring (Burroughs 1961, Wright 1909). Perhaps more importantly, human activities during the spring are generally restricted to these low elevation, snow-free areas, and therefore represent areas of potentially high bear-human conflict.

Based on our grizzly bear spring habitat model, substantial amounts of spring range occur inside the BEA (Fig. 11). The majority of the 231,960 ha of spring range in the BEA is found in the Selway and Lochsa River Valleys. The upper Selway, which is entirely inside the Selway Bitterroot Wilderness Area, has extremely limited spring access. U.S. Highway 12 completely bisects the spring range in the Lochsa River Valley. The highway serves as a major haul route for heavy trucks, especially trucks carrying grain from Montana to the Port of Lewiston. As demonstrated in the Northern Continental Divide Ecosystem, spilled grain is a demonstrated attractant of grizzly bears and represents a potential threat to grizzly bears. Highway 12 is also a major access route for spring black bear hunters. Native

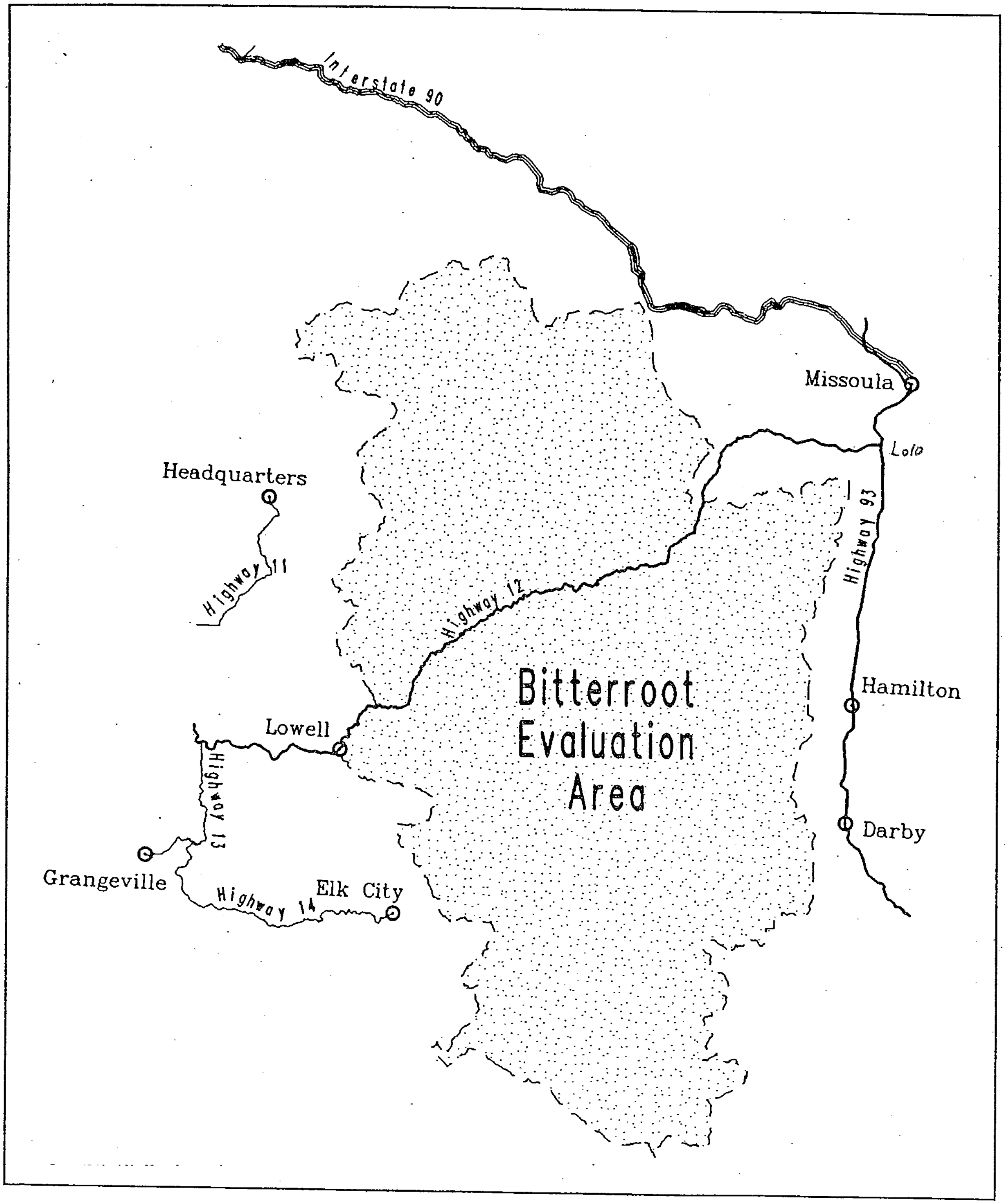

Figure 7. Highways in and around the Bitterroot Evaluation Area.

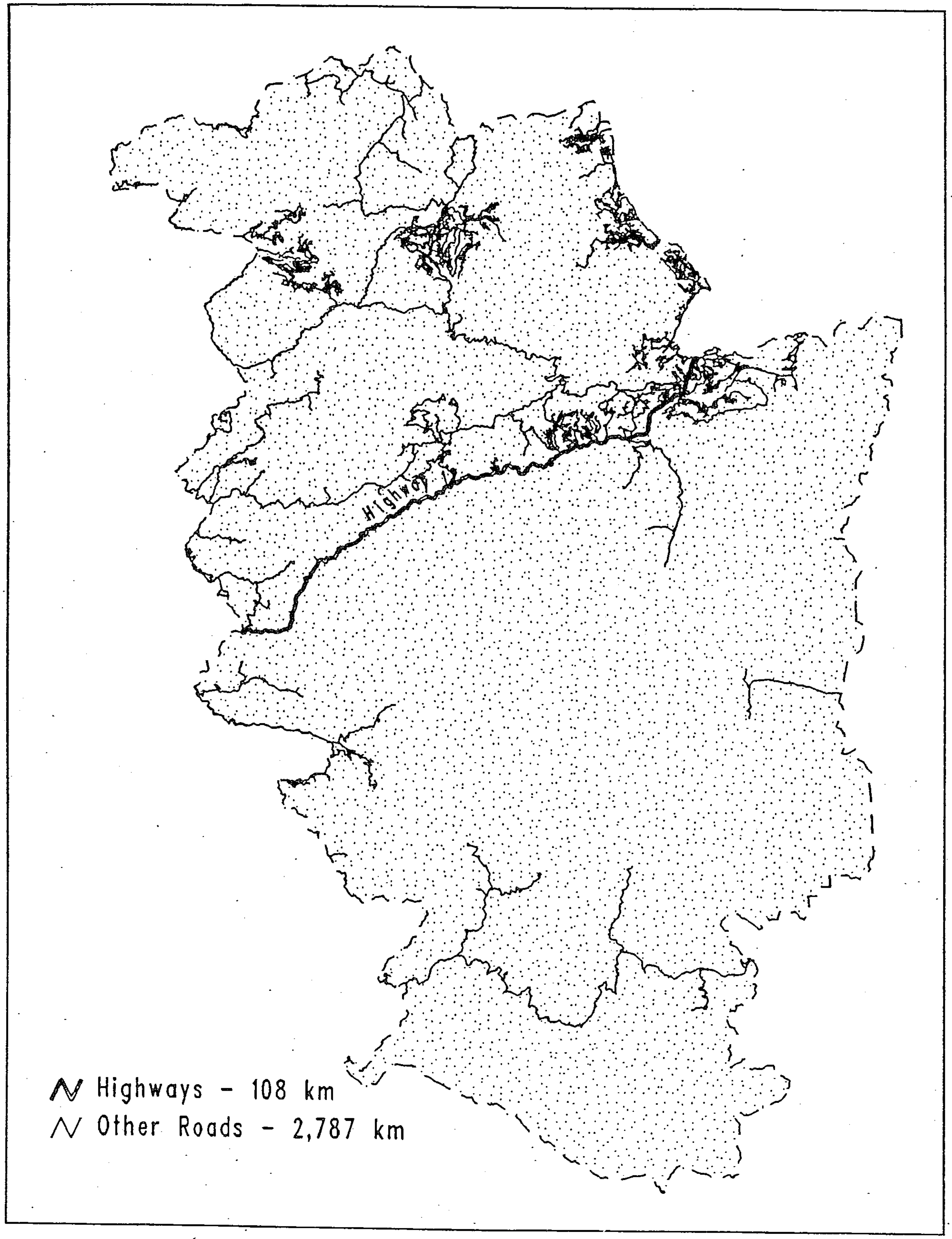

Figure 8. Roads in the Bitterroot Evaluation Area.

Figure 9. Roads inside and outside the Bitterroot Evaluation Area.

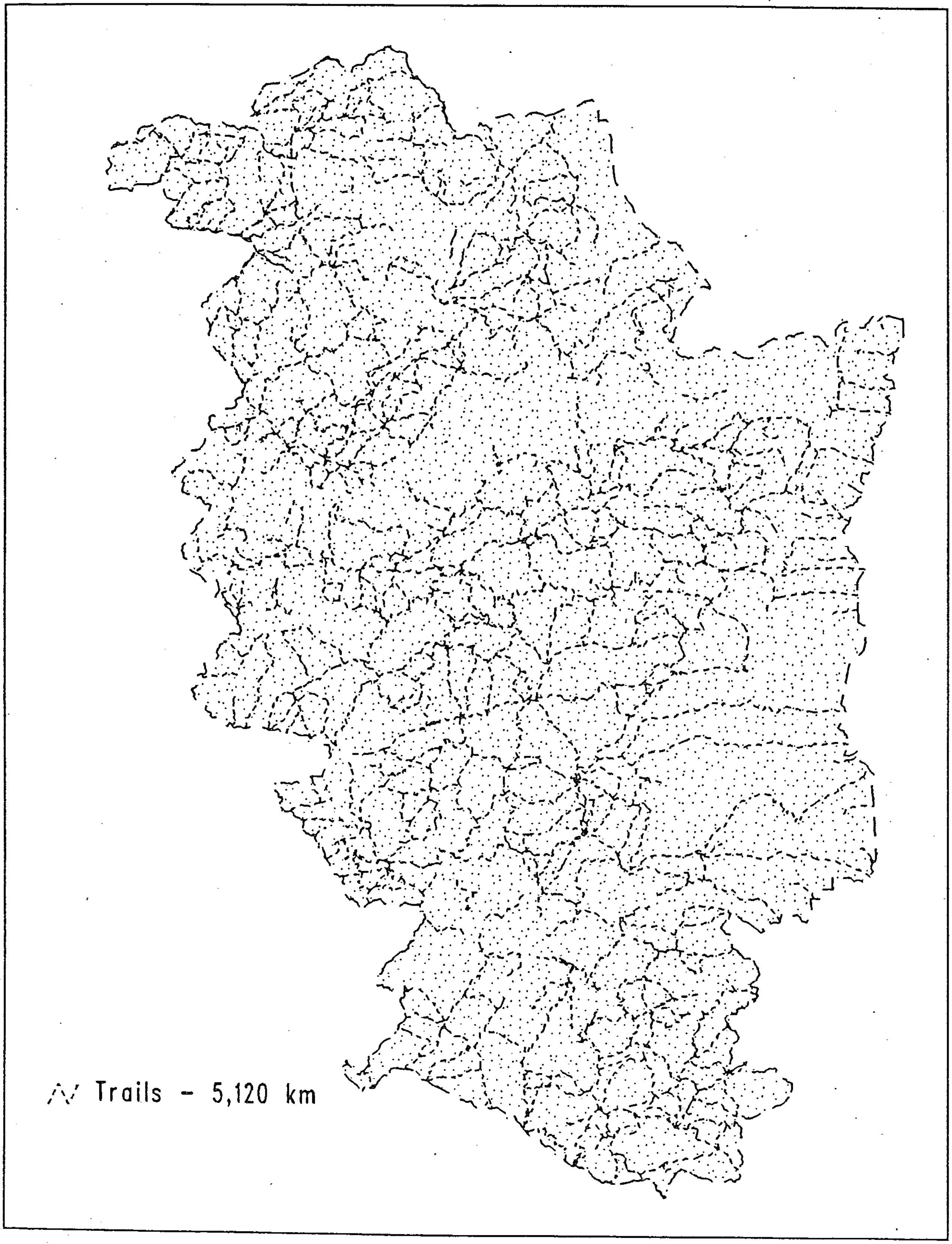

Figure 10. Trails in the Bitterroot Evaluation Area.

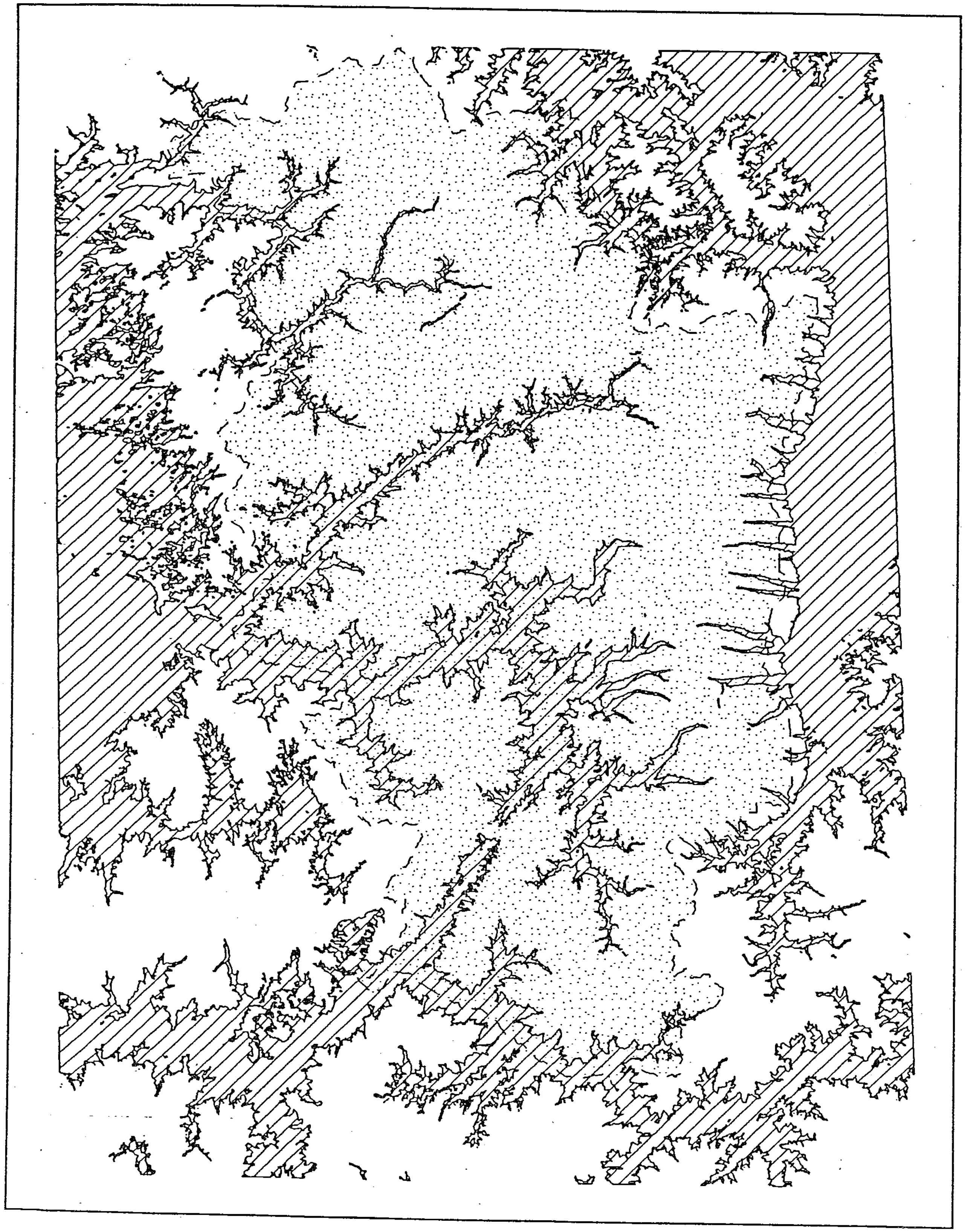

Figure 11. Potential grizzly bear spring habitat in the Bitterroot Evaluation Area modeled as the snow free zone on April 14, 1985.

Americans have year round hunting privileges and use Highway 12 during the spring for hunting. Without careful management, this corridor could develop bear-human conflicts detrimental to grizzly bear recovery.

Smaller amounts of spring habitat occur along the south, north and east sides of the BEA. The Salmon River area is relatively inaccessible during the spring. Road access to the North Fork of the Clearwater River remains blocked usually well into June when more area for bear dispersal has become snow-free. The steep-sided valleys on the eastern side of the Bitterroot Mountains are inside wilderness boundaries and are inaccessible until summer.

Despite the appearance of substantial amounts of spring range inside the BEA, if the entire region is considered and not just the interior of the BEA boundary, most spring range occurs outside the BEA (Fig. 11). The historical evidence cited previously, established that grizzly bears once used these outer areas, for example the Clearwater and Bitterroot Valleys. There is a potential that grizzly bears in a future Bitterroot population would again attempt to use these areas. If so, a potential bear-human conflict could occur to the detriment of grizzly bear recovery.

Sanitation

There are 3 potential sources of artificial food for grizzly bears in the BEA. (1) Recreational backcountry users do not routinely practice safe bear-country camping practices, even though black bears are common. However, this use is light and an educational program coupled with the knowledge of the presence of grizzly bears is likely to make substantial improvements in camping practices. (2) Hunting and outfitter camps represent a greater potential source of artificial food, as well as a greater challenge in education. Hunters are often traditional and are likely to be difficult to convince of the need for clean camping and hunting practices. (3) Several human habitations occur in the BEA, most notably along the Lochsa River at Lowell and Powell and backcountry Forest Service stations and a few private inholdings. In addition to a new education program, these areas will require bear proof garbage containers, not currently in use, to reduce potential bear-human conflicts.

Denning

Deep snow accumulation and mountainous terrain of the BEA provides ideal denning habitat for grizzly bears. Using 1,760 m as the lower limit to denning habitat, 44% of the BEA contains potential denning habitat (Fig. 12). These areas are in primitive or wilderness situations and, with few exceptions, have no human use during the denning seasons.

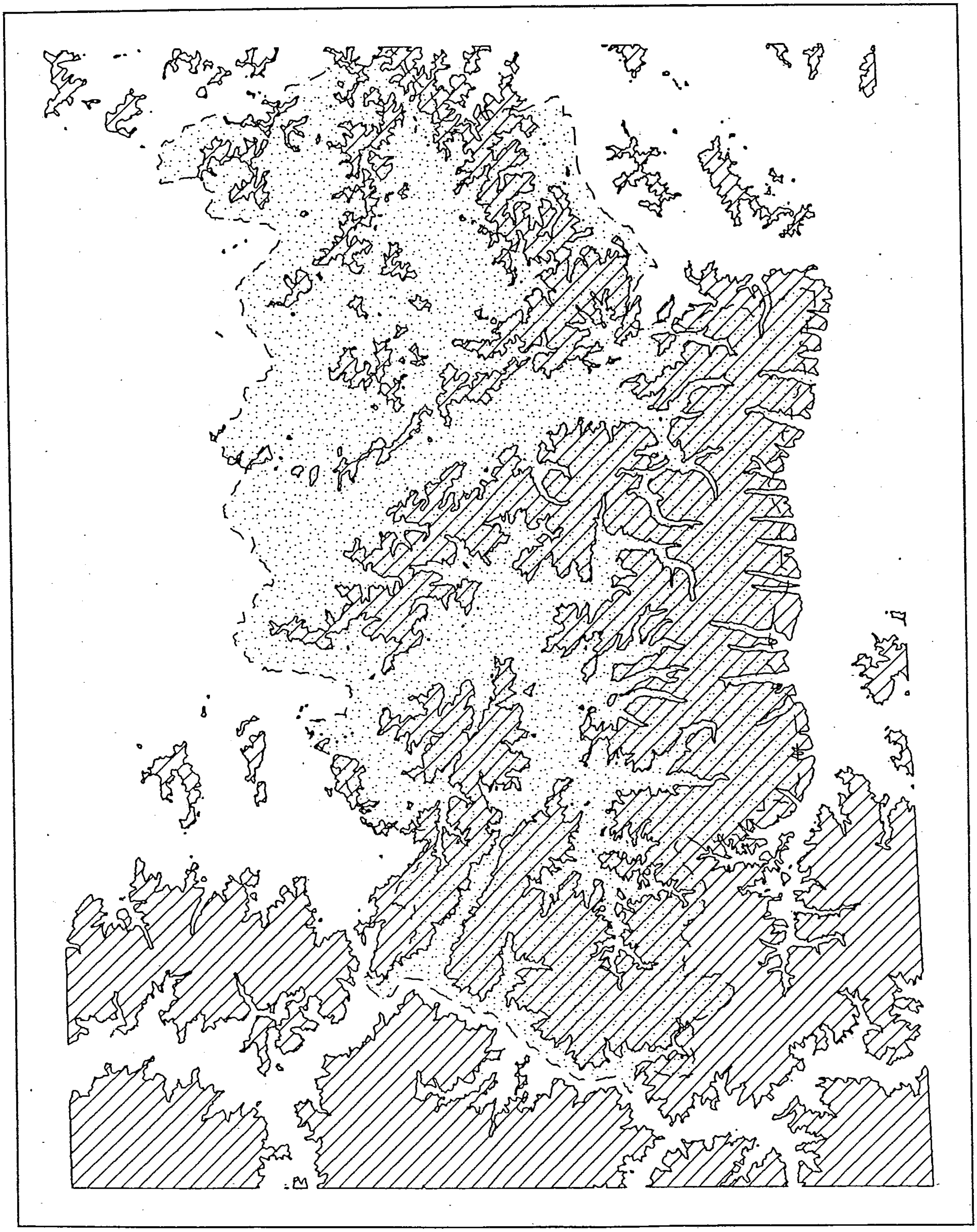

Figure 12. Potential grizzly bear denning habitat in the Bitterroot Evaluation Area.

Safety

Large-scale shooting and trapping were the major causes of extirpation of the grizzly bear in the Bitterroots. While the associated grazing and unlimited hunting no longer occurs in the BEA, shooting continues to be a major potential roadblock to grizzly bear recovery. There are 3 primary sources of this threat (1) identification error and accidental killing during the spring black bear hunting season, (2) identification error and accidental killing during fall elk and deer seasons and (3) direct poaching (G. Servheen, IDFG, pers. comm.).

We do not condone major changes in hunting seasons or regulations to accommodate grizzly bear recovery. Because of the region's importance in elk and deer hunting, it would be impractical, and we believe counter-productive, to limit elk and deer hunting for grizzly bear recovery. A successful recovery program will require the support of hunters.

With hunters afield, a major education effort will be required. Hunters will need to learn how to distinguish grizzly from black bears as well as cooperate with recovery efforts. The existing poster program (Melquist 1985, Davis et al. 1985) would have to be expanded. An efficient education effort could be established in the hunter licensing process, as part of the regulations pamphlets or as a formal hunter education course, or preferably both. Other steps can be taken that would minimize potential conflicts during hunting seasons, such as clean camping practices and general education on grizzly bear ecology that could reduce the myths so often associated with grizzly bears.

Currently, black bear hunters are allowed to bait year-round and to chase with hounds. Again, we believe that a successful recovery program will exist only with the cooperation of hunters and other local resource users. Even with strong education and enforcement programs, however, such practices represent a major threat to grizzly bear recovery. In recent years during study by Idaho Department of Fish and Game, poaching has been the single largest source of mortality on grizzly bears in the Selkirk Ecosystem, accounting for 7 deaths of 11 radio-collared bears. The BEA is likely to be no different. In concert with strong education and law enforcement programs, regulatory changes in spring black bear hunting may need to be considered in order to successfully recover the grizzly bear in the BEA.

Vegetation Types

Earlier studies of potential grizzly bear habitat in the Selway Bitterroot Wilderness Area found a large variety of vegetation types comparable to occupied habitat in other grizzly bear ecosystems (Scaggs 1979, Butterfield and Almack 1985). We have extended and quantified the vegetation mapping across the entire BEA and have reached the same conclusions.

We identified 37 ecological land cover classes characterized by structure and forest habitat types (Table 4). Forest habitat types represent potential climax vegetation (Daubenmire 1952, Pfister 1977, Cooper et al. 1987). The applicability of potential vegetation for grizzly bear habitat mapping may not be clear at first, but in fact, the potential climax vegetation can provide detailed information about plant communities before they reach climax stage. In particular, the understory community typically reaches its climax structure and composition long before the stand reaches its potential climax. When used in conjunction with structural information, the use of potential vegetation for assessing grizzly bear habitat becomes extremely valuable. This relationship has been previously recognized by Mealey et al. (1977) and Butterfield and Key (1985).

Wet meadow complexes at all elevations were the rarest of the vegetation classes (Fig. 13). These types are important to grizzly bears for feeding, particularly in spring. However, our results appear to be due in part to an apparent classification error rather than a shortage of wet meadows. Two characteristics of Landsat MSS data are largely responsible for the error. Firstly, MSS data has a spatial resolution, or pixel size, of 57 m by 57 m. Many of the wet meadows in the BEA are narrow, riparian strips, often with an open tree canopy, too narrow to be identified by MSS data. Secondly, MSS data measures spectral or light reflectance from the earth's surface. Wet meadows had very similar spectral reflectance to 2 other types: open conifer with shrub understory and shrub fields. Some wet meadow complexes were spectrally mis-classified into one these classes, for example, much of Horse Heaven Meadow near Elk Summit was classified as shrub. Both Scaggs (1977) and Butterfield and Almack (1985) found many wet meadow complexes, and they do not appear to be limiting in the BEA.

The other vegetation classes are common and well distributed across the BEA (Fig. 13, Table 5). Fire has played an important role in shaping the vegetation of the BEA (Habeck 1972, Cooper et al. 1978). In particular, extensive shrub fields are the result of catastrophic fires in the early 1900's. Current management policies in the Selway Bitterroot Wilderness Area will assure that fire continues to play a key role in maintaining seral communities. We have no way to compare this diversity of vegetation types to occupied grizzly bear habitat in other ecosystems, but it does appear that the BEA has a rich

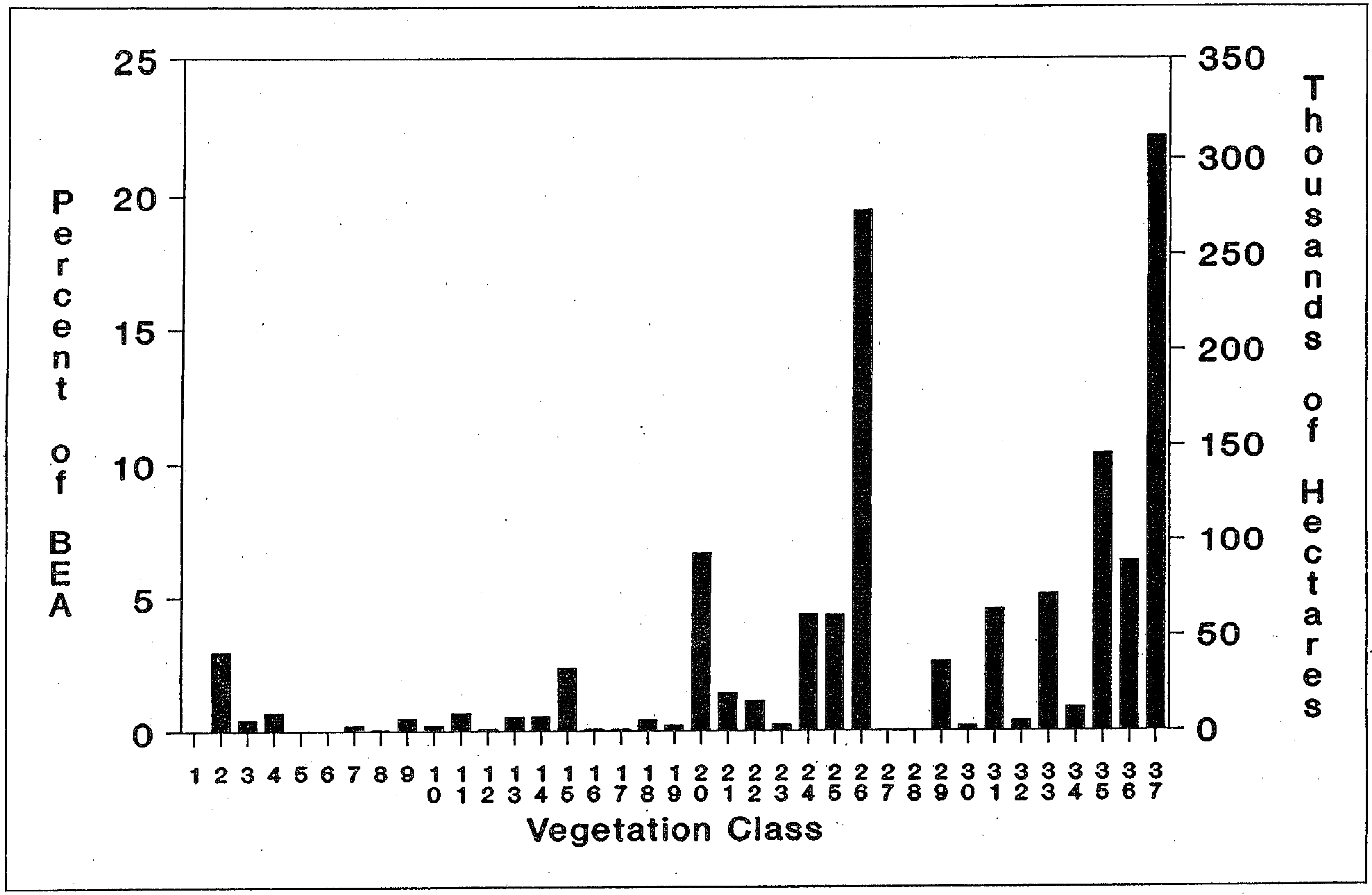

Figure 13. Areal distribution in the Bitterroot Evaluation Area of land cover classes derived from classification of Landsat MSS data.

Table 5. Distribution of ecological land cover classes in national forest districts across the Bitterroot Evaluation Area. Districts are ordered from left to right in an approximate north to south gradient. Districts east of the Bitterroot crest are conspicuously missing cover classess in the ABGR and THPL series.

Forest: District:	St. Joe	Lolo Superior	Lolo Ninemile	Cl'water Canyon	Cl'water Pierce	Cl'water Lochsa	Cl'water Powell	Lolo Missoula	Nezperce Selway	Nezperce Moose Ck.	Nezperce Red River	Nezperce Elk City	Bitt'root Ste'ville	Bitt'root Darby	Bitt'root West Fork	Salmon
Cover Class																
1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	0.05%	0.00%	0.00%
2	0.00%	0.00%	0.53%	0.26%	0.01%	0.25%	1.23%	2.85%	0.15%	2.00%	0.74%	0.00%	16.96%	25.13%	4.70%	3.01%
3	0.73%	1.02%	0.27%	0.33%	0.07%	0.32%	0.31%	0.59%	0.28%	0.27%	0.40%	0.01%	0.81%	0.83%	0.64%	0.77%
4	0.01%	0.00%	0.07%	0.33%	0.07%	0.40%	0.44%	1.19%	0.42%	0.58%	1.03%	0.06%	1.22%	1.11%	1.46%	2.49%
5	0.00%	0.04%	0.07%	0.00%	0.01%	0.02%	0.00%	0.03%	0.03%	0.00%	0.00%	0.00%	0.04%	0.01%	0.00%	0.00%
6	0.00%	0.04%	0.07%	0.00%	0.00%	0.01%	0.00%	0.04%	0.02%	0.00%	0.00%	0.00%	0.01%	0.01%	0.00%	0.00%
7	0.00%	0.04%	0.52%	0.00%	0.00%	0.04%	0.00%	1.38%	0.04%	0.18%	0.39%	0.00%	0.24%	0.53%	0.57%	0.53%
8	0.00%	0.62%	1.12%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.01%	0.00%	0.00%
9	0.00%	3.47%	6.51%	0.00%	0.03%	0.79%	0.00%	1.39%	0.77%	0.22%	0.06%	0.00%	0.84%	0.86%	0.20%	0.01%
10	0.00%	0.00%	0.78%	0.00%	0.07%	0.81%	0.00%	0.12%	1.23%	0.28%	0.01%	0.00%	0.02%	0.05%	0.10%	0.00%
11	0.00%	0.04%	0.69%	0.00%	0.00%	0.03%	0.00%	3.77%	0.18%	0.56%	2.40%	0.00%	2.26%	2.07%	1.35%	1.23%
12	0.00%	0.00%	0.10%	0.00%	0.00%	0.01%	0.00%	1.48%	0.07%	0.07%	0.30%	0.00%	0.21%	0.22%	0.11%	0.05%
13	0.00%	3.51%	6.77%	0.00%	0.03%	0.08%	0.00%	4.20%	0.43%	0.18%	0.54%	0.00%	1.57%	1.59%	0.28%	0.09%
14	0.00%	1.68%	6.18%	0.00%	0.05%	0.24%	0.00%	4.45%	0.57%	0.26%	0.50%	0.03%	1.43%	1.54%	0.36%	0.10%
15	0.00%	8.11%	31.79%	0.00%	0.45%	1.73%	0.00%	13.30%	6.52%	1.34%	1.55%	0.06%	3.54%	3.85%	0.95%	0.14%
16	0.06%	0.00%	0.00%	0.18%	0.26%	0.15%	0.05%	0.00%	0.06%	0.03%	0.03%	0.07%	0.00%	0.00%	0.00%	0.00%
17	0.12%	0.00%	0.00%	0.16%	0.25%	0.20%	0.05%	0.00%	0.05%	0.03%	0.03%	0.09%	0.00%	0.00%	0.00%	0.00%
18	0.11%	0.00%	0.00%	0.47%	0.11%	0.14%	0.32%	0.00%	0.14%	0.40%	0.34%	0.00%	0.00%	0.00%	1.07%	0.91%
19	0.59%	0.00%	0.00%	0.73%	0.18%	0.73%	0.07%	0.00%	0.54%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
20	8.31%	0.00%	0.00%	16.31%	17.02%	17.98%	4.81%	0.00%	11.13%	3.72%	0.94%	1.25%	0.00%	0.00%	0.92%	0.16%
21	1.33%	0.00%	0.00%	2.90%	3.87%	4.72%	0.61%	0.00%	2.58%	1.31%	0.08%	0.21%	0.00%	0.00%	0.20%	0.05%
22	0.03%	0.00%	0.00%	0.50%	0.07%	0.22%	0.67%	0.00%	0.39%	1.27%	1.81%	0.01%	0.00%	0.00%	3.36%	3.77%
23	0.00%	0.00%	0.00%	0.21%	0.08%	0.08%	0.26%	0.00%	0.15%	0.31%	0.45%	0.09%	0.00%	0.00%	0.44%	0.37%
24	3.10%	0.00%	0.00%	6.62%	10.97%	7.95%	4.56%	0.00%	6.40%	2.88%	6.48%	11.28%	0.00%	0.00%	2.41%	1.41%
25	4.12%	0.00%	0.00%	8.85%	10.61%	7.71%	4.26%	0.00%	4.60%	2.87%	4.05%	6.27%	0.00%	0.00%	2.00%	1.29%
26	35.54%	0.00%	0.00%	30.82%	34.23%	27.71%	19.47%	0.00%	31.77%	17.80%	22.16%	31.95%	0.00%	0.00%	11.53%	2.77%
27	0.01%	0.00%	0.01%	0.01%	0.01%	0.02%	0.02%	0.01%	0.00%	0.03%	0.01%	0.00%	0.05%	0.02%	0.00%	0.00%
28	0.03%	0.00%	0.01%	0.01%	0.01%	0.04%	0.03%	0.01%	0.00%	0.03%	0.01%	0.03%	0.02%	0.01%	0.00%	0.00%
29	0.35%	1.24%	1.26%	0.73%	0.12%	0.73%	1.73%	3.61%	0.69%	3.17%	1.59%	0.03%	12.07%	10.67%	3.83%	2.45%
30	0.23%	3.65%	1.47%	0.23%	0.01%	0.29%	0.06%	0.05%	0.41%	0.17%	0.00%	0.00%	0.17%	0.06%	0.00%	0.00%
31	5.45%	18.49%	8.36%	5.15%	2.39%	5.40%	3.69%	3.73%	5.79%	7.35%	1.12%	2.23%	6.33%	5.08%	1.89%	0.70%
32	0.00%	0.00%	0.20%	0.24%	0.16%	0.29%	0.39%	0.60%	0.30%	0.60%	0.20%	0.01%	0.95%	0.68%	0.32%	0.13%
33	0.27%	0.15%	1.36%	0.82%	0.11%	1.08%	3.93%	9.26%	0.70%	5.43%	4.02%	0.00%	21.30%	16.70%	8.99%	17.51%
34	0.00%	0.00%	0.30%	0.28%	0.26%	0.60%	1.02%	1.32%	0.45%	1.33%	1.13%	0.03%	1.08%	0.96%	1.19%	1.14%
35	13.92%	28.17%	10.93%	7.98%	6.21%	7.52%	12.67%	10.28%	7.10%	12.01%	10.42%	15.90%	8.64%	8.08%	10.92%	14.95%
36	3.27%	8.77%	5.31%	5.26%	4.78%	6.62%	7.68%	5.56%	4.78%	9.31%	5.55%	5.94%	5.02%	5.31%	5.31%	5.10%
37	22.43%	20.97%	15.34%	10.61%	7.51%	5.08%	31.69%	30.79%	11.30%	24.01%	31.66%	24.46%	15.16%	14.60%	34.91%	38.90%
	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

mixture of vegetation comparable to occupied grizzly bear habitat in other ecosystem.

Food

Specific food habits of grizzly bears differ among ecosystems (Servheen 1981; 1983; Craighead et al. 1982, Jonkel 1982, Aune et al. 1984, Knight et al. 1984, Almack 1985). Differences in diet among ecosystems may depend on, not only the availability of specific food sources, but also on their relative abundance and individual bears' preferences and selections (Craighead et al. 1982). In the absence of grizzly bears in the BEA from which to collect local food habits data, quantitative comparisons of specific plant and animal food abundance to other ecosystems is not possible.

Grizzly bear foods can, however, be grouped into 3 major categories: (1) meat, (2) herbaceous vegetation and tubers (graminoids and forbs) and (3) fruits and nuts (trees and shrubs). The use of these food categories by grizzly bears is generally associated with seasonal changes in plant phenology and grizzly bear physiology which may hold, at least generally, across ecosystems (Craighead et al. 1982). This grouping also provides us with a convenient outline from which to discuss the potential sources of food for grizzly bears in the Bitterroot Evaluation Area.

Meat. The BEA contains one of the largest elk (*Cervus elaphus*) and deer (*Odocoileus hemionus and O. virginianus*) populations found anywhere. Winter mortality occurs each year and represents a potentially significant source of carrion for grizzly bears in the early spring after emergence from dens. Most of this winter-kill occurs in lower elevations and along valley bottoms. Our spring range model (Fig. 11) demonstrates that this potential source of carrion is distributed throughout the BEA and is isolated in wilderness areas or, with the exception of the Lochsa Valley, are blocked by late snow melt on key access roads. Please refer back to the section on Isolation for our discussion of potential threats to grizzly bear recovery in these spring range areas.

Elk calving areas could provide additional sources of protein later in spring and early summer. We don't have any information from formal surveys, but we suspect that small mammals that are known grizzly bear foods are present and common in the BEA, including ground squirrels (*Spermophilus* spp.), pocket gophers (*Thomomys* spp.), mice (*Peromyscus maniculatus* and *Zapus princeps*) and voles (*Microtis* spp. *Clethrionomys* spp.). We also have no reason to believe that various insects eaten by grizzly bears are not common in the BEA.

Early writings suggest that grizzly bears once utilized fish in the Bitterroot region. Large runs of anadromous chinook salmon (*Oncorhynchus tshawytscha*) and steelhead trout (*Salmo gairdneri*) are known to have occurred seasonally in the region's rivers. It is plausible that the great numbers of grizzly bears killed at one time by Wright (1909) (see earlier section on Population Status) were concentrations of grizzly bears feeding on these great runs of fish. Wright (1909) considered the grizzlies in the region to be skilled at catching fishing. Today, salmon have been reduced to minor numbers in all the river systems in the BEA and steelhead are common only in the lower Clearwater River and Salmon River.

The importance of fish to grizzly bears in the BEA in the past will never be known. Of more concern is of what importance fish, or the lack of, may be to a future grizzly bear population. We note that grizzly bears in other ecosystems do not have access to an anadromous fishery, especially the Cabinet-Yaak, Selkirk, and Northern Continental Divide Ecosystems. Some, but not all, grizzly bears in Yellowstone National Park prey on spawning cutthroat trout (*Salmo clarki*) (Knight et al. 1984). We believe that a strong anadromous fishery is not necessary for grizzly bear recovery in the BEA, provided other foods are available in significant amounts.

Herbaceous vegetation and tubers. Graminoids and forbs, including ferns and their allies, form a major component of grizzly bear diets across all ecosystems throughout all seasons that they are out of their dens (Servheen 1981, 1983; Craighead et al. 1982, Jonkel 1982, Aune et al. 1984, Knight et al. 1984, Almack 1985). Jon Almack, Washington Department of Wildlife, working on the North Cascades Grizzly Bear Evaluation, compiled a list of plants that are known grizzly bear foods in occupied ecosystems in the conterminous 48 United States and southern Canada. We used that list to compile a list of known grizzly bear foods that were sampled in the ecodata plots from the BEA (Table 6). Of the 114 graminoids and forbs that are known grizzly bear foods, 69 (60.5%) were found in the BEA (Table 7). Those plant taxa account for 119 (23.1%) of all the plant taxa identified in the BEA (Table 8).

Graminoids were well distributed, although often in small amounts, across all land cover classes (Appendix, Table 1-A). Sedges (*Carex* spp.) were particularly evenly distributed across all cover types. Sedges and rushes (*Juncus* spp.) were conspicuously dominant in riparian meadow and riparian shrub land cover classes. Bluebunch wheatgrass (*Agropyron spicatum*) and blue bunchgrass (*Festuca idahoensis*) were common in lower and mid to upper montane open conifer classes with grass/forb understories. Pinegrass (*Calamagrostis rubescens*) was common through all the lower

Table 6. List of known grizzly bear food plants found in the Bitterroot Evaluation Area. Complete list was compiled by Jon Almack, Washington Department of Game, from grizzly bear food habits studies in southern Canada and the conterminous 48 United States. Plants with exact species matches are indicated by an asterisk. Plants with matching genera are indicated by a dash.

Code	Scientific Name	Common Name
TREES		
*PINALB	*Pinus albicaulis*	whitebark pine
*PINMON	*Pinus monticola*	western white pine
-PYRMAL	*Malus* spp.	cultivated apple
SHRUBS		
*AMEALN	*Amelanchier alnifolia*	western serviceberry
*ARCUVA	*Arctostaphylos uva-ursi*	bearberry
*BERREP	*Berberis repens*	creeping Oregongrape
*CORSTO	*Cornus stolonifera*	creek dogwood
*CRADOU	*Crataegus douglasii*	black hawthorn
-CRATAE	*Crataegus* spp.	hawthorn
*LONCIL	*Lonicera ciliosa*	trumpet honeysuckle
*LONINV	*Lonicera involucrata*	bearberry honeysuckle
*LONUTA	*Lonicera utahensis*	Utah honeysuckle
*OPLHOR	*Oplopanax horridum*	devil's club
*PRUEMA	*Prunus emarginata*	bittercherry
*PRUVIR	*Prunus virginiana*	common chokecherry
*RIBBRA	*Ribes bracteosum*	stink currant
*RIBLAC	*Ribes lacustre*	swamp currant
*RIBVIS	*Ribes viscosissimum*	sticky currant
*ROSACI	*Rosa acicularis*	prickly rose
-ROSAXX	*Rosa* spp.	rose
*ROSGYM	*Rosa gymnocarpa*	baldhip rose
-ROSNUT	*Rosa nutkana*	Nootka rose
-ROSWOO	*Rosa woodsii*	Wood's rose
-RUBDIS	*Rubus discolor*	Himalayan blackberry
*RUBIDA	*Rubus idaeus*	red raspberry
-RUBLEU	*Rubus leucodermis*	black raspberry
-RUBNIV	*Rubus nivalis*	snow bramble
*RUBPAR	*Rubus parviflorus*	thimbleberry
-RUBURS	*Rubus ursinus*	Douglasberry
-RUBUSX	*Rubus* spp.	raspberry
-SALCAN	*Salix candida*	hoary willow
-SALDRU	*Salix drummondiana*	Drummond willow
-SALIXX	*Salix* spp.	willow
-SALSCO	*Salix scouleriana*	Scouler willow
*SAMCER	*Sambucus cerulea*	blue elderberry
*SAMRAC	*Sambucus racemosa*	black elderberry
*SHECAN	*Sherpherdia canadensis*	buffalo-berry

(continued)

Table 6, continued.

Code	Scientific Name	Common Name
*SORSCO	*Sorbus scopulina*	Cascade mountain-ash
*SORSIT	*Sorbus sitchensis*	Sitka mountain-ash
*SYMALB	*Symphoricarpos alba*	common snowberry
*VACCAE	*Vaccinium caespitosum*	dwarf bilberry
-VACCIN	*Vaccinium* spp.	bilberry
*VACGLO	*Vaccinium globulare*	globe huckleberry
*VACMEM	*Vaccinium membranaceum*	thin-leaved blueberry
*VACMYR	*Vaccinium myrtillus*	dwarf bilberry
-VACOCC	*Vaccinium occidentale*	western huckleberry
*VACSCO	*Vaccinium scoparium*	grouseberry
-VACULI	*Vaccinium uliginosum*	bog blueberry
GRAMINOIDS		
*AGRALB	*Agrostis alba*	redtop
-AGRINT	*Agropyron intermedium*	intermediate wheatgrass
-AGROPY	*Agropyron* spp.	wheatgrass
-AGRSCR	*Agropyron scribneri*	spreading wheatgrass
*AGRSPI	*Agropyron spicatum*	bluebunch wheatgrass
-BROANO	*Bromus anomalus*	nodding brome
-BROBRI	*Bromus brizaeformis*	rattle grass
-BROMUS	*Bromus* spp.	brome
-BROTEC	*Bromus tectorum*	cheat grass
-BROVUL	*Bromus vulgaris*	Columbia brome
*CALCAN	*Calamagrostis canadensis*	bluejoint reedgrass
*CALRUB	*Calamagrostis rubescens*	pinegrass
*CARCON	*Carex concinnoides*	northwest sedge
-CAREXX	*Carex* spp.	sedge
*CARGEY	*Carex geyeri*	elk sedge
-CARHEN	*Carex hendersonii*	Henderson's sedge
-CARILL	*Carex illiota*	sheep sedge
*CARNIG	*Carex nigricans*	black alpine sedge
-CARPAC	*Carex pachystachya*	thick-headed sedge
-CARROS	*Carex rossii*	Ross sedge
-CARSCO	*Carex scopulorum*	Holm's Rocky Mountain sedge
*DESCES	*Deschampsia cespitosa*	tufted hairgrass
*FESIDA	*Festuca idahoensis*	blue bunchgrass
-JUNCON	*Juncus confusus*	Colorado rush
-JUNCUS	*Juncus* spp.	rush
-JUNDRU	*Juncus drummondii*	Drummond's rush
*JUNPAR	*Juncus parryi*	Parry's rush
-LUZCAM	*Luzula campestris*	field woodrush
*LUZHIT	*Luzula hitchcockii*	smooth woodrush
-LUZPAR	*Luzula parviflora*	smallflowered woodrush
-LUZULA	*Luzula* spp.	woodrush
*PHLALP	*Phleum alpinum*	alpine timothy

(continued)

Table 6, continued.

Code	Scientific Name	Common Name
*PHLPRA	*Phleum pratense*	common timothy
*POAPRA	*Poa pratensis*	Kentucky bluegrass
-POASEC	*Poa secunda*	Sandberg's bluegrass
-POAXXX	*Poa* spp.	bluegrass
FORBS		
*ANGARG	*Angelica arguta*	Lyall's arguta
-CASFLA	*Castilleja flava*	yellow paintbrush
-CASLIN	*Castilleja linariaefolia*	narrow-leaved paintbrush
-CASMIN	*Castilleja miniata*	scarlet paintbrush
-CASTIL	*Castilleja* spp.	paintbrush
*CHIUMB	*Chimaphila umbellata*	prince's pine
-CIRARV	*Cirsium arvense*	Canada thistle
-CIRFOL	*Cirsium foliosum*	elk thistle
-CIRSIU	*Cirsium* spp.	thistle
-CIRUND	*Cirsium undulatum*	wavy-leaved thistle
-CIRVUL	*Cirsium vulgare*	common thistle
*CLALAN	*Claytonia lanceolata*	western springbeauty
*CLIUNI	*Clintonia uniflora*	beadlily
*CORCAN	*Cornus canadensis*	bunchberry dogwood
-DISHOO	*Disporum hookeri*	Hooker fairy-bell
-DISPOR	*Disporum* spp.	fairy-bell
-DISTRA	*Disporum trachycarpum*	wartberry fairy-bell
*EPIANG	*Epilobium angustifolium*	fireweed
*ERYGRA	*Erythronium grandiflorum*	pale fawn-lily
*FRAVES	*Fragaria vesca*	woods strawberry
*FRAVIR	*Fragaria virginiana*	blueleaf strawberry
*HEDSUL	*Hedysarum sulphurescens*	yellow hedysarum
*HERLAN	*Heracleum lanatum*	cow-parsnip
-HIEALB	*Hieracium albiflorum*	white-flowered hawkweed
-HIEALE	*Hieracium albertinum*	western hawkweed
*HIEGRA	*Hieracium gracile*	slender hawkweed
-HIERAC	*Hieracium* spp.	hawkweed
*LIGCAN	*Ligusticum canbyi*	Canby's lovage
-LIGGRA	*Ligusticum grayi*	Gray's lovage
-LIGUST	*Ligusticum* spp.	lovage
*LIGVER	*Ligusticum verticillatum*	verticillate-umbel lovage
-LOMATI	*Lomatium* spp.	biscuit-root
*LOMDIS	*Lomatium dissectum*	fern-leaved lomatium
-LOMTRI	*Lomatium triternatum*	nine-leaf lomatium
*LYSAME	*Lysichitum americanum*	skunk cabbage
-MERCAM	*Mertensia campanulata*	Idaho bluebells
-MERPAN	*Mertensia paniculata*	tall bluebells
-MERTEN	*Mertensia* spp.	lungwort
*MITBRE	*Mitella brewerii*	Brewer's mitrewort

(continued)

Table 6, continued.

Code	Scientific Name	Common Name
-MITCAU	*Mitella caulescens*	leafy mitrewort
-MITELL	*Mitella* spp.	mitrewort
-MITPEN	*Mitella pentandra*	alpine mitrewort
-MITSTA	*Mitella stauropetala*	side-flowered mitrewort
*OSMCHI	*Osmorhiza chilensis*	mountain sweet-root
-OSMOCC	*Osmorhiza occidentalis*	western sweet-root
-OSMORH	*Osmorhiza* spp.	sweet-root
-POLMAJ	*Polygonum majus*	wiry knotweed
-POLMIN	*Polygonum minimum*	broadleaf knotweed
-POLPHY	*Polygonum phytolaccifolium*	alpine knotweed
-POLSPE	*Polygonum spergulariaeforme*	fall knotweed
-POLYGO	*Polygonum* spp.	doorweed
-RANACI	*Ranunculus acriformis*	sharp buttercup
-RANACR	*Ranunculus acris*	meadow buttercup
-RANUNC	*Ranunculus* spp.	buttercup
-RANUNI	*Ranunculus uncinatus*	little buttercup
-RUMACE	*Rumex acetosella*	sheep sorrel
-RUMCRI	*Rumex crispus*	curly dock
-RUMEXX	*Rumex* spp.	dock
*SENTRI	*Senecio triangularis*	groundsel
*SMIRAC	*Smilacina racemosa*	western Solomon-plume
*SMISTE	*Smilacina stellata*	starry Solomon-plume
*STRAMP	*Streptopus amlexifolius*	clasping-leaved twisted-stalk
-TARAXA	*Taraxacum* spp.	dandelion
*TAROFF	*Taraxacum officinale*	common dandelion
*TIATRI	*Tiarella trifoliata*	coolwort
-TRIDOU	*Trifolium douglasii*	Douglas' clover
-TRIFOL	*Trifolium* spp.	clover
-TRILAT	*Trifolium latifolium*	twin clover
*TRIOVA	*Trillium ovatum*	white trillium
*TRIPRA	*Trifolium pratense*	red clover
*TRIREP	*Trifolium repens*	white clover
-VERATR	*Veratrum* spp.	false hellebore
-VERCAL	*Veratrum californicum*	California false hellebore
*VERVIR	*Veratrum viride*	American false hellebore
-VIOADU	*Viola adunca*	early blue violet
*VIOGLA	*Viola glabella*	stream violet
-VIOLAX	*Viola* spp.	violet
-VIOORB	*Viola orbiculata*	round-leaved violet
*XERTEN	*Xerophyllum tenax*	beargrass
FERNS AND ALLIES		
*EQUARV	*Equisetum arvense*	common horsetail
-EQUISE	*Equisetum* spp.	horsetail
*GYMDRY	*Gymnocarpium dryopteris*	oak-fern
*PTEAQU	*Pteridium aquilinum*	bracken

Table 7. Number and proportion of known grizzly bear food plants from southern Canada and the conterminous 48 United States found in the Bitterroot Evaluation Area.

	Trees and Shrubs		Graminoids and Forbs	
	Known	In BEA	Known	In BEA
Number of Species	42	33 (78.6%)	83	45 (54.2%)
Additional genera	7	6 (85.7%)	28	24 (85.7%)
Additional other	0	0 (0.0%)	3	0 (0.0%)
Total taxa	49	39 (79.6%)	114	69 (60.5%)

Table 8. Number and proportion of plant taxa found in the Bitterroot Evaluation Area known as grizzly bear food plants in southern Canada and the conterminous 48 United States.

	Trees and Shrubs	Graminoids and Forbs
Number of species	31 (23.5%)	47 (9.1%)
Additional genera	17 (12.9%)	72 (14.0%)
Total food plants in BEA	48 (36.4%)	119 (23.1%)
Total taxa in BEA	132	515

and mid to upper montane conifer types. Smooth woodrush (*Luzula hitchcockii*) was common in subalpine land cover classes. Individual plots often had high cover of various grasses or sedges, most notably bluejoint reedgrass (*Calamagrostis canadensis*), cheat grass (*Bromus tectorum*), rush, bluegrass (*Poa* spp.), and timothy (*Phleum* spp.).

Forbs were also well distributed across all cover types, but unlike grasses, rarely occurred with high percentage cover, with the exception of tall bluebells (*Mertensia paniculata*), beargrass (*Xerophyllum tenax*) and bracken (*Pteridium aqulinum*) in shrub classes, upper montane and subalpine classes, and the lower montane and mid to upper conifer classes, respectively.

Fruits and nuts. Trees and shrubs bearing fruit and nuts are particularly important to grizzly bears for weight gain in preparation for denning. Of the 49 taxa of known tree and shrub grizzly bear food plants, 39 (79.6%) were found in the BEA (Table 7). Forty-eight (36.4%) of the 132 tree and shrub taxa that we found in the BEA are known grizzly bear foods (Table 8).

Whitebark pine (*Pinus albicaulis*) was consistently present with moderate percentage cover in all of the non-riparian subalpine land cover classes in the BEA (Appendix, Table 1-A). A mountain pine beetle (*Dendroctonus monticolae*) infestation killed much of the whitebark pine in the Bitterroot Mountains between 1909 and 1940 (Arno 1970, Pfister et al. 1977). Our data suggests that significant amounts of whitebark pine remain or are regenerating. During our studies, we found bear scats (most likely black bear) consisting almost entirely of whitebark pine nuts. Whitebark pine represents a potentially important source of high energy bear food in the BEA.

Berries are well known food items of grizzly bears across all ecosystems, particularly huckleberries (*Vaccinium* spp.). Globe huckleberry (*V. globulare*) was consistently found with high percentage cover in nearly all of the mid to upper montane and subalpine land cover classes (Table 9). Grouseberry (*V. scoparium*) was even more common in the subalpine classes. Thimbleberry (*Rubus parviflorus*) and rose (*Rosa* spp.) were common in the mid to upper montane classes. A variety of other shrubs were distributed across most land cover classes at lower percentage cover, including western serviceberry (*Amelanchier alnifolia*), bearberry (*Arctostaphylos uva-ursi*), creeping Oregongrape (*Berberis repens*), Utah honeysuckle (*Lonicera utahensis*), bittercherry (*Prunus emarginata*), common chokecherry (*P. virginiana*), and common snowberry (*Symphoricarpos albus*). These and other species, including hawthorn (*Crataegus* spp.), sometimes occur in concentrations, particularly along streams, where black bears utilize them heavily in the late summer and fall.

CONCLUSIONS

The BEA appears to meet many of the habitat criteria defined by Craighead et al. (1982) for grizzly bear habitat. The biological factors related to space, isolation, denning, vegetation and food appear adequate for grizzly bear recovery. Sanitation problems are minor and should be easily rectified with education and regulatory programs. The major obstacle to successful grizzly bear recovery in the BEA are related to potential human-caused mortality. Those mortality sources are primarily associated with hunting, poaching and conflicts associated with U.S. Highway 12. Successful grizzly bear recovery in the BEA will depend on addressing these potential mortality sources through education, enforcement, and regulatory changes.

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APPENDIX

List of Tables

Table 1-A. Constancy and mean percent cover of known grizzly bear food-plants in the Bitterroot Evaluation Area. Two values are given for each observed plant taxa: the value on top is the constancy value (proportion of plots with plant taxa / number of plots sampled * 10), the value on the bottom is the mean percent cover when the plant taxa was present. Refer to table 6 for names to plant taxa codes.

Cover Class	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
No. of Plots	0	101	37	42	1	1	15	0	22	7	40	2	14	23	78	6	4	37	4	108	31	24	4	39	45	260	0	1	103	4	68	8	64	11	71	69	164
TREES																																					
PINALB	.	2	0	0	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	1	3	7	6	3	3	4
	.	3	3	20	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	1	10	10	12	6	3	6
PINMON	.	.	1	0	.	.	.	.	.	.	.	.	.	.	1	2	.	1	.	1	1	1	3	1	2	1	.	.	0	.	0	.	0	1	1	1	0
	.	.	4	10	.	.	.	.	.	.	.	.	.	.	1	1	.	2	.	1	4	2	1	1	1	1	.	.	1	.	3	.	1	1	1	1	1
PYRMAL	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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SHRUBS																																					
AMEALN	.	2	2	3	.	.	7	.	7	7	8	10	8	8	7	3	3	2	.	5	5	7	5	5	5	7	.	.	1	3	3	.	1	1	1	1	1
	.	6	2	2	.	.	1	.	2	3	2	1	3	2	2	5	1	1	.	7	6	2	5	4	4	2	.	.	1	3	2	.	2	1	4	3	2
ARCUVA	.	1	.	0	.	.	2	.	.	.	1	10	4	1	3	2	.	1	.	0	0	3	3	1	1	0	.	.	0	.	.	.	.	.	0	.	.
	.	1	.	10	.	.	10	.	.	.	4	2	10	10	8	1	.	1	.	1	3	10	10	5	22	5	.	.	3	.	.	.	.	.	30	.	.
BERREP	.	1	1	0	.	.	2	.	4	1	3	5	6	5	3	2	.	1	.	2	1	4	5	2	3	2	.	.	0	3	1	.	0	.	0	0	0
	.	2	1	2	.	.	2	.	2	1	2	1	3	2	1	3	.	1	.	4	2	1	1	2	1	1	.	.	1	1	1	.	1	.	2	1	2
CORSTO	.	.	1	1	.	.	.	.	0	1	.	.	.	.	1	.	.	.	3	1	2	.	.	1	0	1	.	.	.	.	.	.	.	.	.	.	.
	.	.	1	1	.	.	.	.	3	3	.	.	.	.	1	.	.	.	1	6	8	.	.	4	2	6	.	.	.	.	.	.	.	.	.	.	.
CRADOU	.	0	1	0	.	.	1	.	.	1	.	.	.	.	.	.	.	1	.	0	0	0	.	1	1	0	.	.	.	.	.	.	.	.	.	.	.
	.	2	2	3	.	.	1	.	.	1	.	.	.	.	.	.	.	1	.	30	3	1	.	1	1	4	.	.	.	.	.	.	.	.	.	.	.
CRATAE	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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LONCIL	.	0	.	0	.	.	.	.	0	1	.	.	.	.	1	.	3	.	.	0	1	1	.	1	1	2	.	.	.	.	.	.	.	.	.	0	.
	.	3	.	1	.	.	.	.	1	1	.	.	.	.	1	.	1	.	.	1	1	1	.	1	1	1	.	.	.	.	.	.	.	.	.	1	.
LONINV	.	.	.	0	.	.	.	.	.	1	.	.	1	.	0	.	.	0	.	0	.	0	.	1	0	0	.	.	.	.	.	.	.	.	0	0	0
	.	.	.	2	.	.	.	.	.	1	.	.	3	.	2	.	.	1	.	1	.	1	.	1	2	1	.	.	.	.	.	.	.	.	1	1	1
LONUTA	.	0	2	1	10	10	.	.	2	.	.	.	1	3	2	.	.	1	.	4	2	2	5	5	2	4	.	.	1	.	2	4	2	1	3	3	3
	.	1	2	2	3	3	.	.	2	.	.	.	3	2	1	.	.	1	.	4	5	1	1	3	2	2	.	.	3	.	2	8	2	3	2	3	2
OPLHOR	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	0	.	1	.	.	.	.	.	.	.	.	.	.	.
	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	.	3	.	.	.	.	.	.	.	.	.	.	.
PRUEMA	.	.	.	1	.	.	1	.	3	4	1	.	.	3	1	.	.	1	3	3	3	2	3	1	3	1	.	.	.	3	1	.	0	.	1	.	0
	.	.	.	1	.	.	1	.	3	5	1	.	.	1	2	.	.	2	1	7	5	2	10	5	4	4	.	.	.	20	2	.	1	.	1	.	1
PRUVIR	.	0	0	0	.	.	1	.	.	3	1	.	2	2	1	.	.	1	.	1	1	2	.	1	0	1	.	.	.	3	0	.	.	.	0	.	.
	.	6	1	1	.	.	1	.	.	1	3	.	1	1	3	.	.	3	.	5	4	1	.	1	1	2	.	.	.	10	1	.	.	.	1	.	.

(continued)

Table 9, continued.

Cover Class	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
RIBBRA	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	0	.	.	.	.	0	.
	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1	.	.	.	.	1	.
RIBLAC	.	0	.	0	.	.	.	.	0	.	.	.	1	0	1	.	.	1	.	1	.	2	.	2	2	1	.	.	1	3	1	.	1	1	1	1	1
	.	1	.	1	.	.	.	.	1	.	.	.	3	1	1	.	.	2	.	1	.	1	.	1	2	3	.	.	3	1	2	.	1	1	1	1	1
RIBVIS	.	0	.	.	.	.	.	.	2	.	.	.	.	0	0	.	.	1	3	2	2	1	.	0	1	1	.	.	1	.	1	.	0	.	0	.	0
	.	1	.	.	.	.	.	.	9	.	.	.	.	1	2	.	.	7	1	2	5	1	.	1	2	1	.	.	1	.	4	.	2	.	1	.	1
ROSACI	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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ROSAXX	.	0	1	1	.	.	1	.	3	1	3	10	5	3	3	2	.	1	3	2	5	2	5	1	3	3	.	.	.	3	1	.	0	.	0	0	0
	.	4	2	1	.	.	1	.	2	1	1	7	1	1	1	3	.	2	1	8	2	1	5	5	4	3	.	.	.	10	2	.	10	.	5	2	5
ROSGYM	.	0	1	1	.	.	.	.	4	4	1	.	3	2	4	.	.	1	.	3	2	3	.	4	3	4	.	.	0	.	1	.	0	.	1	0	1
	.	1	1	1	.	.	.	.	1	1	1	.	1	1	1	.	.	1	.	2	2	1	.	1	1	1	.	.	1	.	1	.	3	.	1	1	2
ROSNUT	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	.	.	.	.	0	.	.	.	.	0	0	.	.	.	.	.	.	0	.	.	.	0
	.	.	.	.	.	.	.	.	.	.	.	.	.	3	3	.	.	.	.	3	.	.	.	.	1	1	.	.	.	.	.	.	1	.	.	.	3
ROSWOO	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	.	.	.	.	0	.	0	.	0	0	0	.	.	.	.	0	.	.	.	.	0	0
	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	1	.	1	.	1	1	1	.	.	.	.	1	.	.	.	.	1	1
RUBDIS	.	.	0	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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RUBIDA	.	0	.	0	.	.	2	.	0	1	.	.	.	1	1	2	.	1	.	0	1	0	.	.	.	0	.	.	0	.	0	.	.	.	0	0	.
	.	1	.	1	.	.	1	.	1	1	.	.	.	1	1	3	.	1	.	1	1	1	.	.	.	2	.	.	3	.	1	.	.	.	3	1	.
RUBLEU	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.
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RUBNIV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.
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RUBPAR	.	0	1	2	.	.	.	.	5	9	.	.	1	2	3	3	3	1	8	6	5	2	.	5	5	6	.	.	1	3	2	.	1	.	2	1	1
	.	1	2	2	.	.	.	.	7	1	.	.	2	1	4	7	20	13	1	7	7	5	.	12	8	3	.	.	2	10	2	.	4	.	5	2	3
RUBURS	.	.	1	0	.	.	.	.	.	.	.	.	1	.	0	2	.	0	.	.	0	.	.	1	0	0	.	.	.	.	.	.	.	.	.	.	.
	.	.	1	1	.	.	.	.	.	.	.	.	3	.	1	3	.	1	.	.	1	.	.	1	1	1	.	.	.	.	.	.	.	.	.	.	.
RUBUSX	.	1	.	.	.	.	.	.	1	.	0	.	.	0	1	.	.	.	.	0	0	.	.	0	.	0	.	.	0	.	.	.	0	.	.	.	.
	.	4	.	.	.	.	.	.	1	.	1	.	.	1	1	.	.	.	.	3	1	.	.	1	.	1	.	.	2	.	.	.	1	.	.	.	.
SALCAN	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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SALDRU	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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(continued)

Table 9, continued.

Cover Class	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
SALIXX	.	1	0	2	10	.	1	.	3	4	1	.	4	2	2	.	.	2	.	2	1	0	.	1	2	1	.	10	0	.	1	.	0	1	1	2	1
	.	7	1	2	3	.	1	.	4	14	2	.	3	3	3	.	.	13	.	10	10	1	.	7	15	3	.	50	6	.	11	.	7	1	2	4	2
SALSCO	.	0	0	0	.	.	2	.	2	1	2	5	2	3	3	.	.	1	.	1	2	.	.	1	1	1	.	.	0	.	1	.	0	1	1	1	1
	.	2	1	1	.	.	4	.	11	1	1	1	15	10	6	.	.	15	.	11	11	.	.	15	8	7	.	.	3	.	11	.	1	1	18	5	2
SAMCER	.	.	.	.	.	.	.	.	.	3	0	.	1	.	.	2	.	.	.	1	1	.	.	1	0	0	.	.	0	.	0	.	.	.	.	0	.
	.	.	.	.	.	.	.	.	.	1	1	.	1	.	.	3	.	.	.	1	1	.	.	1	1	1	.	.	1	.	1	.	.	.	.	1	.
SAMRAC	.	0	1	.	.	.	.	.	1	.	1	.	.	1	.	.	3	1	8	2	2	1	.	1	2	1	.	.	0	5	1	3	1	.	0	1	0
	.	2	1	.	.	.	.	.	2	.	1	.	.	1	.	.	1	1	1	3	1	2	.	4	1	1	.	.	2	1	1	1	2	.	1	1	1
SHECAN	.	.	.	.	.	.	.	.	.	.	0	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	0	.	0
	.	.	.	.	.	.	.	.	.	.	1	.	3	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	3	.	3
SORSCO	.	.	0	0	.	.	.	.	2	.	1	.	1	3	1	3	.	1	3	2	.	1	3	2	1	1	.	.	1	5	2	1	1	1	1	2	1
	.	.	1	1	.	.	.	.	3	.	1	.	3	2	2	2	.	1	3	3	.	1	1	4	1	1	.	.	1	2	3	1	2	20	2	2	2
SORSIT	.	.	0	.	.	.	.	.	.	.	.	.	1	.	0	.	.	.	.	0	.	.	.	.	0	0	.	.	.	.	1	.	0	.	0	0	.
	.	.	1	.	.	.	.	.	.	.	.	.	3	.	1	.	.	.	.	3	.	.	.	.	1	1	.	.	.	.	4	.	3	.	3	1	.
SYMALB	.	1	2	3	.	.	4	.	5	7	4	5	8	6	7	5	3	1	5	5	5	5	8	5	6	6	.	.	.	.	1	.	.	.	0	0	0
	.	3	4	2	.	.	4	.	2	1	6	30	6	6	3	11	1	1	5	7	4	4	1	3	5	3	.	.	.	.	3	.	.	.	2	3	2
VACCAE	.	.	.	0	10	.	.	.	1	.	.	.	1	3	1	.	.	.	.	.	.	1	3	1	0	0	.	10	0	.	1	1	0	2	1	2	0
	.	.	.	1	3	.	.	.	5	.	.	.	3	4	8	.	.	.	.	.	.	5	3	2	1	1	.	1	1	.	2	20	3	2	9	1	1
VACCIN	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	0	.	1	.	.	.	0	.	.	0	.	0	.	0	1	.	0	.
	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	12	.	7	.	.	.	7	.	.	7	.	1	.	5	30	.	1	.
VACGLO	.	0	2	1	.	.	.	.	2	.	.	.	4	3	2	2	3	1	3	5	2	3	3	3	5	4	.	10	3	.	4	4	3	5	6	6	7
	.	1	7	5	.	.	.	.	2	.	.	.	3	6	4	10	1	1	3	13	12	7	3	13	15	6	.	1	5	.	8	5	10	19	11	11	14
VACMEM	.	.	.	0	.	.	.	.	2	.	0	.	1	0	2	.	.	1	.	1	1	1	.	3	1	1	.	.	1	.	1	.	1	.	0	0	2
	.	.	.	3	.	.	.	.	11	.	10	.	1	1	4	.	.	3	.	3	2	1	.	6	4	5	.	.	4	.	8	.	4	.	18	2	14
VACMYR	.	0	0	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	3	0	.	0	.	.	0	.	.	.	0	1	1	0	1
	.	3	1	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	10	1	.	2	.	.	10	.	.	.	3	1	3	12	3
VACOCC	.	.	.	0	10	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	0	.	0	1	.
	.	.	.	10	10	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	12	.	20	.	40	8	.
VACSCO	.	1	1	0	.	.	.	.	.	.	.	.	.	1	1	.	.	1	.	0	.	2	.	2	1	1	.	10	6	.	4	9	6	9	6	7	6
	.	4	3	3	.	.	.	.	.	.	.	.	.	12	3	.	.	2	.	20	.	6	.	7	18	8	.	1	9	.	11	19	15	27	18	13	21
VACULI	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	0	.	.	.	.	.	.	.	.	.	.	.
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(continued)

Table 9, continued.

Cover Class	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
GRAMINOIDS																																					
AGRALB	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	0	.	0	.	0	.	0	.	.	.	.	.	.	.	.	.	.	.
	.	.	.	30	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	3	.	3	.	3	.	10	.	.	.	.	.	.	.	.	.	.	.
AGRINT	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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AGROPY	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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AGRSCR	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	0	.	.	.	.	.	.
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AGRSPI	.	1	0	1	.	.	1	.	0	.	4	.	1	2	1	.	.	0	.	0	0	3	5	0	2	0	.	.	.	.	1	.	.	.	0	.	.
	.	23	3	2	.	.	7	.	3	.	11	.	10	8	5	.	.	10	.	7	1	12	42	1	6	6	.	.	.	.	10	.	.	.	3	.	.
BROANO	.	.	.	0	.	.	1	.	.	.	2	.	.	0	.	.	.	.	.	0	.	.	.	.	0	0	.	.	.	.	.	.	.	.	.	.	.
	.	.	.	2	.	.	3	.	.	.	1	.	.	3	.	.	.	.	.	1	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.
BROBRI	.	.	.	0	.	.	.	.	0	1	0	.	.	.	0	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.
	.	.	.	1	.	.	.	.	1	3	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.
BROMUS	.	.	.	.	.	.	.	.	0	.	1	.	.	.	0	.	.	0	.	.	.	0	.	.	0	.	.	.	0	.	0	.	0	.	.	.	.
	.	.	.	.	.	.	.	.	1	.	3	.	.	.	3	.	.	1	.	.	.	1	.	.	1	.	.	.	1	.	1	.	30	.	.	.	.
BROTEC	.	1	0	1	.	.	1	.	0	.	2	.	.	.	0	.	.	0	.	0	0	1	.	.	0	0	.	.	.	.	.	.	.	.	.	.	.
	.	35	3	1	.	.	10	.	10	.	9	.	.	.	1	.	.	3	.	30	1	3	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.
BROVUL	.	.	1	.	.	.	.	.	0	.	.	.	.	1	1	.	3	.	.	0	.	1	.	0	0	2	.	.	.	.	0	.	.	.	.	.	0
	.	.	1	.	.	.	.	.	1	.	.	.	.	1	1	.	1	.	.	3	.	2	.	1	1	3	.	.	.	.	1	.	.	.	.	.	1
CALCAN	.	0	1	1	10	.	.	.	.	.	.	.	.	.	0	2	.	0	.	0	0	0	.	1	1	0	.	10	0	.	1	3	.	.	1	2	0
	.	2	2	2	10	.	.	.	.	.	.	.	.	.	2	40	.	3	.	15	3	3	.	20	15	9	.	10	2	.	8	7	.	.	8	15	1
CALRUB	.	0	0	0	.	.	.	.	4	4	3	10	6	5	6	2	.	1	.	1	1	3	3	2	2	2	.	.	0	.	2	.	1	.	1	1	1
	.	11	3	1	.	.	.	.	9	5	20	20	17	14	7	40	.	8	.	10	15	10	10	9	3	4	.	.	2	.	4	.	2	.	8	2	11
CARCON	.	0	0	0	.	.	.	.	.	.	0	.	1	1	1	2	3	1	.	0	0	1	3	1	0	0	.	.	1	.	0	.	1	.	0	0	0
	.	1	1	1	.	.	.	.	.	.	1	.	3	2	2	20	70	7	.	14	3	3	1	1	1	1	.	.	3	.	1	.	1	.	3	3	2
CAREXX	.	3	2	2	10	10	1	.	3	4	1	5	1	2	2	7	3	4	3	4	4	3	8	2	3	2	.	10	5	8	5	6	5	3	5	5	2
	.	5	3	3	3	3	2	.	4	1	7	1	1	3	2	7	30	5	3	4	3	4	7	12	14	7	.	10	7	11	7	2	5	4	4	8	1
CARGEY	.	2	0	1	.	.	3	.	5	1	6	10	6	7	4	.	.	1	.	3	1	2	3	0	3	1	.	.	3	.	4	3	4	6	3	3	3
	.	4	1	1	.	.	2	.	7	3	4	2	8	4	4	.	.	2	.	12	12	4	1	1	6	3	.	.	7	.	5	7	6	17	5	7	6
CARHEN	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.
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(continued)

Table 9, continued.

Cover Class	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
CARILL	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	0	1	0	.	0	.	.	.	.	0	.	.	.	0	.	.	.	.
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CARNIG	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.
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CARPAC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.
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CARROS	.	0	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	0	.	0	.	.	.	0	.	0	.	.	1	.	0	.	0	1	0	0	.
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CARSCO	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	0	.
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FESIDA	.	1	0	1	.	.	1	.	.	.	3	.	.	0	0	.	.	0	.	.	.	1	3	0	1	0	.	.	1	.	0	1	1	1	0	.	0
	.	5	1	12	.	.	7	.	.	.	6	.	.	3	14	.	.	3	.	.	.	5	1	1	4	2	.	.	7	.	3	3	3	1	1	.	.
JUNCON	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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JUNCUS	.	0	.	0	.	10	.	.	0	1	.	.	.	.	.	2	5	.	.	1	0	.	.	.	0	.	.	.	0	.	0	.	0	.	.	1	.
	.	1	.	20	.	3	.	.	10	3	.	.	.	.	.	10	25	.	.	8	3	.	.	.	1	.	.	.	4	.	7	.	1	.	.	16	.
JUNDRU	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.
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JUNPAR	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	0	.	2	1	0	0	0
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LUZCAM	.	.	.	.	.	.	1	.	.	.	0	.	1	.	0	2	.	.	.	0	.	0	.	1	.	0	.	.	.	.	0	.	.	.	.	.	.
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LUZHIT	.	2	0	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	0	.	.	4	.	3	5	5	3	4	4	4
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LUZPAR	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	.	.	.	0	0	.	.	.	.	.	.	0	.	.	.	0
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LUZULA	.	0	1	0	.	.	.	.	.	.	.	.	.	0	0	.	3	.	.	0	0	.	.	1	0	1	.	.	.	.	.	.	.	.	0	0	.
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PHLALP	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.
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PHLPRA	.	0	0	1	.	.	.	.	1	1	.	.	.	0	.	3	.	1	.	1	0	1	.	2	1	0	.	.	0	.	.	.	.	.	0	0	.
	.	20	1	4	.	.	.	.	1	1	.	.	.	3	.	20	.	9	.	8	3	1	.	4	5	2	.	.	1	.	.	.	.	.	1	1	.

(continued)

Table 9, continued.

Cover Class	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
POAPRA	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	0	.	0	.	.	.	0	.	.	.	.	0	.	.	.	.	.	.
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POASEC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	0	.	0	.	.	.	.
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POAXXX	.	0	.	.	.	.	.	.	0	.	.	.	.	.	.	.	5	1	.	.	.	.	.	.	.	0	.	.	0	.	0	.	.	1	0	0	.
	.	1	.	.	.	.	.	.	30	.	.	.	.	.	.	.	10	5	.	.	.	.	.	.	.	30	.	.	1	.	10	.	.	1	3	5	.
FORBS																																					
ANGARG	.	.	1	0	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	0	2	.	.	0	.	1	.	.	.	.	.	.	.	.	.	.	0
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CASFLA	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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CASLIN	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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CASMIN	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	0	.	.	.	.	.	.	.	.	0	.	1	1	0	.	0	0	.
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CASTIL	.	0	.	.	.	.	2	.	2	.	1	.	1	2	1	2	3	0	.	0	1	0	.	.	0	0	.	.	0	.	1	.	0	.	0	.	0
	.	1	.	.	.	.	1	.	2	.	1	.	1	2	1	1	3	3	.	5	12	1	.	.	2	1	.	.	1	.	1	.	3	.	1	.	2
CHIUMB	.	0	1	.	.	.	.	.	1	1	0	5	2	2	3	.	.	1	.	1	1	1	3	3	1	3	.	.	0	.	.	.	0	.	1	0	3
	.	1	5	.	.	.	.	.	1	1	1	1	1	1	1	.	.	1	.	3	1	2	1	1	3	2	.	.	1	.	.	.	1	.	3	1	2
CIRARV	.	.	.	.	.	.	.	.	.	.	.	.	1	.	0	.	.	1	.	0	1	0	.	.	0	0	.	.	.	.	.	.	.	.	.	.	.
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CIRFOL	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.
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CIRSIU	.	0	.	0	.	.	1	.	2	1	.	.	1	3	0	.	.	1	.	1	2	1	.	1	0	0	.	.	1	3	0	.	0	.	0	0	0
	.	2	.	1	.	.	1	.	2	3	.	.	1	1	1	.	.	3	.	1	1	2	.	2	1	1	.	.	1	1	3	.	1	.	1	3	1
CIRUND	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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CIRVUL	.	.	0	.	.	.	.	.	.	.	1	.	1	.	0	.	.	1	.	0	1	0	.	.	0	0	.	.	.	.	.	.	0	.	.	.	.
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CLALAN	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.
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CLIUNI	.	.	2	1	.	.	.	.	1	3	.	.	1	1	2	.	3	1	.	3	4	3	3	5	4	7	.	.	0	.	0	.	0	.	1	1	2
	.	.	1	2	.	.	.	.	5	3	.	.	3	7	3	.	1	2	.	3	2	5	3	4	4	3	.	.	2	.	1	.	1	.	6	2	2

(continued)

Table 9, continued.

Cover Class	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
CORCAN	.	.	1	1	.	.	.	.	.	.	.	.	.	0	0	2	.	0	.	1	3	2	.	2	1	2	.	.	0	.	.	.	.	.	0	.	0
	.	.	1	1	.	.	.	.	.	.	.	.	.	1	1	3	.	3	.	1	4	2	.	3	3	3	.	.	3	.	.	.	.	.	5	.	1
DISHOO	.	.	2	1	.	.	.	.	1	4	0	.	1	1	2	2	3	0	.	3	4	0	3	2	2	6	.	.	.	3	.	.	.	.	.	.	0
	.	.	1	1	.	.	.	.	1	1	1	.	1	1	1	3	3	3	.	1	1	1	1	6	2	3	.	.	.	1	.	.	.	.	.	.	2
DISPOR	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.
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DISTRA	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	0	0	0	.	.	.	.	.	.	.	.	.	.	0
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EPIANG	.	1	0	1	10	.	1	.	5	.	1	10	3	3	1	.	.	1	8	4	3	1	3	2	2	1	.	10	3	8	4	6	1	3	2	4	1
	.	1	1	1	1	.	1	.	1	.	1	1	1	2	1	.	.	1	5	5	4	1	3	4	5	1	.	1	1	1	3	1	1	4	2	2	1
ERYGRA	.	1	0	.	.	.	.	.	0	.	1	10	3	2	1	.	.	.	5	1	2	.	.	1	2	1	.	.	2	.	1	4	1	.	2	2	1
	.	1	1	.	.	.	.	.	1	.	1	1	1	1	1	.	.	.	3	2	1	.	.	3	1	1	.	.	1	.	1	1	1	.	1	1	2
FRAVES	.	1	2	2	.	.	3	.	5	6	2	5	4	5	6	5	3	2	3	5	6	5	8	5	5	4	.	.	0	.	1	.	0	.	0	0	1
	.	1	1	1	.	.	1	.	2	2	1	1	2	2	2	2	1	2	3	5	3	2	1	1	2	1	.	.	4	.	1	.	1	.	1	1	1
FRAVIR	.	0	.	.	.	.	1	.	.	1	2	10	4	3	3	2	3	1	5	2	1	1	5	3	2	1	.	.	.	.	.	.	0	.	0	0	0
	.	1	.	.	.	.	1	.	.	1	1	1	2	1	1	3	1	2	5	8	7	1	1	4	2	2	.	.	.	.	.	.	3	.	10	1	1
HEDSUL	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.
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HERLAN	.	.	.	0	.	.	.	.	.	1	.	.	.	.	0	2	.	.	3	0	1	.	.	0	0	0	.	.	.	3	0	.	.	.	.	.	.
	.	.	.	1	.	.	.	.	.	3	.	.	.	.	1	3	.	.	10	3	1	.	.	1	2	1	.	.	.	1	2	.	.	.	.	.	.
HIEALB	.	0	1	0	.	.	1	.	2	3	1	.	1	2	3	.	3	1	.	1	2	3	5	2	3	4	.	.	1	.	0	.	1	1	1	1	1
	.	1	1	1	.	.	3	.	2	1	1	.	1	1	1	.	1	5	.	1	1	1	2	1	1	1	.	.	2	.	3	.	2	1	1	2	1
HIEALE	.	1	1	1	.	.	3	.	1	.	3	5	4	5	2	.	.	1	.	1	2	3	3	1	2	1	.	.	1	3	2	.	1	2	1	1	1
	.	1	1	1	.	.	1	.	1	.	1	1	1	1	1	.	.	1	.	1	1	1	3	2	1	1	.	.	2	1	1	.	1	1	1	1	1
HIEGRA	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.
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HIERAC	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	2	.	.	.	0	0	1	.	1	1	0	.	.	.	.	0	.	0	.	.	.	0
	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	3	.	.	.	3	1	2	.	3	5	1	.	.	.	.	7	.	3	.	.	.	2
LIGCAN	.	0	.	0	.	.	.	.	.	.	.	.	.	.	0	3	3	.	.	0	0	0	.	1	1	0	.	.	0	.	1	1	.	.	1	1	1
	.	1	.	3	.	.	.	.	.	.	.	.	.	.	2	2	10	.	.	5	10	3	.	2	2	5	.	.	3	.	6	1	.	.	4	3	2
LIGGRA	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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LIGUST	.	.	.	.	10	.	.	.	.	1	.	.	.	1	0	.	.	.	.	.	.	0	.	0	0	0	.	.	0	.	0	1	1	1	0	1	0
	.	.	.	.	3	.	.	.	.	10	.	.	.	2	2	.	.	.	.	.	.	1	.	1	1	1	.	.	4	.	1	1	1	3	1	2	1

(continued)

Table 9, continued.

Cover Class	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
LIGVER	.	.	1	.	.	.	.	.	1	1	1	.	1	1	1	.	.	0	3	1	.	1	3	1	1	2	.	.	.	.	1	.	.	.	0	0	0
	.	.	2	.	.	.	.	.	1	3	2	.	1	1	2	.	.	1	1	3	.	7	1	1	2	2	.	.	.	.	7	.	.	.	1	1	2
LOMATI	.	.	.	.	.	.	1	.	.	.	1	.	.	.	0	.	.	.	.	0	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	1	.	.	.	1	.	.	.	1	.	.	.	.	2	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
LOMDIS	.	0	0	1	.	10	2	.	.	1	1	.	1	0	1	.	.	0	.	0	1	1	.	.	0	0	.	.	.	.	0	.	.	.	0	.	.
	.	1	1	1	.	3	2	.	.	1	1	.	3	1	1	.	.	1	.	2	1	1	.	.	1	1	.	.	.	.	1	.	.	.	1	.	.
LOMTRI	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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LYSAME	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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MERCAM	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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MERPAN	.	.	0	.	.	.	.	.	.	.	.	.	.	.	0	3	.	1	5	2	0	1	3	1	1	0	.	.	0	5	0	1	0	.	.	0	0
	.	.	3	.	.	.	.	.	.	.	.	.	.	.	2	15	.	2	20	4	10	10	1	1	1	2	.	.	17	7	2	1	1	.	.	1	2
MERTEN	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	0	.	0	0	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	0
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MITBRE	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	0	3	0	0	0	.	10	0	.	0	.	0	.	0	0	0
	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	1	1	1	1	1	.	1	1	.	1	.	3	.	1	1	1
MITCAU	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.
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MITELL	.	.	0	.	.	.	.	.	1	1	.	.	.	.	1	.	3	1	.	2	1	1	.	2	2	2	.	.	0	.	1	.	0	.	1	0	1
	.	.	1	.	.	.	.	.	2	3	.	.	.	.	1	.	1	1	.	3	1	1	.	1	1	1	.	.	2	.	1	.	1	.	2	3	2
MITPEN	.	.	0	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	0	.	.	0	.	.	.	.	.	.	0	0
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MITSTA	.	0	1	0	.	.	1	.	0	1	0	.	.	.	0	.	.	1	3	2	3	0	.	1	2	1	.	.	0	.	0	.	.	.	.	.	0
	.	1	1	1	.	.	1	.	1	1	1	.	.	.	1	.	.	5	3	2	1	3	.	2	1	1	.	.	7	.	1	.	.	.	.	.	3
OSMCHI	.	0	1	1	.	.	.	.	1	6	.	.	1	1	3	3	3	1	3	2	2	2	3	4	2	6	.	.	0	.	0	.	0	.	0	0	1
	.	1	1	1	.	.	.	.	2	1	.	.	1	1	1	2	1	1	1	1	1	1	1	1	1	1	.	.	1	.	1	.	1	.	1	1	1
OSMOCC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0
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OSMORH	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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POLMAJ	.	.	.	1	.	.	1	.	.	.	2	.	.	.	0	.	.	0	.	0	.	.	.	.	1	0	.	.	.	.	0	.	.	.	.	.	.
	.	.	.	1	.	.	1	.	.	.	1	.	.	.	1	.	.	3	.	1	.	.	.	.	1	1	.	.	.	.	1	.	.	.	.	.	.

(continued)

Table 9, continued.

Cover Class	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
POLMIN	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.
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POLPHY	.	0	.	.	.	.	.	.	0	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	1	.	1	0	0
	.	3	.	.	.	.	.	.	1	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	1	.	1	.	1	1	3
POLSPE	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.
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POLYGO	.	0	0	0	.	.	.	.	.	.	1	.	.	.	.	.	.	0	.	0	.	2	3	.	0	0	.	.	.	.	0	.	.	.	0	.	.
	.	1	1	1	.	.	.	.	.	.	1	.	.	.	.	.	.	1	.	1	.	1	1	.	1	2	.	.	.	.	2	.	.	.	1	.	.
RANACI	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.
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RANACR	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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RANUNC	.	0	.	0	.	.	.	.	0	.	0	.	1	0	0	2	.	1	.	1	1	0	3	1	1	0	.	.	1	.	0	.	0	.	0	0	0
	.	1	.	1	.	.	.	.	1	.	3	.	3	1	1	3	.	1	.	1	1	1	1	1	1	1	.	.	1	.	1	.	1	.	1	4	1
RANUNI	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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RUMACE	.	.	0	1	.	.	.	.	.	.	0	.	.	.	.	2	.	1	.	0	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.
	.	.	1	2	.	.	.	.	.	.	3	.	.	.	.	1	.	3	.	4	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
RUMCRI	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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RUMEXX	.	1	.	1	.	.	1	.	1	.	1	.	1	0	0	.	3	2	.	1	0	3	.	1	0	1	.	.	1	.	0	.	1	1	0	1	0
	.	2	.	1	.	.	2	.	1	.	1	.	1	1	1	.	3	1	.	3	1	1	.	7	1	1	.	.	13	.	7	.	9	10	23	8	7
SENTRI	.	0	0	0	.	.	.	.	1	1	.	.	1	0	1	2	.	0	3	2	1	2	3	2	2	1	.	.	1	5	1	4	1	1	2	2	1
	.	2	1	1	.	.	.	.	2	1	.	.	3	3	2	1	.	1	3	2	2	4	1	2	1	2	.	.	2	10	1	7	2	1	2	1	3
SMIRAC	.	.	.	0	.	.	.	.	.	1	0	.	.	.	1	.	.	0	.	0	1	.	.	0	1	1	.	.	.	.	1	.	.	.	.	.	0
	.	.	.	1	.	.	.	.	.	1	1	.	.	.	1	.	.	1	.	3	1	.	.	3	1	1	.	.	.	.	1	.	.	.	.	.	1
SMISTE	.	.	1	1	.	.	.	.	2	6	.	5	1	2	3	3	.	1	5	5	5	2	3	4	5	6	.	.	0	.	0	.	0	.	1	0	1
	.	.	1	1	.	.	.	.	2	4	.	1	1	1	2	7	.	1	3	4	2	4	1	3	4	3	.	.	1	.	1	.	2	.	5	1	2
STRAMP	.	.	.	1	.	.	.	.	.	.	.	.	.	0	0	.	.	.	.	0	.	0	.	1	0	1	.	.	.	.	0	.	.	.	0	0	0
	.	.	.	1	.	.	.	.	.	.	.	.	.	10	1	.	.	.	.	1	.	1	.	1	1	2	.	.	.	.	1	.	.	.	2	1	1
TARAXA	.	0	1	1	.	.	.	.	.	1	.	5	.	.	0	.	3	1	.	1	1	0	.	1	0	0	.	.	0	.	.	.	.	.	.	0	.
	.	1	1	2	.	.	.	.	.	1	.	1	.	.	1	.	3	1	.	1	1	1	.	1	1	1	.	.	1	.	.	.	.	.	.	1	.
TAROFF	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	2	.	1	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.
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(continued)

Table 9, continued.

Cover Class	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
TIATRI	.	.	1	1	.	.	.	.	.	.	.	.	.	0	1	.	.	.	.	1	2	2	3	2	1	4	.	.	0	.	.	.	0	.	1	0	1
	.	.	1	1	.	.	.	.	.	.	.	.	.	10	1	.	.	.	.	1	1	1	3	1	2	2	.	.	1	.	.	.	1	.	3	1	3
TRIDOU	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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TRIFOL	.	0	1	1	.	10	3	.	1	.	0	.	1	.	0	2	3	4	.	1	1	2	.	2	1	1	.	.	0	.	.	.	.	.	.	.	.
	.	1	1	1	.	1	1	.	1	.	1	.	1	.	1	3	3	2	.	2	5	2	.	5	1	3	.	.	1	.	.	.	.	.	.	.	.
TRILAT	.	0	1	0	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	0	1	.	.	0	.	1	.	.	.	.	.	.	.	.	.	.	.
	.	3	1	1	.	.	.	.	45	.	.	.	.	.	.	.	.	.	.	7	10	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.
TRIOVA	.	.	1	0	.	.	.	.	0	1	.	.	1	1	2	2	3	1	3	3	5	2	3	5	4	6	.	.	0	.	1	.	0	.	2	1	2
	.	.	1	1	.	.	.	.	1	1	.	.	1	1	1	50	1	1	1	1	1	1	1	2	1	1	.	.	1	.	1	.	1	.	1	1	1
TRIPRA	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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TRIREP	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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VERATR	.	0	0	.	.	.	.	.	.	1	.	.	.	.	.	.	3	.	.	0	.	.	.	0	0	0	.	.	0	5	1	4	0	.	1	1	0
	.	1	1	.	.	.	.	.	.	1	.	.	.	.	.	.	10	.	.	1	.	.	.	3	1	2	.	.	1	1	2	4	1	.	1	1	2
VERCAL	.	.	.	0	.	.	.	.	.	.	.	.	.	0	.	2	3	.	.	0	0	0	.	.	.	0	.	.	.	.	1	.	.	.	0	0	0
	.	.	.	1	.	.	.	.	.	.	.	.	.	1	.	20	1	.	.	5	3	1	.	.	.	3	.	.	.	.	1	.	.	.	1	10	2
VERVIR	.	.	.	.	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	0	.	.	.	.	0	0	.	.	0	.	1	.	0	1	1	0	0
	.	.	.	.	.	.	.	.	3	.	.	.	.	.	1	.	.	.	.	5	.	.	.	.	2	1	.	.	2	.	2	.	1	1	2	3	1
VIOADU	.	0	1	0	.	.	.	.	.	.	.	.	.	0	.	2	.	.	.	.	.	.	.	1	.	0	.	.	.	.	.	.	.	.	0	.	.
	.	1	1	.	.	.	.	.	.	.	.	.	.	1	.	10	.	.	.	.	.	.	.	7	.	1	.	.	.	.	.	.	.	.	1	.	.
VIOGLA	.	.	1	0	.	.	.	.	0	.	.	.	1	.	0	.	.	1	.	1	1	0	3	1	2	2	.	10	0	5	1	.	.	.	1	1	1
	.	.	1	2	.	.	.	.	1	.	.	.	1	.	1	.	.	1	.	1	1	3	3	1	3	1	.	1	3	1	1	.	.	.	1	2	1
VIOLAX	.	.	.	0	.	.	1	.	1	3	0	.	1	1	2	.	3	1	.	1	1	.	.	1	2	1	.	.	.	.	0	.	.	1	1	1	1
	.	.	.	1	.	.	1	.	2	2	1	.	1	2	2	.	1	1	.	1	1	.	.	2	1	2	.	.	.	.	3	.	.	1	6	1	2
VIOORB	.	0	1	0	10	.	.	.	0	.	.	.	1	0	1	.	.	1	.	1	2	1	3	3	2	4	.	.	0	.	.	.	0	.	1	1	2
	.	1	1	1	3	.	.	.	1	.	.	.	3	3	2	.	.	1	.	1	1	2	3	2	2	1	.	.	1	.	.	.	1	.	2	2	1
XERTEN	.	2	1	0	.	.	.	.	4	.	1	5	4	4	3	.	.	2	3	3	2	3	3	4	4	3	.	.	7	.	6	9	7	10	9	8	9
	.	9	30	30	.	.	.	.	16	.	1	30	1	26	8	.	.	8	1	9	6	13	20	19	10	11	.	.	15	.	18	30	14	31	17	24	22
FERNS AND ALLLIES																																					
EQUARV	.	.	1	1	.	.	.	.	0	3	.	.	.	.	0	2	.	2	.	0	1	0	.	1	1	0	.	.	.	.	0	.	.	.	.	0	0
	.	.	2	1	.	.	.	.	1	15	.	.	.	.	1	3	.	3	.	6	2	1	.	1	6	1	.	.	.	.	1	.	.	.	.	1	1

(continued)

Table 9, continued.

Cover Class	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
EQUISE	.	0	.	0	.	.	.	.	.	.	.	.	.	.	.	2	3	0	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	.	2	.	1	.	.	.	.	.	.	.	.	.	.	.	1	1	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
GYMDRY	.	.	1	.	.	.	.	.	.	.	.	.	.	.	0	.	.	.	.	0	1	.	.	1	0	1	.	.	.	.	.	.	.	.	.	.	.
	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	2	1	.	.	1	1	3	.	.	.	.	.	.	.	.	.	.	.
PTEAQU	.	0	1	1	.	.	2	.	4	7	1	.	1	3	3	5	.	2	10	5	5	3	.	3	4	4	.	.	0	5	1	.	0	1	0	0	0
	.	1	3	5	.	.	5	.	18	2	4	.	10	33	12	24	.	2	23	12	11	14	.	9	7	6	.	.	1	5	10	.	30	1	2	3	2