Black bear habitat use in west-central Idaho
by James W Unsworth

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Fish and Wildlife Management
Montana State University
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Abstract:
Black bear (Ursus americanus) habitat use patterns were studied in west-central Idaho from 1982-1983. Ten adult female bears were instrumented with radio transmitters. Bears' were relocated 64 0 times during the study. Uncut' timbered sites were important bedding areas and timber components along drainages served as travel corridors. Open timber components were used in spring as foraging areas. Open timber/shrubfield components were used as foraging areas and bedding sites. Riparian areas were preferred as feeding sites and used as travel corridors. Aspen components were preferred by bears with cubs. They provided dense horizontal cover and were often adjacent to shrubfields. The meadow component was used in the spring as a foraging area for grasses and forbs. Rock/talus and sagebrush/grass components were avoided. Selection cut/shrubfield components were preferred as feeding sites for berry species. Other selection cut components were used in proportion to availability. Clearcuts were avoided. Abies grandis/Vaccinium globulare, Abies grandis/Acer glabrum, and Pseudotsuga menziesii/Physocarpus malvaceus habitat types received over 90% of the use. The Abies grandis habitat types were important food producers and the Pseudotsuga menziesii/Physocarpus malvaceus habitat type was most often used for bedding. Topographic features that enhance the growth of mesic vegetation were preferred. Female bears preferred areas in cover, but would venture from cover to seek food. Timber and hunting management recommendations are presented.

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MONTANA STATE UNIVERSITY
Bozeman, Montana

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ABSTRACT

Black bear (Ursus americanus) habitat use patterns were studied in west-central Idaho from 1982-1983. Ten adult female bears were instrumented with radio transmitters. Bears were relocated 640 times during the study. Uncut timbered sites were important bedding areas and timber components along drainages served as travel corridors. Open timber components were used in spring as foraging areas. Open timber/shrubfield components were used as foraging areas and bedding sites. Riparian areas were preferred as feeding sites and used as travel corridors. Aspen components were preferred by bears with cubs. They provided dense horizontal cover and were often adjacent to shrubfields. The meadow component was used in the spring as a foraging area for grasses and forbs. Rock/talus and sagebrush/grass components were avoided. Selection cut/shrubfield components were preferred as feeding sites for berry species. Other selection cut components were used in proportion to availability. Clearcuts were avoided. Abies grandis/Vaccinium globulare, Abies grandis/Acer glabrum, and Pseudotsuga menziesii/Physocarpus malvaceus habitat types received over 90% of the use. The Abies grandis habitat types were important food producers and the Pseudotsuga menziesii/Physocarpus malvaceus habitat type was most often used for bedding. Topographic features that enhance the growth of mesic vegetation were preferred. Female bears preferred areas in cover, but would venture from cover to seek food. Timber and hunting management recommendations are presented.

INTRODUCTION

Black bear (Ursus americanus) populations occur throughout much of Idaho, but are largely confined to coniferous forests in the northern two-thirds of the state and isolated areas of eastern Idaho (Beecham 1977). There are many competing uses for these forested areas including mining, mineral and oil exploration, recreation, water development, livestock grazing, and timber production. Many of these uses have dramatic effects on wildlife habitats, but timber production and the associated increase in access probably has the greatest effect on black bears. In the Pacific Northwest, thousands of hectares of timber are clearcut each year (Lindzey and Meslow 1977), and forest management plans that take black bear habitat needs into consideration are rare.

The effects of logging on wildlife have been described by many researchers. Wallmo et al. (1972) found that mule deer (Odocoileus hemionus) were attracted to logged areas which produced increased amounts and varieties of forage. Logging activities at low elevations have generally benefited white-tailed deer (Odocoileus virginianus) in the northern Rockies by providing seral shrubs which are important as winter forage (Pengelly 1963). In some areas

with heavy snow accumulation, overstory removal has had negative effects on white-tail populations that depend on dense stands to intercept snow on winter ranges (Mundinger 1979). Elk (*Cervus elaphus*) were found to use clearcuts less than 10 years old in proportion to availability, but avoided older cuts (Hershey and Leege 1976).

Gashwiler (1970) found varying responses of small mammal populations to clearcuts. Deer mice (*Peromyscus maniculatus*), Townsend's chipmunk (*Eutamias townsendii*), Oregon vole (*Microtus oregoni*), and snowshoe hare (*Lepus americanus*) populations increased in clearcut areas. Red-back voles (*Clethrionomys occidentalis*), Douglas' squirrels (*Tamiasciurus douglasii*), and northern flying squirrels (*Glaucomys sabrinus*) were eliminated from clearcut areas. Removal of old growth forests reduces habitat for pileated woodpeckers (*Dryocopus pileatus*) and the northern spotted owl (*Strix occidentialis*) (Luman and Neitro 1980), but habitat for early seral stage species such as mountain bluebird (*Sialia mexicana*) and Brewer's sparrow (*Spizella breweri*) is enhanced.

Black bear populations have been the focus of many kinds of studies in many areas of the United States and Canada (Barnes and Bray 1967, Beecham 1980, Erickson et al. 1964, Jonkel and Cowan 1971, Kemp 1972, Lindzey 1976, Stickley 1957). Activity and food habits studies have

provided important information on bear activity patterns and their relationship to the foods eaten by bears (Amstrup and Beecham 1976, Landers et al. 1979, Rogers 1976, Tisch 1961). Habitat use studies have been conducted in Montana (Jonkel and Cowan 1971), Alberta (Fuller and Keith 1980), California (Kelleyhouse 1980, Novick and Stewert 1982), and Virginia (Vaughan et al. 1983). Other studies related directly to timber management and bears have been conducted in Montana (Zager 1983), Idaho (Young 1984), and Washington (Lindzey and Meslow 1977). Because black bear populations are unique products of specific habitat parameters which influence population dynamics, social organization, reproductive potential, and availability of suitable den sites (Beecham 1980), data from differing geographic areas may not be applicable to west-central Idaho. With the increased popularity of black bears as game animals and increasing demands on forest lands as resource producers, management plans are needed that consider the welfare of black bears and their habitat.

The major goal of this research was to document female black bear habitat use patterns in the Middle Fork of the Weiser River drainage of west-central Idaho and to use this information in formulating timber management guidelines which can be used by land managers for the benefit of the black bear population in west-central Idaho. Specific objectives were to: 1) quantify seasonal habitat use by

female black bears and determine physical and environmental factors which affected utilization; 2) identify relationships that existed between black bear food plants (variety, abundance, and phenology) and habitat use; 3) identify the effect of different silvicultural practices on black bear habitat use; and 4) prepare timber management guidelines.

STUDY AREA

The study area is located on the Middle Fork of the Weiser River in west-central Idaho about 13 kilometers (km) southeast of Council, Idaho. Major geographic features include Council Mountain to the north and West Mountain Ridge to the east. Elevations range from 1070 meters (m) to 2470 m on Council Mountain (Figure 1).

Two major rock types are present: basalt rocks of the Columbia River Formation and granite rocks of the Idaho Batholith. Soils derived from basalt are fine to medium in texture with depths varying from 76 centimeters (cm) to 125 cm. Soils derived from granitic rocks are generally coarse textured and depths range from 60 cm to 100 cm. Erodibility of basaltic soil is low. Granitic soils are moderately to highly erodable. The area includes strongly glaciated, periglaciated, fluvial, and depositional lands (Larsen et al. 1973).

Climate is influenced by the Aleutian low in the winter months and the Pacific high during the summer. Mean annual precipitation ranges from 635 millimeters (mm) at lower elevations to 1143 mm at upper elevations. Eighty percent of the annual precipitation occurs from October through April as snow. Temperatures recorded at Council range from -32 degrees Clesius (C) to 43 degrees C, with a mean annual temperature of 3.7 degrees C (Larsen et al. 1973)

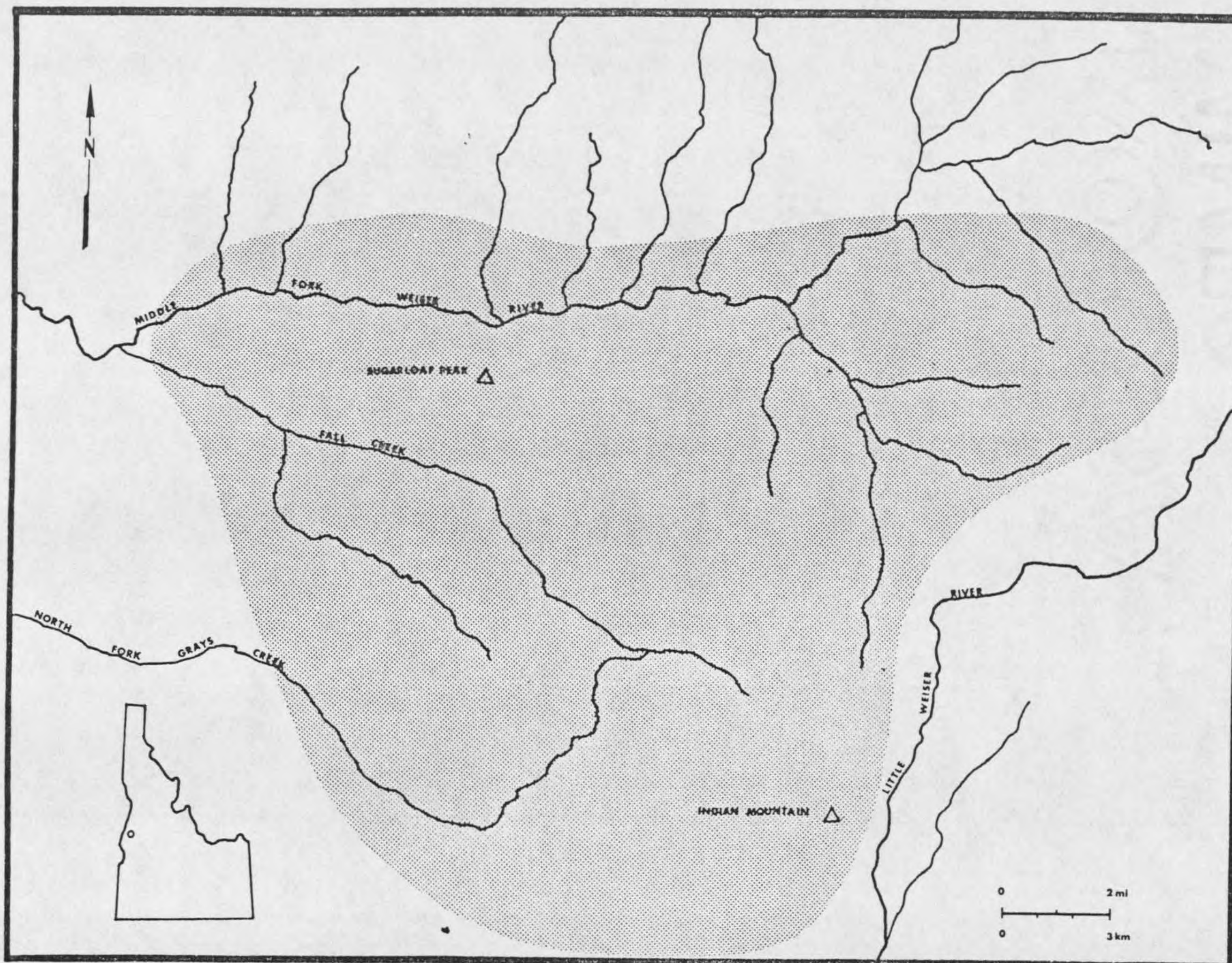

Figure 1. Study area on the Middle Fork of the Weiser River.

Plant communities at lower elevations are dominated by big sagebrush (Artemisia tridentata), grasses, and forbs. Ponderosa pine (Pinus ponderosa) grows in scattered stands at lower elevations and is the dominant species from 1200 m to 1525 m. Douglas fir (Pseudotsuga menziesii) and Grand fir (Abies grandis) replace pondersoa pine as the dominant species at about the 1525 m to 1850 m level. Lodgepole pine (Pinus contorta), subalpine fir (Abies lasiocarpa), Englemann spruce (Picea engelmannii), and western larch (Larix occidentalis) occur on the grand fir sites which are common in the upper and wetter portions of this zone. Quaking aspen (Populus tremuloides) is scattered throughout the area. Whitebark pine (Pinus albicaulis) is present on the highest sites. Important shrub and undergrowth species include hawthorne (Crataegus douglasii), chokecherry (Prunus virginiana), bittercherry (Prunus emarginata), elderberry (Sambucus cerulea), buffaloberry (Shepherdia canadensis), huckleberry (Vaccinium globulare) and red-osier dogwood (Cornus stolonifera). Important forbs and grasses include balsamroot (Balsamorhiza spp.), lomatium (Lomatium spp.), wild onion (Allium spp.), bluebunch wheatgrass (Agropyrom spicatum), and Idaho fescue (Festuca idahoensis). Nomenclature is from Hitchcock and Cronquist (1976).

The major land uses affecting the area are commercial timber cutting and livestock grazing. Logging on public lands began in the 1950s and has continued since. Over 225

million board feet of timber were removed from the Council Ranger District from 1960 to 1970. Approximatly 1000 cows and calves graze the study area. The grazing season on United States Forest Service lands runs from July until mid-October. Other uses of the study area include fishing, hunting, camping, and berrypicking.

METHODS

Trapping and Handling

Black bears were captured with Aldrich spring-activated foot snares set in or adjacent to cubby sets or on trails leading to sets. Sets were baited with spawned out salmon (Oncorhynchus tshawytscha). Snares were attached to "green" drag logs or living trees adjacent to cubbies and trails.

On the Council study area, bears were immoblized with intramuscular injections of Ketaset (ketamine hydrochloride, 2 milligrams (mg)/.45 kilogram (kg) of body weight) and Rompun (xylazine hydrochloride, 1 mg/.45 kg of body weight). Drugs were administered with a syringe mounted on the end of a 2 m "jab stick".

Bears were marked with individually numbered plastic ear tags and tattooed with the same number in the upper lip. Weight and other physical measurements were recorded, along with physiological parameters from all captured bears. Vaginal smears were taken, and appearance of mammary glands and vulvas were used to determine reproductive status (Reynolds and Beecham 1980). Bears were aged using the cementum-annuli technique (Stoneberg and Jonkel 1966) and by observer estimates of tooth wear and canine length.

Instrumenting and Monitoring

Ten adult female bears were instrumented with radio-transmitters. Females were radio-collared because of their reproductive importance, and their smaller home ranges (Lindzey and Meslow 1977, Poelker and Hartwell 1973, Reynolds 1977, Stickley 1957) helped to expedite relocations.

The Council bear population was known to be diurnal and crepuscular (Amstrup and Beecham 1976, Reynolds and Beecham 1980) therefore, monitoring of black bears was concentrated during daylight hours. Bears were monitored for two field seasons, May to November in 1982 and April to November 1983. Five bears were removed from their dens in March 1984 to replace radio collars and determine cub production. Two other radioed bears were captured in June 1984 with dogs and reinstrumented for future study.

Bears were monitored from the ground and relocations were classified as 1) visual--bear was seen; 2) close--within 100 m, determined from signal strength or hearing bear without triangulation; 3) close triangulation--within 300 m, triangulation and signal strength; and 4) triangulation. Close triangulation and triangulation were used infrequently and were included in the habitat analysis only if all compass bearings intersected, roughly, at a single location and if the location were within a large homogeneous habitat component (Young 1984). Locations were

plotted on U.S. Geological Survey orthophotographs (scale 1:24,000) and topographic maps (scale 1:62,500). Locations were assigned X,Y coordinates utilizing Universal Transverse Mercator (U.T.M.) meridians.

Activity was recorded as 1) bedding, 2) feeding, 3) traveling, 4) denning, or 5) unknown. Radio collars were equiped with motion sensitive devices that changed the pulse to a slow mode if the collars were motionless for 2 minutes. The pulse remained fast if the animal was moving. Activity was determined from pulse rates and observing bears or looking for sign in the area the bear had been using. Also bears were considered traveling if there was a significant change in the direction of a signal during the location process.

Habitat Sampling at Bear Locations

Habitat sampling was conducted in two ways. At locations where the bear was not observed or sign detected, the following site characteristics were recorded when possible: elevation, slope, aspect, topography, horizontal configuration and distance to the nearest cover, water, and road (Steele et al. 1981). Topography was recorded as ridge top, upper slope, mid-slope, lower slope, bench or flat, or stream bottom. Horizontal configuration was classified as convex (dry), straight, concave (wet), or undulating. A bear was considered in cover if it could not

be seen by the observer from a distance of 100 m. Habitat types, as classified by Steele et al. (1981), were recorded for each bear location. Ponderosa pine and subalpine fir habitat types were each grouped as a series for analysis. Areas without an identifable overstory were not assigned habitat types. If the bear was observed or if the location could be determined exactly from feeding or bedding sign, then the vegetation was sampled using a 375 square meters (m^2) circular plot (Pfister and Arno 1980). With this method the observer estimates the percentage canopy cover of each plant species within the plot and assigns it to a coverage class (1=0-1%, 2=>1-5%, 3=>5-25%, 4=>25-50%, 5=>50-75%, 6=>75-95%, or 6=>95-100%).

Habitat component classification (Zager et al. 1980) was also utilized but modified for the Council study area. Habitat components were used to supplement habitat types because of the need for classifying non-forested, seral stages and sites where timber had been harvested (Table 1). The distance from the center to the edge (size) of the component and the distance to the nearest different component were recorded. If timber had been harvested from the site, post-logging treatment was also noted. Overstory canopy closure was estimated and assigned a coverage class value. Stands were classified as even or uneven aged. Vertical diversity was measured by estimating the coverage

Table 1. Habitat component classification system used at the Council study area, 1982-1983.

Habitat component	Description
1. Timber (T)	Unlogged stand of timber with canopy closure > 60%.
2. Open Timber (OT)	Unlogged stand of timber with canopy closure > 30 but < 60%. Undergrowth dominated by grasses and forbs.
3. Open Timber /Shrubfield (OTS)	Unlogged stand of timber with canopy closure > 30 but < 60%. Undergrowth dominated by shrubs.
4. Riparian (R)	Streamside or moist areas with well developed mesic vegetation.
5. Aspen (A)	Stands with dense overstory dominated by quaking aspen.
6. Shrubfield (S)	Unlogged areas with timber canopy closure < 30%. Undergrowth dominated by shrubs.
7. Meadow (M)	Open sites dominated by grasses and forbs.
8. Rock/Talus (RS)	Extensive areas of exposed bedrock or rock slides.
9. Sagebrush /Grass (SG)	Open areas dominated by big sagebrush, grasses, and forbs.
10. Roads (RD)	Cleared or graded areas that are not blocked to vehicular travel.
11. Clearcut (C)	Logged areas with overstory completely removed. Dominated by shrubs.
12. Selection cut /Shrubfield (SCS)	Logged areas with overstory < 30% and undergrowth dominated by shrubs.
13. Selection cut /Open Timber (SCOT)	Logged areas with overstory > 30%, but <60%. Undergrowth dominated by shrubs.
14. Selection cut /Timbered (SCT)	Logged areas with overstory > 60% and sparse undergrowth dominated by shrubs and forbs.

class of all vegetation in each of four strata: 0-1m, >1-2m, >2-8m, and >8m (Young 1984).

Habitat and Plant Phenology Sampling at Random Sites

In order to determine the availability of habitat components and types, and other measured habitat characteristics, 489 random plots were measured throughout the study area. Habitat characteristics at each plot were sampled with the same methods described for visual and sign documented bear locations.

Phenological stages of plants that have been identified as important bear foods on the Council study area (Amstrup and Beecham 1976, Beecham 1976, 1977, Reynolds and Beecham 1980) were recorded throughout the field seasons on permanent plots located at varying elevations and aspects and at bear and random locations. Phenological stages were recorded using a modification of the method described by West and Wein (1971) (Table 2).

Table 2. Phenological stages and codes used at Council study area, 1982-1983.

Phenology code	Phenologic stage	
	Shrubs	Grasses & forbs
0	Flower	Vegetative growth
1	Fruit set	Flower buds
2	Fruit swelling	Flower
3	Fruit turning color	Fruit set
4	Fruit ripe	Fruit swelling
5	Fruit dry or dropping	Plant curing

Data Analyses

Significant differences between the use and availability of specific habitat charateristics were determined with the chi-square, goodness of fit test (Nie et al. 1975, Zar 1974). Preference, avoidance, or use in proportion to availability was determined with the Bonferroni Z test (Marcum and Loftsgaarden 1980). Habitat characteristics were considered preferred, if they were used more than in proportion to availability and avoided, if used less than in proportion to availability. Differences between median coverage classes of bear food plants at bear use locations and on random plots were determined using the Mann-Whitney U test (Zar 1974). Differences in use of habitat components and types, when classified according to activity, season, and presence or absence of cubs, were tested with chi-square goodness of fit tests. Significance level for all tests was $P < 0.10$.

RESULTS

Sample Characteristics

Data on the ten adult female bears were captured and instrumented with radio transmitters in 1982 are presented in Table 3. Bears were relocated 640 times during the study:

Table 3. Age, reproductive status, color phase, and number of relocations of female black bears on the Council study area,1982-1983.

Bear	Age-1983	No. Cubs 1982	1983	1984	Color phase	No. of Relocations
01	10.5	0	*1	0	Brown	63
04	7.5	0	0	2	Black	74
39	5.5	2	0	2	Black	71
41	8.5	0	*1	0	Brown	78
45	11.5	0	2	0	Brown	14
49	14.5	0	2	0	Brown	71
55	15.5	0	2	0	Brown	63
56	8.5	0	2	0	Black	66
59	6.5	0	*1	0	Black	76
63	9.5	1	0	3	Brown	73

* Bears 01, 59, and 41 left the den with 2 cubs, but each lost 1 during the summer of 1982.

197 visuals (30.8%), 379 close (59.2%), 53 close triangulations (8.3%), and 11 triangulations (1.7%). Bear number 45 was not monitored during 1983, except to determine cub production, because her home range was on the extreme southern edge of the study area and attempts to obtain relocations were overly time consuming.

Overall Habitat Component Use

Female black bears on the Council study area did not use all habitat components in proportion to their availability (X^2=244.7, d.f.=13, P<0.001). With all seasons and activities combined, bears selected for timber, open timber/shrubfield and riparian components and selected against meadow, road, rock/scree, sagebrush/grass, and clearcut components. All other components were used in proportion to availability (Figure 2).

The radio tagged bears did not select for or against different sized habitat components (X^2=5.401, d.f.=3, P=0.1438) or certain distances from the edge of components (X^2=5.435, d.f.=3, P=0.1437).

Seasonal Habitat Component Use

Habitat component use differed significantly between seasons (X^2=52.7, d.f.=12, P<0.001). Spring(April-June) and summer/fall(July-November) habitat component use differed significantly from availability (X^2=88.2, d.f.=13, P<0.001 and X^2=237.8, d.f.=13, P<0.001, respectively). Timber was preferred in both spring and summer/fall. All selection cut components were used in proportion to availability, and rock/talus and clearcut components were avoided during both seasons. The shrubfield component was avoided and all other components were used in proportion to availability in the

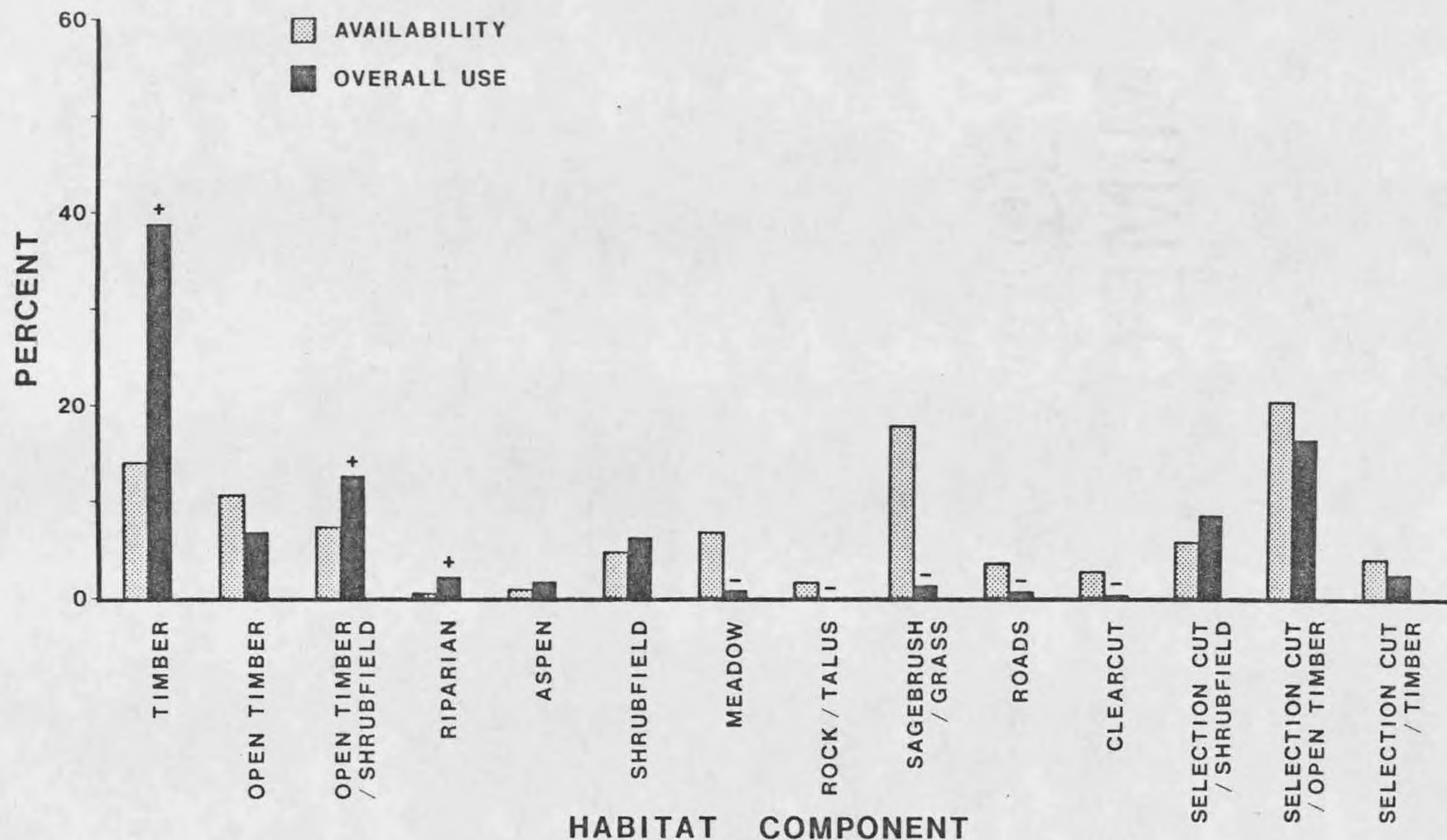

Figure 2. Overall habitat component availability and use by 10 female black bears on the Middle Fork of the Weiser River study area, 1982-1983. A + or - indicates a significant difference ($p<0.10$) from availability.

spring. In the summer/fall, open timber, meadow, and road components were selected against; open timber/shrubfield, riparian, and aspen components were selected for; and shrubfields were used in proportion to availability (Figure 3).

Habitat Component Use by Bears With and Without Cubs

Habitat component use differed significantly between females with cubs and females without cubs (X^2=26.4, d.f.=12, P=0.009). Neither females with cubs nor females without cubs used all habitat components completely in proportion to their availability, (X^2=196.57, d.f.=13, P<0.001 and X^2=123.4, d.f.=13, P<0.001, respectively). Both selected for timber, against meadow, rock/talus, clearcut, and sagebrush/grass, and used proportionally shrubfield, riparian, and all selection cut habitat components. Bears with cubs preferred open timber/shrubfield and aspen, and avoided open timber, meadow, and road habitat components. Bears without cubs avoided meadow and used open timber, open timber/shrubfield, and road habitat components in proportion to availability (Figure 4).

Activity and Habitat Component Use

The activity classification of bear relocations were: 127 feeding (19.6%), 283 bedding (43.7%), 49 traveling (7.6%), 19 denning (2.9%), and 170 unknown active (26.2%). Locations were recorded as "unknown active" when the

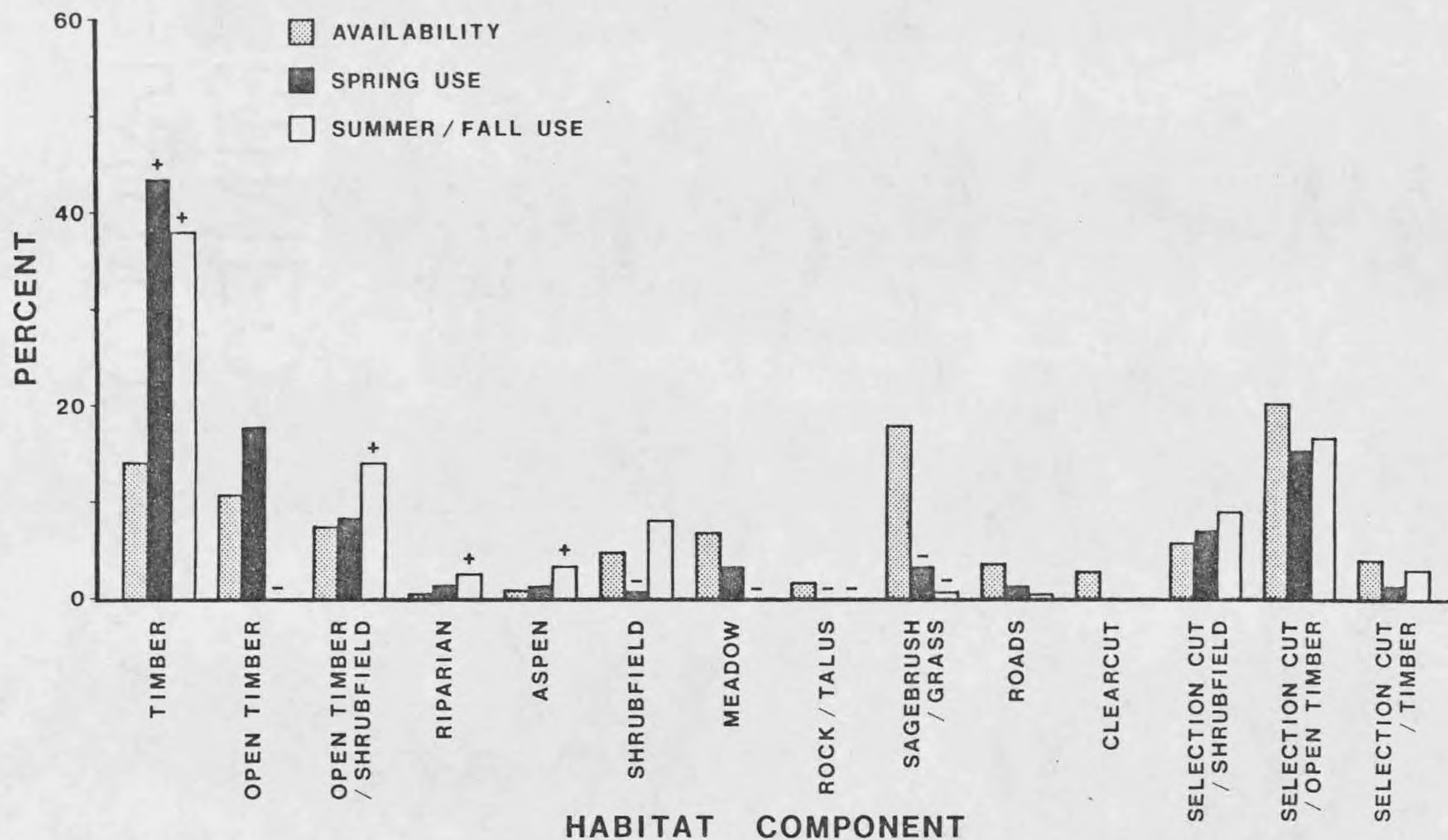

Figure 3. Habitat component availability and seasonal use by 10 female black bears on the Middle Fork of the Weiser River study area, 1982-1983. A + or - indicates a significant difference ($p<0.10$) from availability.

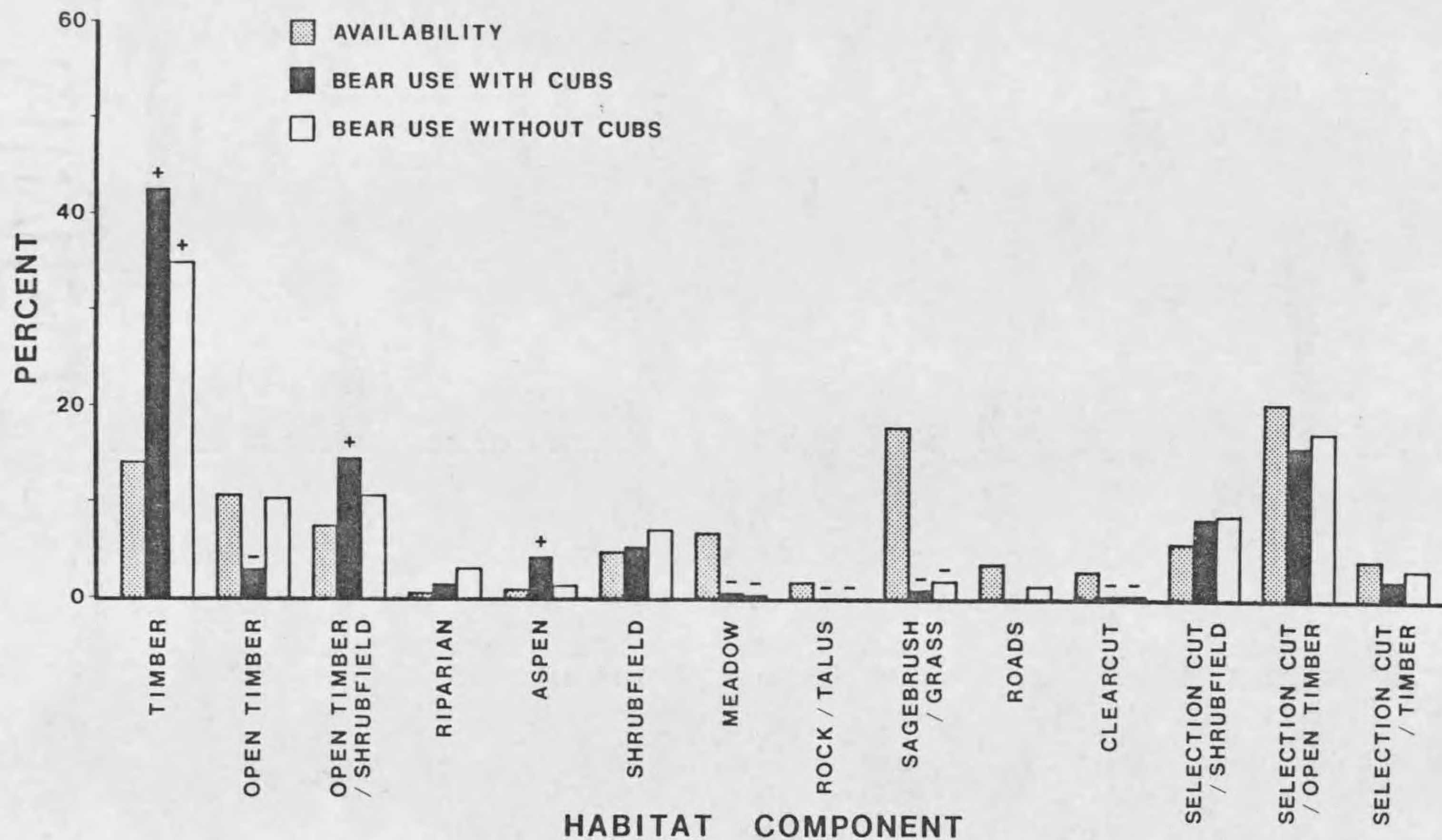

Figure 4. Habitat component availability and use by 10 female black bears with and without cubs on the Middle Fork of the Weiser River study area, 1982-1983. A + or - indicates a significant difference ($p<0.10$) from availability.

registered an active reading, but the bear was not seen and evidence of activity from sign was not detected at the location site. The majority of these locations was probably feeding, but other activities, such as grooming, nursing young, breeding, and den preparation, must also be included in this category.

Bear use of habitat components for bedding varied significantly from availability for some components (X^2=228.4, d.f.=13, P<0.10). The timbered component was the only habitat component selected for by bedding bears. Selection cut/shrubfield, selection cut/timber, open timber/shrubfield, shrubfield, riparian, and aspen components were used in proportion to availability and all other components were selected against (Figure 5).

Component use at feeding locations also varied significantly from availability, as calculated from random vegetation plots (X^2=70.3, d.f.=13, P>0.001). Selection cut/shrubfield and shrubfield components were preferred and clearcuts were avoided for feeding. Other components were used in proportion to availability by feeding bears. Small sample sizes for traveling and denning locations precluded valid analysis in terms of use and availability of habitat components.

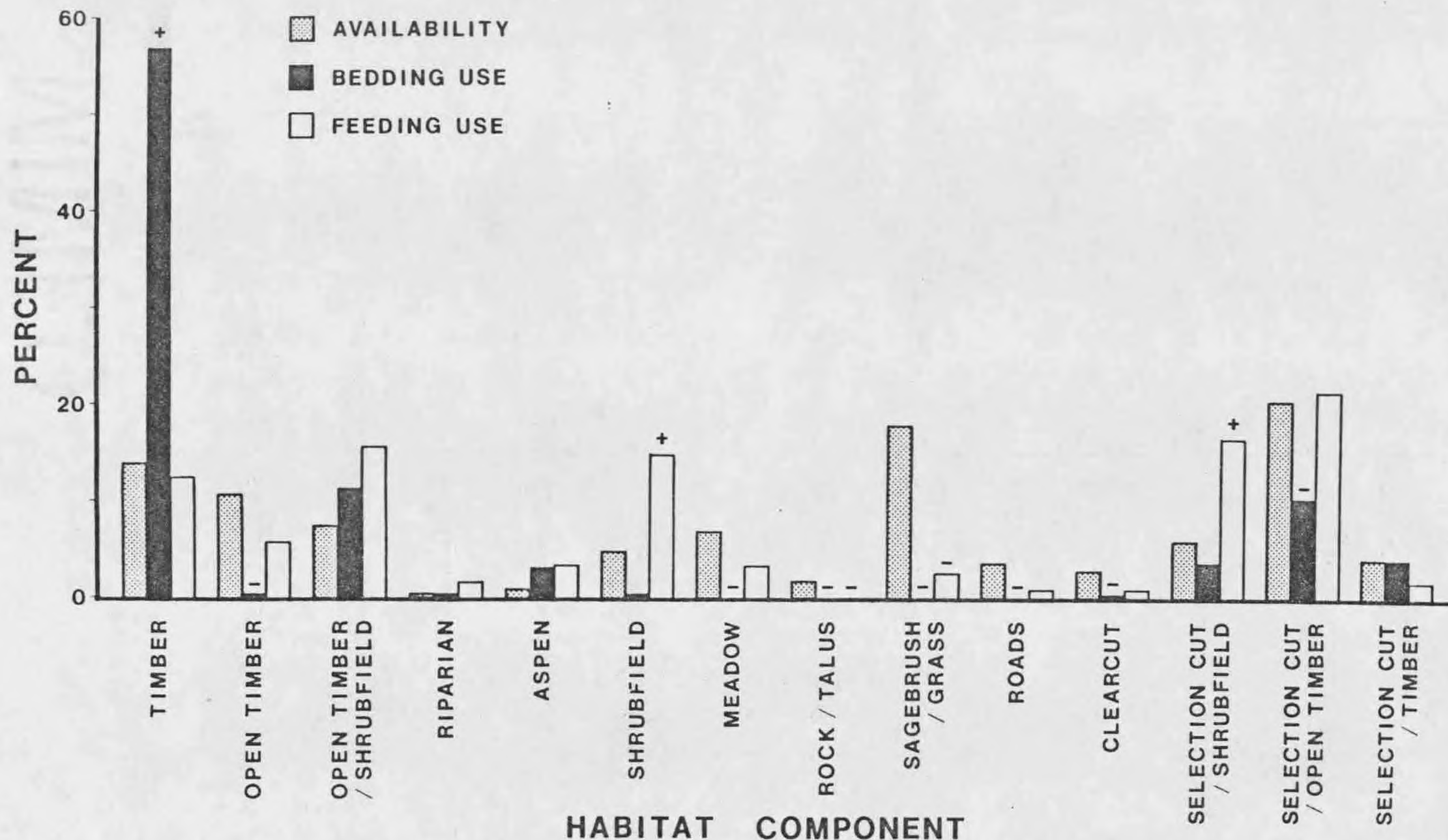

Figure 5. Habitat component availability and use by 10 female black bears when feeding and bedding on the Middle Fork of the Weiser River study area, 1982-1983. A + or - indicates a significant difference ($p<0.10$) from availability.

Overall Habitat Type Use

Many habitat types are present on the Council study area and other vegetation types, lacking overstory, are also present. The vegetation types that could be classified as habitat types are presented in Table 4. Some types were grouped into series to increase sample size.

Table 4. Percent availability of most common habitat types and series used for analysis, Council study area 1982-1983.

Percent available	Habitat type or series
14.3	*Abies grandis* /*Vaccinium globulare*(ABGR/VAGL)
34.1	*Abies grandis* /*Acer glabrum*(ABGR/ACGL)
8.2	*Abies grandis* /*Spirea betulifolia*(ABGR/SPBE)
20.8	*Pseudotsuga menziesii* /*Physocarpus malvaceus*(PSME/PHMA)
7.7	*Psuedotsuga menziesii* /*Symphoricarpos albus*(PSME/SYAL)
4.5	*Pseudotsuga menziesii* /*Symphoricarpos oreophilus*(PSME/SYOR)
5.3	*Pinus ponderosa* Series (PIPO series)
5.3	*Abies lasiocarpa* Series (ABLA series)

Habitat type use was not proportionate to habitat type availability when all bear locations were combined (X^2=96.7, d.f.=8, P<0.001). Bears preferred ABGR/ACGL and PSME/PHMA habitat types. Bears avoided PSME/SYAL, PSME/SYOR, ABGR/SPBE, and ABLA series types. Other habitat types and series were used in proportion to availability (Figure 6).

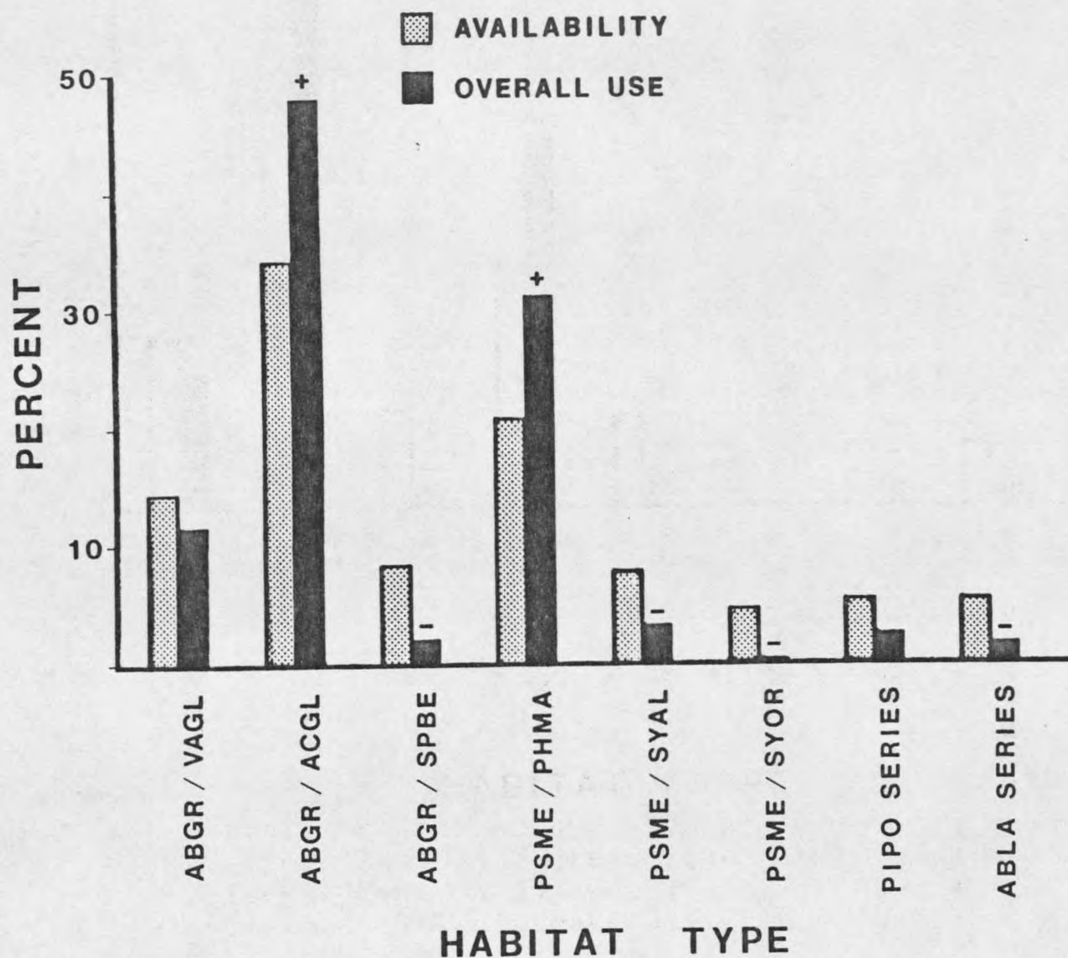

Figure 6. Overall habitat type availability and use by 10 female black bears on the Middle Fork of the Weiser River study area, 1982-1983. A + or - indicates a significant difference ($p<0.10$) from availability.

Seasonal Habitat Type Use

Habitat type use did not vary significantly between spring and summer/fall (X^2=8.3, d.f.=8, P=0.406). Habitat types were used disproportionately from expected in the spring (X^2=43.8, d.f.=8, P<0.001) and summer/fall (X^2=77.4, d.f.=8, P<0.001). The pattern of preference and avoidance of habitat types seasonally was identical to that described for overall habitat use, except PSME/SYAL was used in proportion to availability during the summer/fall (Figure 7).

Habitat Type Use by Bears With and Without Cubs

Habitat type use approached a significant difference between bears with and without cubs (X^2=12.6, d.f.=8, P=0.126). ABGR/ACGL and PSME/PHMA were selected for, and PSME/SYOR and ABGR/SPBE were selected against by all bears. Bears with cubs used all other types in proportion to availability and bears without cubs avoided PSME/SYAL, ABLA series, and PIPO series. ABGR/VAGL was used in proportion to availability by bears without cubs (Figure 8).

Activity and Habitat Type Use

Habitat type use varied significantly between feeding and bedding female black bears (X^2=38.7, d.f.=8, P<0.001) and both, feeding and bedding locations, were not used in proportion to expected use from random locations, (X^2=15.5, d.f.=8, P=0.049 and X^2=93.6, d.f.=8, P<0.001, respectively). No habitat types were preferentially selected by feeding

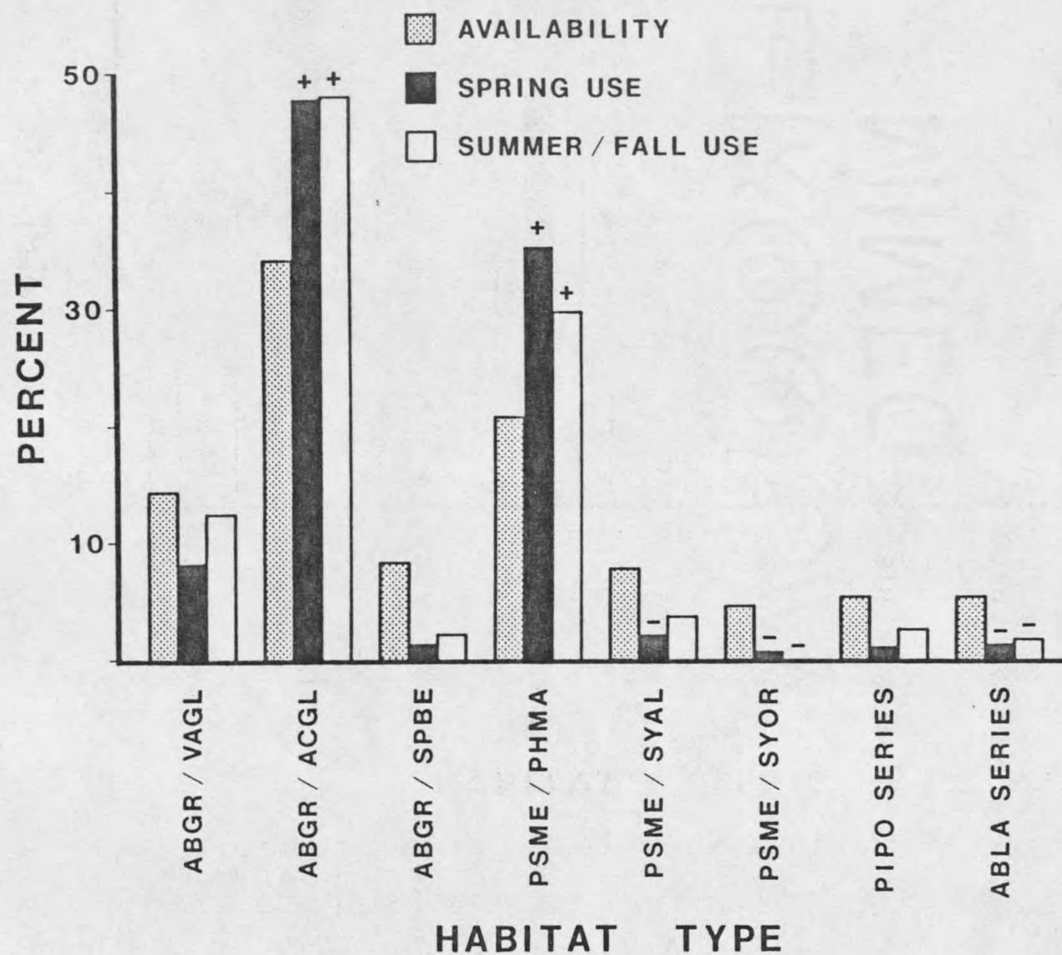

Figure 7. Habitat type availability and seasonal use by 10 female black bears on the Middle Fork of the Weiser River study area, 1982-1983. A + or - indicates a significant difference ($p<0.10$) from availability.

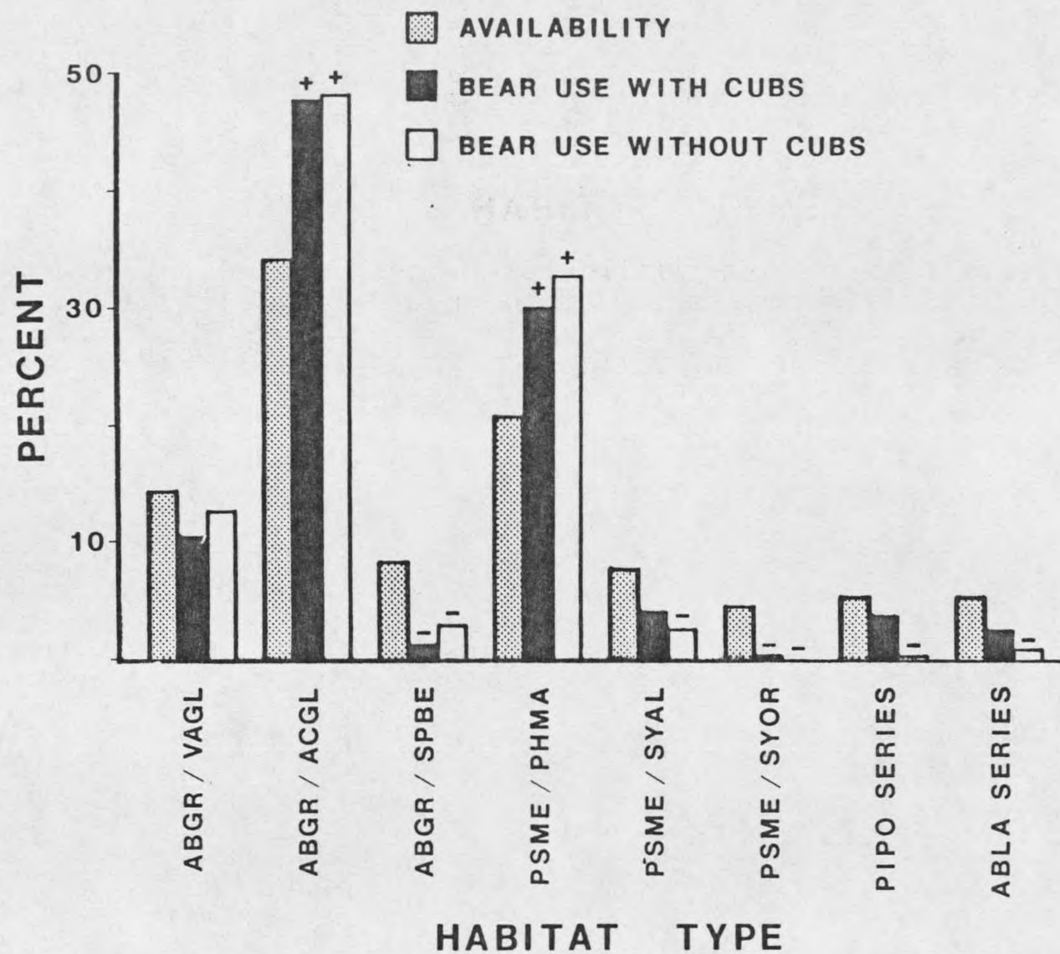

Figure 8. Habitat type availability and use by 10 female black bears with and without cubs on the Middle Fork of the Weiser River study area, 1982-1983. A + or - indicates a significant difference ($p<0.10$) from availability.

bears, ABLA series and PSME/SYOR were selected against, and all other types were used in proportion to availability. Bedded bears preferred PSME/PHMA types, used ABGR/ACGL, and ABLA series types in proportion to availability, and avoided other types (Figure 9).

Aspect Use

The aspect at bear locations was determined from compass bearings and then categorized into the four major directions for analysis (Table 5). Aspect was also recorded for random locations.

Overall, bears did not use aspects in proportion to availability (see Table 6 for X^2 and P values). When broken down by season, presence of cubs, and activity, bears were selective in all categories except when feeding (Table 6). Use of aspects did not differ significantly between seasons or for bears with and without cubs, (X^2=1.56, d.f.=3, P=0.6683 and X^2=.86, d.f.=3, P=0.8344, respectively).

Aspect use did differ between feeding and bedding locations (X^2=22.92, d.f.=3, P<0.001). Female black bears used aspects in proportion to availability when feeding. Bedded bears selected for north aspects, used east aspects in proportion to availability, and selected against west and south aspects. Overall, seasonally, and bears with and without cubs used aspects similar to bedded bears, except

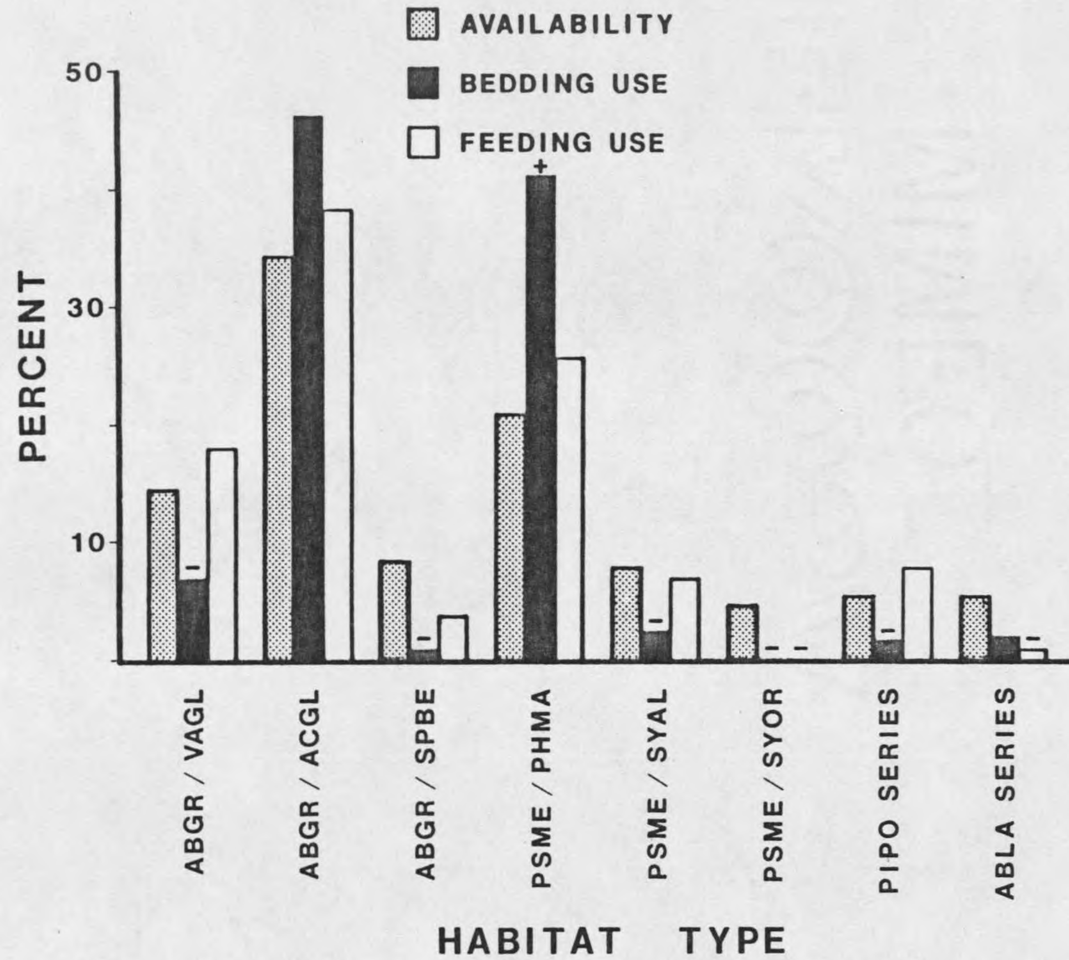

Figure 9. Habitat type availability and use by 10 female black bears when feeding and bedding on the Middle Fork of the Weiser River study area, 1982-1983. A + or - indicates a significant difference ($p<0.10$) from availability.

Table 5. Percentage use of aspects by overall, season, reproductive status, and activity catagories for 10 female black bears on the Council study area, 1982-1983.

Aspect	Random Avail.	Overall Use	Spring Use	Summer /Fall Use	With Cubs Use	Without Cubs Use	Feeding Use	Bedding Use
North	27.6	51.9	53.5	51.4	53.5	50.4	37.0	59.0
East	15.1	14.8	12.9	15.4	14.1	15.4	16.5	14.5
South	20.9	7.4	5.8	7.9	6.7	8.0	16.5	5.7
West	36.4	25.9	27.7	25.3	25.6	26.1	29.9	20.8
N	489	649	155	494	312	337	127	283

Table 6. Chi-square and P values for aspects at bear locations (overall, by season, presence of cubs, and activity classification), compared to random availability of aspects on the Council study area, 1982-1983.

	Overall Use	Spring Use	Summer /Fall Use	With Cubs Use	Without Cubs Use	Feeding Use	Bedding Use
Chi-Square	88.27	41.84	73.83	65.83	55.83	5.29	86.48
P	<.001	<.001	<.001	<.001	<.001	.1506	<.001

d.f.=3

Use of Topography

Bears did not use topography in proportion to availability (Tables 7 and 8). Overall, bears avoided ridge tops and upper slopes, preferred lower slopes, and used other topography types in proportion to availability.

In spring, bears used all topography classes in proportion to availability except lower slopes, which were preferred. During summer/fall, bears preferred lower slopes and stream bottoms, avoided ridge tops, upper, and mid-slopes, and used benches or flats in proportion to availability.

Female black bears with cubs avoided ridge tops, used upper and mid-slopes in proportion to availability, and selected for other topographic classes. Bears without cubs selected for lower slopes, selected against ridge tops and upper slopes, and used other classes in proportion to availability.

Bedded bears preferred lower slopes, avoided ridge tops, and used other topography in proportion to availabiliity. Feeding bears avoided ridge tops and mid-slopes, preferred benches or flats and stream bottoms, and used upper and lower slopes in proportion to availability.

Table 7 . Percentage use of topography by overall, season, reproductive status, and activity catagories for 10 female black bears on the Council study area, 1982-1983.

Topography	Random Avail.	Overall Use	Spring Use	Summer /Fall Use	With Cubs Use	Without Cubs Use	Feeding Use	Bedding Use
Ridge Top	9.6	3.8	5.9	3.1	5.0	2.7	4.1	3.2
Upper Slope	21.9	15.6	15.8	15.5	16.3	14.9	16.3	16.5
Mid-slope	47.5	40.5	43.4	39.6	39.7	41.3	29.3	44.4
Lower Slope	13.5	26.6	25.0	27.0	25.7	27.4	24.4	28.3
Bench/Flat	5.1	7.2	6.6	7.3	6.0	8.2	17.1	3.9
Stream Bottom	2.3	6.4	3.3	7.3	7.3	5.5	8.9	3.6
N	488	629	152	477	300	329	123	279

Table 8. Chi-square and P values for topography classes at bear locations (overall, by season, presence of cubs, and activity) compared to random availability of topography on the Council study area, 1982-1983.

	Overall Use	Spring Use	Summer /Fall Use	With Cubs Use	Without Cubs Use	Feeding Use	Bedding Use
Chi-Square	58.04	14.72	61.35	37.39	48.76	50.80	35.19
P	<.001	.0121	<.001	<.001	<.001	<.001	<.001

d.f.=5

west aspects were used in proportion to availability during spring.

Horizontal Configuration Use

Female black bears did not use horizontal configuration classes in proportion to availability as observed on random sites (Tables 9 and 10). Overall bears selected for concave (wet) and undulating sites, and selected against convex (dry) and straight sites.

Bears without cubs and all bears during the summer/fall exhibited the same pattern observed for overall use, but bears with cubs and all bears during the spring used convex and undulating sites in proportion to availability. Feeding and bedded bears selected for concave and undulating, selected against straight, and used convex sites in proportion to availability.

Distance to Roads

Distance to roads was categorized in 5 classes: on road, 0-25m, >25-50m, >50-100m, and >100m from a road. For use/availability analysis, distances were grouped as 0-50m and >50m from roads. Random distribution of these distance classes and percentage of classes used by bears are presented in Table 11. Female bears did not use these distance classes in proportion to availability (Table 12).

Overall, bears selected against distances <50m and preferred distances >50m from roads. this pattern was

Table 9. Percentage use of horizontal configuration classes by overall, season, reproductive status, and activity catagories for 10 female black bears on the Council study area, 1982-1983.

Horizontal Config.	Random Avail.	Overall Use	Spring Use	Summer /Fall Use	With Cubs Use	Without Cubs Use	Feeding Use	Bedding Use
Convex (dry)	31.5	24.2	30.3	22.3	26.0	22.6	23.4	27.0
Straight	41.6	21.3	26.2	19.7	22.1	20.4	21.0	21.9
Concave (wet)	13.3	35.3	24.8	38.5	35.6	34.9	39.5	34.1
Undulating	13.5	19.3	18.6	19.5	16.3	22.0	16.1	17.0
N	486	627	145	462	289	318	124	270

Table 10. Chi-square and P values for horizontal configurations at bear locations (overall, by season, presence of cubs, and activity) compared to random availability of horizontal configuration classes on the Council study area, 1982-1983.

	Overall Use	Spring Use	Summer /Fall Use	With Cubs Use	Without Cubs Use	Feeding Use	Bedding Use
Chi-Square	97.81	18.05	107.5	64.14	79.98	49.96	57.89
P	<.001	.0007	<.001	<.001	<.001	<.001	<.001

d.f.=3

Table 11. Percentage use of distance classes from roads by overall, season, reproductive status, and activity catagories for 10 female black bears on the Council study area, 1982-1983.

Dist. to Road	Random Avail.	Overall Use.	Spring Use	Summer /Fall Use	With Cubs Use	Without Cubs Use	Feeding Use	Bedding Use
0-50m	18.8	9.1	6.1	10.0	9.7	8.5	13.7	4.3
> 50m	81.2	90.7	94.0	89.8	90.2	91.2	85.4	95.7
N	489	627	149	477	298	328	123	277

Table 12. Chi-square and P values for distance classes from roads at bear locations (overall, by season, presence of cubs, and activity) compared to random availability of distance classes from roads on the Council study area, 1982-1983.

	Overall Use	Spring Use	Summer /Fall Use	With Cubs Use	Without Cubs Use	Feeding Use	Bedding Use
Chi-Square	22.35	13.98	14.92	11.74	16.55	36.05	31.61
P	<.001	.0001	.0003	.0006	<.001	<.001	<.001

d.f.=1

consistent for bears with or without cubs and in both spring and summer/fall seasons. Feeding bears used both distance classes in proportion to availability and bedded bears selected against distances 0-50m from roads and used distances >50m in proportion to availability.

Distance to Water

The distance of bear locations and random locations to water was recorded as 0-25m, >25-50m, >50-100m, and >100m. Distances were combined into two classes for analysis, 0-100m and >100m to water. Bears did not use these distance classes in proportion to availability (Tables 13 and 14). Overall, in spring and summer/fall, with or with out cubs, or when feeding or bedded, female black bears selected for areas within 100m of water and against areas greater than 100m from water.

Distance to Cover

Distance to cover was measured at all bear locations and all random sites. Distances were classified as in cover, or 0-25m, >25-50m, >50-100m, and >100m from cover. Bears showed a strong preference for cover (Tables 15 and 16). Female bears preferred to be in cover and avoided all distances classes away from cover, except when feeding. Feeding bears used areas <25m from cover in proportion to availability.

Table 13. Percentage use of distance classes from water by overall, season, reproductive status, and activity catagories for 10 female black bears on the Council study area, 1982-1983.

Dist. to Water	Random Avail.	Overall Use	Spring Use	Summer /Fall Use	With Cubs Use	Without Cubs Use	Feeding Use	Bedding Use
0-100m	34.0	60.2	59.2	60.5	60.8	59.6	64.2	57.9
> 100m	65.8	39.8	40.7	39.5	39.2	40.4	35.8	42.0
N	488	601	140	461	282	319	120	269

Table 14. Chi-square and P values for distance classes from water at bear locations (overall, by season, presence of cubs, and activity) compared to random availability of distance classes from water on the Council study area, 1982-1983.

	Overall Use	Spring Use	Summer /Fall Use	With Cubs Use	Without Cubs Use	Feeding Use	Bedding Use
Chi-Square	74.11	29.03	66.87	47.53	56.07	36.49	40.78
P	<.001	<.001	<.001	<.001	<.001	<.001	<.001

d.f.=1

Table 15. Percentage use of distance classes from cover by overall, season, reproductive status, and activity catagories for 10 female black bears on the Council study area, 1982-1983.

Dist. to Cover	Random Avail.	Overall Use	Spring Use	Summer /Fall Use	With Cubs Use	Without Cubs Use	Feeding Use	Bedding Use
In Cover	35.2	80.0	66.4	84.2	73.8	85.6	62.9	90.5
0-25m	35.4	15.3	23.3	12.8	19.4	11.6	27.4	7.7
25-50m	15.3	3.5	6.8	2.5	4.4	2.8	8.1	1.5
50-100m	7.2	1.1	2.0	.4	2.4	0.0	1.6	.4
>100m	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N	489	621	146	475	294	327	124	274

Table 16. Chi-square and P values for distance classes from cover at bear locations (overall, by season, presence of cubs, and activity) compared to random availability of distance classes from cover on the Council study area, 1982-1983.

	Overall Use	Spring Use	Summer /Fall Use	With Cubs Use	Without Cubs Use	Feeding Use	Bedding Use
Chi-Square	250.1	49.67	253.4	118.9	209.1	37.94	219.6
P	<.001	<.001	<.001	<.001	<.001	<.001	<.001

d.f.=4

Elevation and Slope

Elevation of bear locations was taken from topographic maps (scale 1:24,000). Elevation of bear locations varied significantly by month ($F=11.56$, d.f.=5, $P<0.001$) (Figure 10). In April and May, bears were at low to mid-elevations, then mean elevation of location increased until August. During September and October/November bears returned to low elevations until denning.

Slope of bear locations varied significantly by activity ($F=3.843$, d.f.=4, $P=0.0043$) (Figure 11). The steepest slopes were choosen by bedded bears. Gentler slopes were used by feeding bears. Traveling, denning, and unknown active used all slopes.

Microhabitat Analysis

Bears tended to chose sites where ripe fruit was available. Table 17 lists the median phenologic stage of shrubs in selection cut/shrubfield and shrubfield habitat components preferred by female black bears as feeding sites. Stage 5 represents plants with ripe fruit.

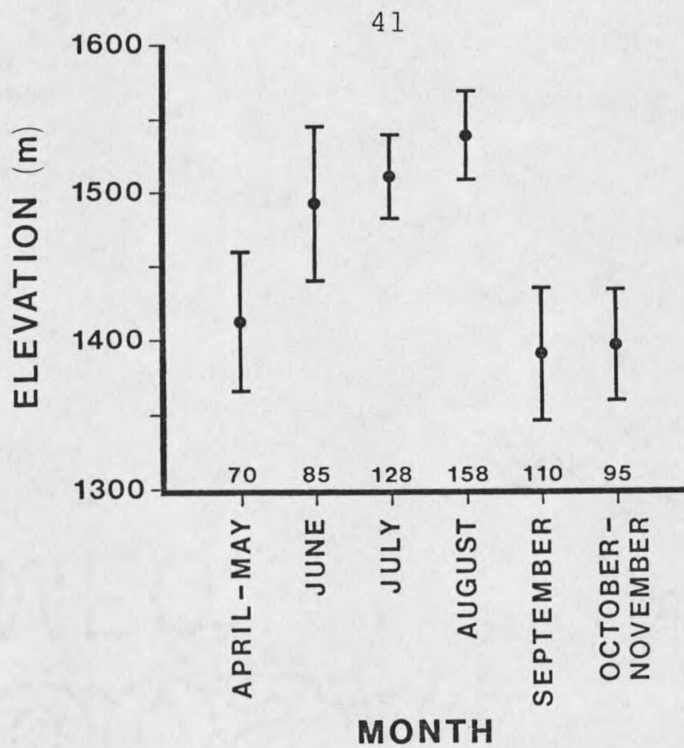

Figure 10. Mean elevation with standard error and sample size of bear locations by month, on the Middle Fork of the Weiser River study area, 1982-1983.

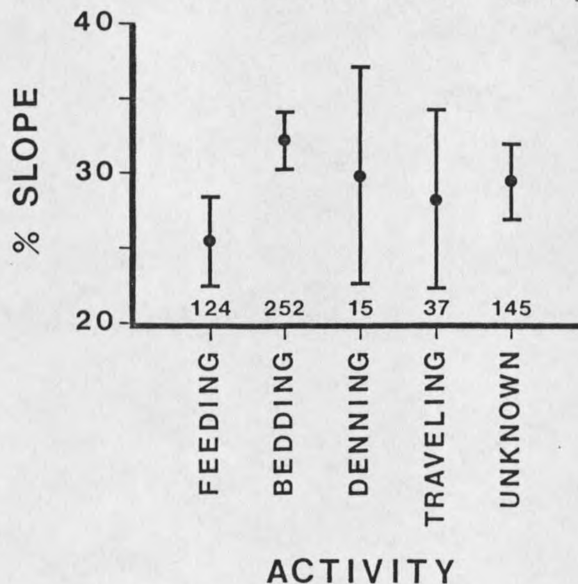

Figure 11. Mean slope with standard error and sample size of bear locations by activity, on the Middle Fork of the Weiser River study area, 1982-1983.

Table 17. Median phenologic stage, of some berry species, found at feeding sites in selection cut/shrubfield and shrubfield habitat components on the Council study area, 1982-1983.

Habitat Component	Hawthorne	Bittercherry	Huckleberry	Buffaloberry
Selection Cut/Shrub.	5(1)*	4(1)	5(13)	5(5)
Shrubfield	5-6(11)	5(14)	-	-

* number of locations in parentheses

At all bear locations which could be verified visually or by sign and at random sites, coverage classes of known plant species were recorded. Appendices A and B list the median coverage class, when plants were present, and frequency (the percentage of plots that contained a species) of identified plants at random and bear locations. In shrubfield and selection cut/shrubfield components, the median coverage classes of important bear foods was compared between random and bear locations. Shrubfield and selection cut/shrubfield components were chosen for this analysis because they were used extensively by feeding bears.

In shrubfield components, the most important bear foods were hawthorn, bittercherry, and chokecherry. The median coverage class of hawthorn in shrubfields at bear locations was significantly greater (P=0.018) than in shrubfields sampled as random sites (Table 18). Coverage classes of chokecherry and bittercherry were not

significantly different between bear and random locations, (P=0.599 and P=0.259, respectively).

Table 18. Frequency and median coverage class of some important bear foods on the Council study area, 1982-1983.

	Huckleberry*	Hawthorn	Bittercherry	Chokecherry
Random loc.	54/3.0	32/4.8	55/3.0	46/2.2
Bear loc.	74/4.7	65/5.4	80/2.8	60/1.8

* Huckleberry was sampled in the selection cut/shrubfield component, other species were sampled in the shrubfield component.

Huckleberry is an important bear food found in selection cut/shrubfields. At bear locations, median coverage class of huckleberry was significantly greater (P=0.064) than at random sites within this component (Table 18).

DISCUSSION

Habitat Component Use

Habitat use is related to a variety of factors. Herrero (1972, 1983), discussing the phylogeny of black bears, noted their physical and behavioral adaptions to the forest biome and in particular their reliance on trees for escape, protection, play, sleep, and relaxation. Black bears are very adaptable as evidenced by their widespread distribution in North America, but their range is limited almost exclusively to forested areas.

Timber was the most frequently used habitat component on the Council study area (38.8%). It was preferred by all bears regardless of season or reproductive condition. The high use of this component was due to the selection of timbered sites for bedding. When bears were using timber components, 65% were classified as bedding locations. Bedding areas were typically on steep slopes with north or east aspects. Beds were usually oval shaped and scraped out in the duff on the uphill side of a tree, in dense timber with little ground cover. Scats were often found near beds. These sites were cool and the sparse ground cover enabled the bear to see. Trees also provided a ready means to escape enemies.

In northern Idaho, bears also preferred timbered areas with sparse understory as bedding sites, even when bears were in shrub dominated selection cuts (Young 1984). In California, Kellyhouse (1980) noted that bears used mixed conifer forest, with an estimated canopy coverage of 68%, as traveling, resting, and escape cover during all seasons. Blanchard (1983) found that grizzly bear day beds in Yellowstone National Park were almost exclusively in forested communites (99%) at or near the base of a tree. European brown bears (Ursus arctos arctos), in Norway, constructed beds very similar to bears on the Council study area in dense spruce (Picea abies) thickets or timber stands near the base of vertical objects (Mysterud 1983).

Timber habitat components were used by feeding bears in proportion to availability. Huckleberry, buffaloberry, twin-berry, and serviceberry were found in timbered components but with lower coverage classes than in more open components. Seasonally important forbs and grasses were also found in timber.

Open timber components were used in proportion to availability during the spring and selected against during summer/fall. Bears with cubs selected against open timber components and bears without cubs used them in proportion to availability. Open timber components were avoided by bedding bears but were used in proportion to availability by feeding

bears.

Nearly 70% of the use of open timbered components occurred in spring. Bears fed on grasses and forbs in this component during spring. By mid-summer these sites were dry, and phenology of food plants was past the stage preferred by bears. It is difficult to explain the selection against this component by bears with cubs. The overstory should have provided security (Herrero 1972); however, bears with cubs may also prefer the security of a shrub understory. On the Council study area bears with cubs of the year used a limited number of habitat components in spring. After leaving the den, females with cubs remained in dense stands of timber and seldom ventured into open areas. Alt et al. (1980) noted that females with small cubs restricted their movement, possibly due to the lack of mobility of their offspring. Reynolds and Beecham (1980) did not believe that cubs limited the movement of females, except for a short time following emergence from dens. I do not believe that movements were restricted (except during early spring), but that in general females with cubs selected for sites having greater cover.

Open timber/shrubfields were heavily used during summer/fall and by bears with cubs during all seasons. Bears readily bedded in this component and used it in proportion to availability for feeding. This component offered bears a variety of fall food items; the dense cover was adequate for

bedding; and it provided security for females with cubs.

On the Council study area riparian components made up a very small percentage of the total area. Overall, bears selected for this component, but sample sizes were small. Bears selected for areas < 100m from open water during all seasons and activities. As described, riparian components had well developed mesic vegetation, and I believe that during dry years this component would be more important. Riparian areas were selected as feeding sites by black bears in northern Idaho (Young 1984) and as feeding areas and traveling corridors in California (Kellyhouse 1980).

Aspen components were used in proportion to availability, except this component received higher than expected use by bears with cubs. The overall structure of this component was somewhat similar to open timber/shrubfield components. Two aspen stands in particular were frequented by bears. Both provided bedding areas adjacent to bittercherry shrubfields used by bears for feeding. In Alberta, black bears selected for aspen cover during all seasons (Young and Ruff 1982).

Shrubfields were preferred by feeding bears during the summer/fall, but during spring were used less than in proportion to availability. During spring, when bears were feeding on grasses and forbs, other components produced greater amounts of these foods. Shrubfields were very

important sources of berries in summer and fall, and over 90% of their use occurred after August. Hawthorn, bittercherry, and chokecherry were the most sought after species in shrubfields. Bears would converge on these rich feeding areas in the fall. Reynolds and Beecham (1980) also noted the importance of hawthorn shrubfields to Council bears. Zager (1980) found that grizzly bears in Montana selected for shrubfields during fall.

Use of meadow components on the Council study area was concentrated during spring. I believe my findings understate the overall importance of meadows to bears near Council. This is in part due to female bears with cubs selecting against meadows and the lack of bear locations during the spring of 1982. In 1982, eight of the radioed bears were without cubs, but few bears were captured in time to adequately sample their spring habitat use. Incidental observations of non-radioed bears feeding in meadows were numerous and radioed bears were observed using meadows on a return to the study area in the spring of 1984. On the study area, meadow components provide a wide range of forbs and grasses important in the spring diet (Beecham 1976). In Montana, Servheen (1983) found grizzly bears selected for wet meadows during the fall. Meadows were very important spring feeding sites for California black bears (Kellyhouse 1980).

Rock/talus components were selected against by bears

during all seasons and for all activities. The lack of bear foods and cover on these site were probably the limiting factors.

Sagebrush/grass components were also selected against by bears near Council. Although food plants were present and some feeding use was noted in the spring, other components apparently provided more preferred foods and types of cover.

Logging units made up over 30% of the available habitat components on the study area. Selection cuts of all types were used in proportion to availability overall, seasonally, and by bears with and without cubs.

When only feeding locations were considered, bears preferred selection cut/shrubfields and used other selection cuts in proportion to availability. On the Council study area, selection cuts provided a wide variety of bear foods as a result of reduced canopy coverage and little or no scarification following harvest. Young (1984) found that bears in northern Idaho preferred selection cuts during all seasons. He felt this selection was due to abundant food species and available trees for escape cover. In Arizona, Mollohan (1982) found that adult female bears selected for selectively logged areas that were harvested 50-60 years ago. These were mixed conifer and hardwood stands that provided dense cover and grasses.

Bedded bears used selection cut/shrubfields less than

in proportion to availability and open timbered and timbered selection cuts in proportion to availability. I believe that the greater security provided by increased canopy coverage in open timbered and timbered selection cuts contributed to the use of these components for bedding. Security cover is important for bears. Zager (1980) emphasized the importance of buffer areas adjacent to roads and small amounts of residual cover in clear cuts. He also noted the importance of timber "stringers" along travel routes. Young and Ruff (1982) noted that bears increased use of heavy spruce cover during the fall hunting season.

Clearcut components made up a small portion of the study area (2.7%) and bears were observed using them only twice during the study. Clearcuts were less than 8 years old, and although some bear foods were present on these sites, foods most commonly found in scats did not appear to be as abundant as in more mature stands. Black bears in northern Idaho avoided clearcuts in all seasons (Young 1984). Bears in western Washington selected for clearcuts 18-25 years old and selected against areas cut 9-14 years previously (Lindzey and Meslow 1977). In northern Montana, Jonkel and Cowan (1971) found that black bears seldom used recently logged areas but used a 10 year-old clearcut as much as surrounding areas. Clearcuts on the Council study area will be used in the future; however, windrowing and soil scarification by dozer will delay the recovery of

important bear food plants (Zager 1980, Martin 1983).

Historically, seral vegetation was maintained by wildfire or other catastrophic events such as avalanches. Many of the early to mid-seral vegetation types are important to black bears because of high mast production. Martin (1983) found the most productive sites for globe huckleberry production were on mesic, north, and east exposures which had burned 25-60 years ago or had been clearcut and broadcast burned 8-15 years ago. Telfer (1974) recognized the importance of diversity of forest types to wildlife species. In the boreal forest of Canada, he felt logging could be used to provide this diversity. In northern Idaho, Leege and Hickey (1971) found that burning could be used to rejuvenate shrub species important to elk as winter browse species. These species included chokecherry, bittercherry, and serviceberry, all important bear food species. Fire is a natural process, and a high percentage of the plant species present on a site before a burn survive and reestablish. Other plants with airborne seeds are also some of the first to reestablish after wildfire (Lyon and Stickney 1976).

In northwestern Montana, Zager et al. (1983) found that most important bear food shrubs increased in canopy coverage 35-75 years following wildfires and on clearcuts that were broadcast burned. He felt that timber harvest

techniques could, to some extent, be used to simulate the positive effects of wildfire. He determined that bulldozer scarification had a negative effect on shrub species that resprouted from rhizomes or root crowns, and that coverage of most key shrubs declined following clearcuts when slash was dozer piled and burned. On clearcuts that were not scarified, vegetation resembled post-wildfire communities. The reduction of canopy cover and competition and alteration of soil moisture and nutrient regimes following logging appear to simulate, somewhat, the effects of wildfire (Zager 1980).

On Long Island, Washington, berry-producing shrub species were 7-8 times more abundant in recently logged areas than in old conifer or alder stands (Lindzey and Meslow 1977). Lindzey and Meslow (1977) felt that the availability of berry species on recently logged sites may have contributed to their high preference by bears. They also felt that cover and the juxtaposition of vegetation types had an important effect on habitat selection and that the presence of cover, along with food abundance, was important in determining habitat selection.

Habitat Type Use

ABGR/VAGL, ABGR/ACGL, and PSME/PHMA habitat types covered over 68% of the area and received over 90% of the use. ABGR/VAGL and ABGR/ACGL habitat types were important

because they contained a large variety of food plants, and were productive sites where adequate cover were usually available. PSME/PHMA habitat types were used primarily as bedding areas. Large areas in this type frequently had the characteristics I described for beds in the discussion of the timbered component.

Feeding bears did not prefer any habitat type, but they did select against PSME/SYOR and ABLA series types. This is an indication that black bears are selecting feeding habitat on a pragmatic basis rather than the theoretical model described by the habitat type classification of Steele et al. (1981). Bears feed in areas where foods are present and do not limit themselves to particular habitat types. Most habitat types potentially include large varieties of seral stages and physiognomic types which results in a great amount of overlap in bear food abundance ratings between types. A few habitat types, such as PSME/PHMA, are less complex in terms of potential successional stages (as compared to ABGR/VAGL and other ABGR types) (Steele and Geier-Hayes 1982, 1983), and their use by bears is more easily explained.

Aspect, Topography, and Horizontal Configuration Use

The preference for north aspects, except by feeding bears, was due to the use of northern slopes as bedding areas and travel corridors. The PSME/PHMA habitat type,

which provided dense overhead coverage and open undergrowth conditions favored for bedding and travel corridors were primarily located on north exposures. On the Council study area, finger ridges extend in a westerly direction and at lower elevations are only timbered on the north slopes. Hawthorn shrubfields are usually on lower slopes and south exposures. In the late summer and fall bears would travel down the north side of these finger ridges and slip into the shrubfields on the opposite slopes to feed. Food plants were present on all aspects, and bears did not select against any aspect when feeding.

Bears consistently preferred the lower portion of hillsides. They were more mesic than other areas and provided cover as well as food. Benches or flats and stream bottoms were preferred by feeding bears. These sites were also typically more mesic than other areas, and most shrubfields were located on this type of topography. Upper slopes and ridge tops were used as feeding areas in the spring but were the first land forms to desiccate and only provided foods during that season. Mid-slopes were the next to dry, and although shrub species that provided bear foods were present on these slopes, small benches or flats on mid-slopes supported the densest stands.

The observed preference for concave or undulating sites by bears was probably related to their more mesic nature compared to convex and straight areas. During the

spring, bears used convex sites in proportion to availability. At this time of year, convex sites were still moist, and food plants were present. Bears with cubs used convex sites in proportion to availability throughout the year. This could be related to the absence of trees in some concave or undulating areas. Bears with cubs may seek feeding sites on the basis of protective cover as much as on food availability.

Distance to Roads, Water, and Cover

Roads were used in spring and by feeding bears and bears without cubs in proportion to availability when analyzed as a habitat component. When distance to roads was used as the criterion, only feeding bears used distances 0-50m to roads in proportion to availability. This inconsistency is probably due to the arbitrary method used to combine distance classes for analysis. Both methods do indicate that feeding bears are less likely to avoid areas where human contact is possible than bedding bears. The female segment of the Council bear population has essentially been unhunted since 1973. Although bears would readily run or climb trees at the sight or smell of observers, some habituation could be occurring on the area. Selection against roads by bears with cubs is probably related to lack of security cover. Roads on the Council study area were not normally used as travel routes. Forested

types on the study area generally lack undergrowth that would inhibit travel by bears.

In northern Idaho, Young (1984) reported that female black bears selected against roads, but males used roads in proportion to availability. He speculated that female avoidance of roads was a function of innate maternal instincts to avoid open areas and that use by males was a function of their high mobility and the use of roads as travel routes.

Manville (1983) reported that Michigan black bears used oil pipeline right-of-ways, oil well service lanes, and lumber roads as travel routes. Increased access along these roads increased bear vulnerability to hunters. Schallenberger (1980) noted the loss of habitat and increased human disturbance along roads in Montana.

Council bears showed a high positive selection for areas within 100m of open water. During this study, I did not observe bears drinking water, but the hot dry summers could make water important. This close association with water could also be related to the high productivity of mesic sites in terms of bear foods. Mollohan (1982) found that bears in Arizona were within 0.25 mile of water at over 60% of the bedding sites and 50% of feeding sites.

Horizontal cover was very important to female bears. Bears would use areas < 25m from cover in proportion to

availability when feeding, but during other activities bears preferred to be in cover. The importance of cover to bears has been stated by other authors (Herrero 1972, Lindzey and Meslow 1976, and Young 1984). I feel that overstory cover is important to bears with cubs, but horizontal cover is important to all bears. Bears are willing to venture from cover if food is available and human activity is not detected. Bears were frequently observed in open meadows during spring and in shrub fields during the fall, however, bears were usually observed from long distances. When bears are intently feeding in these, areas they are vulnerable to hunters.

Elevation, Slope, and Plant Use

The general feeding pattern for bears in North America is spring use of forbs and grasses and use of hard and soft mast in summer and fall (Beeman and Pelton 1980, Bennet et al. 1943, Graber and White 1983, Grenfell and Brody 1983, Landers et al. 1979). This same general pattern occurs on the Council study area,and habitat use is closely related to the temporal availability and phenological "ripeness" of food plants (Beecham 1976, Amstrup and Beecham 1976, Reynolds and Beecham 1980).

The importance of mast, both soft and hard, to the well being of bear populations is well documented. Bears frequently lose weight during spring, and these losses must

be made up for during the summer and fall berry seasons (Beecham 1980, Jonkel and Cowan 1971). Rogers (1976) noted a close association between mast and berry crop failures and poor reproduction in black bears.

Elevational movements by Council bears were associated with the quality and quantity of important foods (Amstrup and Beecham 1976, Reynolds and Beecham 1980). The mean monthly elevational movements I observed were consistent with their findings. Bears fed on grasses and forbs during spring at low elevations and followed their phenologic progression to higher elevations by mid-July. During July and before huckleberries and buffaloberries were ripe, bears fed extensively on ants in selection cuts. Female black bears were observed feeding on ants on several occasions in selection cuts. During 1982, I observed bear number 59 methodically foraging on ants in a select cut. In a 50 minute period, she moved between and broke up 11 stumps and fed on ants and larvae in each. Food habits studies for the Council area (Beecham 1976, 1977) revealed a high frequency and percent volume of ants during mid-summer. I believe that ants and grubs are an important food source for bears at Council during the transition from foraging on forbs and grasses to soft mast. Kellyhouse (1980) found that black bear use of high-elevation partial cuts was greatest during August and noted foraging by bears in logs and stumps. Other authors also reported foraging on ants by black and

grizzly bears, (Grenfell and Brody 1983, Maehr and Brady 1984, Hamer and Herrero 1983, Graber and White 1983). Some bears fed on huckleberries and buffaloberries until they were no longer available then went to lower elevations to feed on chokecherries, bittercherries, and hawthorn berries. Bears whose home ranges did not include large stands of huckleberries or buffaloberries or were at lower elevations switched to chokecherries, bittercherries, and hawthorn berries. I did not record these bears making elevational movements in search of huckleberries but did record bears moving from higher elevation ranges down into low elevation berry patches in search of the other species.

The slopes used by bears varied significantly with activity. Bears used steep northern aspects as bedding sites, and gentler areas were used when feeding. I do not feel that bears are selecting these sites on the basis of gradient, but on the basis of the vegetation characteristics, which are affected by slope and other qualities of topography.

Microhabitat Analysis

Although the results of the microhabitat analysis are preliminary, they indicate that bears may be selecting habitat on a smaller scale than that at which lands are managed or habitat measured. This analysis indicates that bears selected feeding sites on the basis of density of food

plants and not just on food plant presence. I believe that this information reaffirms the need for silvicultural practices that maintain the highest density of important berry producing shrubs if bear habitat is to be maintained or improved. Another implication of this analysis is the need of obtaining visual locations verses close locations or triangulations when habitat use is being stratified by activity. With the use of motion sensitive transmitters, a high degree of accuracy can be expected when bears are classified as bedded; however, when bears are active the researcher can only be assured of a feeding location if the bear is observed or sign of feeding is detected.

SUMMARY, CONCLUSIONS, AND MANAGEMENT RECOMMENDATION

Summary

1. Uncut timbered sites are very important components of the Council study area and only represent 13.9% of the total area. This component was used for all activities, with bedding being the most important. Timbered stands along drainages were important as travel corridors.

2. Open timber components were important as spring foraging areas, and open timber/shrubfield components were important foraging areas and were used by bears for bedding throughout the year.

3. Riparian areas made up only a small portion of the study area but were positively selected for by Council bears. Bears foraged in this component, and when adjacent to roads, the dense vegetation provided cover for traveling bears.

4. Aspen components were preferentially selected for by bears with cubs. They provided dense horizontal cover and often were near bittercherry shrubfields.

5. Shrubfield components were the most important source of fall foods. Bears converged on shrubfields in late summer to forage on chokecherries, bittercherries, and hawthorn berries.

6. Meadow components were used during spring as foraging areas for forbs and grasses. I believe meadows are a more important habitat component than indicated from telemetry data.

7. Rock/talus and sagebrush/grass components lacked foods and cover and were selected against by Council bears.

8. Selection cuts of all types were used extensively on the study area. Reduced canopy coverage and little or no post-logging treatment produced sites with high frequency and coverage classes of important bear foods. Residual timber provided bedding areas.

9. Clearcuts were avoided by Council bears. Clearcuts were less than 8 years old, had been intensely scarified and lacked vertical diversity. Although bear food plants were present, they did not appear to be producing the quantities of fruit available in other components.

10. ABGR/VAGL, ABGR/ACGL, and PSME/PHMA habitat types received over 90% of the use. ABGR/VAGL and ABGR/ACGL types were very productive and provided important bedding and feeding areas. The PSME/PHMA habitat type was important for bedding and travel corridors to low elevation feeding sites.

11. Northern aspects were highly preferred when bears bedded. Feeding bears were catholic in their use of aspect. Topographic features and horizontal configurations that resulted in more mesic vegetation, such as, lower slopes, benches and flats, concave, or undulating terrain were evidently preferred by bears. Bedded bears used steep sites and feeding bears were located on gentler terrain.

12. Female black bears avoided roads except when feeding, selected areas within 100m of open water, and had a high preference for cover, especially when accompanied by cubs. Bear were willing to venture from cover in search of food.

Conclusions

The Council study area presently supports a healthy black bear population. Under very restrictive hunting regulations since 1975, the median age of this population has increased from 2.5 to 5.5 years (Beecham 1980, Beecham and Unsworth 1983). The population appears to be stable and production is relatively high.

Since the initiation of this study in 1973, selective logging has continued, and clearcut logging has been undertaken in some stands. A large portion of the important bear habitat on the Council study area is a result of past logging activities. Although many bear foods are found on sites which do not support commercial timber, huckleberry, buffaloberry, bittercherry, chokecherry, and hawthorne are

all important bear food producers that are abundant on timbered lands. Timber harvest methods and post-logging treatments have changed radically in the last 10 years with shifts from high-grade selection cutting to clearcutting. Current plans call for a series of thinnings which ultimately will result in clearcuts. Intensive post-logging site treatments follow each stage. Forest managers have shifted from little or no post-treatment or broadcast burning to dozer piling of slash in windrows or "jackpot" piles and burning in conjunction with extensive soil scarification. In the long run this shift in treatment could have a detrimental effect on black bear habitat.

Road building has increased in the last 10 years. The U.S. Forest Service has an active road closure program on a portion of the study area during the fall big game hunting season, but new roads on private and federal lands have increased access. Logging adjacent to these roads has reduced visual barriers in some situations. If hunting is resumed, bears will be more vulnerable than in the past.

The methods used for determining utilization and availability of habitat assume that each individual has an opportunity to select any of the habitats that are considered available and that observations are done in a random and unbiased manner (Neu et al. 1974). Some problems exist with the interpretation of this kind of data.

Peek et al. (1982) recognized a habitat preference was not neccesarily equivalent to a habitat requirement and that animals could prefer habitats that were not required for survival or reproduction. Preference for some types of habitat that are in oversupply may not be detected and what appears to be selection against other habitats, could be related to the availability of relatively more preferred sites. Areas which are selected against or used in proportion to availability may become increasingly more important to animals as more preferred sites are altered. The habitat use and population characteristics of a given species change with time and habitat availability; therefore, the recommendations from a study such as this should be applied narrowly, to areas of similar types and proportions of habitat.

Timber management

1. Soil scarification should be kept at a minimum.

2. Timber on north aspects and along streams should be harvested with uneven aged silvicultural systems to maintain cover.

3. Dense pole sized timber stands on north and east aspects in the PSME/PHMA habitat type should be maintained as bedding areas.

4. Standing mature trees should be retained in logged over areas to enhance their use by females with cubs after shrubs have recovered.

5. Aspen stands should be maintained.

6. Clearcut components were not used by female black bears at the time of this study. I believe that recommendations from other areas in regards to clearcuts could apply to the Council area.

   A. Slash should be broadcast burned or not treated, but not piled. If slash must be piled, a brush blade and not an excavation blade should be used (Zager and Jonkel 1984).

   B. Irregular borders should be created to maximize adjacent cover (Young 1984, Zager 1980).

   C. Patches and strips should be maintained as travel routes and protective cover (Young 1984, Zager 1980).

7. Timber harvest plans should be designed to provide/ promote the juxtaposition of different aged cuts.

Hunting Management

1. I recommend maintaining a hunting closure in the Middle Fork of the Weiser River and Little Weiser River drainages. Because of the open nature of the habitat and its proximity to major human population centers in Idaho, it provides a unique opportunity for the nonconsumptive observation of bears in their natural habitat. The area may also be functioning as an important bear population reservoir to adjacent heavily hunted drainages.

2. If bear hunting is resumed in the Middle Fork of the Weiser River and Little Weiser River Drainages. I recommend the following:

A. Present road closures should stay in effect through mid-June.

B. The following roads should be closed during spring:

a. Fall Creek road from the mouth of Fall Creek to its intersection with the Mica Creek road at Mica saddle.

b. Cabin Creek road.

c. Little Weiser River road from Four-bit Creek to Mica saddle.

C. Visual barriers should be maintained along all roads where possible and new roads should be built in areas where vegetative or topographic cover protects bears from view when they are feeding in open meadows during the spring or shrubfields in the fall.

D. Baiting and the use of dogs should be unlawful.

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APPENDICES

APPENDIX A

HABITAT COMPONENT DESCRIPTIONS

Timber

Timber components were unlogged stands with canopy closure > 60%. Because they were dependent on topograpic and environmental conditions, stands were comprized of a varity of sizes and types of tree species. At the highest elevations, subalpine fir dominated with lodgepole pine and Englemann spruce intermixed. Mid- to upper elevation and mesic sites at lower elevations were dominated by grand fir with Douglas fir and ponderosa pine as important seral species. On more xeric sites at mid- elevations, Douglas fir was the most important tree species and ponderosa pine was present in varying amounts. At the lowest elevations and on the dryest sites, ponderosa pine was the dominant tree species.

Although the undergrowth on timbered components was relatively depauperate compared to more open forested components, all shrub species present on the study area, with the exception of bitterbrush (*Purshia tridentata*), were present. Few species exceded a median cover class of 1.5; however, huckleberry, bittercherry, buffaloberry, ninebark (*Physocarpus malvaceus*), or mountain maple (*Acer glabrum*) occasionally formed a dense undergrowth.

Grasses and sedges were present on almost all sites. A varity of forbs were present, shade tolerant species being most common. *Smilacina* spp., *Fragaria* spp., *Adonocaulon*

bicolor, Arnica cordifolia, Chimaphila umbellata, Gallium triflorum, Goodyera oblongifolia, Osmorhiza depauperata, Pyrola spp., Rudbeckia occidentalis, Thalictrum spp., Trillium spp., and Viola spp. were the most frequently encountered forbs in timber components.

Open Timber

Open timber components were unlogged sites with canopy closure between 30 and 60%. All tree species mentioned in the discription of the timbered component were present but with lower median coverage classes.

All shrub species, except redstem ceanothus (Ceanothus sanguineus), were represented in this component at low densities. For the most part undergrowth was dominated by graminoids and forbs. Sites were frequently adjacent to meadows and were often times transition areas between meadows and more heavily timbered components. The most common forbs were Lomatium spp., Smilacina spp., Fragaria spp., Achillea millefolium, Arnica cordifolia, Aster spp., Balsamorhiza spp., Galium triflorum, Geranium spp., Lupinus spp., Osmorhiza depauperata, Penstemon spp., Potentilla spp., Thalictrum spp., and Veratrum viride.

Open Timber/Shrubfield

Open timber/shrubfield components were also unlogged and had the same complement of tree species as timber and open timber components, but the undergrowth was dominated by dense stands of shrubs. These sites were usually moister than open timber components and often occured at low elevations with concave horizontal configurations. Trees were most often large and well spaced. Canopy coverage classes ranged from 30 to 60%. Graminoid coverage classes were greater, but in general forbs were present at lower frequencies and median coverage classes than in open timber components.

At low elevations hawthorn, bittercherry, chokecherry, ninebark, and common snowberry (Symphoricarpos albus) dominated the shrub layer. At mid- to high elevations and on more mesic sites serviceberry (Amelanchier alnifolia), huckleberry, twin-berry (Lonicera spp.), white spiraea (Spiraea betulifolia), willow (Salix spp.), mountain-ash (Sorbus scopulina), mountain maple and alder (Alnus sinuata) were common.

Riparian

Well developed riparian vegetation was relatively rare on the Council study area. All tree species were represented in this component. The presence of cottonwood (Populus trichocarpa) and red-osier dogwood were important indicators

for this component.

Many shrubs were present including rose (Rosa spp.), syringa (Philadelphus lewisii), and current (Ribes spp.). Moist site forbs and grasses comprized a lush undergrowth.

Aspen

Aspen components were dominanted by quaking aspen. These sites were scattered throughout the study area, often in places where snow would accumulate on leeward slopes. In aspen components with relatively open canopies, shrubs dominated the undergrowth and in stands with high canopy closure forbs and graminoids dominated.

Shrubfield

Shrubfield components were unlogged sites with canopy closure of < 30%. These components were usually at low elevations, with concave to straight horizontal configurations. Tree species were often absent, or if present were usually ponderosa pine and/or Douglas fir.

The shrub and forb species were similar to those present in open timber/shrubfield components. Low elevation hawthorn/bittercherry shrubfields are included in this group. They occur in seasonally moist side drainages and flats on south and west exposures.

Meadow

Meadow components are areas with <10% canopy closure, are seasonally moist and dominated by forbs and grasses. Shrubs are present but of low frequencey. The "onion beds" of the Council study area are examples. Important forbs are *Lomatium* spp., *Allium* spp., *Achillea millefolium*, *Aster* spp., *Balsamorhiza* spp., *Eriogonum* spp., *Lupinus* spp., *Penstemon* spp., and *Potentilla* spp.

Rock/Talus

Rock/talus components are characterized by extensive areas of exposed bedrock or rock slides. Vegetation is sparse with trees and shrubs being nearly absent. The most common forbs present are *Lomatium* spp., *Allium* spp., *Eriogonum* spp., *Penstemon* spp., and *Sedum* spp.

Sagebrush/Grass

The sagebrush/grass component makes up a considerable proportion of the Council study area. It is found at low elevations and on south to west exposures. Trees are rare on these sites and if present, are usually ponderosa pine or Douglas fir. Grasses are common. Dry site shrubs are the dominant plant species including big sage, bitterbrush, and common snowberry. Forbs include *Lomatium* spp., *Allium* spp., *Tragopogon partensis*, *Achillea millefolium*, *Balsamorhiza* spp., *Eriogonum* spp., *Penstemon* spp., and *Polygonum* spp.

Road

Roads were cleared or graded areas not blocked to vehicular travel. The main Middle Fork of the Weiser River road was built in the 1930's, and there has been good access to most parts of the study area, since 1965. In recent years, road closures have been in effect on parts of the study area. Many tree and shrub species were represented in vegetation plots centered on roads. Roads bisected all other habitat components and types. Graminoids were common along roads and some forbs, such as, Fragaria spp., Achillea millefolium, Penstemon spp., Potentilla spp., Rudbeckia occidentalis, Taraxacum spp., and Verbascum thapsus were usually present.

Clearcut

Although clearcutting is a common timber harvest method on the Payette National Forest, the Council study area had few. The timber from these sites was harvested in 1977 and 1978. Slash was windrowed and burned with varing amounts of success and the sites were scarified and replanted, mostly with Douglas fir and pondersoa pine.

Shrub species presently dominate clearcut components. Current, huckleberry, elderberry, twin-berry, shiny-leaf ceanothus (Ceanothus velutinus), rose, willow, and white spiraea. Some well represented forbs are Cirsiom spp., Achillea millefolium, Arnica cordifolia, Balsamorhiza spp.,

and *Polygonum* spp. Graminoids make up a large portion of the ground cover.

Selection Cut/Shrubfield

Selection cut/shrubfield components were logged areas with < 30% canopy closure. These components are dominated by dense stands of shrubs interspersed with small clumps of sappling (0-4"dbh) or pole sized (>4-12"dbh) timber. Grand fir is the most common tree species, but ponderosa pine and Douglas fir are also present. Post-logging treatment on these sites was minimal with some broadcast burning and little or no scarification or replanting. Most areas classified as selection cut/shrubfield components were cut between 1966 and 1972.

Dominant shrubs on these sites include buffaloberry, huckleberry, service berry, current, twin-berry, ninebark, willow, white spiraea, and common snowberry. Graminoids are common and a wide varity of forbs, including *Fragaria* spp., *Arnica cordifolia*, *Castilleja* spp., *Epilobium augustifolium*, *Penstemon* spp., *Potentilla* spp., *Rudbeckia occidentalis*, and *Thalictrum* spp.

Selection Cut/Open Timber

Selection cut/open timber components were similar to selection cut/shrubfields, except with canopy coverage between 30 and 60% and a wider varity of sizes and species of trees. Post logging treatments were the same and many of

these sites were also harvested from 1966-1972. Some sites classified as selection cut/open timber were harvested from 1946 to 1962 and during the 1960's, probably could have been classified as selection cut/shrubfield components.

Undergrowth species present in selection cut/open timber components were similar to those found in selection cut/shrubfields. Ninebark, common snowberry, rose, mountain maple, service berry, twin-berry, current, and huckleberry are all common in selection cut/open timber components. Graminoids and forbs are well represented with Smilacina spp., Fragaria spp., Arnica cordifolia, Aster spp., Chimaphila umbellata, and Thalictrum spp. frequently represented.

Selection Cut/Timber

Selection cut/timber components were logged or thinned sites with canopy closure > 60%. These sites have occured as a result of recent thinning operations in pole sized stands or the removal of individual trees on a very selective basis. In recently thinned stands, slash is usually jackpot piled and burned and soil is scarified. When individual trees were removed, little or no post-logging treatment occured. This type of very selective logging has occurred on the Council study area, since the 1880's most often large Douglas fir and ponderosa pine were removed. At present when pole sized stands are thinned, slash is bull dosed into a

pile and burned.

All conifer species were represented on selection cut/timbered sites. Shrubs were moderately dense with huckleberry, twin-berry, ninebark, rose, willow, and white spiraea frequently present. Graminoids and forbs were not as dense as on open timber and shrubfield selection cuts. Smilacina spp., Adenocaulon bicolor, Arnica cordifolia, Chimaphila umbellata, Goodyera oblongifolia, Hieracium spp., Osmorhiza depauperata, Penstemon spp., and Rudbeckia occidentalis were common forbs in this component.

APPENDIX B

HABITAT COMPONENTS AND CORRESPONDING PAYETTE NATIONAL FOREST INVENTORY STRATA NUMBER

Table 19. Habitat component classifications used in this study and their closest equivalent Payette National Forest inventory stratas.

Habitat Component	Inventory Strata Number
Timber	23,26,32,35
Open timber	24,27,31,34
Open timber/shrubfield	24,27,31,34
Shrubfield	25,28,30
Meadow	60
Rock/talus	40
Sagebrush/grass	60
Road	60
Riparian	?
Aspen	?
Clearcut	20
Selection cut/shrubfield	21
Selection cut/open timber	21,22
Selection cut/timber	22

APPENDIX C

FREQUENCY AND MEDIAN COVERAGE CLASS OF VEGETATION IN HABITAT COMPONENTS

Table 20. Frequency (percent of plots with species)/median coverage class (1=0-1%, 2=>1-5%, 3=>5-25%, 4=>25-50%, 5=>50-75%, 6=>75-95%, or 7=>95-100%) of selected plant species at bear locations, by habitat component, on the Middle Fork of the Weiser River study area, 1982-1983.

Species	T^{+}	OT	SCS	SCOT	SCT	M	OTS	S	R	A	RD	RS	C	SG
N =	67	27	26	43	1	3	37	20	8	6	3	0	1	5
Graminoids														
Grass*	36/1.2	78/2.4	70/1.8	77/1.6	100/2.0	66/2.0	82/2.9	80/3.5	50/2.5	66/1.2	100/3.3	......	100/1.0	100/4.8
Sedge*	......	56/1.3	39/1.3	54/2.0	......	......	......	......	25/1.5	33/1.5	66/2.5	......	100/1.0	......
Trees														
Abies grandis														
0-4"dbh	66/3.1	41/2.4	81/1.8	84/2.1	100/2.0	......	14/1.8	10/1.0	63/1.3	50/1.3	100/2.0	......	......	......
4-12"dbh	60/3.2	45/2.9	77/2.8	80/2.9	100/4.0	......	25/1.9	......	25/2.0	33/3.5	100/2.3	......	......	20/2.0
12-18"dbh	33/3.0	15/3.2	24/2.5	38/2.8	100/3.0	......	6/3.0	......	25/2.5	......	......	......	......	......
>18"dbh	15/3.3	12/2.3	4/2.0	10/3.5	......	......	3/4.0	......	......	......	......	......	......	......
Abies lasiocarpa														
0-4"dbh	2/4.0	4/2.0	......	......	......	......	......	......	......	......	......	......	......	......
4-12"dbh	2/3.0	8/3.5	......	......	......	......	......	......	......	......	......	......	......	......
12-18"dbh	3/2.5	......	......	......	......	......	3/1.0	......	......	......	......	......	......	......
>18"dbh	......	4/3.0	4/1.0	......	......	......	......	......	13/5.0	......	......	......	......	......
Larix occidentalis														
0-4"dbh	......	......	......	3/1.0	......	......	......	......	......	......	......	......	......	......
4-12"dbh	......	......	......	5/1.5	......	......	......	......	......	......	......	......	......	......
12-18"dbh	......	......	......	......	......	......	......	......	......	......	......	......	......	......
>18"dbh	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Picea engelmannii														
0-4"dbh	3/3.0	......	8/1.0	3/1.0	......	......	......	......	25/2.0	......	......	......	......	......
4-12"dbh	3/3.0	......	8/2.0	3/2.0	......	......	......	......	13/3.0	......	......	......	......	......
12-18"dbh	2/3.0	......	4/4.0	......	......	......	......	......	......	......	......	......	......	......
>18"dbh	......	......	......	3/2.0	......	......	......	......	......	......	......	......	......	......
Pinus contorta														
0-4"dbh	......	......	......	......	......	......	......	......	......	......	......	......	......	......
4-12"dbh	2/2.0	......	......	......	......	......	......	......	......	......	......	......	......	......
12-18"dbh	2/3.0	......	......	......	......	......	......	......	......	......	......	......	......	......
>18"dbh	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Pinus ponderosa														
0-4"dbh	15/1.2	49/2.1	24/1.5	28/1.2	......	66/2.5	22/1.5	10/1.5	25/1.0	17/2.0	33/2.0	......	100/3.0	......
4-12"dbh	17/2.0	52/2.4	12/2.0	14/1.9	......	33/2.0	36/2.1	10/1.0	13/2.0	17/3.0	......	......	......	......
12-18"dbh	15/2.3	41/2.8	4/3.0	28/2.3	......	66/2.0	22/2.8	15/1.8	13/4.0	......	......	......	......	......
>18"dbh	24/2.9	56/1.8	8/3.0	17/3.0	......	......	22/3.1	......	13/4.0	......	......	......	......	20/1.0
Psuedotsuga menziesii														
0-4"dbh	53/1.8	56/1.8	35/1.1	33/1.3	......	33/1.0	36/1.6	15/1.8	25/1.0	......	33/3.0	......	100/1.0	......
4-12"dbh	41/3.4	49/2.1	20/2.1	38/2.5	......	33/2.0	52/2.6	20/1.5	25/1.5	17/3.0	66/2.0	......	100/3.0	20/1.0
12-18"dbh	41/3.1	30/2.5	4/4.0	31/2.9	......	......	22/2.8	......	......	......	......	......	......	......
>18"dbh	21/3.1	23/3.2	......	14/2.8	......	......	11/3.5	10/1.5	13/3.0	......	......	......	......	......
Populus tremuloides														
0-4"dbh	3/1.0	23/1.8	4/2.0	7/1.3	......	33/1.0	17/1.5	30/1.5	13/1.0	33/3.0	......	......	......	......
4-12"dbh	3/1.5	8/2.5	......	3/3.0	......	......	14/1.8	20/1.5	25/2.5	33/3.5	......	......	......	......
12-18"dbh	......	......	......	......	......	......	......	5/3.0	13/3.0	......	......	......	......	......
>18"dbh	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Populus trichocarpa														
0-4"dbh	......	......	......	......	......	......	......	......	......	......	......	......	......	......
4-12"dbh	......	......	......	......	......	......	3/2.0	5/1.0	25/3.0	......	......	......	......	......
12-18"dbh	......	......	......	......	......	......	3/3.0	5/2.0	......	......	......	......	......	......
>18"dbh	......	......	......	......	......	......	......	5/3.0	......	......	......	......	......	......

Table 20. cont.

Species	T	OT	SCS	SCOT	SCT	M	OTS	S	R	A	RD	RS	C	SG
Shrubs														
Prunus virginiana*	5/1.8	15/1.2	4/2.0	7/2.3	......	......	46/2.1	60/1.8	......	17/1.0	......	......	100/2.0	40/2.5
Prunus emarginata*	12/1.7	15/3.0	8/2.3	24/1.3	......	66/2.5	57/2.6	80/2.8	......	84/2.3	33/2.0	......	100/2.0	20/2.0
Shepherdia canaden.*	5/2.0	......	43/2.1	35/2.3	......	......	3/1.0	......	......	......	......	......	......	......
Cornus stolonifera*	2/1.0	19/2.0	8/2.5	5/1.5	......	......	6/2.5	......	88/4.3	......	......	......	......	......
Amelanchier alnifo.*	38/1.5	63/1.4	50/1.2	49/1.4	......	33/2.0	57/1.9	30/1.3	50/1.2	17/1.0	......	......	100/1.0	20/1.0
Ribes spp.*	15/1.2	26/1.1	50/1.9	42/1.2	......	......	19/1.7	5/3.0	75/2.0	17/1.0	100/1.0	......	......	......
Vaccinium globulare*	35/2.8	26/2.6	74/4.7	66/4.1	100/2.0	......	11/2.5	......	25/2.5	......	33/2.0	......	......	......
Crataegus douglasii.*	......	15/2.5	4/4.0	7/5.0	......	33/2.0	38/3.3	65/5.4	13/2.0	......	......	......	......	......
Sambucus spp.*	5/2.0	4/1.0	16/1.5	10/1.2	......	......	14/1.1	40/1.3	......	17/1.0	33/1.0	......	100/1.0	......
Sorbus scopulina*	9/1.1	8/1.0	12/1.3	7/1.0	100/2.0	......	9/1.3	......	13/2.0	......	33/2.0	......	......	......
Lonicera spp.*	33/1.6	19/2.8	77/2.0	52/1.5	......	......	17/1.8	......	25/2.5	......	......	......	......	20/2.0
Acer glabrum	39/2.1	30/2.5	27/2.0	31/1.9	100/3.0	......	30/2.1	10/1.5	63/1.8	17/1.0	66/1.5	......	......	......
Alnus sinuata	3/1.5	4/3.0	20/2.7	......	......	......	......	......	50/4.0	......	33/1.0	......	......	......
Artemisia tridenta.	......	4/1.0	......	3/1.0	......	33/3.0	6/1.5	15/1.3	......	......	......	......	......	20/3.0
Berberis repens	5/1.3	15/1.2	12/1.3	24/1.0	......	33/2.0	19/1.1	10/1.0	13/1.0	......	......	......	......	......
Ceanothus sanguin.	3/1.5	8/1.0	4/3.0	3/3.0	......	......	9/2.8	5/2.0	......	17/3.0	33/2.0	......	......	......
Ceanothus velutinus	......	......	35/1.9	42/1.8	......	......	11/2.2	......	13/1.0	33/1.5	......	......	100/3.0	20/2.0
Holodiscus discolor	......	4/1.0	......	......	......	......	......	5/1.0	......	17/3.0	......	......	......	......
Philadelphus lewis.	......	8/1.5	......	......	......	......	......	5/1.0	......	......	......	......	......	......
Physocarpus malva.	63/3.3	52/3.1	47/2.2	66/2.9	100/3.0	......	68/4.3	30/2.0	50/1.5	66/2.5	66/2.8	......	......	......
Purshia tridentata	......	4/1.0	......	......	......	66/1.5	11/1.2	30/1.3	......	......	......	......	100/1.0	80/2.5
Rosa spp.	53/1.1	66/1.5	66/1.2	68/1.1	......	33/1.0	28/1.2	25/1.1	75/1.3	100/1.3	66/1.5	......	100/1.0	20/2.0
Rubus parviflorus	23/1.0	......	43/1.6	17/1.1	......	......	11/1.2	......	50/1.5	66/1.2	33/2.0	......	......	......
Salix spp.	44/1.8	38/1.9	66/2.1	68/2.0	......	......	44/2.4	15/1.3	50/3.0	84/3.3	100/2.0	......	100/1.0	......
Spiraea pyramidata	53/1.4	71/1.5	85/2.2	94/1.8	......	33/3.0	46/2.3	15/1.8	38/3.0	84/1.8	66/1.5	......	100/4.0	......
Symphoricarpos alb.	39/1.3	63/2.6	43/2.0	45/1.4	100/1.0	33/3.0	73/2.7	50/2.2	50/1.2	84/1.3	33/1.0	......	100/2.0	40/1.5
Symphoricarpos ore.	6/1.2	12/2.3	4/2.0	3/3.0	......	33/1.0	19/1.8	15/3.0	......	17/2.0	......	......	100/3.0	20/2.0
Forbs														
Lomatium spp.*	2/1.0	4/1.0	......	3/1.0	......	66/1.5	9/2.0	20/1.5	......	......	......	......	......	......
Allium spp.*	......	......	......	......	......	66/3.0	......	10/1.5	......	......	......	......	......	......
Hydrophyllum capita.*	2/1.0	14/1.5	......	10/1.0	......	......	6/1.5	......	13/1.0	......	33/1.0	......	......	......
Smilacina spp.*	66/1.1	45/1.4	35/1.3	40/1.2	......	......	44/1.3	10/1.0	50/1.5	33/1.0	100/1.0	......	100/1.0	......
Cirsium spp.*	......	8/1.0	16/2.0	7/1.0	......	......	9/1.0	......	13/1.0	50/1.0	33/1.0	......	......	20/2.0
Habenaria hyperborea*	......	......	4/1.0	......	......	......	......	......	......	......	......	......	......	......
Tragopogon partensis*	......	4/1.0	4/1.0	3/2.0	......	......	19/1.0	30/1.3	......	......	......	......	......	40/1.0
Viccia virginiana*	2/1.0	8/1.0	12/2.0	3/1.0	......	......	9/1.0	......	25/1.5	17/1.0	33/1.0	......	......	......
Trifolium spp.*	......	4/1.0	4/1.0	......	......	33/2.0	3/3.0	......	13/1.0	......	66/1.0	......	......	20/2.0
Actea rubra*	5/1.0	......	......	......	......	......	3/1.0	......	13/1.0	......	......	......	......	......
Sidalcea spp.*	......	......	......	......	......	......	3/1.0	......	13/1.0	......	......	......	......	......
Fragaria spp.*	32/1.1	60/1.5	39/1.1	47/1.1	......	33/1.0	28/1.1	15/1.3	13/2.0	50/1.0	100/1.3	......	......	......
Clematis spp.*	2/1.0	4/1.0	......	3/1.0	......	......	......	......	......	......	......	......	......	......
Liliaceae*	11/1.1	30/1.3	8/1.0	21/1.1	......	......	11/1.2	5/1.0	13/1.0	......	33/1.0	......	......	......
Achillea millefol.	2/1.0	26/1.2	16/1.0	7/1.0	......	33/2.0	33/1.0	35/1.0	......	50/1.0	100/1.0	......	......	......
Aconitum columbianum	......	8/1.0	......	3/1.0	......	......	3/2.0	10/1.0	......	......	......	......	......	......
Adenocaulon bicolor	11/1.1	4/1.0	8/1.0	12/1.0	......	......	6/1.0	......	13/1.0	......	......	......	......	......
Antennaria spp.	......	......	8/1.0	......	......	......	......	......	......	......	......	......	......	......
Apocynum spp.	3/1.0	8/1.5	......	12/1.0	......	......	3/2.0	......	13/1.0	......	......	......	......	......
Arenaria spp.	18/1.0	12/1.0	12/1.0	10/1.2	......	......	3/1.0	......	......	......	......	......	......	......
Arnica cordifolia	57/1.2	49/1.6	74/1.2	77/1.3	100/3.0	......	28/2.0	......	38/1.0	17/1.0	100/1.3	......	......	......

Table 20. cont.

Species	T	OT	SCS	SCOT	SCT	M	OTS	S	R	A	RD	RS	C	SG
Artemisia ludovic.	......	4/1.0	4/1.0	......	......	......	9/1.0	......	......	17/1.0	......	......	......	......
Aster spp.	8/1.0	26/1.0	47/1.0	17/1.0	......	34/1.0	22/1.1	5/1.0	13/1.0	34/1.0	33/1.0	......	......	20/1.0
Balsamorhiza spp.	2/1.0	......	8/1.5	......	......	100/2.3	25/1.1	45/1.1	......	......	......	......	......	100/2.0
Calochortus spp.	......	......	......	3/1.0	......	......	......	......	......	......	......	......	......	20/1.0
Castilleja spp.	......	......	8/1.0	3/1.0	......	......	6/1.5	5/1.0	......	......	......	......	......	20/2.0
Chimaphila umbel.	36/1.1	34/1.4	35/1.0	54/1.1	......	......	3/1.0	......	25/1.0	17/1.0	......	......	......	......
Collinsia spp.	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Crepis spp.	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Delphinium spp.	......	4/2.0	......	......	......	66/1.5	......	......	......	......	......	......	......	20/2.0
Disporum spp.	8/1.0	......	......	3/1.0	......	......	3/1.0	5/1.0	......	......	......	......	......	......
Epilobium august.	......	12/1.0	4/1.0	4/1.0	......	......	14/1.3	......	......	17/1.0	......	......	......	......
Erigeron spp.	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Eriogonum spp.	......	......	......	......	......	......	3/1.0	......	......	......	......	......	......	20/1.0
Galium triflorum	24/1.0	30/1.7	20/1.1	31/1.2	100/2.0	......	19/1.1	10/1.0	50/1.2	33/1.0	66/1.0	......	......	40/1.5
Geranium spp.	3/1.0	9/1.0	12/1.0	10/1.0	......	......	6/1.0	5/1.0	......	......	......	......	100/1.0	......
Gilia spp.	......	4/1.0	......	......	......	......	3/2.0	......	......	......	......	......	100/1.0	20/1.0
Goodyera oblong.	41/1.0	12/1.0	12/1.0	12/1.1	......	......	......	......	......	......	......	......	......	......
Grindelia spp.	......	4/1.0	......	......	......	......	......	5/1.0	......	......	......	......	......	......
Helianthella spp.	......	......	4/1.0	......	......	......	9/1.0	15/1.3	......	......	......	......	......	20/1.0
Hieracium spp.	2/2.0	......	......	3/1.0	......	......	6/1.0	......	......	......	......	......	......	......
Lactuca serriola	......	......	......	......	......	......	......	......	......	......	......	......	......	20/1.0
Lupinus spp.	......	4/1.0	4/1.0	7/1.3	......	100/1.0	13/1.0	25/1.1	......	17/1.0	......	......	......	40/1.5
Osmorhiza depauper.	25/1.0	49/1.2	16/1.0	38/1.1	......	......	38/1.2	5/1.0	38/1.3	33/1.0	33/2.0	......	......	......
Penstemon spp.	8/1.0	4/1.0	35/1.0	42/1.0	......	33/1.0	17/1.1	15/1.3	......	17/1.0	100/1.3	......	100/1.0	20/1.0
Peonia brownii	2/1.0	15/1.0	4/1.0	......	......	......	......	5/1.0	......	......	......	......	100/1.0	40/1.0
Polemonium spp.	5/1.0	8/1.0	4/1.0	3/1.0	......	......	3/1.0	......	......	......	......	......	......	......
Polygonum spp.	......	4/1.0	......	3/1.0	......	......	6/2.5	5/1.0	......	......	......	......	......	20/1.0
Potentilla spp.	......	12/1.0	20/1.1	10/1.0	......	33/2.0	17/1.0	10/1.0	13/1.0	50/1.0	33/1.0	......	100/2.0	......
Pyrola spp.	3/1.0	......	......	3/1.0	......	......	3/1.0	......	......	17/1.0	......	......	......	......
Rudbeckia occident.	5/1.0	19/1.1	24/1.1	19/1.0	......	......	11/1.2	5/1.0	25/1.0	50/1.0	33/1.0	......	......	......
Sedum spp.	2/1.0	......	......	......	......	66/2.0	3/3.0	5/1.0	......	......	......	......	......	......
Taraxacum spp.	2/1.0	12/1.0	4/1.0	3/1.0	......	......	11/1.0	......	......	33/1.0	100/1.0	......	......	......
Thalictrum spp.	36/1.1	30/1.3	58/1.1	42/1.3	100/1.0	......	19/1.1	......	25/1.0	50/2.0	33/1.0	......	......	......
Trillium spp.	23/1.0	4/1.0	24/1.1	5/1.0	......	......	......	......	13/1.0	......	......	......	......	......
Urtica spp.	2/1.0	......	......	......	......	......	......	......	13/1.0	......	......	......	......	......
Veratrum viride	5/1.0	30/1.2	12/1.3	5/1.0	......	33/3.0	22/1.2	15/1.0	......	17/1.0	......	......	......	......
Verbascum thapsus	......	15/1.0	12/1.0	10/1.0	......	......	19/1.1	15/1.0	13/1.0	33/1.5	66/1.0	......	......	......
Viola spp.	5/1.0	15/1.0	4/1.0	4/1.0	......	......	6/1.0	......	25/1.5	......	33/1.0	......	......	......
Vicia spp.	......	23/1.0	......	10/1.0	......	......	13/2.0	......	......	......	33/1.0	......	......	......
Vertical Diversity														
0-1m	4.1	5.3	5.8	5.5	5.0	6.0	6.2	5.5	5.8	5.5	4.8	...	6.0	5.8
1-2m	3.0	3.2	3.9	3.2	3.0	2.8	5.2	4.5	4.5	4.5	3.0	...	4.0	1.0
2-8m	4.8	3.2	3.4	3.5	2.0	3.0	3.5	4.5	4.5	4.0	3.0	...	3.0	1.0
> 8m	4.6	3.1	2.7	3.2	5.0	2.5	3.0	2.0	3.5	3.0	2.8	...	1.0	1.0

* Bear foods

+ Timber(T), Open timber(OT), Open timber/shrubfield(OTS), Riparian(R), Aspen(A), Shrubfield(S), Meadow(M), Rock/talus(RS), Sagebrush/grass(SG), Roads(R), Clearcut(C), Selection cut/shrubfield(SCS), Selection cut/open timber(SCOT), and Selection cut/timber(SCT)

Table 21. Frequency (percent of plots with species)/median coverage class (1=0-1%, 2=>1-5%, 3=>5-25%, 4=>25-50%, 5=>50-75%, 6=>75-95%, or 7=>95-100%) of selected plant species at random locations, by habitat component, on the Middle Fork of the Weiser River study area, 1982-1983.

Species N =	T[+] 68	OT 52	SCS 28	SCOT 99	SCT 19	M 33	OTS 36	S 22	R 2	A 4	RD 17	RS 8	C 13	SG 87
Graminoids														
Grass*	50/1.1	78/1.5	83/2.0	75/1.5	85/1.2	73/2.7	78/2.9	96/3.1	100/1.5	50/3.5	95/1.2	75/1.3	54/1.1	98/4.0
Sedge*	42/1.3	70/1.7	43/1.2	51/1.4	37/1.2	19/1.5	48/1.6	5/3.0	50/1.0	50/1.5	48/1.2	13/2.0	85/1.8	6/1.3
Trees														
Abies grandis														
0-4"dbh	58/2.9	33/1.4	61/1.3	69/2.1	90/3.1	......	17/2.0	5/1.0	50/1.0	25/1.0	42/1.4	......	39/1.1	......
4-12"dbh	55/3.3	31/1.9	43/2.3	66/2.8	85/4.1	7/1.5	23/3.2	......	......	50/1.5	53/2.0	......	8/2.0	......
12-18"dbh	30/2.9	6/2.8	8/1.5	23/2.3	32/3.0	......	3/3.0	......	......	......	6/2.0	......	......	......
>18"dbh	15/3.1	11/2.5	4/3.0	9/3.0	11/3.0	......	2/2.0	......	......	......	......	......	......	......
Abies lasiocarpa														
0-4"dbh	11/3.0	14/1.4	8/1.0	......	......	7/1.0	9/1.0	......	......	......	......	......	......	......
4-12"dbh	11/4.6	12/2.2	11/3.0	3/1.5	6/2.0	7/1.5	9/1.3	......	......	......	......	......	......	......
12-18"dbh	2/5.0	12/2.8	......	......	......	......	6/1.5	......	......	......	......	......	......	......
>18"dbh	......	4/3.0	......	......	......	......	......	......	......	......	......	......	......	......
Larix occidentalis														
0-4"dbh	......	......	......	2/2.0	......	......	......	......	......	......	6/1.0	......	......	......
4-12"dbh	......	......	4/1.0	3/1.5	6/3.0	......	......	......	......	......	......	......	......	......
12-18"dbh	2/3.0	......	......	2/1.0	6/3.0	......	......	......	......	......	......	......	......	......
>18"dbh	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Picea engelmannii														
0-4"dbh	12/1.8	......	25/1.4	5/1.2	11/1.0	......	......	......	......	......	18/1.3	......	16/1.0	......
4-12"dbh	9/2.2	2/1.0	8/2.5	3/2.0	16/2.0	......	......	......	......	......	6/1.0	......	......	......
12-18"dbh	2/2.0	......	......	4/2.8	......	......	......	......	......	......	......	......	......	......
>18"dbh	......	......	......	3/3.0	......	......	3/4.0	......	......	......	6/1.0	......	......	......
Pinus contorta														
0-4"dbh	2/2.0	......	4/1.0	3/1.0	......	......	3/1.0	......	......	......	......	......	24/1.0	......
4-12"dbh	8/3.3	......	......	3/2.5	16/3.0	......	......	......	......	......	......	......	......	......
12-18"dbh	2/3.0	......	......	2/3.0	......	......	3/4.0	......	......	......	6/2.0	......	......	......
>18"dbh	......	......	......	2/4.0	......	......	......	......	......	......	......	......	......	......
Pinus ponderosa														
0-4"dbh	9/1.1	45/1.5	47/1.4	46/1.2	11/1.5	22/1.4	39/1.7	10/1.0	50/2.0	50/1.0	48/1.1	......	85/1.3	9/1.4
4-12"dbh	31/2.8	49/1.9	15/2.5	35/2.2	6/2.0	9/2.2	28/3.1	5/1.0	......	......	6/2.0	13/2.0	7/3.0	6/2.0
12-18"dbh	21/2.4	37/2.1	11/2.9	18/2.3	......	4/3.0	14/2.3	10/1.5	......	25/1.0	6/2.0	......	......	4/2.0
>18"dbh	23/2.9	27/2.9	4/2.0	18/2.4	16/3.0	4/1.0	14/3.0	5/1.0	......	......	......	......	......	3/2.0
Psuedotsuga menziesii														
0-4"dbh	36/1.9	62/1.4	54/1.3	44/1.3	16/1.3	......	50/1.5	5/2.0	......	50/1.0	24/1.2	13/1.0	47/1.0	5/1.0
4-12"dbh	45/3.2	54/2.3	25/2.6	34/2.8	32/3.3	7/2.0	48/3.0	10/1.0	......	......	18/1.8	13/1.0	......	3/1.0
12-18"dbh	27/2.6	33/2.7	4/2.0	19/2.5	27/3.0	7/2.5	12/2.5	......	......	......	6/2.0	......	8/1.0	3/1.0
>18"dbh	15/3.0	20/2.5	8/1.5	5/3.0	6/3.0	4/1.0	12/3.0	......	......	......	......	......	......	......
Populus tremuloides														
0-4"dbh	8/1.1	22/1.7	11/1.8	13/1.4	6/1.0	4/1.0	6/1.5	23/1.3	......	75/2.0	6/1.0	......	16/1.5	2/1.0
4-12"dbh	9/1.8	8/2.2	4/1.0	8/2.3	6/2.0	......	......	19/2.2	......	100/3.0	......	......	......	......
12-18"dbh	......	......	......	......	......	......	......	......	......	......	......	......	......	......
>18"dbh	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Populus trichocarpa														
0-4"dbh	......	......	......	2/2.0	......	......	......	......	......	......	......	......	16/1.0	......
4-12"dbh	......	......	......	......	......	......	......	10/1.5	50/2.0	......	......	......	......	......
12-18"dbh	......	......	......	......	......	......	......	......	......	......	......	......	......	......
>18"dbh	......	......	......	......	......	......	......	......	......	......	......	......	......	......

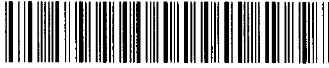
Table 21. cont.

Species	T	OT	SCS	SCOT	SCT	M	OTS	S	R	A	RD	RS	C	SG
Shrubs														
Prunus virginiana*	12/1.3	16/1.3	4/1.0	9/1.3	......	4/2.0	23/1.1	46/2.2	......	......	6/1.0	......	......	14/1.4
Prunus emarginata*	17/1.6	35/1.2	18/3.0	26/1.8	6/3.0	7/2.5	42/2.6	55/3.0	......	25/1.0	36/1.5	13/2.0	16/1.5	19/1.5
Shepherdia canaden.*	6/1.5	2/1.0	29/2.0	26/1.9	27/1.3	......	......	......	......	......	30/1.1	......	24/3.0	......
Cornus stolonifera*	2/1.0	6/1.3	......	6/1.3	......	......	3/1.0	5/3.0	50/5.0	......	12/1.0	......	......	......
Amelanchier alnifo.*	37/1.2	64/1.1	43/1.2	59/1.1	16/1.0	7/1.5	25/1.3	23/1.7	50/2.0	100/1.5	6/1.0	13/1.0	24/1.8	9/1.0
Ribes spp.*	17/1.1	33/1.2	43/1.5	35/1.2	27/1.3	13/1.0	12/1.5	13/1.0	100/2.5	......	42/1.2	13/1.0	62/2.8	3/1.0
Vaccinium globulare*	36/3.0	14/3.0	54/3.0	35/3.6	64/3.3	......	17/2.5	......	50/2.0	......	30/1.3	......	62/2.9	......
Crataegus douglasii*	2/1.0	8/2.5	8/2.5	7/1.1	......	......	3/3.0	32/4.8	50/2.0	......	......	......	......	9/1.2
Sambucus spp.*	6/1.0	14/1.0	11/1.0	13/1.3	6/1.0	4/2.0	14/1.1	28/1.5	......	......	6/1.0	......	47/1.3	12/1.2
Sorbus scopulina*	9/1.3	6/1.3	29/1.5	13/1.2	11/1.0	7/2.5	20/2.3	......	......	......	12/1.5	......	16/1.5	......
Lonicera spp.*	42/1.2	12/1.5	50/1.7	38/1.4	53/1.3	10/1.3	23/1.3	......	......	......	24/1.0	......	39/2.3	2/1.0
Acer glabrum	36/1.7	24/1.9	25/2.4	38/1.7	......	7/3.0	34/2.8	5/3.0	50/3.0	25/3.0	26/1.2	......	8/1.0	2/1.0
Alnus sinuata	6/1.5	4/1.5	18/4.0	10/2.3	6/2.0	......	6/4.5	5/3.0	50/2.0	......	18/2.0	......	24/3.0	......
Artemisia tridentata	2/1.0	12/1.3	......	3/1.0	......	37/1.4	20/2.3	23/1.8	......	......	......	25/1.0	......	51/2.0
Berberis repens	14/1.2	16/1.2	11/1.3	23/1.1	6/1.0	4/2.0	14/1.3	10/1.5	50/1.0	50/1.0	......	......	15/1.0	7/1.3
Ceanothus sanguineus	2/1.0	......	11/2.3	8/1.4	22/1.5	......	6/2.0	14/2.8	......	......	6/1.0	......	8/1.0	2/1.0
Ceanothus velutinus	5/1.0	10/1.3	36/2.3	38/1.5	22/2.8	13/1.8	25/1.7	......	......	100/1.2	53/1.1	13/1.0	47/1.3	4/1.3
Holodiscus discolor	2/1.0	2/2.0	......	......	......	......	......	......	......	......	......	......	......	......
Philadelphus lewisii	2/2.0	6/1.3	......	2/1.0	......	......	6/1.5	14/1.8	50/2.0	......	......	......	......	5/1.5
Physocarpus malva.	53/3.3	52/3.3	36/4.0	47/2.9	43/3.2	7/1.5	48/4.0	32/4.3	50/3.0	25/4.0	30/1.9	......	24/5.0	12/2.5
Purshia tridentata	......	6/2.0	......	2/2.0	......	10/2.0	12/1.5	32/2.0	......	......	......	13/2.0	......	64/1.6
Rosa spp.	59/1.2	39/1.1	54/1.1	69/1.1	64/1.4	7/1.0	23/1.2	28/2.0	100/1.5	100/1.2	42/1.4	......	47/1.0	13/1.0
Rubus parviflorus	17/1.3	6/1.3	22/1.8	20/1.1	22/1.0	......	3/1.0	5/1.0	50/2.0	25/1.0	36/1.5	......	31/1.2	2/2.0
Salix spp.	33/1.4	49/1.4	79/2.8	60/1.8	43/1.8	10/1.8	28/2.1	28/3.0	50/1.0	75/2.8	42/1.8	......	93/2.2	3/1.5
Spiraea betulifolia	64/1.5	58/1.5	79/2.5	76/1.9	53/2.0	10/1.8	45/2.5	14/3.0	......	100/1.5	48/1.3	......	85/2.1	7/1.0
Symphoricarpos alb.	50/1.6	72/1.9	40/3.3	56/1.7	16/1.8	9/1.8	37/1.4	60/2.7	50/2.0	100/1.5	42/1.4	25/1.5	31/2.2	30/1.6
Symphoricarpos ore.	6/1.2	16/1.5	18/2.7	11/2.3	6/1.0	31/1.5	42/2.3	19/5.0	......	......	......	......	......	5/1.8
Forbs														
Lomatium spp.*	3/1.0	20/1.1	8/1.0	5/1.0	......	70/2.2	28/2.7	41/1.8	......	......	6/1.0	100/1.5	......	71/1.5
Allium spp.*	......	4/1.0	......	3/1.0	......	49/2.1	14/2.7	9/1.0	......	......	......	75/1.0	......	44/1.2
Hydrophyllum capita.*	......	......	......	2/1.0	......	......	......	......	......	......	......	......	......	3/1.0
Smilacina spp.*	50/1.1	22/1.1	22/1.1	32/1.0	27/1.0	......	14/1.0	10/1.5	......	50/1.0	6/1.0	......	31/1.2	3/1.0
Cirsiom spp.*	......	8/1.0	12/1.0	18/1.1	16/1.0	......	......	5/1.0	......	......	12/1.0	......	47/1.0	9/1.1
Habenaria hyperborea*	......	......	......	......	......	......	......	......	......	......	6/1.0	......	8/1.0	......
Tragopogon partensis*	......	6/1.0	4/1.0	4/1.0	......	......	3/1.0	41/1.0	50/1.0	......	12/1.0	13/1.0	......	48/1.2
Viccia virginiana*	3/1.0	2/1.0	11/1.0	2/1.0	6/1.0	......	3/1.0	5/2.0	......	25/1.0	......	......	......	6/1.1
Trifolium spp.*	......	4/1.0	......	......	......	7/1.5	......	......	......	......	5/1.0	......	8/1.0	2/1.0
Actea rubra*	6/1.0	4/1.0	4/1.0	2/1.0	......	......	6/1.5	......	......	......	12/1.0	......	8/3.0	......
Sidalcea spp.*	2/1.0	......	......	2/1.0	......	......	6/2.5	5/2.0	......	......	......	......	......	......
Fragaria spp.*	21/1.1	47/1.1	29/1.5	34/1.2	16/1.0	......	17/1.1	28/1.1	50/2.0	75/1.3	65/1.1	13/1.0	31/1.5	4/1.0
Clematis spp.*	......	......	......	3/1.0	......	......	3/1.0	......	......	......	......	......	......	......
Liliaceae*	17/1.1	20/1.1	4/1.0	17/1.1	......	4/2.0	25/1.1	......	......	......	......	......	......	3/1.0
Achillea millefol.	5/1.3	50/1.1	33/1.1	19/1.0	......	61/1.2	25/1.1	55/1.0	50/1.0	75/1.0	77/1.0	......	47/1.0	53/1.0
Aconitum columbianum	......	......	15/1.0	4/1.0	......	10/1.3	6/2.0	......	......	......	18/1.0	......	8/1.0	......
Adenocaulon bicolor	17/1.0	2/2.0	......	11/1.1	27/1.0	......	......	......	50/2.0	......	18/1.0	......	8/1.0	......
Antennaria spp.	......	4/1.0	15/1.0	3/1.0	......	13/1.2	14/1.3	......	......	......	30/1.0	50/1.2	8/1.0	9/1.2
Apocynum spp.	3/1.0	6/1.0	15/1.0	15/1.3	......	4/1.0	9/1.0	19/1.5	50/1.0	25/1.0	24/1.0	......	6/1.0	10/1.2
Arenaria spp.	14/1.1	10/1.1	8/1.0	7/1.1	16/1.0	......	6/1.0	......	......	......	......	......	8/1.0	3/1.0
Arnica cordifolia	53/1.4	22/2.0	36/1.2	44/1.3	69/1.4	7/1.0	12/1.5	5/1.0	......	50/1.5	47/1.0	......	47/2.5	2/1.0

Table 21. cont.

Species	T	OT	SCS	SCOT	SCT	M	OTS	S	R	A	RD	RS	C	SG
Artemisia ludovic.	......	2/1.0	......	3/1.0	......	4/1.0	14/1.3	......	......	......	12/1.0	13/1.0	......	......
Aster spp.	25/1.0	45/1.1	25/1.2	30/1.1	26/1.3	46/1.3	31/1.3	23/1.1	......	......	24/1.0	......	31/1.5	25/1.1
Balsamorhiza spp.	3/1.0	29/1.3	......	6/1.1	......	52/1.8	42/1.3	64/1.4	......	......	......	38/1.3	......	91/2.0
Calochortus spp.	......	12/1.0	......	......	......	4/1.0	3/1.0	......	......	......	......	13/2.0	8/1.0	10/1.0
Castilleja spp.	5/1.0	8/1.0	29/1.3	12/1.0	6/1.0	7/1.5	14/1.3	......	......	25/1.0	6/1.0	......	31/1.2	......
Chimaphila umbel.	39/1.0	12/1.3	15/1.0	35/1.1	54/1.1	......	3/1.0	......	......	......	8/1.0	......	......	......
Collinsia spp.	......	......	......	2/1.0	11/1.0	......	......	5/1.0	......	......	6/1.0	......	......	......
Crepis spp.	2/1.0	......	4/1.0	2/1.0	11/1.0	......	3/1.0	......	......	......	......	......	......	2/1.0
Delphinium spp.	......	......	......	......	......	10/2.8	......	......	......	......	......	......	......	2/1.0
Disporum spp.	2/1.0	......	......	......	......	......	......	......	......	......	......	......	......	......
Epilobium august.	9/1.0	12/1.3	33/1.1	16/1.1	5/1.0	7/1.5	6/1.5	5/2.0	50/1.0	50/1.0	24/1.0	......	31/1.2	......
Erigeron spp.	......	......	4/1.0	6/1.0	......	4/1.0	12/1.0	5/1.0	......	......	......	......	......	......
Eriogonum spp.	......	6/1.3	......	3/1.0	......	43/1.7	17/1.0	23/1.0	......	......	......	88/1.4	......	49/1.2
Galium triflorum	24/1.0	24/1.3	25/1.0	26/1.0	16/1.0	......	14/1.1	14/1.3	......	......	12/1.0	......	47/1.0	2/1.0
Geranium spp.	14/1.0	31/1.1	15/1.0	15/1.0	6/1.0	19/1.3	3/1.0	10/1.0	......	50/1.0	24/1.0	......	......	3/1.0
Gilia spp.	......	14/1.0	......	3/1.0	......	16/1.3	17/1.0	5/1.0	......	......	......	13/1.0	......	4/1.0
Goodyera oblong.	23/1.0	12/1.1	......	10/1.0	37/1.0	......	9/1.0	......	......	......	......	......	......	......
Grindelia spp.	......	......	......	......	......	......	3/1.0	10/1.5	......	......	......	13/1.0	......	7/1.3
Helianthella spp.	......	2/2.0	4/1.0	3/1.0	......	4/1.0	6/2.5	19 1.0	......	......	......	......	8/2.0	7/1.3
Hieracium spp.	6/1.0	2/1.0	4/1.0	13/1.0	43/1.0	7/1.0	3/1.0	......	......	......	6/1.0	......	16/1.0	3/1.0
Lactuca serriola	......	......	......	2/1.0	......	......	......	10/1.0	......	......	6/1.0	13/1.0	......	12/1.1
Lupinus spp.	5/1.0	24/1.0	4/1.0	11/1.2	6/1.0	49/1.7	14/1.1	28/1.3	50/1.0	......	12/1.0	......	......	18/1.4
Osmorhiza depauper.	46/1.0	25/1.0	18/1.0	27/1.0	27/1.0	......	12/1.0	14/1.3	......	50/1.0	24/1.0	......	......	......
Penstemon spp.	11/1.0	24/1.0	50/1.0	36/1.0	27/1.0	37/1.2	34/1.0	32/1.0	......	......	65/1.0	88/1.1	100/1.0	35/1.0
Peonia brownii	5/1.0	18/1.0	11/1.0	11/1.1	......	13/1.5	17/1.0	......	......	25/1.0	12/1.0	25/1.5	100/3.0	4/1.0
Polemonium spp.	11/1.2	14/1.1	22/1.3	9/1.2	6/2.0	7/1.5	9/1.8	......	......	......	12/1.0	......	......	......
Polygonum spp.	......	8/1.0	4/1.3	9/1.1	......	13/1.5	17/1.5	19/1.2	......	......	......	13/1.0	......	56/1.5
Potentilla spp.	8/1.0	35/1.0	43/1.1	21/1.1	11/1.0	40/1.1	37/1.1	28/1.1	......	25/1.0	48/1.0	13/1.0	......	5/1.0
Pyrola spp.	12/1.0	4/1.0	4/1.0	5/1.0	16/1.0	......	3/1.0	......	......	......	......	......	......	......
Rudbeckia occident.	24/1.0	18/1.0	40/1.1	22/1.1	27/1.1	19/1.3	3/1.0	......	......	......	42/1.1	......	16/1.0	......
Sedum spp.	......	14/1.1	......	3/1.5	......	13/1.8	12/1.0	14/1.0	......	......	12/1.0	50/1.0	......	27/1.1
Taraxacum spp.	......	......	8/1.0	6/1.0	6/1.0	4/1.0	......	5/1.0	50/2.0	25/1.0	48/1.0	......	16/1.0	2/1.0
Thalictrum spp.	56/1.1	37/1.2	54/1.0	38/1.4	12/1.0	7/2.5	20/1.8	14/1.3	......	75/2.0	12/1.0	......	47/1.3	......
Trillium spp.	14/1.0	4/1.2	8/1.0	8/1.1	22/1.0	......	6/1.0	......	......	25/1.0	......	......	16/1.0	......
Urtica spp.	......	2/1.0	8/1.5	2/1.0	......	......	3/1.0	......	......	......	6/1.0	......	16/1.5	2/2.0
Veratrum viride	8/1.0	20/1.1	18/1.1	4/1.3	6/1.0	16/1.1	3/2.0	19/1.2	......	75/2.5	6/1.0	......	31/1.5	3/1.0
Verbascum thapsus	......	14/1.0	15/1.0	19/1.1	16/1.0	......	6/1.0	28/1.1	50/1.0	25/1.0	42/1.0	......	12/1.0	4/1.3
Viola spp.	15/1.1	10/1.0	8/1.0	8/1.0	6/1.0	......	3/1.0	......	......	25/1.0	......	......	16/1.0	......
Vicia spp.	2/1.0	2/1.0	......	3/1.0	......	......	......	......	......	......	......	......	8/1.0	......
Vertical Diversity														
0-1m	4.7	5.6	6.1	5.6	4.6	5.4	5.5	5.9	3.0	5.8	3.3	2.5	5.8	5.2
1-2m	2.8	2.9	4.1	2.9	3.3	1.4	3.3	4.3	2.5	3.5	1.9	1.0	3.0	1.3
2-8m	4.9	3.3	3.0	3.4	5.2	1.5	3.7	3.7	2.5	2.8	2.3	1.0	1.0	1.0
> 8m	5.0	2.6	2.6	3.6	5.8	1.4	3.8	1.0	3.0	1.5	2.5	1.0	1.0	1.0

* Bear foods
+ Timber(T), Open timber(OT), Open timber/shrubfield(OTS), Riparian(R), Aspen(A), Shrubfield(S),Meadow(M), Rock/talus(RS), Sagebush/grass(SG), Roads(R), Clearcut(C), Selection cut/shrubfield(SCS), Selection cut/open timber(SCOT), Selection cut /timber(SCT)



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