FINAL DRAFT

HELLSGATE WINTER RANGE MITIGATION PROJECT
LONG-TERM MANAGEMENT PLAN

PROJECT REPORT 1993

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ABSTRACT

A study was conducted on the Hellsgate Winter Range Mitigation Project area, a 4,943 acre ranch purchased for mitigating some habitat losses associated with the original construction of Grand Coulee Dam and innundation of habitat by Lake Roosevelt. A Habitat Evaluation Procedure (HEP) study was used ***to*** determine habitat quality and quantity baseline data and future projections. Target species used in the study were sharp-tailed grouse (Tympanuchus phasianellus), mule deer (Odocoileus hemoinus), mink (Mustela vison), spotted sandpiper (Actiius colchicus), bobcat (Felis reufs), blue grouse ***(Dendragapus obscurus),*** and mourning dove ***(Zenaida macroura).*** From field data collected, limiting life values or HSI's (Habitat Suitability Index's) for each indicator species was determined for existing habitats on project lands. From'this data a long term management plan was developed.

This report is designed to provide guidance for the management of project lands in relation to the habitat cover types discussed and the indicator species used to evaluate these cover types. In addition, the plan discusses management actions, habitat enhancements, and tools that will be used to enhance, protect and restore habitats to desired conditions. Through planned management actions biodiversity and vegetative structure can be optimized over time to reduce or eliminate, limiting HSI values for selected wildlife on project lands.

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INTRODUCTION

This Hellsgate Winter Range Mitigation project was proposed by the Colville Confederated Tribes (CCT) as partial mitigation for hydropower's share of wildlife habitat losses resulting from the construction of Grand Coulee Dam. The project is funded by the Bonneville Power Administration (BPA) and carried out in cooperation with CCT, the US. Fish and Wildlife Service (USFWS), Columbia Basin Fish and Wildlife Authority (CBFWA), Bureau of Indian Affairs (BIA), Northwest Power Planning Council (NPPC), and others. The project will be consistent with Section 1003 (b) (7) of the NPPC's Wildlife Rule, which addresses mitigation for wildlife losses due to the Federal Columbia River Power System.

The NPPC and BPA approved the Hellsgate Winter Range Project as partial mitigation for impacts associated with construction of Grand Coulee Dam. The focus of this project is the protection and management of critical winter habitat for big game and shrub-steppe/sharp-tailed grouse habitat in northcentral Washington,

Consistent with the Northwest Power Planning Council's Wildlife Rule, the BPA has acquired the land through purchase with a willing seller. **The biological requirements of wildlife and protection of critical habitat will take precedence over all other considerations, including livestock grazing and recreational opportunities, in the management of project lands.**

PROJECT ENVIRONMENT

Description

The project lies in the southeast corner of the Colville Indian Reservation about 15 air miles upstream from Grand Coulee Dam. The site is a 4,943 acres ranch, within an area (Hellsgate Game Reserve) the Tribe currently has in special management status because of its importance as big game winter range. There are 12 separate parcels of land that make up this ranch (See Figure 1.). These include a wide diversity of vegetative types and habitats for a variety of wildlife. Some of the parcels border or are adjacent to the Columbia River at lower elevations (1,290 ft. mean sea level) others are at higher elevations, up to 4,762 ft. The area is remote, major human activities are associated with logging, cattle grazing, and limited agricultural crop production. The majority of the land is in Tribal ownership, with the remainder in private, state or county property. Vegetation types within the project boundaries include shrub-steppe on south and west facing exposures with ponderosa pine and bitterbrush on other low elevations. Riparian areas and draws contain deciduous trees and shrubs with coniferous trees dominating the higher elevations, Large areas of rangeland with some Conservation Reserve Program (CRP) land dominate the large flat plateaus above Lake Roosevelt.

Climate

The daily temperature on the study area can vary from a low of minus 10 degrees in winter, to highs of over 100 degrees in summer. The winters at the lower elevations along the lake are cold but not usually too severe. The annual precipitation averages 12.70 inches, occurring mostly in the form of snow. From 1980 to 1990, below normal precipitation has resulted in drought like conditions with low soil moisture, dry growing seasons, and deficient annual soil recharge.

Soils

Soils of the area were classified and mapped by the Soil Conservation Service (SCS 1980). They are the result of glacial action and weathering of the granite substratum. Most of the soils in the area are sandy or gravely loams. They are deep, well drained and support a variety of vegetation types, Tribal Geographic Information Systems (GIS) maps show the different soil types corresponding well with the different habitat cover types associated with project lands.

Wildlife and Habitat

Wildlife resources on the project lands include reptiles, amphibians, birds and mammals. Some threatened and sensitive species of wildlife frequent this area and will benefit from mitigation measures. Extripated species may be reintroduced, following habitat management and/or enhancement. Wildlife distribution is dependant on suitable habitat (habitat is defined by cover type). Cover types used in this report describe areas that provide for the necessary life functions, (breeding, nesting, hiding, loafing, feeding, and traveling) for a particular species that represents a guild of species using that cover. Cover types serve three basic functions; (1) facilitate the selection of evaluation species, (2) extrapolation of data from sampled areas to unsampled areas can be done with some

confidence reducing the amount of sampling necessary, and (3) separation of the study area into cover types facilitates treatment of HEP data.

Description of Cover Habitat Types

Eight general cover types exist within the project area : shrub-steppe, agriculture, coniferous forest, Ponderosa pine savanna, riparian, rock, shoreline and mixed forest

Table 1. Habitat cover types ranked by acres and percent of total area.

Habitat Cover Type	Acres	Percent of Total Area
Shrub-steppe (SS)	1,985	40.17 %
Agriculture (AG)	1,137	23.01 %
Coniferous Forest (CF)	1,050	21.25 %
Ponderosa P. Savanna (PP)	570	11.53 %
Riparian (RIP)	147	2.97 %
Rock (RR)	35	0.71 %
Shoreline (SL)	14	0.28 %
Mixed Forest (MF)	4	0 . 9 8
TOTALS	**4,943**	**100.00 %**

Shrub-steppe habitat in the report is defined as dry sites occupied by shrubs and herbaceous vegetation with ground surface dominated by grasses, bare ground, litter, rock and erosion pavement. Shrub-steppe areas are primarily rangeland, devoid of tree canopy closure, and dominated by understory species such as bitterbrush, sagebrush, rabbitbrush, cactus, serviceberry, and currant. Grass species of this cover type include bluebunch wheatgrass, needle-and-thread, Idaho fescue, basin wildrye, and some annuals like cheatgrass. This cover type dominates project lands covering 40 percent of the total area or 1,984 acres. Wildlife species typically found in this cover type include mule deer, sharp-tailed grouse, western meadowlark, badger, coyote, cottontail rabbit, snowshoe hare, burrowing owl, sagebrush vole, Northern Pacific rattlesnake, northern harrier hawk, and grasshopper sparrow. Grazing impacts have reduced native steppe vegetation communities, as described by Daubenmire (1970.), and altered this cover type on all project lands.

Agriculture habitat consists of areas used for the growing of cereal grains, alfalfa hay, and land taken out of production for the Conservation Reserve Program (CRP). CRP land makes up the majority of the land use and is planted in alfalfa, intermediate and crested wheatgrass. Other species such as cheatgrass and threeawn grass are also present. This cover type makes up 23 percent of the area or 1,137 acres. Wildlife species occurring in this cover type include mourning dove, meadowlark, sharp-tailed grouse, cottontail rabbit, small mammals, badger, coyote, ringneck pheasant, Hungarian partridge, Canada geese, horned lark, barn swallow, white-tailed deer and mule deer. Many species use this cover type for food and are closely linked to adjacent cover types.

Coniferous forest habitat is characterized by intermixed stands of Ponderosa pine, Douglas fir, larch, and/or grand fir with varying understory vegetation. Understory species may include, oceanspray, current, redstem ceanothus, ninebark, snowberry, bitterbrush, and Myrtle boxwood. This cover type makes up 1,050 acres or 21 percent of the total area. Wildlife occurring in this cover type include, blue grouse, white-tailed deer, spruce grouse, black bear, elk, pine marten, pileated woodpecker, various birds and small mammals.

Ponderosa pine savanna habitat consists of pine trees and shrubs over grassland vegetation in a parklike setting. The dominant tree is the ponderosa pine, scattered over the area in clumps or standing alone. The dominant shrub is bitterbrush and, in some areas, Columbia hawthorne, red-osier dogwood, common snowberry, serviceberry, rose, mockorange and Oregon grape can be found. This cover type makes up 12 percent of the study area and contains 570 acres. Wildlife species using this cover type on the Reservation include mule deer, white-tailed deer, elk, blue grouse, turkey, various song birds and small mammals,

Riparian habitat consists of areas that are directly influenced by water year round (streams, lakes, or ponds),ephemeral springs, or meadows that may or may not contain deciduous trees and shrubs. Common trees and shrubs of this cover type may include, alder, aspen, cottonwood, red-osier dogwood, Columbia hawthorne, willow, water birch, serviceberry, chokecherry, smooth sumac, blue-berry elder, snowberry, and rose species. On wet sites devoid of trees and shrubs herbaceous hydrophytes such as cattail, bulrush, pondweed, sedge, and water milfoil can be found. This cover type occupies 147 acres, 3 percent of the total area, but is extremely important to a variety of wildlife such as mink, beaver, muskrat, raccoon, stripped skunk, coyote, ruffed grouse, white-tailed deer, small mammals, reptiles, amphibians and black bear. Birds found in and around the area include, wintering sharp-tailed grouse, warblers, waterfowl, songbirds, hawks, great blue heron, California quail, and ringnecked pheasant, Waterfowl species common to emergent wetlands include mallard, Canada goose, coot and various teal species.

Rock habitat is described as rocky, steep or difficult topography, usually excluding grazing and occurs mainly on talus, scree or boulder strewn slopes, or major rock outcrops along Lake Roosevelt. The typical vegetation includes deep rooted shrubs of serviceberry, mockorange, and chokecherry Grasses include bluebunch wheatgrass, Sandberg bluegrass, and cheatgrass. Forbs include arrowleaf balsamroot, Lomatium sp., buckwheat and bitterroot. This cover type, only 35 acres, is 0.7 percent of the total project area.

Shoreline habitat is described as narrow strips of land bordering Lake Roosevelt and are essentially beaches. These beaches are composed of sand, gravel, cobble, rock, or boulders. Depending on gradient and soils this cover type may contain some vegetation such as grasses, herbs and shrubs. This small cover type covering 14 acres (normal pool el. 1,290 ft. mean sea level) or 0.3 percent of the total area, is dependant upon water levels controlled by Grand Coulee Dam. Low water levels expose long wide stretches of this

cover type and at full pool (1,3 10 ft. mean sea level) this cover type is non-existent. Wildlife using this cover type include spotted sand pipers, shore birds, waterfowl, raptors, and mule deer.

Mixed Forest habitat is described as areas covered by both conifers and deciduous trees with a variety of understory vegetation and grasses. Only one area of the project lands contain this small cover type (4 acres), a transition zone between riparian and coniferous forest. Numerous species of wildlife would use this cover habitat type if the area was larger in size.

All cover types described above may have inclusions of other cover types or rock outcropping within their boundaries.

METHODS

Using Habitat Evaluation Procedures (HEP) developed by the U.S. Fish and Wildlife Service (USFWS), a baseline study was conducted on project lands. The HEP consisted of a Technical Task Team responsible for selecting representative habitats and indicator species for evaluation. The HEP model for each species uses measurable variables that are combined into an equation which provides the sample site Habitat Suitability Index (HSI) for that particular species. A weighted HSI value is determined for each species utilizing all the sample sites after being weighted by the size of the area sampled. This overall HSI, which is a number between 0 and 1, is a quality index or measure of the capacity of the area to meet the life requisites of the indicator species. Aerial photos, both 1983 and 1991, were used to determine existing cover types. GIS satellite imagery maps of the area determined the extent of each cover type, acreage and physical features. After ground verification, complete project maps containing cover types, roads , streams, property boundaries, lakes, Range, Township and section lines, were made of all project lands. Prior to field data collection, extensive preparation into the area background and wildlife species within the project was researched from reference materials, personal communication with people who live in the study area, wildlife biologists, and Tribal and State data. Eight previously described wildlife habitat cover types were identified in the Hellsgate Big Game Wintering Area and seven wildlife indicator species were chosen to evaluate these habitat cover types. The HEP field survey team sampled all cover types for each selected indicator species based on HEP models developed for each species (See Table 2.). Areas of typical habitat within each cover type were sampled and weighted to calculate the Habitat Suitability Index's (HSI's) for each indicator species. The best method for sampling habitat is outlined by the USFWS Blue Book for each particular species. Techniques used for the vegetative analysis survey included line transects, Robe1 pole readings, Daubenmire microplots, densiometer readings, clinometer readings, diversity of species in the area, successional stage and remote sensing.

SELECTED INDICATOR SPECIES FOR HELLSGATE HEP

Selection of evaluation (indicator or target) species form the basis of a HEP analysis (U.S.Dept. Interior 1976). Indicator species are used in HEP to quantify habitat suitability and determine changes in the number of available Habitat Units (HU's). One HU is equal to one acre of optimum habitat. A HEP assessment is directly applicable only to the evaluation species selected. Species selected for this evaluation were based on their particular habitat requirements indicative of certain vegetative types representing groups of species utilizating common environmental resources (GUILDS), or species that preform a key role (nutrient cycling or energy flows) in a community and serves as indicators for a large segment of the wildlife community (U.S.Dept. Interior 1980). Species were also selected if they were known to be sensitive to specific land use actions, thereby serving as early warning species for the affected wildlife community.

Table 2. SURVEY TECHNIQUES FOR FIELD DATA COLLECTION

Technique	Variable
Columbian Sharp-tailed Grouse	
Robe1 Pole	Vertical Structure
Micro Plot (.lm sq.)	% Bare Ground, % Vegetative Litter, % Grasses, % Forbs, and Height of Grasses and Forbs
Photo Plot	Vegetative Trends and Structure
Maps	Distance to Water or Leks
Line Transect	% Bud Producing Shrubs and Trees
Densiometer	% Deciduous Tree Crown Cover
Mule Deer	
Technique	Variable
Line Transect	% Woody Evergreen Vegetation
Tape Measure	Height of Shrubs
Clinometer	Height of Trees
Densiometer	% Shrub Crown Cover
Ocular Estimation	% Area Consisting of Variable Topography
Mourning Dove	
Technique	Variable
Remote Sensing	Distance to Water
Ocular Estimation	Abundance of Seed Source
Remote Sensing	Interspersion of Cover Types
Line Intercept	% Canopy (Closure)
Spotted Sandpiper	
Technique	Variable
Micro Plot	% Herb. Ground Cover
Remote Sensing	Distance to Water
Line Intercept	% Organic Ground Cover
Mink	
Technique	Variable
Line Transect / Densiometer	% Tree Canopy Closure
Remote Sensing	% Year with Surface Water

Blue Grouse

Technique	Variable
Line Intercept	% Canopy Cover entire area
Line Intercept	% Shrub crown cover
Graduated Rod	Ave. Height of Shrub Canopy
Line Intercept	% Herbaceous Canopy Cover
Line Intercept /Tape measure	Ave. Height of Herb. Canopy
Line Intercept / Count	Diversity of Herb. Vegetation per Cover Type
Remote Sensing	Distance to Nearest Edge

Bobcat

Technique	Variable
Line intercept	% Canopy Cover Herb. Vegetation
Ocular Estimate	Shrub Distribution
Densiometer	% Canopy Cover Shrubs
Remote Sensing	% Area Structure

The following species were chosen by the Technical Task Team (TTT) for the HEP

Shrub-steppe; Sharp-tailed grouse, Mule deer, Red-tailed hawk, Chukar, Hungarian partridge, Elk, Badger, Rattlesnake, Whitetail Jackrabbit, Burrowing owl, Great Basin Pocket Mouse, Bobcat, and Meadowlark.
Ponderosa pine savanna; Blue grouse, White-tailed deer, Mule deer, Elk, Black bear, Goshawk, Bobcat, and song birds.
Agriculture; Hungarian partridge, Quail, Elk, Mule deer, White-tailed deer, Pheasant, Canada geese, Waterfowl, Mourning dove, Red-tailed hawk, and Meadowlark.
Coniferous forest; Red squirrel, Flying squirrel, Pileated woodpecker, Blue grouse, Great Horned owl, Barred owl, and Snowshoe hare.
Riparian; Ruffed grouse, Flicker, Beaver, White-tailed deer, Mink, woodpecker, song birds, Osprey, Kingfisher, Great Blue Heron, and Yellow warbler.
Shoreline; Spotted sandpiper, Canada geese, Osprey, Great Blue Heron, and Killdeer.
Rock; Bobcat, Yellow bellied marmot, and Bushytail woodrat.
Mixed forest; Blue grouse, Mule deer, Ruffed grouse, White-tailed deer, and song birds

REASONS FOR SELECTION OF INDICATOR SPECIES

Indicator species by cover types were chosen by the Technical Task Team (TTT). After discussion, the list was narrowed to Sharp-tailed grouse, Mule deer, White-tailed deer, Meadowlark, Mourning dove, Canada geese, Hungarian partridge, Blue grouse, Pine squirrel, Mink, Ruffed grouse, Bobcat, Spotted sandpiper, Killdeer, and Yellow warbler. The final list and reasons for selection are as follows;

INDICATOR SPECIES AND COVER TYPES

Sharp-tailed Grouse was selected for shrub-steppe because it represents the guild of species found in the shrub-steppe cover type (Marks and Marks 1987). The other species use a portion of the shrub-steppe, but are not totally dependant on this cover type (Buss

and Dziedzic 1955). A model exists for this species and it is a high priority evaluation species (Ashley 1990). Historically, these grouse were abundant in the project area (Millar and Graul 1980), now their numbers are limited throughout the Reservation and are probably absent on the project area.

Mule Deer was selected for subsistence and cultural reasons, Mule Deer utilize a wide variety of cover types (Fiedler and McKay 1984, and Griffith 1988). The project area is a critical wintering area for this deer and other species (Kerr 1979 and Leckenby 1986). A model was developed for this species (Ashley 1990) and used on other hydropower projects. Mule deer were evaluated for winter use of shrub-steppe and the Ponderosa pine cover types.

Mourning Dove was selected to represent the guild of species that inhabit the Agricultural cover type. An unpublished model (USFWS 1978) is available to measure habitat variables. The model will measure the quality of the cover type for wildlife using agricultural / grassland areas. The other species selected for this cover type were not dependant on just this cover type alone, or used other areas for life requirements, Some had no models readily available or did not fit the specific cover type.

Spotted Sandpiper was chosen to represent the shoreline areas of the project. This species is a good representative of this cover type and the USFWS has developed an unpublished model (Dorsey 1987) for this species. Spotted sandpipers use the area and represent this cover type the best. The other species discussed do not depend on this cover type for all life requirements.

Mink was chosen over the other species because it represents the Riparian cover type the best and gets all its life requirements from this cover type. The Mink model was developed by the USFWS (Allen 1986) to represent species using riparian areas. The model covers species in and around riparian areas used by the mink.

Blue Grouse was selected to represent the mixed forest and coniferous forest cover types. It is a good representative of species using these cover types. A model was developed by the USFWS for this species (Schroeder 1984). Blue grouse extensively use these cover types for life requirements. The other species considered did not adequately represent the mixed / conifer forest cover types for this study.

Bobcat was selected to represent the rock cover type. The USFWS model was modified for the Chief Joseph Dam Mitigation Study and applies to the Hellsgate area as well (Bodurtha 1991). The bobcat is a year round resident and makes extensive use of this cover type for all life requirements

RESULTS

Columbian Sharp-tailed Grouse

In this study the method of obtaining a measure of habitat quality (Stralser 1991) followed the same methods described in the Tracy Rock Sharp-tailed Grouse Site Specific Management Plan (Cope and Berger, 1992.). Robe1 pole readings (Robe1 et al, 1970.) and 0.1 m. squared microplot measurements (modified from Daubemnire, 1959.) were combined in the HSI model to determine a measure of quality habitat on project lands (Mients et al, 1992). Assumptions made previously to field sampling were: 1) Wintering areas exist and are not the limiting factor, 2) Leking areas are abundant but not in use, 3) Nesting and brood rearing habitat seems to be the primary limiting factor on project lands (Saab et al 1985 and Marks and Marks 1987). Based on these assumptions, habitat was evaluated using random Robe1 pole readings taken every 50 meters in the four compass directions and averaged to give a mean Visual Obstruction Reading (VOR) for each plot (Robe1 et al, 1970). A running mean established when sufficient sampling effort was achieved. Also at each plot two microplot readings (north and south) two meters from the pole were averaged to obtained percent ground cover (nesting and hiding) of grasses and forbs. Table 3. shows the parameters of optimum habitat for the sharp-tailed grouse.

Table 3. Optimum Sharp-tailed Grouse Habitat Parameters
1. VERTICAL GRASS HEIGHT : > 30 cm.uniform vegetation or 36 cm. patchy veg,
2. SHRUB CANOPY COVER : 20 % to 40 %
3. GRASS / FORB DENSITY : 70%
4. ROBEL POLE VOR's : 1.5 to 2.0 (spring), 2.5 or > late May/June

Sharp-tailed grouse rated a **weighted 0.4 (6** sites) in the **shrub-steppe cover type, (1,985 acres)** and **agriculture** (CRP) fields (1,137 **acres).** Table 4. shows the results of the field sampling data after analysis.

Table 4. Habitat evaluation results showing VOR's and Percent microplot composition for nesting and brood rearing habitat on project lands.

LOCATION & HABITAT TYPE	VOR	GRASS	FORB	NUMBER
Site 1. Lundstrum Flat CRP / SS	0.4	17.0 %	2.4 %	30 plots
Site 2. Kuehne Ranch SS	0.2	8.5 %	2.3 %	30 plots
Site 3, Kuehne Ranch SS	0.5	30.0 %	1.5 %	30 plots
Site 4. Lundstrum Flat CRP / SS	0.6	19.0 %	14.0 %	40 plots
Site 5. Simons Place CRP / SS	0.6	19.0 %	9.0 %	30 plots
Site 6. Simons Place CRP / SS	0.7	16.0 %	18.0 %	50 plots

Mule deer rated a weighted **0.5 (9** sites) in the **shrub-steppe** cover type (1,985 **acres)** and the **Ponderosa pine savanna** cover type (570 **acres).** The limiting factors in this study appear to be low HSI values in shrub and herbaceous cover, little or no hiding cover, and lack of preferred shrubs (USDA, Forest Service 1978). Habitats with this quality rating have reduced carrying capacity for this indicator species (Kerr 1979).

Mourning dove rated a weighted 0.6 (5 sites), in the **agricultural** cover type with 1,137 **acres** The agriculture cover types varied between land parcels for the mourning dove. The above average reading was due in part to abundant seed source availability, but lacked reproductive cover (trees for nesting). More scattered trees with large limbs, higher than 11 ft. from the ground, are needed for nesting to achieve a higher HSI rating.

Blue grouse rated **0.9 (10 sites)** in the **coniferous forest** habitat type with 1,050 **acres** and in the **mixed forest** type with 4 **acres** of total habitat. The model uses the relative area of each cover type to determine a HSI for the total area used by the blue grouse. The lowest component value drives the model (either food or cover) and the areas tested rated high in all these areas.

Mink rated a weighted **0.3 (7** sites) in the **riparian** habitat with 147 **acres of** total habitat. Mink are a semiaquatic predator and need water most of the year for foraging. The areas evaluated lacked year round water, severely limiting the prey base for this species. Cover was also limited within the 328 ft. zone associated with foraging / cover value. Overall this species rated very low for this habitat cover type. Riparian zones are usually rich in species diversity and composition in and around streams and ponds. The project area lacks species composition and diversity within this cover type.

Bobcat rated a weighted 0.6 (4 sites), in the **rock cover type** with 35 **acres** of total habitat. The limiting factors for this indicator species was the food and cover value derived from the model. This predator relies on small mammals which utilizes dense understories for concealment and food, for most of its year round food. Dense shrubs and herbaceous vegetation are required for prey species to reach levels to support bobcat populations. Dense understory vegetation provides the bobcat with stalking and ambush cover. If cover requirements are met, reproduction values will not be limiting within the cover type. Rock habitat is preferred by bobcats to meet reproductive requirements for den sites, resting areas, and as shelter that is inaccessible or easily protected.

Spotted sandpiper rated fairly high **0.7** (1 site), in the **shoreline cover type** with 14 **acres** of total habitat. Dependant on reservoir levels this cover type can change quickly from desirable habitat to unfit habitat for spotted sandpipers. Distance to water and herbaceous cover were equally important and of low value for this species. Large distances from nesting cover to feeding areas makes the young chicks vulnerable to predation. Also, lack of suitable vegetation in nesting areas limits the shoreline value for this species. The average IHSI score and Habitat Units for each wildlife habitat indicator species and respective habitat are summarized below :

Table 5. Target species, cover type, suitability index and HU's totaled by cover type.

TARGET SPECIES	TARGET HABITAT	HSI	HABITAT UNITS
Mule Deer	P. Pine Savanna / Shrub-steppe	0.5	285 I992
Sharp-tailed Grouse	Shrub-steppe / Agriculture	0.4	794 / 455
Mourning Dove	Agriculture	0.6	682
Blue Grouse	Coniferous Forest / Mixed Forest	0.9	945 /4
Mink	Riparian	0.3	44
Bobcat	Rock	0.6	21
Spotted Sandpiper	Shoreline	0.7	10

DISCUSSION

Management of project lands presents two choices for the future, 1) future with no action taken, leaving the land as is without any management, maintaining fences and CRP obligations and 2) active management of the property to achieve objectives and goals.

FUTURE ANALYSIS WITH NO ACTION

Since the late 1800's the area has been used without a sound ecological management plan. Logging selectively removed the best trees. Effective fire suppression has resulted in the increase of some species at the expense of others. Grazing practices have decreased native species of plants and animals. Introduced and exotic plants and animals have proliferated. Natural ecological conditions have deteriorated. Forested areas have suffered from increased stand density leading to deteriorated forest health. The area was once an open parklike expanse with open-grown Ponderosa pines the dominant trees over native shrubs and bunchgrasses. Now, fire prevention has allowed areas of Douglas firs to move toward climax, establishing dense Douglas fir thickets throughout the area. The firs are not very disease and insect tolerant and, when overstocked, they compete for limited soil moisture. This has lead to unhealthy stands and loss of habitat. Fire danger is increased because of the fuel loading under the mature trees.

Shrub-steppe habitat under present use will deteriorate further with no action, Perennial grasses and desired shrubs have been replaced by annuals and undesirable woody vegetation. Soil moisture recharge is lacking, due in part to a capped surface layer lacking ground litter. Bare ground is present between plants and the trend is towards further erosion of the top soil over time.

The agriculture habitat type is dominated by cheatgrass and annuals replacing native grasses and shrubs. The CRP lands will be maintained until 1997 by contract obligation. The CRP areas lack diversity and the vigor of planted grasses wane over time. Bare ground appears between plants and invader annuals or noxious weeds compete for available soil moisture. Agricultural lands used for pasture will not revert back to previous habitat unless management action is taken to activate growth of desired vegetation on these lands.

Riparian areas lack diversity and structure due to past management practices. Livestock spend the majority of the year in the riparian zone, grazing on the succulent vegetation as fast as it grows. As perennial grass and forb species dwindle, bare ground and annuals or weeds replaced the natural vegetation, Trees and shrubs are affected also. New shoots are eaten, no recruitment is taking place and older shrubs, and some trees, have altered growth forms.

The amount of shoreline habitat cover is subject to power fluctuations and water storage. Reservoir levels during the year, eliminate shoreline cover or create large zones of exposed beach.

Nature will eventually reach an ecological balance without management efforts, but this may take hundreds of years. Wildlife communities within the area will change and these communities could exclude sensitive species now existing on project lands. The new communities may not be desirable (weeds, diseased forests, etc.) or estheticly pleasing for public use. The Tribes would lose ceremonial and subsistence resources now available on project lands.

FUTURE ANALYSIS WITH MANAGEMENT

MANAGEMENT OBJECTIVES

1, Maintain viable wildlife populations and habitat diversity in the Hellsgate Big Game Winter Range Area.

2. Develop indices for monitoring habitat and wildlife populations over the life of the project,

3. Promote better public and Tribal understanding about the project including an awareness of wildlife and habitat values on project lands.

4. Restore wildlife habitat values, through management, to areas that have been adversely altered under previous management practices.

5. Permanent photo plots and / or transects can be used on all parcels and sensitive areas to document yearly changes in habitat and management actions designed to restore those habitats.

MANAGEMENT ACTIONS TO RESTORE HABITAT CONDITIONS

1. Restore damaged riparian areas, both vegetation, banks and beds (planting desired species in sufficient numbers along stream corridors).

2. Restore lost shrub-steppe habitat in selected areas (planting clumps of bitterbrush, Wyoming big sage, shrub-steppe grasses and forbs).

3. Protect and enhance critical wintering habitat for deer and elk.

4. Increase vegetative diversity and structure to large blocks (over 50 acres) of agriculture land. This may be accomplished by planting deciduous trees and shrubs in draws and by planting islands of conifers in selected sites throughout the fields.

5. Establish food plots for selected wildlife species in key areas,

6. Reestablish and manage habitat for possible reintroduction of sensitive species in former areas of use.

‘7. Limit road access to protect wildlife from disturbance during certain times of the year.
8. Develop water facilities in needed areas,
9. Use appropriate tools to accomplish management actions, such as:
   a. planting and seeding - revegetating native populations, providing food plots, etc.
   b. road closures - restricting traffic to main areas, replanting old logging trails, etc.
   c. grazing - using livestock to achieve desired vegetative conditions.
   d. fire - destroying noxious weeds, underburning to control unwanted species, etc.
   e. weed control - physical, mechanical, burning and chemical.
   f. shrub rejuvenation - cable chaining*, burning, and pruning.

* Cable chaining is dragging a large anchor chain suspended between two tractors across and over a stand of shrubs with the intent of crushing or mashing the vegetation to promote new growth and rejuvenate decadent patches of old growth.

MONITORING PROGRAM

A resource monitoring plan will provide the wildlife manager with necessary information to make sound decisions and apply adaptive management to the project. The effects of habitat management strategies will be evaluated and monitored annually for the life of the project. Monitoring will include the following:

1, Determining if the management activity is working as designed, needs modification or should be terminated.
2.. Identify unanticipated impacts or unpredictable outcomes.
3. Insure management activities are being implemented as scheduled.
4. Provide for a continual comparison of management plan benefits versus economic, social and environmental costs.

Wildlife monitoring within the project area will focus on mule deer, elk, white-tailed deer, grouse species, and other indicator species chosen for this study. Both temporary and permanent monitoring techniques will be used. Photo plots taken before during and after on project lands will document and record management actions. Lek surveys, deer route surveys, grouse drumming routes, nesting surveys and flushing counts are a few techniques that can and will be initiated. Vegetative communities will be monitored to determine stability and / or change. Nongame responses to habitat management will also be monitored. A list of birds and mammals and their relative abundance on project lands will be developed. Wildlife population surveys conducted throughout the year, will aid in the evaluation process. Areas of special significance such as fawning, displaying or nesting areas will be identified and monitored. A list of observed species using or occurring on project lands will be updated over time.

WILDLIFE HABITAT ENHANCEMENTS

FENCING OPTIONS

1. No fencing of Project lands.
2. Partial fencing of Project lands.
3. Total fencing of Project lands, repair old fence and construct new fence

1. Fencing is costly, time and labor intensive, and has to be maintained. Fencing may not be necessary on some project lands in the Hellsgate area if lands used for grazing are purchased for wildlife and the Tribes decide not to renew grazing leases bordering project lands. 2. Partial fencing, establishment of drift fences may keep livestock off project lands or out of critical wildlife areas if grazing leases are renewed. 3. Fencing of project lands will prevent livestock trespass and protect restoration of native vegetation from livestock. Any grazing that occurs on project lands will be under strictly controlled conditions. Fencing contracts will be put up for bids to encourage local community involvement with the project. All fences will be constructed within technical specifications, according to management plan objectives. Boundary fences may be marked to make identification of project lands distinguishable from other adjacent property. Annual fence maintenance and repair will be conducted by the project manager

CONSTRUCTION AND COST OF FENCING

Perimeter fences should be constructed using 4 strand barbed wire with steel posts every 16 feet with stays between posts. Additionally, fences will have wooden corner and stretch posts. Appropriate costs associated with construction of these fences is $5,000.00 per mile for new fence and $2,000.00 per mile for repair to existing fences. Repair to existing fence may seem high but the existing fence in some areas will require extensive work.

Perimeter fencing	Miles of Fence	New I Existing
Kuehne Ranch	10.2	Repair existing
Williams Flat	1.4	New and Repair
Sand Hills	6.5	New
Lundstrum Flat	5.0	Repair existing
Simons Place	5.7	Repair existing
Bridge Creek	1.8	Repair existing
Friedlander (3 parcels)	3.0	New
Friedlander	2.5	New
Friedlander	1.25	New
Friedlander Meadow	2.3	Repair existing
Sclome Creek	1.75	New
Baulne Place	2.6	Repair existing
TOTAL	50.0 miles of fence	

HABITAT TREATMENTS

To increase the abundance and diversity of wildlife species in the project area and provide necessary life requirements (food, hiding, resting, nesting, travel and reproductive cover) native vegetation will be established or enhanced through management. A vegetative management plan will be designed for the project area. The plan will include base line habitat conditions, identify optimum seasonal habitat conditions required by certain species of wildlife, determine the type and level of seasonal use, schedule fence maintenance checks, and be flexible to reflect changes needed to attain management goals. In addition, perennial vegetation should be reestablished on croplands to restore the native

habitat to preagricultural conversion conditions. Plants appropriate for each cover type can be grown from seed or nursery stock can be obtained when revegetating habitat types according to the management plan. Various plant sources are available within the state and the Tribal nursery will grow species at our request and obtain seeds to germinate hard to find native forbs and grasses. Thirty percent of the 147 acres of riparian habitat needs replanting of trees and understory vegetation, the other 70 percent needs enhancing of existing vegetation. If three rows of shrubs and / or trees are planted, spaced 6 ft. apart, the total number of stems will be 1,815 per acre. Eighty percent of the shrub-steppe habitat needs replanting to desired shrubs, grasses and forbs and the remaining 20 percent needs enhancing. Planting shrubs, forbs and grasses in clumps or patches throughout the area can reestablish a shrub-steppe community (Daubenmire 1970). Existing agricultural fields will be converted back to and maintained in a natural condition unless the project manager determines another cover type is more suitable to achieve project goals.

WATERING FACILITIES

In summer, water may be a limiting factor to some species of wildlife. It is necessary to ensure that permanent and seasonal water sources are available throughout the project area. An inventory of locations of all water and potential water sources on project lands will enable the project manager to evaluate and manage water resources. Possible water enhancements could include, restoration of former dry seeps, deepening ponds, or enlarging and drilling wells. Dry seeps can be excavated by hand or backhoe depending on size and location to reach the water table. Most seeps located on the property are small and require no major alteration of existing landscape. After excavation gravel or a catch basin will be placed in the bottom so water can be collected for the benefit of wildlife. Past management allowed livestock access to these areas, breaking down side banks which tilled in and compacted the seeps forcing the water to go subsurface. Certain areas where seeps had formed into ponds, now dry, can be reclaimed using state and federal approved and accepted methods and techniques. The methods may require the physical removal of soil (by hand, mechanical or chemical reaction) to a required depth before water recharge takes place. Planting the appropriate vegetation around water areas can further enhance and protect this resource.

RECREATION OPPORTUNITIES

The project lands have considerable potential for a variety of recreational opportunities that are compatible with the wildlife of the area. Boaters on Lake Roosevelt use the Reservation side of the lake for overnight camping. Some of the better sites are on project lands. Impact to wildlife is minimal. Other areas are used by Tribal membership throughout the year for camping and recreational purposes. The area has opportunities for hikers and outdoor enthusiasts to view and take pictures of wildlife throughout their life cycle. These uses will be explored, evaluated and prioritized. Some will require specific developments such as designated camping areas, sanitary facilities, designated trails, viewing areas, etc. These can be developed over time on an opportunistic or as needed basis.

EXOTIC WILDLIFE

Exotic naturalized wildlife on project lands include: Ring-necked pheasants, Hungarian and Chukar partridge and California quail. These species will be managed for on an opportunistic basis, however management will focus on native species to protect as well as encourage their recovery on project lands. Native plant and wildlife species fulfill certain subsistence and ceremonial needs of the Tribes, therefore they will receive priority consideration over exotic species.

OFF-ROAD VEHICLES

Off-road vehicle use will be regulated on the project lands. Vehicle use essentially will be restricted to established roads to protect wildlife populations, habitat and to control the spread of noxious weeds. Extensive logging in the past has produced a network of abandoned roads that crisscross project lands. These old roads will be evaluated as to vehicle use in relation to adverse wildlife impacts. Some roads will be used as a trail system, others will be closed and replanted with appropriate vegetation.

FIRE CONTROL

Fire suppression on Project lands will be under the control of BIA Forestry. Controlled burns for management purposes will be coordinated with BIA Fire Control. Potential fire danger from existing and future conditions will be evaluated by the Project Leader and coordinated with BIA Fire Control. Fire is an effective management tool when utilized correctly. Burning can control unwanted species, fight disease, control insect infestation, lower fuel loading in forested areas, and help desired species compete for nutrients, space and available soil moisture. Fire was part of the natural environment in the past, and to maintain a healthy ecosystem must be employed in future management of these properties.

FORESTRY PRESCRIPTIONS

To achieve desired habitat conditions for wildlife in forested areas, proper forestry practices must be employed. Undesired species can be selectively cut eliminating competition with desired species. Snags will be left for wildlife and recruitment trees for future snags will also be available in the proper densities on project lands. Maintenance of desired trees with proper spacing between (basal area) will reduce fire danger, transmission of root diseases, and limit infestations of undesirable insects. No major logging is planned for the immediate future, however thinning cuts and prescribed burning will enhance forested areas and achieve management objectives. To maintain a healthy, structurally diverse forest certain management actions will have to be taken, on a case by case basis, to reach the desired results.

WEED CONTROL

Weed control will be accomplished as required by Tribal, state and county regulations through measures described below. Some weeds are desirable for the seeds and cover they produce and are part of a balanced community of living organisms, Noxious weeds need to be controlled because they are invader species that out compete native vegetation for available space and offer no value to wildlife. Management actions will include: 1) pulling out by hand individual plants so that populations will not be established, 2) for

larger areas, mechanized farming equipment will be used to remove weeds and reseed native forbs and perennial grasses, 3) controlled burns to destroy weeds before they spread seeds or in areas not suitable for other means of control, and 4) chemical control applied using the regulations set by Tribal, state and federal agencies governing the use of pesticides will be observed. Chemical means will be used only when other methods are deemed unfeasible for controlling noxious weeds on a particular site. The project manager will annually conduct surveys to detect and control the presence of noxious weeds.

PREDATOR CONTROL

Predators are required to help maintain balance in a healthy ecosystem. Present management will be designed to allow for natural predator prey interactions. Management activities will be aimed at providing habitat that will insure security of prey populations while supporting predator populations as well. If it becomes evident, based on scientific data, that control of predators is necessary to maintain the desired population level of a prey species then control may be initiated. This will be on a case by case basis. There are no plans for a general predator control program for the project. If predator control becomes necessary then specific control methods such as trapping or shooting can be used. Tribal members using traditional and subsistence methods will be encouraged to harvest problem species as an effective means of predator control.

GENERAL MANAGEMENT ACTION BY LAND PARCEL

The desired goals of this wildlife management area are (1): To have a balanced ecosystem for the future through active management (2): To sustain, protect and enhance this ecosystems resources for the people of the area, and (3): To achieve quality of life values, through a diversified landscape with clean air and water and healthy, stable populations of plant and animal life reflecting sustainable biodiversity. Four key elements need to be managed in order to reach and maintain these goals. They are succession; water cycle, mineral cycle and energy flow within the ecosystem. By monitoring these four elements, and applying adaptive management practices to them, we can achieve management goals for sustainable populations of wildlife and a healthy ecosystem.

Description and Evaluation of Cover Types by Land Parcel

(See maps of land parcels, figures 1. through 11,)

Kuehne Ranch Site (Figure 2.) contains 1,288 acres of degraded shrub-steppe habitat, used mostly for cattle grazing. The southern portion of the site, 133 acres, is in agriculture cover type and is used for alfalfa hay production. The Ponderosa pine savanna cover type covers 3 1 acres within the shrub-steppe cover type used for rangeland. The shrub-steppe area used as rangeland for cattle production contains invader species such as cheatgrass and mustard that dominate the vegetative community. Management actions include restoration of this cover type to a healthy shrub-steppe ecosystem (Daubenmire 1970). Perennial grasses and forbs in mosaic plots will be established throughout the area so that natural reseeding can replace annual grasses and noxious weeds (Brown and Martinsen, 1967). Any large areas of noxious weeds will be treated to reduce competition with new grasses and forbs. The area once contained large stands of

bitterbrush and native grasses that were used by big game and other wildlife during winter. Patches of bitterbrush and Wyoming Big Sage will be planted to augment natural regeneration of lost habitat. Management efforts will aim for ratios of grasses, forbs and shrubs that are in proper balance for wildlife that use this habitat. The perimeter of this land parcel is mostly fenced as well as some cross fencing of pastures. Two fields, comprising about 133 acres are currently in irrigated hay production, These will be managed to provide for increased wildlife values and decreased maintenance requirements. One field will be converted back to shrub-steppe grasslands with some deciduous trees and ponderosa pines to offer structural habitat diversity The other field will be maintained partly as pasture for deer and geese and partly for food plots for the benefit of all wildlife in the area. A scattering of old growth Ponderosa pine on 3 1 acres will be managed as seed trees, establishing young scattered pines as future replacement trees.. An ephemeral spring runs through the property from northeast to southwest in a large drainage that at one time contained riparian trees and shrubs. The riparian draw will be rehabilitated over time to replace old or dying shrubs and trees and to increase shrub diversity and density. Some planting may be necessary to accomplish this goal. These areas are natural travel corridors for big game and need to be revitalized and extended. They also can provide critical winter habitat for sharp-tailed grouse. After management actions for habitat restoration have progressed sufficiently, reintroduction of species such as sharp-tailed grouse will be considered. The sharp-tailed grouse that were once abundant in this area should prosper if habitat can be adequately restored and managed. This site is also a wintering area for big game and bald eagles.

Williams Flat Site (Figure 3,) is located at Range 34 East, Township 28 North, Sections 4, 5, 6, 8, and 9. Cover types within this parcel include; Ponderosa pine 3 18 acres, Coniferous forest 122 acres, Shrub-steppe 258 acres, Agriculture (CRP) 207 acres, Riparian 13 acres, and Rock 34 acres. The majority of the parcel lies on a large terrace above Lake Roosevelt. There are two springs on the property, one lies northwest between the CRP fields and the other lies above Brody Creek at the eastern boundary of the property. A corral is located near the second spring and the area has many roads through the property. Along the northern edge of the property a drift fence was erected to keep cattle From grazing to the north. The rest of the property is not fenced. There are outbuildings used to store farm equipment in the northwest corner of the property near the CRP field. Most of the shrub-steppe habitat lacks vegetative diversity and lies on steep hillsides intermixed with the rock habitat type. Decadent shrub stands need revitalization. The grasses of this cover type are mostly annuals that need to be replaced by perennial grasses and forbs. Management actions will include increasing diversity of plant species and structure of the area. Ponderosa pines are thinly scattered over 3 17 acres in this parcel except for the CRP field. Planting replacement trees or encouraging natural reseeding will maintain the proper canopy coverage and spacing needed to perpetuate this cover type. The 122 acres of coniferous forest has been recently logged and will not require a commercial harvest for years to come. Protection and enhancement of this cover type is a main objective. Stocking density of tree species may need to be controlled to maintain stand health and desired condition through thinning and controlled burns. Desired forest conditions and canopy coverage will be maintained for those

species of wildlife using this cover type. The 5 acres containing riparian vegetation in the south facing draw could be benefited by development of a spring if feasible. Availability of water will create more diversity and structure in the draw and support more wildlife in the area. The remaining 7 acres lies adjacent to Brody creek which is seasonally intermittent. Overgrazing in the past has decreased the number of plant species and riparian conditions in general. Management actions to increase diversity and structure, by planting and protection, would increase the size and coverage of this habitat type. Big game frequent this area especially in winter and blue grouse and associated wildlife use this site year round. Restoration of the riparian corridor may also extend the period of stream flow.

Sand (Figure 4.) is predominantly Shrub-steppe (29lacres), and Ponderosa pine savanna (133 acres), with bitterbrush the dominant shrub (Youtie, Griffith and Peek, 1988). Some Agriculture cover type (34 acres), occurs as grassland with some clumps of bitterbrush located at the northern end of the property. The property lies north and south with Redford canyon bisecting the northern half of the area. Adjacent to watercourses, scattered bands of riparian vegetation (27 acres total) occur. The area is not fenced and has been used for cattle grazing for many years. There are no buildings on the property and the area around it has been logged or burned. Some of the area has been partially burned (Kramp et al, 1983) and was used extensively for grazing. Unregulated livestock use, in terms of stocking densities and seasonal concentration led to overgrazing, producing capping of the top soil in some areas. The past tire created open spaced areas destroying some bitterbrush and Ponderosa pine stands. As the name implies, the soils of the area are fine sands. Some erosion has occurred on steep areas within this site. Management practices to retain moisture for future vegetative growth, control erosion and increase bitterbrush stand vigor will be applied (Giunta, et al., 1978). In other parts of this parcel, controlled burning or crushing of stagnant bitterbrush plants might revitalize them and would increase their food and cover value to wildlife (Ferguson, 1972 and Kufeld et al, 1973). The Ponderosa pines would be managed to maintain the recommended basal area and prescribed thinning or periodic burns would control the number and spacing (Fiedler, et al., 1992). Natural reseeding or treeplanting will be used to ensure maintenance of this habitat cover type.

Lundstrum Flat Site (Figure 5.) has 387 acres of agricultural land, that in the past produced cereal grains. There are 14 acres of shoreline habitat between the agricultural land and Lake Roosevelt along with 1 acre of rock habitat. Included in this parcel is 291 acres of shrub-steppe habitat located in the gullies emptying into Lake Roosevelt. The area also contains 4 acres of riparian cover bordering Brody creek. The area was fenced north and south and bounded by Lake Roosevelt to the west. New fence is needed in some places and the old fence needs repair. No buildings are on the property, however there is an old abandoned homestead on neighboring land. This parcel is relatively flat and was predominantly used for agricultural purposes in the past. The abandoned farm land, now used for grazing, has a vegetative composition of rabbit brush, crested wheatgrass, some alfalfa and three awn grass as well as invader species that have replaced native vegetation. There is bare ground between plants with little ground litter. The

surrounding 48 acres of shrub-steppe habitat has some soil capping but contains greater diversity of vegetation Annual grasses are invading areas of open space and competing with desirable species for available soil moisture. Management actions to increase the diversity of perennial grasses, forbs, preferred shrubs, and trees for structure, hiding cover, and travel corridors will be planned. This area once supported sharp-tailed grouse (Miller and Graul 1980) and may again through management, when desired habitat conditions are achieved and in balance. This area contains all 14 acres of shoreline habitat cover type, depending upon reservoir levels. Hydropower fluctuations create no cover, at high water levels, or hundreds of feet of shoreline at low pool levels, so vegetative communities have little or no chance to establish a riparian zone for wildlife use.

Simons Site (Figure 6.)(616 acres) is located at Range 35 east, Township 28 north, sections 29, 32, and 33 and consists of Coniferous forest 174 acres, Ponderosa pine 88 acres, Shrub-steppe 78 acres, Riparian 19 acres, and 257 acres of Agricultural land (now in CRP). George Creek runs through the property from north to southeast, passing through the upper CRP field, and is bordered by riparian cover. The CRP fields are on a lake terrace overlooking Lake Roosevelt to the southwest, The upper CRP field is surrounded by Coniferous forest and bitterbrush. The lower CRP field contains human development with old houses, a collapsed barn, abandoned farm equipment and out buildings. One barn is still usable if repairs are made to the structure. These structures are located near the main road in the northwest corner of the lower CRP field. The large CRP fields require management to increase vegetative diversity and structure. Management actions will include planting trees in clumps or as borders for security cover and travel lanes for wildlife (Carson 1985). Surrounding shrub-steppe habitat, 78 acres, will be encouraged to reoccupy portions of the CRP lands. Wyoming Big Sage will be planted for its food value to big game and cover for some species of wildlife (Welch and McArthur 1979 and Wambolt and McNeal 1987). The moist draws on the area containing riparian vegetation, 19 acres, will be enhanced by planting desired shrubs and trees and managing the water cycle for longer periods of soil moisture. Ponderosa pine savanna (87 acres) and Coniferous forest (174 acres) make up the rest of the site. Forestry prescriptions (Fiedler and McKay 1984) for these cover types will follow Tribal recommendations on forestry as long as wildlife is the main consideration. The area was selectively harvested for the mature trees in the past and fire suppression has been maintained for an extended period of time. The results of this management has allowed trees, primarily Ponderosa pine, to dominate the area. Intermittent light underburns will be planned to help maintain overall ecosystem health and allow brush, grasses and forbs to grow producing forage for wildlife. Additional stocking control may be necessary to maintain desired stand conditions, such as cover forage ratios.

Friedlander Complex Site (Figure 7.) is comprised of three separate parcels. Coniferous forest habitat type dominates these parcels with 504 acres. Riparian habitat (14 acres) along the stream courses, will be managed to increase biodiversity and productivity. Used currently for grazing, the area was selectively logged for the mature trees and future logging is not expected to be needed for several decades. Stand health will be maintained by management actions to generate scattered large overstory trees, a healthy understory,

and increased biodiversity. Access to these parcels will be primarily by foot from maintained roads. The old logging roads will be closed and replanted to give wildlife security. Past grazing practices have altered the shrubs and eliminated regrowth of seedlings. Fencing of project boundaries will eliminate this problem and allow the system to return to a vigorous condition.

Friedlander Meadow Site (Figure 8.) contains a 16 acre meadow, used for grazing, and 80 acres of Coniferous forest. The south fork of Ninemile Creek runs through the northwest corner of the meadow. From the meadow, facing east, the land rises sharply 400 A. up a finger of Whitestone Ridge and drops 300 ft. to an unnamed creek and than back up 200 ft. to another finger ridge. The slopes of the ridges are covered with conifers, mainly Douglas fir and Ponderosa pine. The unnamed creek has 4 acres of Riparian vegetation along the steep banks. The meadow lacks riparian vegetation along the creek banks. Livestock have virtually eliminated the riparian vegetation along the creek and there is considerable damage to the stream banks, Management actions are to fence the boundary of this parcel, protecting stream banks from livestock damage and the planting of desired riparian vegetation along the stream course, Further stream bank erosion will be prevented by revegetating the banks and adding structure to the stream channel.

Sclome Creek Site (Figure 9.) contains 112 acres of coniferous forest and 8 acres of riparian vegetation. This area lies outside the Hellsgate Reserve, is not fenced and was logged in the past. This parcel is on the side of a gentle ridge running north and south sloping east to Sclome Creek. The riparian area contains aspen and Columbian hawthome over understory vegetation, The hillside is composed of Snowberry and Oceanspray with Ponderosa pine the dominant tree species. Livestock have utilized the riparian areas for longer time periods than desired causing deformed shrubs, no regeneration of trees and shrubs and damaged stream banks. The management action for these areas will be to provide wildlife with both horizontal habitat diversity and vertical structural diversity along the stream course. The upland area containing the conifers has been selectively harvested in the past. These areas will be managed to promote forest health and to protect the riparian areas within this parcel. The resources will be maintained and enhanced using light underbums, thinning of targeted species, and enhancement of important big game food shrubs (Kufeld et al, 1973).

Baulne (pronounced bow en) Site (Figure 10.) has two habitat cover types, agriculture (79 acre hay field) and 58 acres of coniferous forest. The perimeter of the area is completely fenced, some repairs are needed in the upland portions. The site also contains a residence and associated outbuildings. It is situated well to be used as a temporary Wildlife Management Area (WMA) headquarters. The area had a stream running through the agricultural portion from northeast to southwest, but this stream was covered by landfill to prepare the area for a sub-irrigated hay field. The source of the stream is a perennial spring located in the north portion of this parcel of land. The agricultural portions lie in a flat meadow while the forested areas are on steep hill sides and finger ridges. In the recent past the east hillside was burned, trees with charred bark

and abundant Redstem Ceanothus dominate the area. The understory shrubs especially the Redstem ceanothus will be maintained and enhanced for wildlife.

Bridge Creek Site (figure 11.) contains 24 acres of agriculture habitat used as pasture, 4 acres of mixed forest, and 30 acres of riparian habitat cover. In previous years portions of this area have been burned to eliminate successional riparian cover and maintain a pasture area for horses. The site has a residence that is no longer in use and will be secured from the public use until needed. The site is bisected by the Sanpoil Highway (Rt 21) Bridge Creek road and the Sanpoil River. Almost all of the riparian habitat lies to the east of the highway and north of Bridge Creek road. Management efforts will be directed at thinning overstory trees and shrubs allowing grasses and forbs to increase providing foraging areas and biodiversity for wildlife. The mixed forest area will be encouraged to develop naturally, some management will be necessary to reduce fire fuel loading. A portion will be managed in open areas for waterfowl. The property is fenced except the west side, 4 acres of mixed forest, which abuts a rock outcrop running the length of the property.

Kuehne Mitigation Project

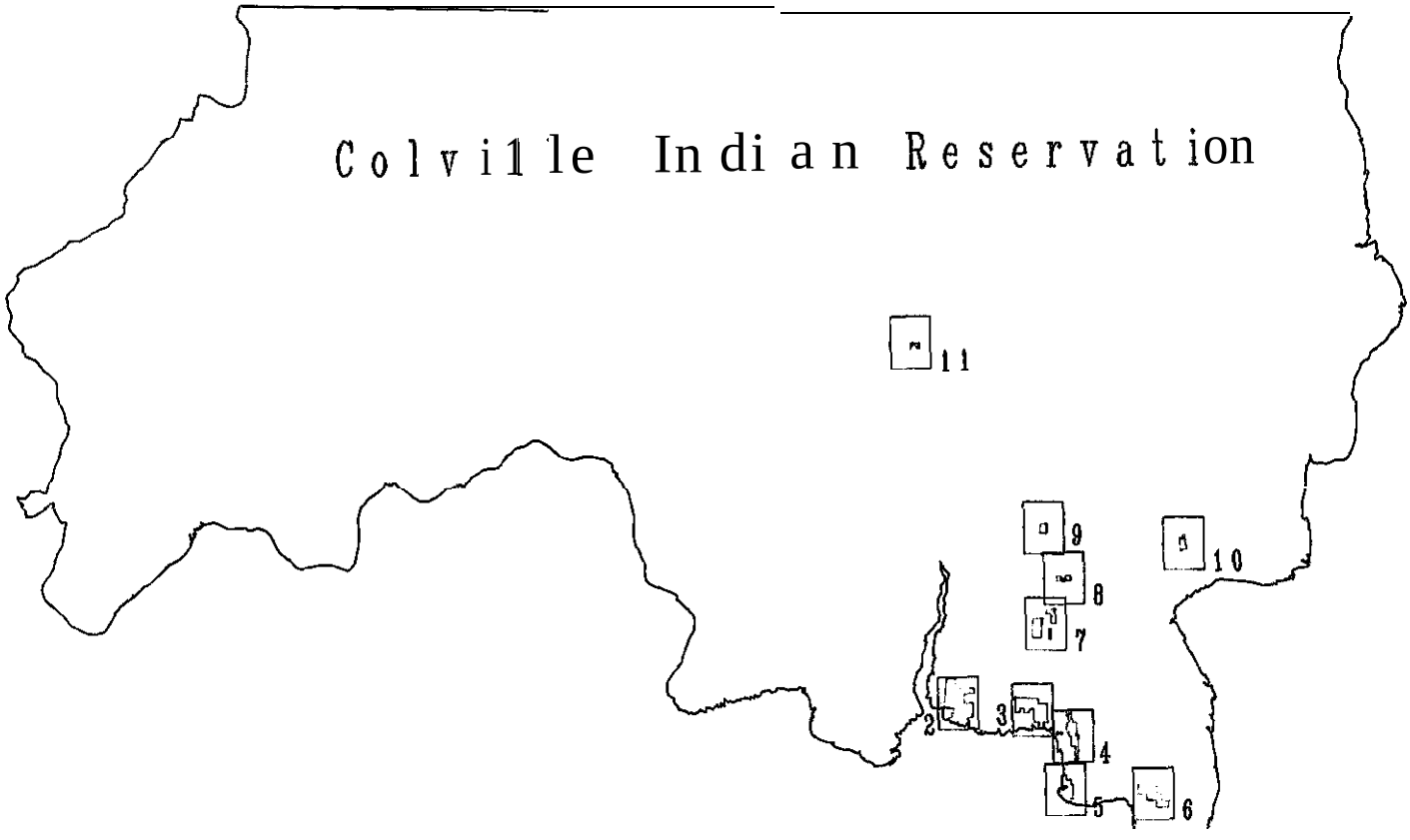

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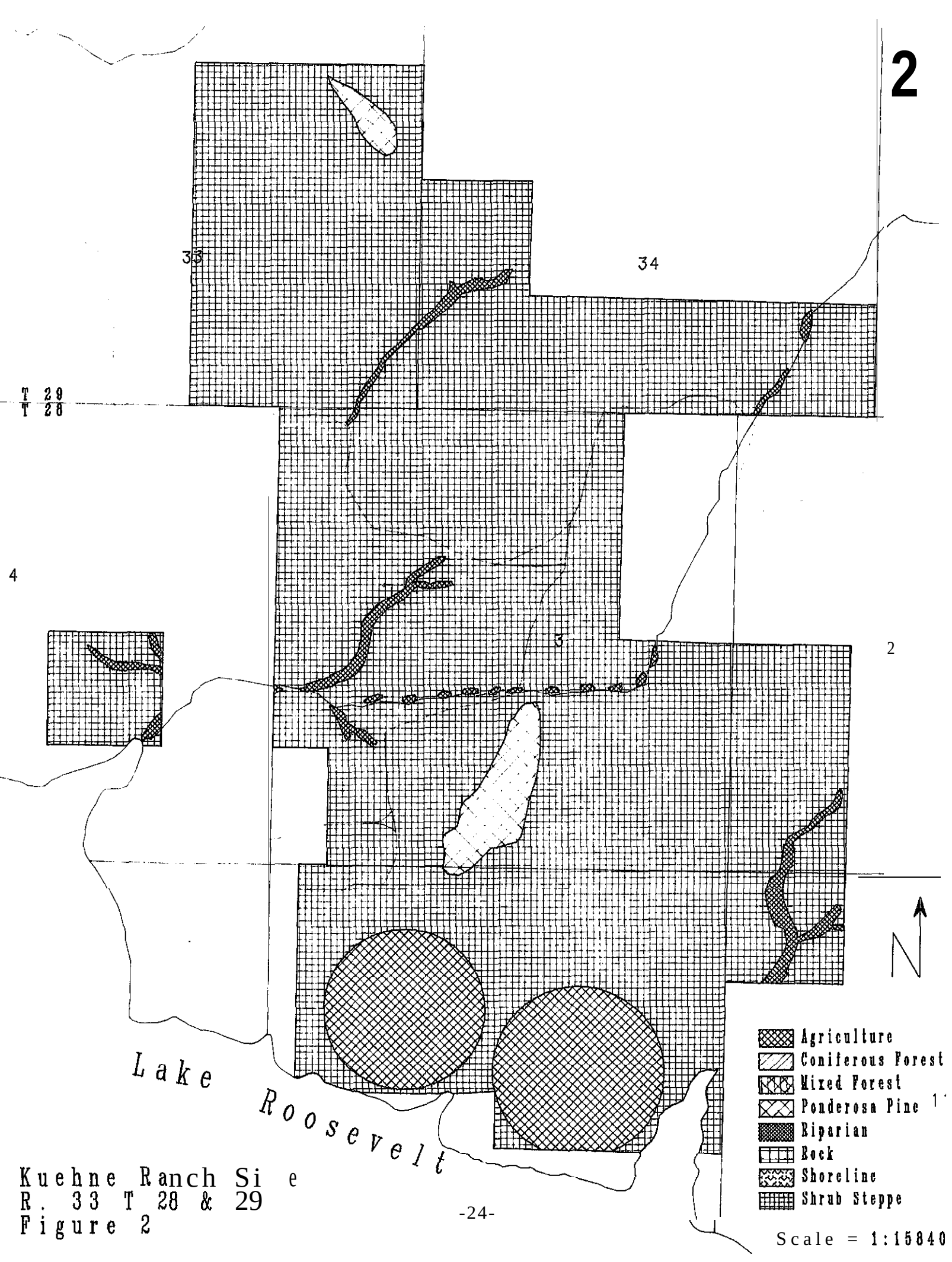
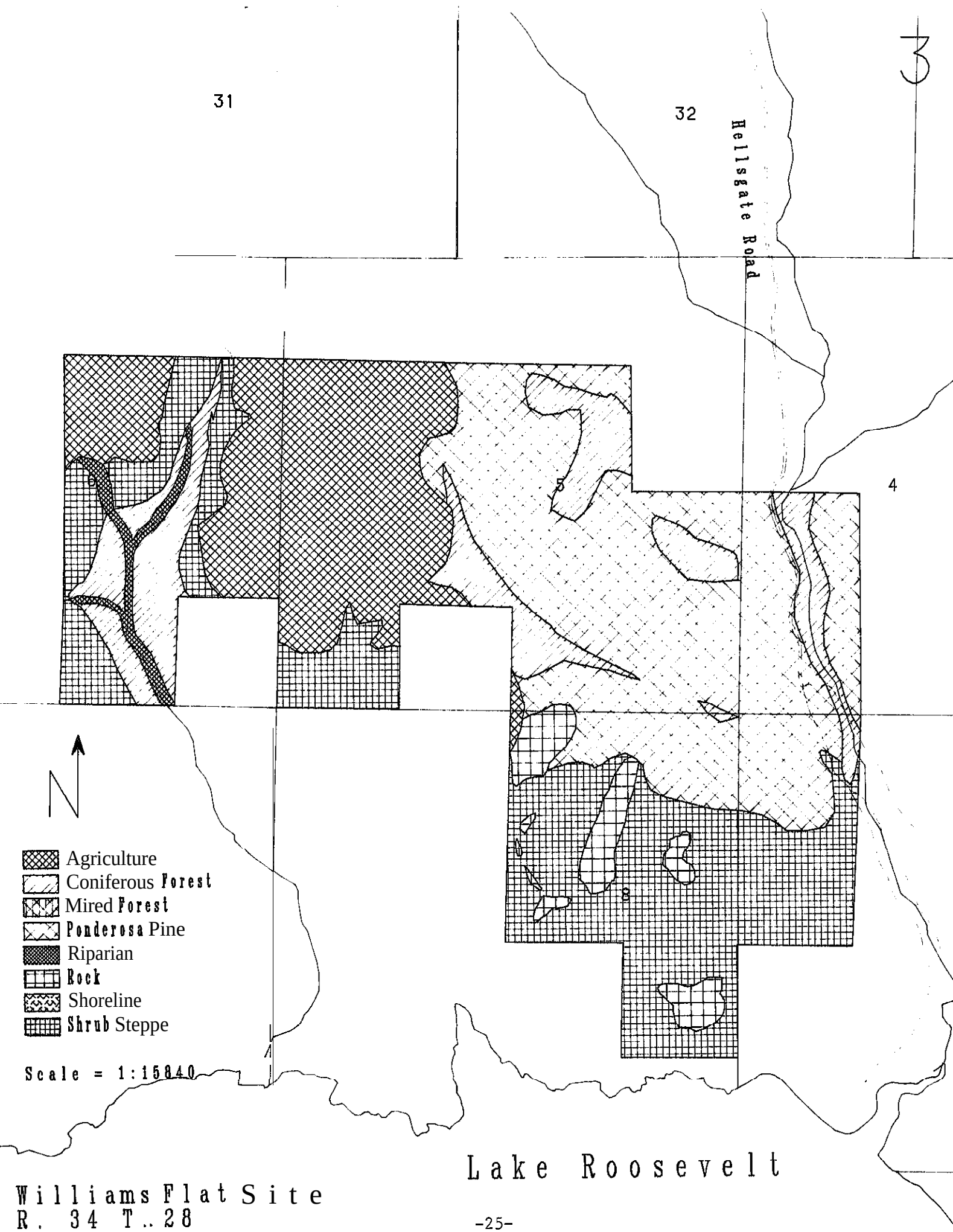
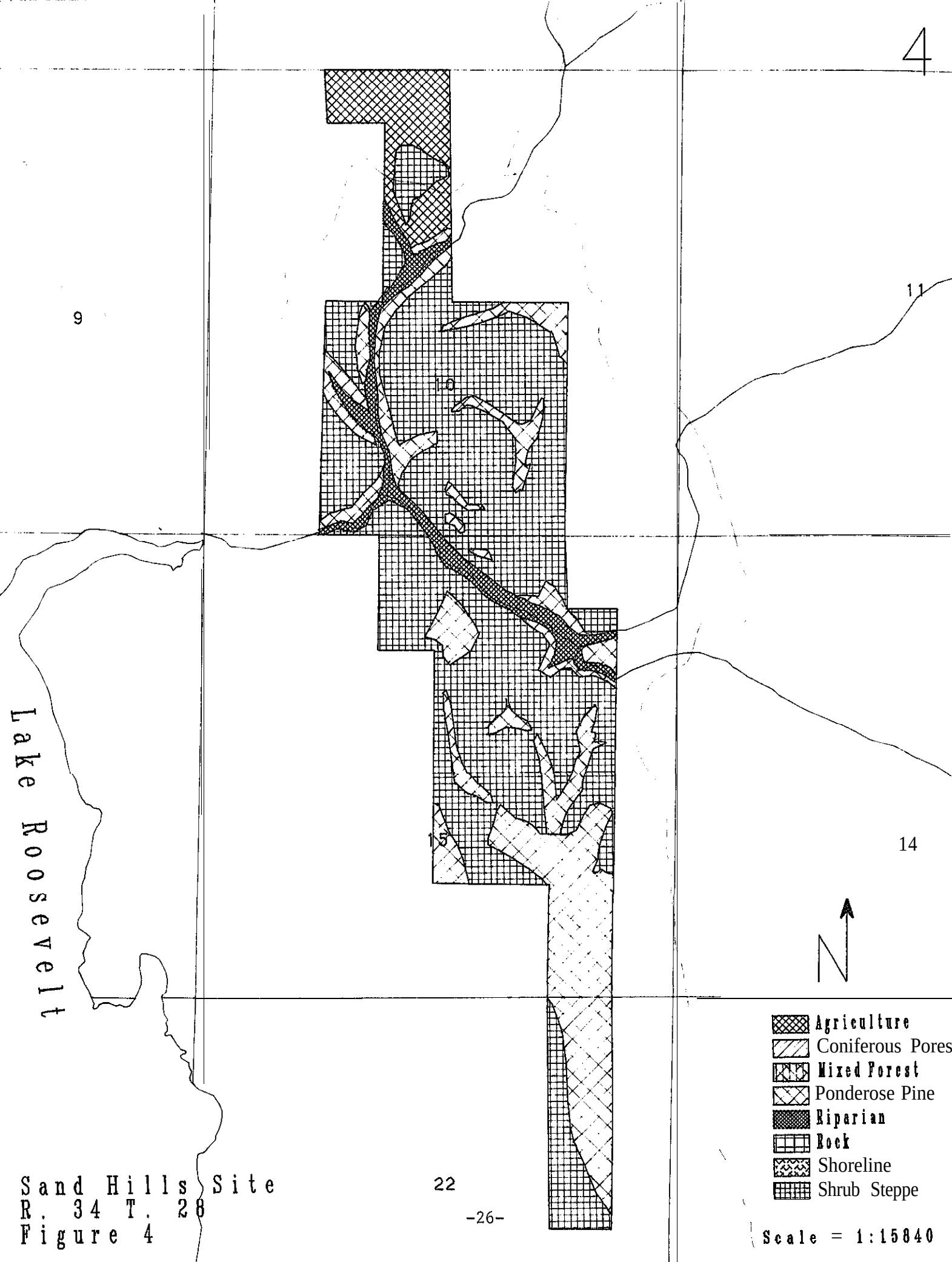
Figure 1



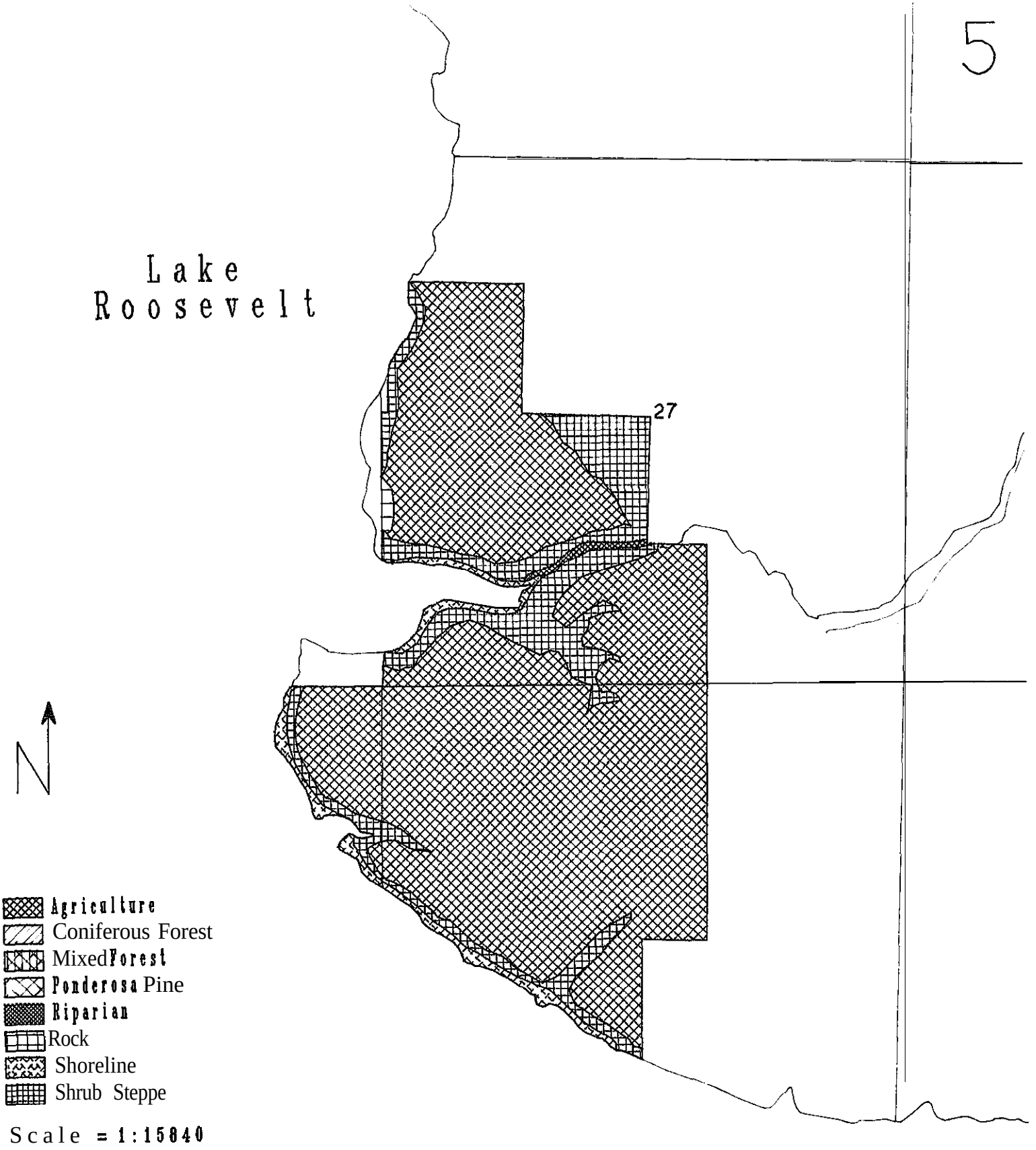
Kuehne Ranch Site
R. 33 T 28 & 29
Figure 2



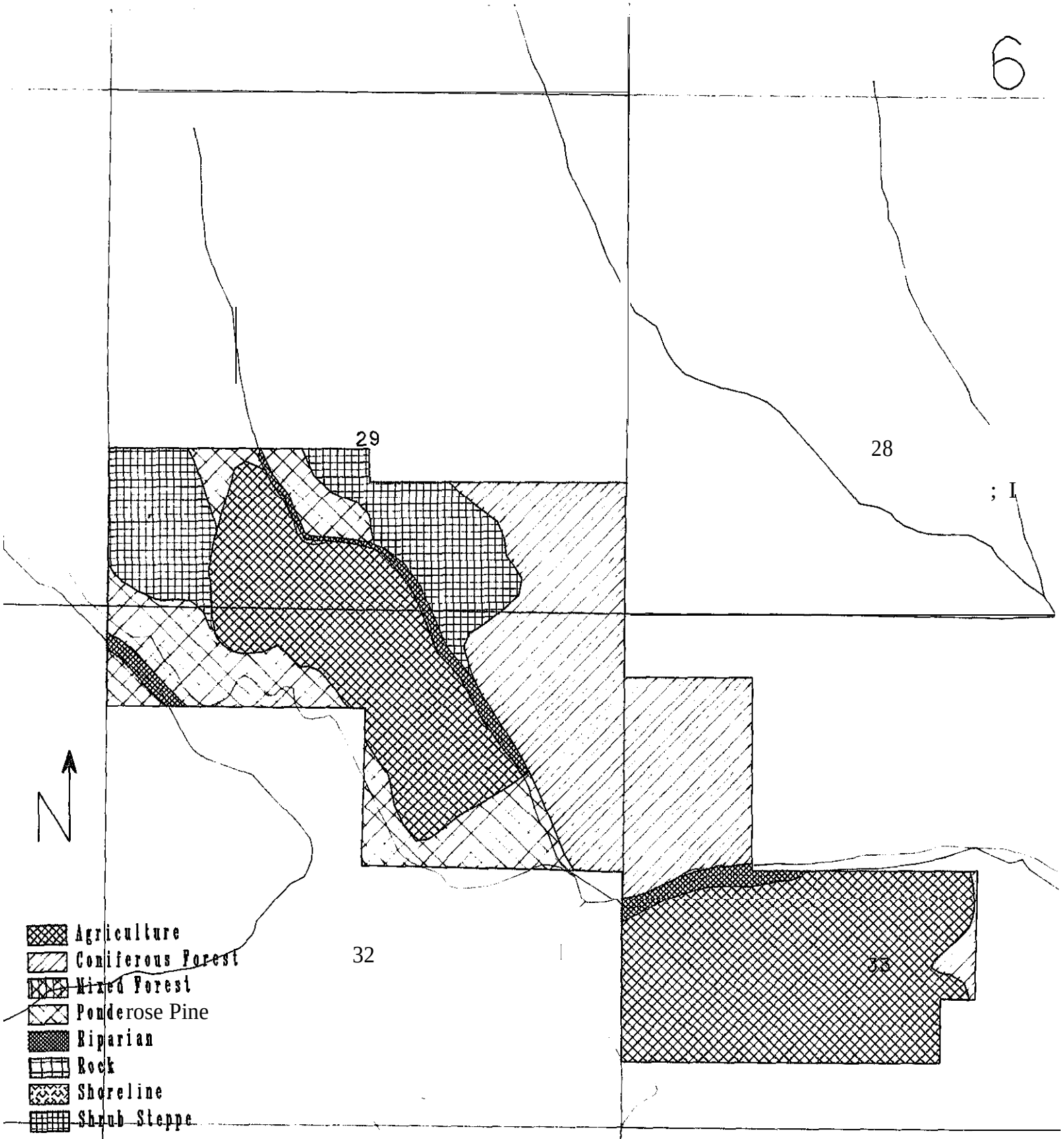
Williams Flat Site
R. 34 T. 28
Figure 3



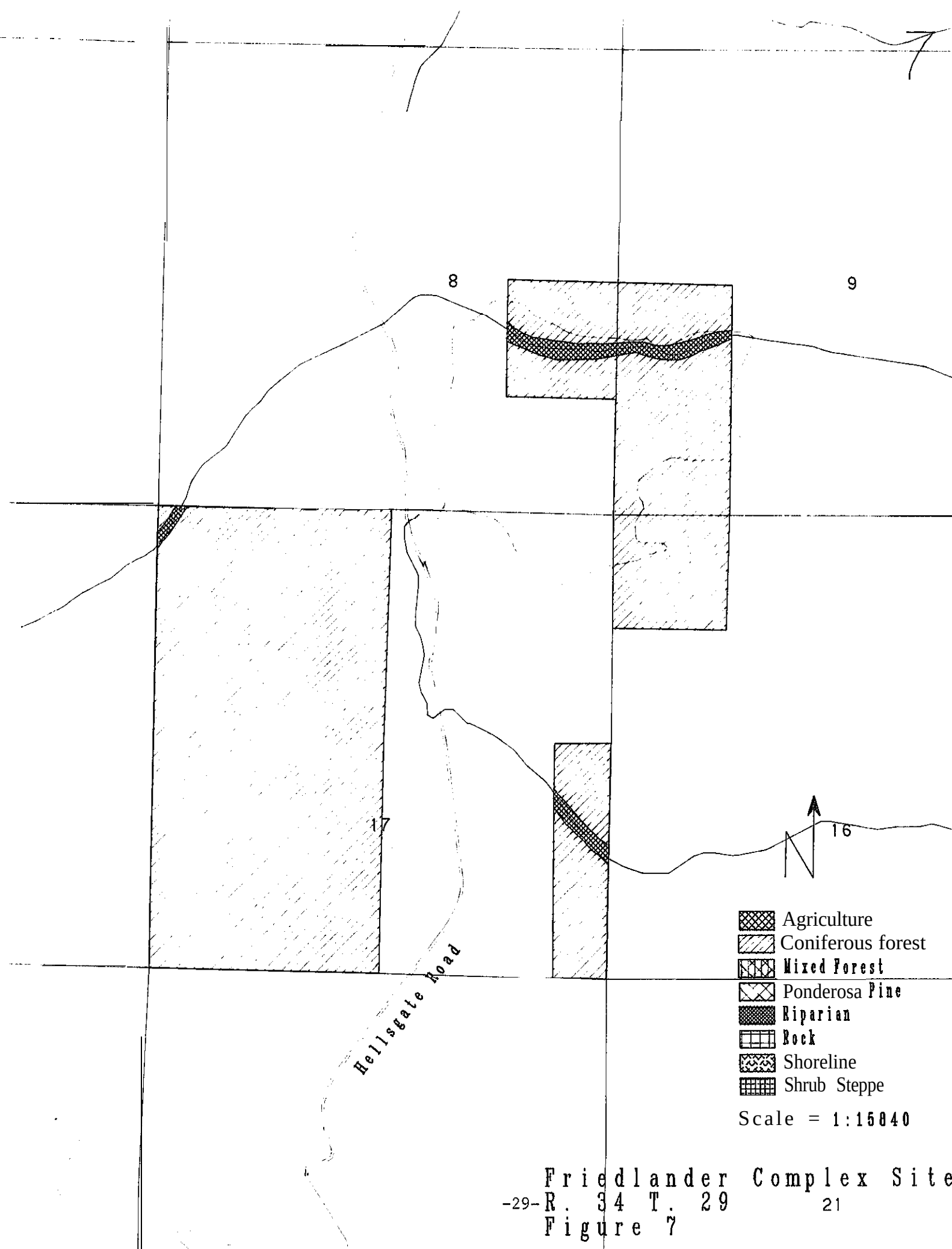
Sand Hills Site
R. 34 T. 28
Figure 4



Lundstrum Flat Site
R. 34 T. 28
Figure 5

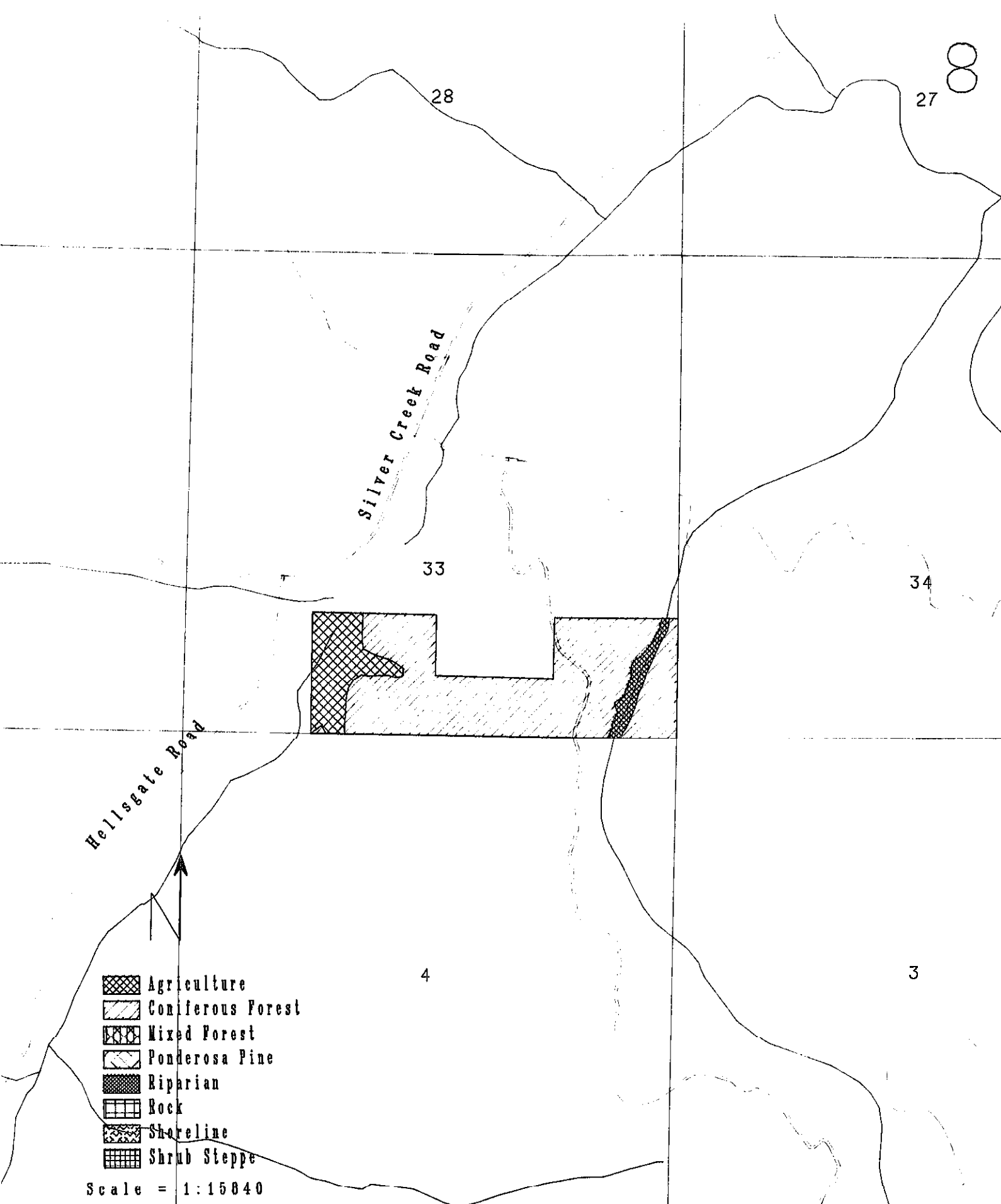


Simons Place Site
R. 35 T. 28
Figure 6

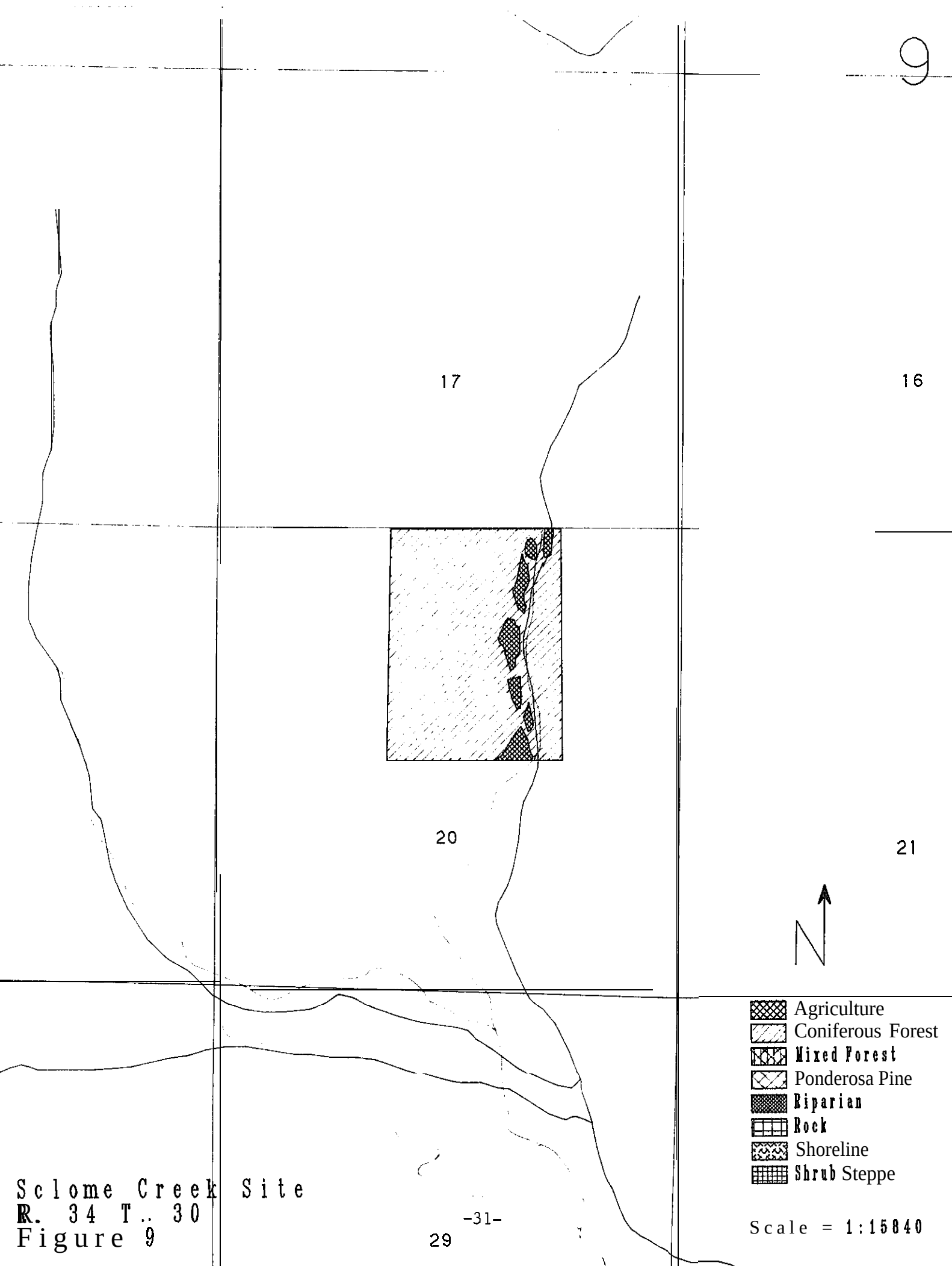


Friedlander Complex Site
R. 34 T. 29 21

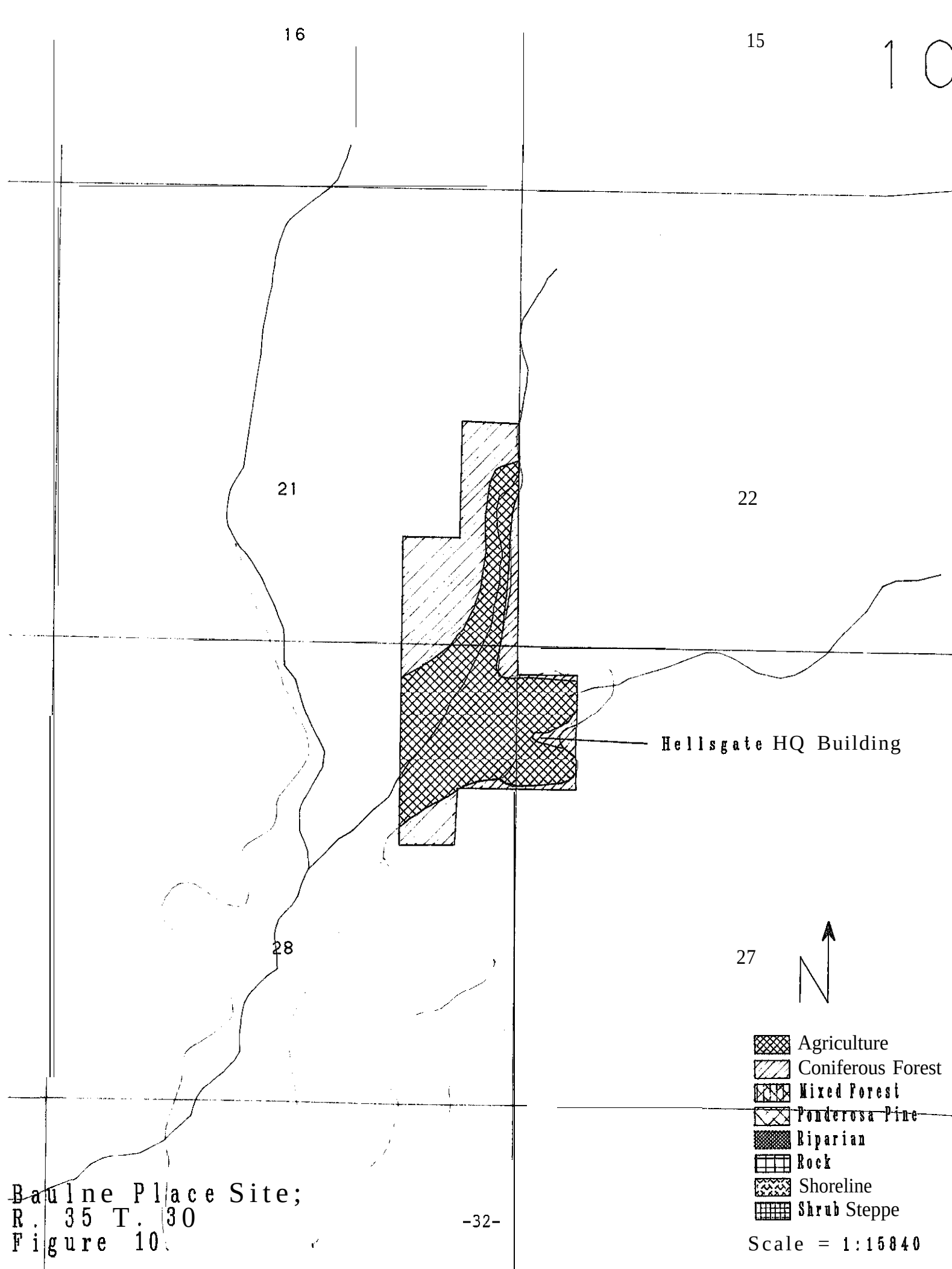
Figure 7



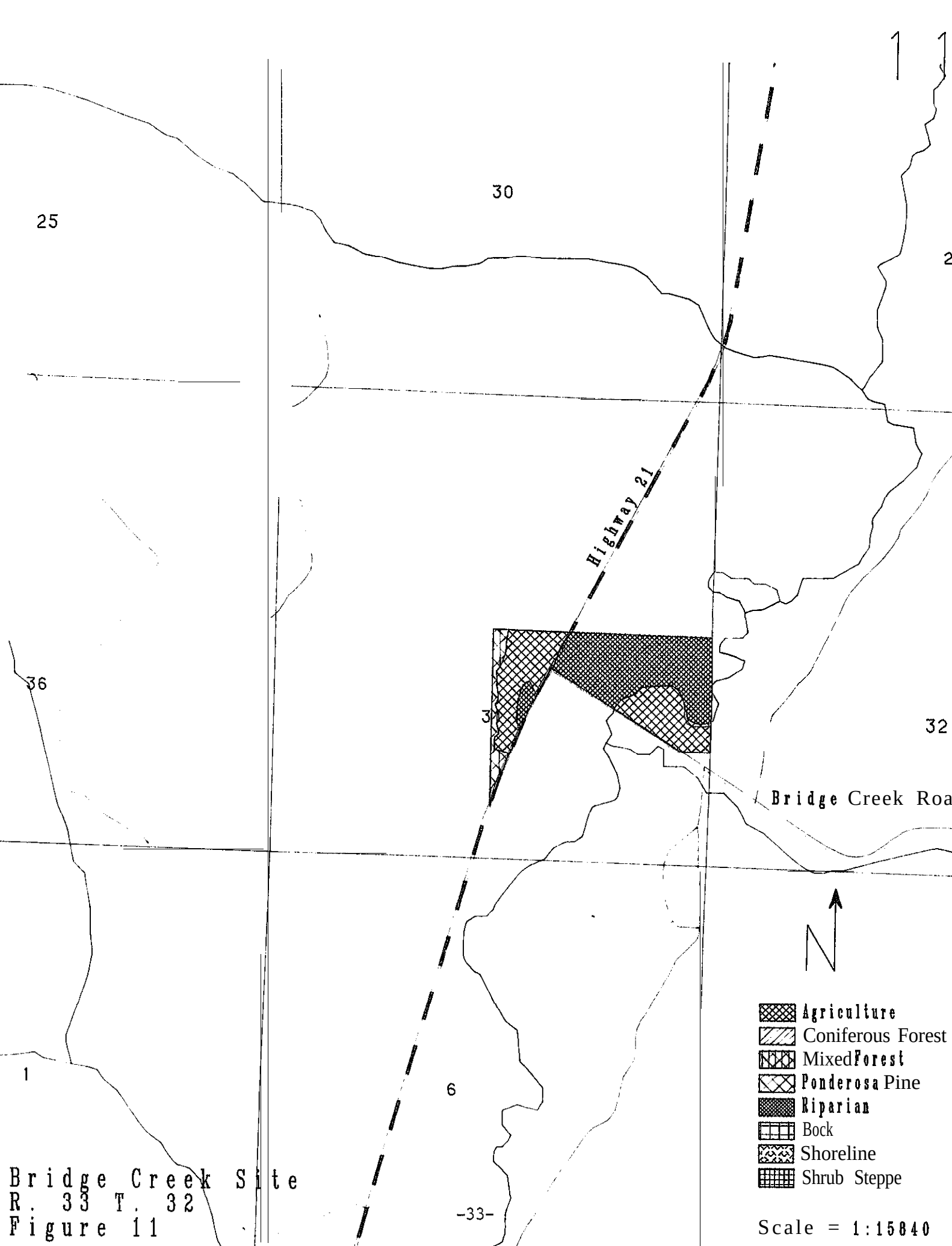
Friedlander Meadow Site
R. 34 T. 30
Figure 8



Sclome Creek Site
R. 34 T.. 30
Figure 9



Baulne Place Site;
R. 35 T. 30
Figure 10.



Bridge Creek Site
R. 33 T. 32
Figure 11

APPENDJX A

Technical Task Team Members

Joe DeHerera	Bonneville Power Administration (BPA)
Peter Paquet	Northwest Power Planning Council (NPPC)
Diana MacDonald	Pacific Northwest Utilities Conference Committee (PNUCC)
Gary Kohler	Ferry County Commissioner (local government)
Terry Knapton	Planning Director Ferry County
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Jerry Marco	CCT Fisheries, Wildlife Department
Bill Gardiner	CCT Forestry, Wildlife Department
Brett Dumas	CCT Vegetation Specialist
Dan Hall	CCT Geographic Information Systems (GIS)
Jim Orwin	Bureau of Indian Affairs (BIA) Land Operations
Adeline Fredine	CCT Cultural Resources
Bill Stevens	BIA Forestry
Steve Rolph	BIA Soils
Jeff Goebel	CCT Intergrated Resource Management Planning Coordinator
Francis Somday	Colville Tribal Enterprises Corporation (CTEC) and Tribal Member

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APPENDIX B

Unpublished Habitat Evaluation Procedure (HEP) Models

1. **Sharp-tailed grouse** **(Tympanuchus phasianellus)**
2. **Mule deer** (Odocoileus hemionus)
3. **Mourning Dove** (Zenaida macroura)
4. **Spotted Sandpiper** **(Actitis macularia)**
5. **Bobcat** **(Felis rufus)**

USFWS Published HEP Models (BLUE BOOKS)

6. **Mink** **(Mustela vison)**
7. **Blue Grouse** **(Dendragapus obscurus)**

The modified Habitat Suitability index (HSI) developed based on habitat data collected on the Tracy Rock Study Area as well as existing and proposed HSI models.

Habitat Suitability Index Model: Columbian Sharp-tailed Grouse

% Equivalent Optimum Area

$$\text{Providing Nest/Brood Cover} = \sum_{i=1}^{n} \frac{SIV3_i + SIV6.}{2} \times SIV4_i \times N_i$$

WHERE:

n = Total number of nest/brood cover types.

$SIV3_i$ = The suitability index for residual vertical cover in cover type i determined by Robel Pole VOR (Prose 1987).

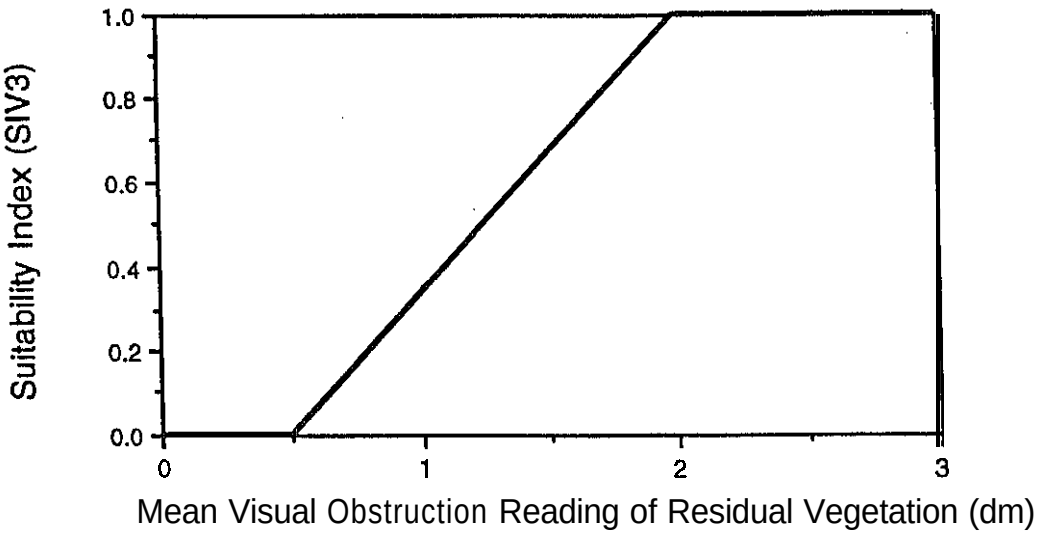
$SIV6_i$ = The suitability index for residual horizontal cover provided by grasses and forbs in cover type i determined by 0.1 m microplot (Modified from Ashley 1992).

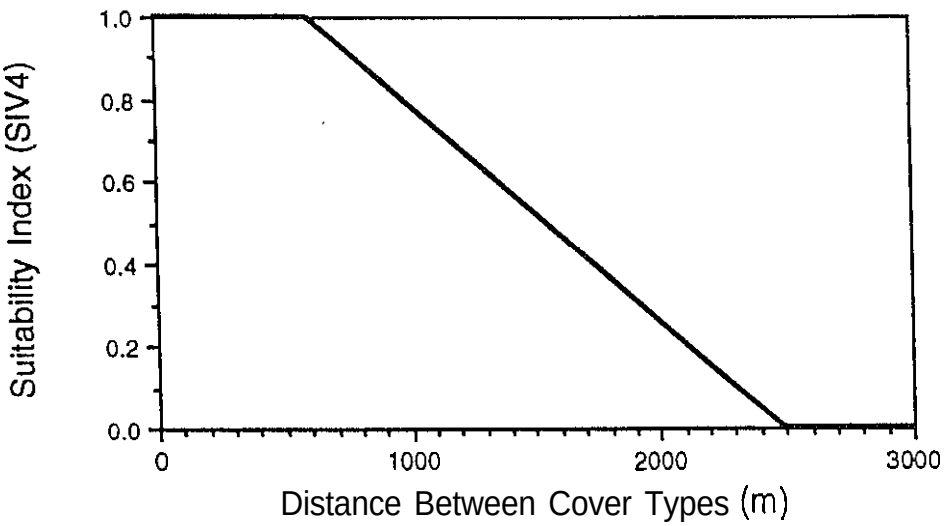
$SIV4_i$ = The mean suitability index for distance between nest/brood cover type i and the nearest cover type providing winter food/cover (including available cropland) (Meintz et al. 1991).

N_i = Percent of study area in cover type i (Prose 1987).

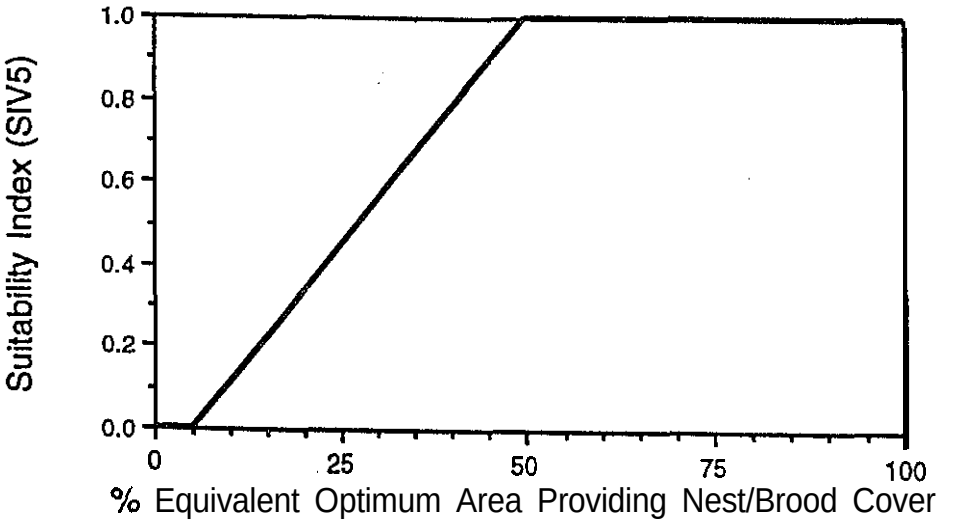
*** HSI for Nest/Brood Cover = SIV5 (Meintz et al. 1991).

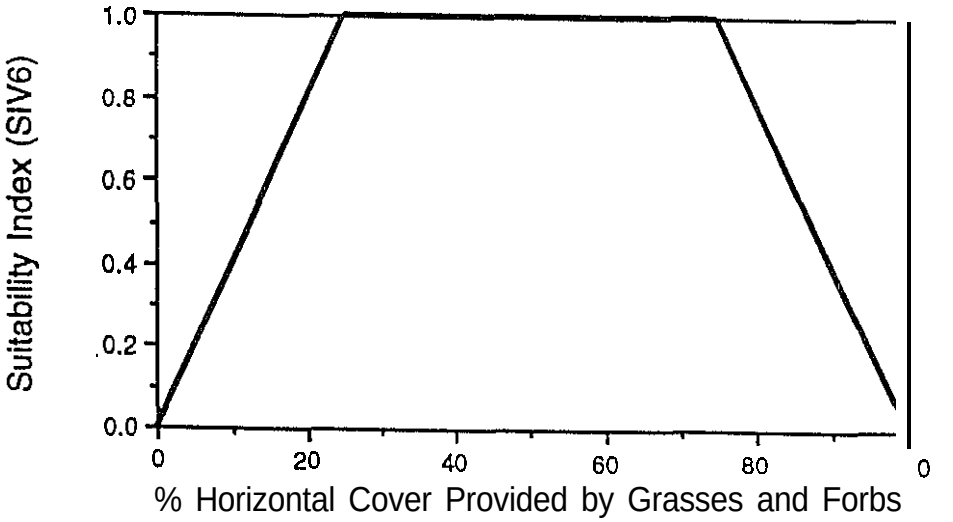
Continued.


Suitability Index (SIV3)
1.0
0.8
0.6
0.4
0.2
0.0
0
1
2
3
Mean Visual Obstruction Reading of Residual Vegetation (dm)


Suitability Index (SIV4)
1.0
0.8
0.6
0.4
0.2
0.0
0
1000
2000
3000
Distance Between Cover Types (m)

Continued.


Suitability Index (SIV5)
1.0
0.8
0.6
0.4
0.2
0.0
0
25
50
75
100
% Equivalent Optimum Area Providing Nest/Brood Cover


Suitability Index (SIV6)
1.0
0.8
0.6
0.4
0.2
0.0
0
20
40
60
80
0
% Horizontal Cover Provided by Grasses and Forbs

UNPUBLISHED HABITAT SUITABILITY INDEX MODEL

MULE DEER by Paul Ashley 1990

CHARACTERISTICS

Mule deer are best distinguished by the small black tipped tail, evenly forked antlers, and large (4 inch) scent glands on the outside of the metatarsals.

FOOD AND HABITAT REQUIREMENTS

The availability of adequate browse is often the limiting factor for mule deer populations over much of their range (Shchneegas and Bumstead 1977). Browse often furnishes 75% or more of the mule deer's winter diet. Forbs and grasses are supplemental winter foods and their availability will result in an increased food value for mule deer. Quantity and quality of nutritious forage in the spring has a major effect on mule deer production and survival (Wallmo et al. 1977).

Thermal cover is provided by woody vegetation over 5 feet tall with a crown cover exceeding 50%. Hiding cover is defined as vegetation greater than 24 inches tall that can hide 90% of a bedded deer at 150 feet or less (Hall 1985). Topographic relief also provides hiding cover value as well as thermal protection from winds (Zender, Ashley, pers comm 1990).

STATUS IN WASHINGTON

Overall deer populations in southeast Washington are not low now. However, if an extended series of droughts or severe winters significantly reduced current numbers, many herds could not rebuild very easily with the existing low buck/doe ratios. A ratio of about 15 bucks for every 100 does is needed for adequate reproduction. However, most southeast Washington mule deer herds have declined to less than 5 bucks per 100 does.

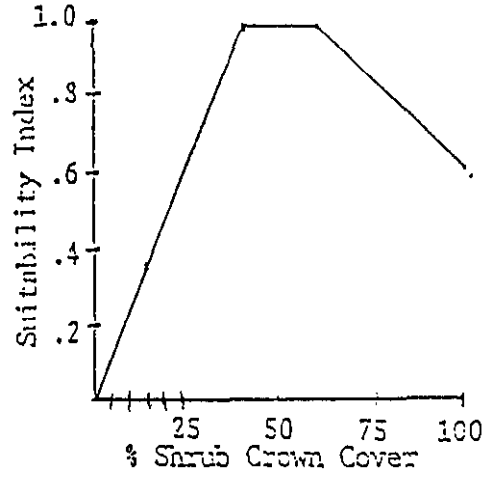
MULE DEER
(Odocoileus hemionus)
Shrub-Steppe (SS)

Draft 10/90

Variable 1: Percent Shrub Crown Cover ≤ 5 ft in height
(do not consider small conifers as shrubs)

V1 Field values:

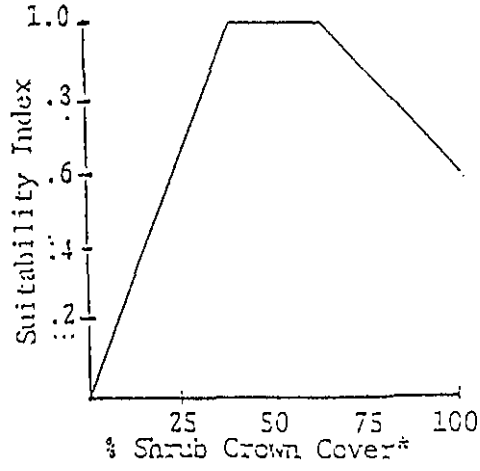
		0% =	0
		< 25% =	.2
25	-	40% =	.7
41	-	60% =	1.0
61	-	100% =	.8



Variable 2: Percent Shrub Crown Cover of preferred shrubs ≤ 5 ft in height*

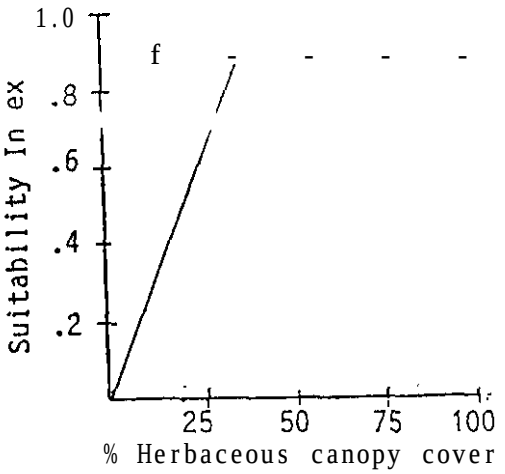
V2 Field values:

		0% =	0
		< 25% =	.2
25	-	40% =	.7
41	-	60% =	1.0
61	-	100% =	.8



* Preferred shrubs include, but are not limited to: bitterbrush, serviceberry, nine bark, chokecherry, rose spp., squaw current, willow, water birch, aspen.

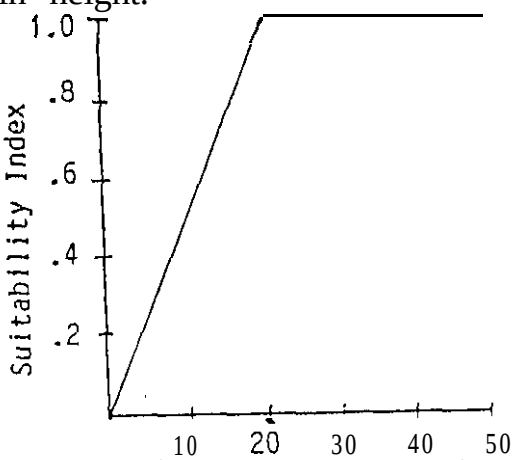
Variable 3: Percent herbaceous canopy cover.



V3 Field values:

O%= 0
<25% = .2
'3 - 40% = ./
>40% = 1.0

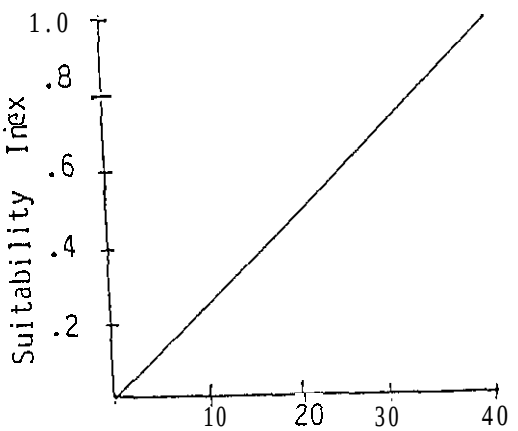
Variable 4: Percent of area consisting of woody evergreen vegetation >.6 feet in height.



V4 field values:

0% = 0
1 - 10% = .2
11 - 20% = .7
>20% = 1.0

Variable 5: Percent of area consisting of variable topcgraphy.



VS Field values:

<10% - 0
10 - 20% = .3
21 - 30% = .6
31-40%= .8
>40% = 1.0

$$HS1 = \left[\left(\frac{V1+V2+V3}{3} \right) \times \left(\frac{V4+V5}{2} \right) \right]^{1/2}$$

MOURNING DOVE
Grassland/Agricultural Type

General

The mourning dove (Zenaida macroura) is found in a wide variety of habitats in the Upper Sonoran and Transition zones of Washington and Oregon (Gabrielson and Jewett 1940; Jewett et al. 1953).

Food Requirements

The mourning dove is almost entirely a seed-eater (Edminster 1954). Weed seeds, grain from cultivated crops, and tree seeds comprise most of the dove's diet. Korschgen (1958) found that seeds from grasses (Poaceae), spurges (Euphorbiaceae), legumes (Fabaceae) and composites (Asteraceae) were eaten in Missouri. Food items derived from agricultural crops made up over 70 percent of the diet. The bulk of their diet consi those seeds that are in plentiful supply in a particular habitat at a specific time of year (Edminster 1954). Mourning doves in Alabama preferred to feed in large open areas that were relatively free of vegetation which could limit their vision (Moore and Pearson 1941).

Water Requirements

Edminster (1954) believes that doves require water daily. However, Johnsgard (1973) states that they can subsist several days without water. Doves were found within 3 to 4 mi. (4.8-6.4 km) of water in Iowa (McClure 1943). Cowan (1952) identified preferred watering areas in California as shallow stream or pond edges having sandy, gently sloping banks devoid of vegetation.

Cover Requirements

No specific cover requirements for the mourning dove were found in the literature. It may seek cover in forested or shrubby areas.

Reproductive Requirement<

A complex of scattered cropland and mixed forest with narrow peninsulas of trees or hedgerows extending into open fields represents good nesting cover (Hopkins and Odum 1953; Edminster 1954; and Keeler 1977). Keeler (1977) found that doves preferred to nest in isolated trees or in shade trees near dwellings.

Openly growing trees in hedgerows: orchards, windbreaks or fields were identified as suitable for nest sites by Edminster (1954). Harris et al. (1963) reported that 63 percent of observed nests in Minnesota were in isolated trees and 29 percent were on the edge of shelterbelts.

A preferred nest site is usually a horizontal limb of a tree (Moore and Peterson 1941; Edminster 1954). Cowan (1952) reported that doves in California preferred to nest about 11 feet (3.4 m) off the ground. Nests in Illinois and Michigan were between 10 and 30 feet (3-9 m) above the ground (Hanson and Kossack 1963; Caldwell 1964). Nesting sites in Texas were clear of concealing vegetation at heights from 8 to 12 feet (2.4-3.6 m) under the tree canopy, thereby providing an open view on all sides (Swank 1955). Large trees are most often used for nesting (Edminster 1954).

Special Habitat Requirements

Roost trees sheltered from the wind are necessary in fall and winter (Edminster 1954). In Iowa, grit was usually sought at watering areas and on roadsides (McClure 1943).

Interspersion Requirements

Interspersion of veqetative types is essential for good dove habitat. Farmland or open country-with scattered woody plants is desirable habitat for mourning doves. Edminster (1954) states that woody vegetation is more important in the form of individual plants than as extensive cover.

Mourning doves are so highly mobile that home range sizes are entirely dependant on local habitat conditions. Mated males with nests are territorial, with territory sizes ranging from 75 to 100 yards (67.5-90.0 m) in diameter (Jackson and Baskett I964).

Special Considerations

Farming and the presence of cropland increases habitat suitability for mourning doves. Cultivation, grazing, and other practices that encourage weedy annuals and cultivated plants are all beneficial to this species (Browning 1962). The current trend toward intensive, clean farming is detrimental to dove habitat (Keeler 1977).

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DRAFT

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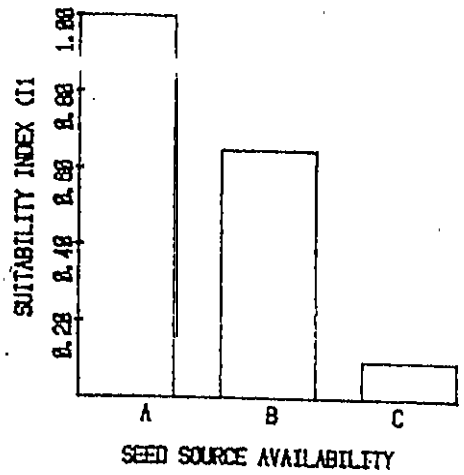
MOURNING DOVE

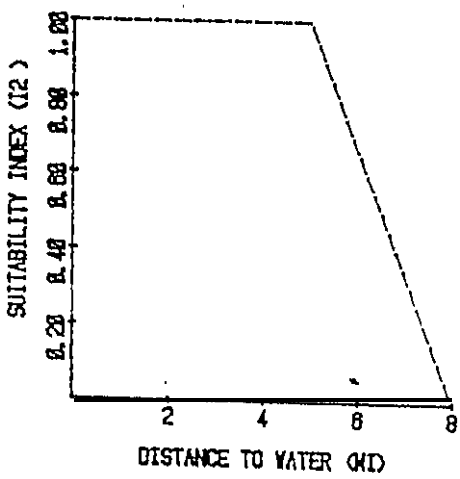
GRASSLAND/AGRICULTURAL

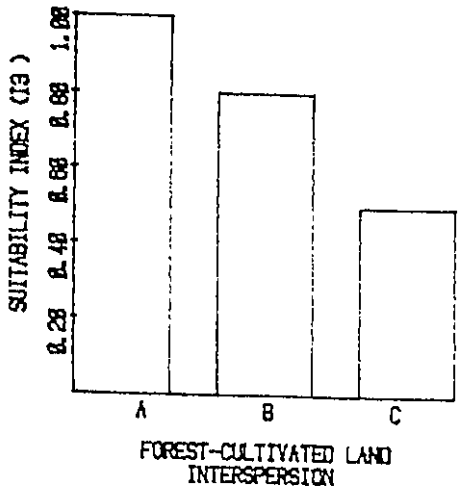


A=VERY ABUNDANT SEED SOURCE AVAILABLE. THESE SEEDS MAY BE FROM TREES, SHRUBS, GRASSES, OR THE GRAIN FROM CULTIVATED CROPS. LARGE OPEN AREAS AVAILABLE FOR THE MOURNING DOVE TO FEED IN.

B=SEED SOURCE MODERATE WITH NO LARGE OPEN AREAS

C=NO APPARENT SEED SOURCE WITHIN THE RANGE OF THE MOURNING DOVE





A=FOREST CONTIGUOUS TO CULTIVATED CROPS WITH PENINSULAS OF TREES OR HEDGEROWS EXTENDING INTO CULTIVATED LAND TYPE

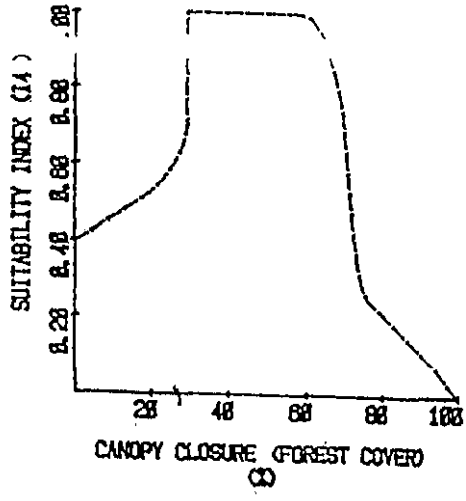
B=FOREST CONTIGUOUS TO CULTIVATED CROPS LACKING PENINSULAS OF FOREST EXTENDING INTO CULTIVATED LAND TYPE

C=FOREST NOT CONTIGUOUS TO ANY CULTIVATED LAND

DRAFT

MOURNING DOVE

GRASSLAND/AGRICULTURAL



HABITAT SUITABILITY INDEX

Mourning Dove in Grassland/Agricultural Type

Ecoregion 2410

Food Value $(X_1) = I_1$

Where: I_1 = Suitability Index (SI) of seed source availability.

Water Value $(X_2) = I_2$

Where: I_2 = SI of distance to water.

Reproductive Value $(X_3) = (I_3 \times I_4)^{1/2}$

Where: I_3 = SI of forest-cultivated land interspersion.

I_4 = SI of percent canopy closure (forest cover).

The Habitat Suitability Index is the lowest X_n value.

Spotted Sandpiper - Willamette Ecoregion

Geoffrey L. Dorsey

Bent (1929) stated that the spotted sandpiper (Actitis macularia) was a widely distributed-species. occurring on the margins of sandy ponds, sea shores. and rocks bordering streams.

Hays (1973) reported that spotted sandpiper nests were located in grasey upland areas of an island. Oring and Knudson (1973) stated that spotted sandpipers used all the sparsely vegetated areas on an island as nest sites. Bent (1929) stared that nest sites were variable; high areas **of** sand island in high. rank sedge grass, on grassy, overgrown gravel bars. in driftwood piles. under extending tree branches. under rock ledges. and under decayed logs representing reported nest sites. Nest sites are close to water (Rent 1929). Oring and Knudson stated that sported sandpipers nest in sparsely vegetated areas. Bent (1929) stated that spotted sandpipers will not nest in densely wooded areas. Oring and Knudson (1973) reported 3/98 nests beneath dense shrubs or trees. Oring and Knudson (1973) attributed nest placement in a wooded area on an island to disturbance by fisherman and intensive aggressive encounters of sandpipers for nesting territories. Wooded areas represent marginal nesting habitat (Oring and Knudson 1973). Oring and Knudson (19'73) reported no spotted sandpipers nesting in densely wooded areas surrounding a lagoon. Bent (1929) repotted that spotted sandpipers nest just above the highwater mark on tree-lined shores. Stout (196'7) stated that nests are often remote from water.

Oring and Knudson (1973) reported that initial nest site selection occurred when scattered herbaceous and grassy cover was less than 10 cm in height (sandy area). Oring and Knudson (1973) observed four nests in herbaceous cover 0.5 m in height and 30 m or less from the beach. Three nests were located in mixed deciduous woods 8-13 m high and 20-50 m from the beach. Miller and Killer (1948) stated that all nests were situated to be well shaded at all times. Miller and Miller (1948) reported that nests were at least 12.19 m apart. Miller and Miller (1948) observed 35/39 nests in thickly growing grass 15.24 - 76.2 cm in height.

Hays (1973) stated that spotted sandpipers have a nesting site fidelity; 66 percent of marked birds returning to the previous years nesting area.

Stout (1967) reported that spotted sandpipers were territorial In winter

Miller and killer (1946) reported a colonial breeding situation. 38 paris/5.46 ha. Kuenzel and Wiegert (1973) reported a territorial size of approximately 1.21 ha per bird. Heideman and Oring (1976) stated that 4-5 pairs/6.8 ha was a greater concentration than typically encountered. Heideman and Oring (1976) reported 10 acitve nests/l.6 ha in a dense deciduous woods to sparsely vegetated beach habitat.

Spotted sandpipers feed primarily on insects, especially aquatic *insects*

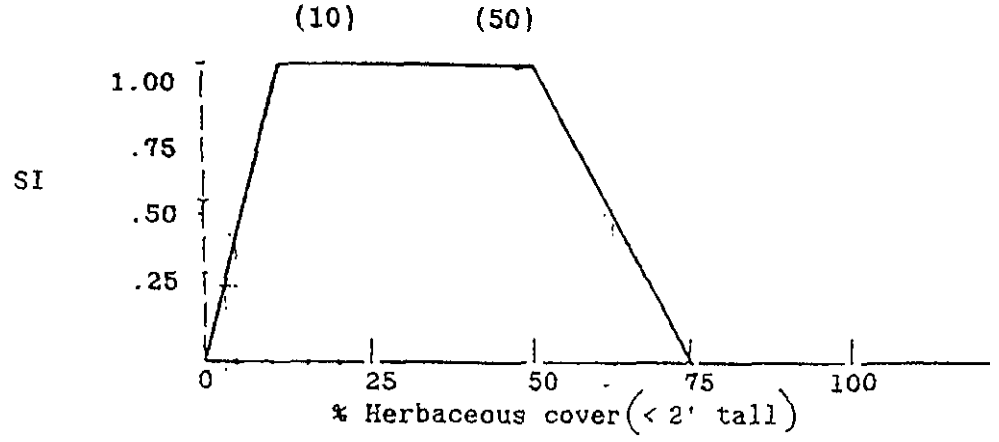
SPOTTED SANDPIPER SUITABILITY INDEX

Nesting Cover (VI)

A mosaic of herbaceous ground cover with an overall density of less than 50% and less than 2' high (an overstory of deciduous trees can be present in one ground cover requirements are met).

Flooding probably not a significant problem as the sandpiper is quite capable of renesting if necessary.

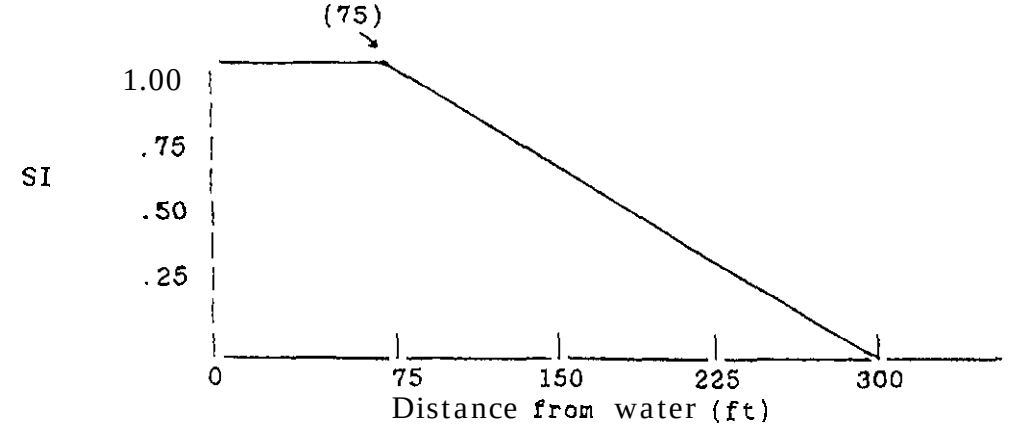
[150 **ft.** transect, 25 ft. intervals. Begin transect where V3 crosses daily high water mark and continue lnland 150 ft.] (go at angle if necessary to stay in cover)



Nesting *distance from water* (va)

Optimum Nesting habitar is within *75* ft. of water

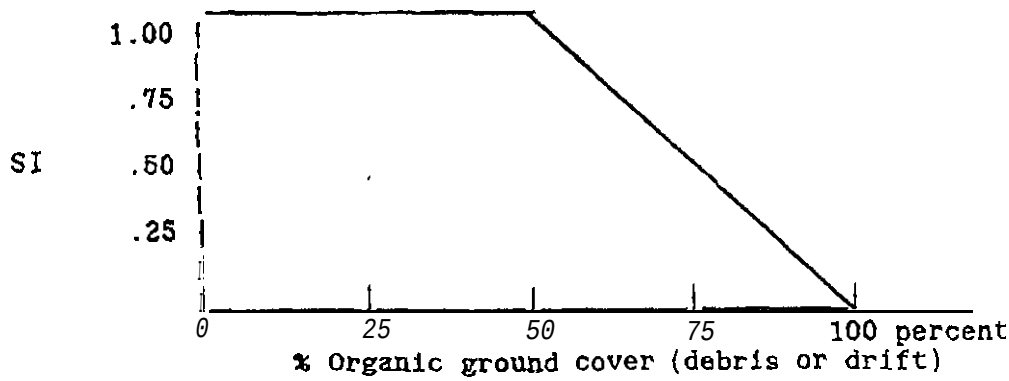
[measure minimum distance between nesting habitat and water]



Foraging habitat (V3) -

Open or sparsely vegetated shorelines (gravel, riprap, or sandy substrates) within 150 feet (45 m) of water (normal pool) which may contain some organic debris or drift.

[Begin transect at EOW and go inland 150 ft. with measurements every 25 ft.]
(If cover type ends before 150 feet, angle transect to obtain 150 ft cover type)
(50)



Model Equation

$$HSI = \frac{V1 + V2 + V3}{3}$$

UNPUBLISHED SUITABILITY INDEX MODEL

BOBCAT by Tim Bodurtha 1991

Habitat Use Information

General

The bobcat can be found throughout the contiguous United States, southern Canada, and northern Mexico (Young 1958). Extreme variations in habitat types accompany the locational variations which can range from swamps to deserts to mountain ranges (Young 1958).

Food Requirements

In general, like most predators, bobcats are opportunists and will attempt to take most anything available including insects, fish, reptiles, amphibians, birds, and mammals. Mammalian prey, however, is the most important group.

Bobcats feed primarily on rabbits and hares (lagomorphs) as inferred from studies which showed relatively high percentage in their diets even when prey populations were low (Beasom and Moore 1977, Fritts and Sealander 1978). Knich (1990) found that during a lagomorph decline bobcat home ranges expanded to areas that contained alternate prey, although energy returns from these prey sources were suboptimal. Mountain beavers (Anolodontra rufa) and snowshoe hares (Leous americanus) were the primary foods for bobcats in Western Washington (Knick et al. 1984). Other prey species of the bobcat include deer (Odocoileus sp.), porcupine (Erethizon dorsatum), squirrels and marmots (Family Scuridae), pocket gophers (Family Geomyidae), woodrats (Neotoma sp.), beaver (Castor canadensis), pocket mice and voles (Family Heteromyidae), and various birds. The cottontail rabbit (Svlvilasus sp.) appears to be the principle prey of the bobcat throughout its range. In the west, other rodents, especially woodrats, may be important prey items when cottontails are not abundant (McCord and Cardoza 1982).

The importance of the primary prey species in bobcat diets necessitates consideration of the general food and habitat requirements of the prey. Prey items such as mice, squirrels, and grouse (Family Tetraonidae) , may be important in particular cover types that are less suitable for rabbits or hares. Voles were the most frequent item in bobcat scats in central Idaho in winter and summer (Koehler and Hornocker 1989). In winter bobcats used lower elevation, open areas, and in summer used higher elevations and a variety of forest habitats. Knowles (1981) observed bobcats preferred dense understories where prey were most abundant. Litvaitis et al. (1986) reported that bobcats avoided sparse understories and that hare densities appeared to be greatest in dense understories regardless of whether a hardwood or softwood

Water Requirements

Water does not appear to be a major factor in habitat distribution.

However, no literature was found which addressed the relationships of bobcats to free water.

Cover Requirements

In its northern range the bobcat is adapted to a wide variety of cover types which generally includes broken country, including swamps, conifer stands and rocky ledges (McCord and Cordoza 1982). Rollings (1945) believed that prey abundance, protection from severe weather, availability of rest areas, dense cover, and freedom from disturbance were all factors in bobcat habitat selection. Bailey (1974) observed that broken, rocky terrain was a significant element of bobcat habitat in southeast Idaho.

In regions that contain dissected plateaus, the upslope, broken terrain along the rims between the top of the plateaus and the canyon bottomlands contain the best habitat for bobcat (pers. comm., Steve Knick). The amount of this habitat is probably the major limiting factor for bobcat populations in regions of scabland topography because of the territorial habits of females. The number of female bobcats that can occupy a territory is likely determined by the size and extent of the broken terrain and rocky escarpments of the area (pers. comm., Steve Knick). Bobcats may extend their home ranges into higher elevation summer habitats are available; but retreat to low elevations in winter due to snow cover. Low elevation riparian areas may be very important during these times (pers. comm., David Brittell).

Habitat features in all cover types are related to hunting and stalking. The hunting habits of bobcats are typical of most members of the cat family and prey may be attacked when moving or stationary. Stalking and ambush tactics are commonly used to overtake their prey (Rollings 1945, Young 1958). Sufficient camouflage cover, in the form of shrubs, trees, and large rocks, is needed to conceal the bobcat until within a short distance from its prey (Rollings 1945, Young 1958).

Ledges appear to be the most important terrain feature in bobcat habitat in the northern portion of its range. Ledges were the most critical terrain feature that provided protective cover from weather and harassment (McCord 1974). Rocky terrain was also considered an important habitat component in Missouri (Hamilton 1982) and in southeast Idaho (Baily 1974).

Rollings (1945) found that bobcats in Minnesota occupy both upland and lowland habitats during summer, but preferred dense conifer forests in winter. In central Idaho, wintering bobcats selected habitats that contained rocky terrain with an overstory over habitats that did not (Koehler and Hornocker 1989).

Diurnal resting areas are temporary hiding places used during the day. These sites are usually occupied for one night (Rolings 1945, Young 1958). Commonly mentioned resting sites include rockpiles, rock outcrops, dense vegetation, and hollow logs (Young 1958). Anderson (1990) indicated that bobcat diurnal loafing sites in

southeast Colorado were primarily steep-sloped, rock areas with dense vertical cover.

Reproductive Requirements

The importance of rockpiles, caves, or broken rocky ledges for dens is well documented. A cover type containing these features would likely satisfy reproductive needs (pers. comm., Steve Knick). These areas are used for refuge, breeding, raising young, and shelter. Den sites are often very similar to diurnal sites (Rollings 1954, Young 1958). In California small rocky areas above the desert floor were used for denning and sanctuaries (Zezulak and Schwab 1979).

Model Applicability

Geographic Area and Cover Type

This model was specifically developed for use on the Chief Joseph Dam Wildlife Mitigation Planning Habitat Evaluation Procedure (HEP) study and applies only to the steep, canyon-like topography associated with the rim and trough of the Columbia River corridor that cuts through the Columbia Plateau in north-central Washington at Rufus Woods Lake. The physiography of the canyon is dominated by level to moderately sloping terraces, connected by rolling terrain or steep sloping escarpments. Many of these escarpments have eroded away forming extremely rugged breaks with complex microrelief. Steep granite outcrops are common at lower elevations, whereas basalt outcrops and talus are typical at higher elevations. The canyon formed by the Columbia River averages 1476 feet in depth, and 1.9 to 3.7 miles in width. Elevations range from 955 feet on the Rufus Woods Lake to 2625 feet on the plateau above the canyon, to over 3937 feet on the foothills to the northeast.

Within the context of the study, use of the model is for areas defined as the 'rock' habitat type (cover type). These areas were characterized as steep difficult topography, mainly on north facing slopes or as major rocky rooted shrubs, principally mock orange (Philadelphus lewesii), as well as forbs such as arrowleaf balsamroot (Balsamorhiza saqittata) and bunchgrasses primarily bluebunch wheatgrass (Agropyron spicatum) .

The vegetation of the region is typical of arid grass-shrublands dominated by big sagebrush/grassland communities. Large areas of the canyon are dominated by basin big sagebrush (Artemesia tridentata) . Bitterbrush (Purshia tridentata) occurs commonly at lower elevations on deep, sandy or gravelly soils. Three-tip sagebrush (Artemesia tripartita) is dominant on the more steeply slopes and shallow soils of the canyon along the rim of the plateau.

The cooler, moister climate of the plateau in combination with deep, fertile soils favors bunchgrass communities, primarily bluebunch wheatgrass, Idaho fescue (Festuca idahoensis), and needle-and-thread grass (Stipa comata). Cheatgrass (Bromus

tectorum) is often a dominant component for all these steppe communities, especially on more disturbed sites.

Throughout the area, giant wildrye (Elymus cinereus) is found in low-lying areas where soil moisture and alkalinity is high. Deciduous shrubs such as mock orange, redosier dogwood (Cornus stolonifera) , and serviceberry (Alemanchier alnifolia) are common in seasonally moist draws and at the base of rock slides and cliffs where water collects. Perennial water courses and seeps support a number of deciduous tree species including quaking aspen (Populus tremuloides) , cottonwood (Populus trichocarpa), hawthorn (Crataeaus doiualasii), and mountain alder (Alnus incana). Ponderosa pine (Pinus Ponderosa) and Douglas fir (Psuedotusa douglasii) are very limited in distribution, occurring only on the very steep, north-facing slopes.

Season
This model represents year-round habitat needs for bobcats in canyon-like habitats of the Columbia River trough in north-central Washington.

Minimum Habitat Area
No wublished data could be found on home rance sizes for bobcats inhabiting the Columbia River trough in north-contral Washington. However, the areas of 'rock' habitat type along the river are not apparently too small or isolated to support bobcats (pers comm. George Brady). Long narrow coulees or draws that extend upslope from the river corridor are large enough and extensive enough to preclude these habitats. Although agriculture is widespread on the plateaus, there appears to be enough broken terrain to allow dispersal. Furthermore, about 150,000 acres of agricultural lands in Douglas County are now under the Conservation Reserve Program (CRP) which is slated to revert this land back into better wildlife habitat which could aid dispersal of bobcats in Douglas County (pers. comm. George Brady).

Model Description

Model Outputs
This model for bobcats applies to the steep, rocky, canyonland habitat of the Columbia River corridor in the sagebrush steppe region of the Columbia Plateau in north-central Washington.

Variables
Vegetation components within the rock cover type can be used assuming there is a direct relationship with prey abundance. Food availability is defined in this model by areas of herbaceous/shrubby vegetation. Cover and reproductive needs are assumed to be satisfied by the habitat structure within the rock cover type.

Variable	Life Requisite
% canopy cover of herbaceous vegetation (V1)	Food
Shrub distribution (V2)	Food
% canopy cover of shrubs (V3)	Cover
% area consisting of rockpiles, roc rocky ledges, boulder fields, talus and cliffs (include only tops and b of cliffs and not cliff faces) (V4)	Cover

HSI

Food Requirement

This model assumes the primary prey species for bobcats are bushy-tailed woodrats (Neotoma cinerea) and mountain cottontail rabbits (Sylvilagus nuttailli) . Bushy-tailed woodrats are likely the main food source within the study area and within the rock habitat type (pers. comm. George Brady). It's also very likely that cottontail rabbits are an important bobcat prey that inhabits the area and this habitat type. Other small mammals such as mice, marmots, gophers, and aquatic furbearers are probably preyed upon to a lesser extent.

This model also assumes that bobcat prey are supported by areas of herbaceous and shrubby vegetation. Bush-tailed woodrats, which commonly occur in rocky areas, feed upon the green portions of forbs and shrubs, but also eat twigs, nuts, and seeds. Furthermore, woodrats store large quantities of forbs and shrubs for the upcoming winter (Zeveloff and Collett 1988).

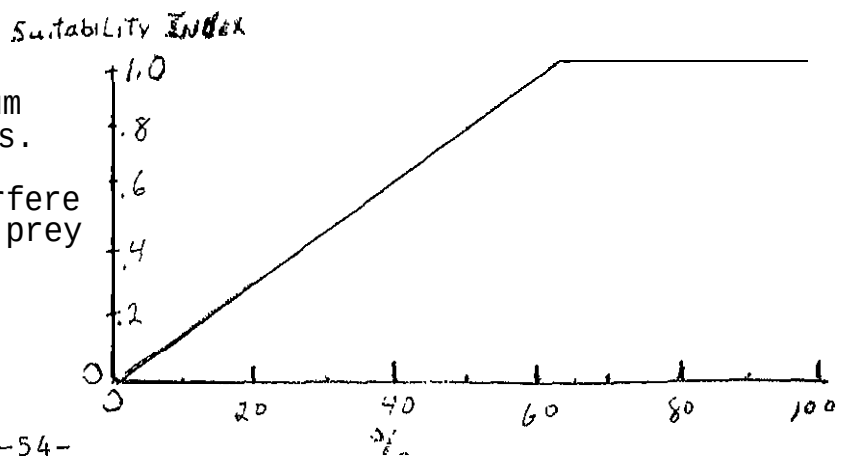
Mountain cottontails occur in thick sagebrush stands where there is prevalency of rocky hills and canyon country (Zeveloff and Collett 1988). They are also typically found in brushy areas that provide concealment from predators and sites to build burrows. Within the sagebrush region, the most important food for mountain cottontails in all seasons is sagebrush. Grasses are preferred in the spring and summer, however, succulent weedy forbs may also be a significant food source (Chapman et al. 1982).

Variable 1. Percent canopy cover of herbaceous

Assumes:

(1) 65% cover provided optimum habitat for rodents/lagomorphs.

(2) 100% cover will not interfere with bobcats ability to find prey



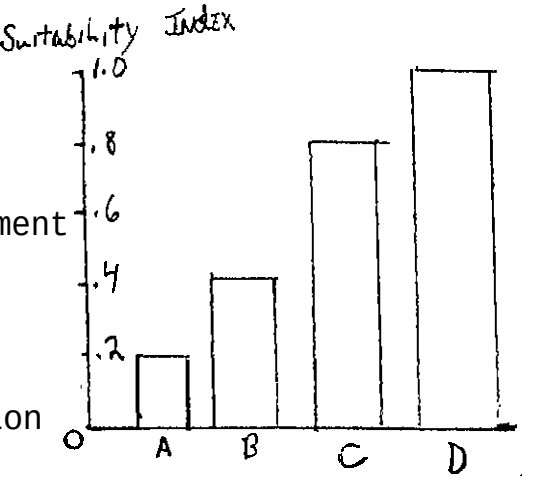
Variable 2. Shrub distribution

Assumes:

(1) dense shrub stands provide winter food, escape cover, burrow sites, and protection from inclement weather.

(2) dense stands of shrubs provide concealment for bobcat stalking and ambushing.

A - none to few shrubs
B - scattered single shrubs,
C - scattered groups of shrubs
D - continuous dense shrubby vegetation



Cover/Reproduction Reauirements

Based on information inferred from other studies in different habitats, and from interviews with local bobcat experts, the following characteristics are assumed to provide the optimum cover components within the 'rock' habitat type.

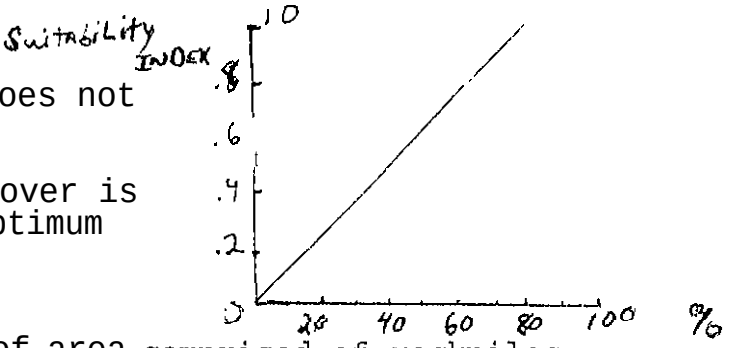
Rocky terrain is the most important habitat component. Rocky terrain with the addition of trees and shrubs, particularly shrubs, intermixed would enhance the area for bobcats by providing stalking and ambush cover , thermal breaks for protection from inclement weather, and increased availability of prey species. Knowles (1985) showed a close association between vegetation density and bobcat use, finding that bobcats selected habitats with greater than 52% vertical cover. Furthermore, a rocky ledge factor should provide some indication of the available rock dens and diurnal resting sites. A good den site would be one that is sheltered and inaccessible or easily protected.

Variable 3. Percent canopy cover of shrubs

Assumes:

(1) 100% shrub cover does not limit bobcat use

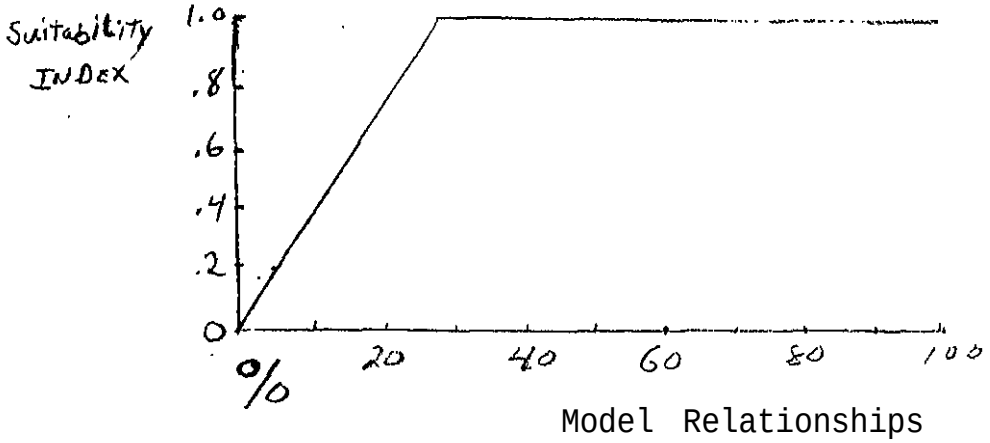
(2) Increasing shrub cover is directly related to optimum cover for bobcats



Variable 4. Percent of area comprised of rockpiles, rock outcrops, rocky ledges, boulder fields, talus slopes and cliffs [include only tops and bottoms of cliffs and not cliff faces (pers comm., Steve Knick)]

Assumes:

(1) Bobcats prefer rocky or broken terrain.



Model Relationships

In order to calculate suitability indices for food and for cover, the variables for each life requisite were combined into an equation. Because food requirements and cover/reproductive requirements are of equal importance, the SI's were derived to express each life requisite as separate values for the overall HSI determination (see below).

Suitability Indices

Food

$$SI_f = \frac{V1 + 2V2}{3}$$

Cover/reproduction

$$SI_{c/r} = \frac{V3 + 2V4}{3}$$

Determining Overall Habitat Suitability Index (HSI)

Compare the SI values for life requisite. Based on the limiting factor concept the HSI is equal to the lowest life requisite value for bobcat in the study area.

General Assumptions

Food

A. Coyer to allow bobcats to stalk and ambush prey is important.

B. Prey density positively influences quality of habitat for bobcats.

c. Majority of bobcat prey species are associated with grass/forb and shrub areas.

Cover

A. Bobcats prefer the rock habitat type to meet cover requirements in the study area.

B. Shrub cover enhances bobcat cover components within the rock habitat type.

C. Rocky terrain is the most important cover component within the rock habitat type.

D. Bobcats require rest shelters.

E. The interspersion of shrubs and rocky areas within the rock habitat type creates quality micro-habitat sites by bobcats of the area.

Reproduction

A. If cover requirements are met, reproduction will not be limiting.

Water

A. Water will not be limiting in the study area in view of the proximity of Rufus Woods Lake and the mobility of bobcats.

Assumptions Used in Applying the Bobcat Model

A. The rock habitat type were well dispersed throughout the study area

B. Bobcat preferred the rock habitat type within the study area.

C. The terrain of the rock habitat type was assumed to he adequately diverse, rocky, and broken and supported bobcats in the study area.

D. A prey base for bobcats exists in the study area and its abundance is related to the extent of herbaceous and shrubby vegetation.

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APPENDIX C

LIST OF SPECIES MENTIONED IN THE REPORT

GRASSES	
Idaho Fescue	*Festuca idahoensis*
Bluebunch Wheatgrass	Agropyon spicatum
Needle-and-Thread	*Stipu comata*
Cheat Grass	*Bromus tectorum*
Sandberg bluegrass	*Poa sandbergii*
Basin wild rye	*Elymus cinereus*
Alfalfa	*Medicago sativa*
Intermediate wheatgrass	*Agropyron intermedium*
Crested wheatgrass	*Agropyron cristatum*
Threeawn grass	*Aristida sp.*
FORBS	
Cattail	*Typha lafifolia*
Bulrush	*Scirpus americanus*
Pondweed	*Potamogeton sp.*
Sedge	Carex *sp.*
Milfoil	*Myriophyllum sp.*
Arrowleaf balsamroot	*Balsamorhiza sagittata*
Lomatium	*Lomatium sp.*
Buckwheat	*Eriogonum sp.*
Bitterroot	*Lewisia rediviva*
SHRUBS	
Bitterbrush	*Purshia tridentata*
Sagebrush	*Artemisia tridentata*
Rabbitbrush	Chrysothamnus nauseosus
Cactus	*Opuntiafragilus*
Serviceberry	*Amelanchier alnifolia*
Wax currant	*Ribes cereum*
Oceanspray	*Holodiscus discolor*
Redstem ceanothus	*Ceanothus sanguineus*
Ninebark	*Physocarpus malvaceus*
Snowberry	*Symphoricarpus albus*
Myrtle boxwood	*Pachystima myrinites*
Columbia hawthorne	*Crataegus columbiana*
Red-osier dogwood	*Cornus stolonifera*
Rose	*Rosa nutkana*
Mockorange	*Philadelphus lewisii*
Oregon grape	*Berberis repens*
Alder	*Alnus teniufilia*

Chokecherry	*Prunus virginiana*
Smooth sumac	*Rhus glabra*
Blue-berry elder	*Sambuscus glauca*
TREES	
Ponderosa pine	*Pinusponderosa*
Douglas fir	*Pseudotsuga menziesii*
Western larch	*Larix occidentalis*
Grand fir	*Abies grandis*
Cottonwood	*Populus trichocarpa*
Aspen	*Pupulus tremuloides*
Willow	*Salix sp.*
Birch	*Betula occidentalis*
ANIMALS	
Mule deer	*Odocoileus hemoinus*
Whitetail deer	*Odocoileus virginianus*
Mink	*Mustela vison*
Bobcat	*Felis rufus*
Badger	*Taxidea taxus*
Coyote	*Canis latrans*
Cottontail rabbit	*Sylvilagus nuttalli*
Snowshoe hare	*Lepus americanus*
Sagebrush vole	*Lagurus curtatus*
Black bear	*Ursus americana*
Elk	*Cervus elaphus canadensis*
Pine marten	*Martes pennanti*
Beaver	*Castor canadensis*
Muskrat	*Ordatra zibethica*
Racoon	*Procyon lotor*
Stripped skunk	*Mephitis mephitis*
Whitetail jackrabbit	*Lepus townsendi*
Great basin pocket mouse	*Perognathus parvus*
Yellow bellied marmot	*Marmota flaviventris*
Bushytail woodrat	*Neotoma cinerera*
Red squirrel	*Tamiasciurus hudsonicus*
Plying squirrel	*Glaucomys sabrinus*
BIRDS	
Sharp-tailed grouse	*Tympanuchus phasianellus*
Spotted sandpiper	*Actitus colchicus*
Mourning dove	Zenaida macroura
Blue grouse	*Dendragapus obscurus*
Burrowing owl	*Athene cunicularia*
Western meadowlark	*Sturnella neglecta*

Northern harrier hawk	***Circus cyaneus***
Grasshopper sparrow	***Ammodramus savannarum***
Ring-necked pheasant	***Phasianus colchicus***
Canada goose	***Branta canadensis***
Horned lark	***Eremophila alpestris***
Hungarian partridge	***Perdix perdix***
Barn swallow	***Hirundo rustica***
Spruce grouse	***Dendragapus canadensis***
Pileated woodpecker	***Dryocopus pileatus***
Turkey	***Meleagris gallopavo***
Ruffed grouse	***Bonasa umbellus***
Warblers	***Dendroica sp.***
Great blue heron	***Ardea herodias***
California quail	***Callipepla califonica***
Hawks	***Accipiter sp.***
Mallard	Anus ***platyrhynchos***
coot	***Fulica americana***
Teal	*Anus* ***sp.***
Red-tailed hawk	***Buteo jamaicensis***
Chukar	***Alectoris*** chuckar
Goshawk	***Accipiter gentilis***
Great horned owl	***Bubo virginianus***
Barred owl	***Strix varia***
Flicker	***Colaptes auratus***
Osprey	***Pandion haliaetus***
Kingfisher	***Alcedinidae sp.***
Yellow warbler	***Denroica coronata***
Bald eagle	***Haliaeetus leucocephalus***

REPTILES

Northern Pacific rattlesnake	***Cortalus viridis***

Appendix D

HELLSGATE WINTER RANGE MITIGATION
BASELINE HEP ANALYSIS

MULE DEER HABITAT UNITS = 1,277 Total

LOCATION : Shrub-steppe / Ponderosa Pine Savanna Cover Habitat
1,985 Total Acres I570 Total Acres = 2,555 Total Acres

SITE NUMBER	1.	2.	3.	4.	5.	6.	7.	8.	9.
HSI per Site	0.5	0.3	0.3	0.6	0.4	0.4	0.2	0.4	0.4
Acres per Site	318	318	132	87	132	87	500	500	500

VARIABLES

Vl : % Shrub Cover< 5 ft. in height
0 % = 0.0
<25 %= 0.2
25 - 40 %= 0.7
41 - 60 % = 1.0
61 - 100 % = 0.8
Vl value = 17% PP, 20% SS

V2 : % Preffered Shrub Cover ≤ 5 ft.
0 % = 0.0
<25 %= 0.2
25 - 40 % = 0.7
41 - 60 % = 1.0
61 - 100 % = 0.8
V2 value = 16% PP, 2% SS

V3 : % Herbaceous Cover
0 % = 0.0
<25 %= 0.2
25 - 40 % = 0.7
>40 % = 1.0
V3 value = 11% PP, 18% SS

V4 : % Woody Evergreen Cover ≥ 6ft.
0 % = 0.0
1 - 10 % = 0.2
11 - 20 % = 0.7
> 20 % = 1.0
V4 value = 2% PP, 0 % SS

V5 : % Variable Topography
< 10 % = 0.0
10 - 20 % = 0.2
21- 30 % = 0.6
31 - 40 % = 0.8
> 41 %=1.0
V5 value = 12% PP, 45% SS

Weighted HSI = 0.5 x 1,985 + 570 = 1,277 Total Habitat Units

HELLSGATE WINTER RANGE MITIGATION
BASELINE HEP ANALYSIS 1993

SHARP-TAILED GROUSE HABITAT UNITS = **1249 Total**

LOCATION: Shrub-steppe / Agriculture Cover Habitat Weighted HSI = HSIX Acres
1,985 SS Acres / 1,137 AG Acres = 3,122 Total Acres Total Acres

SITE NUBMER	1.	2.	3.	4.	5.	6
HSI per Site	0.4	0.2	0.5	0.6	0.6	0.7
Acres per Site	445	644	644	455	160	175
VARIABLES						
VOR's	0.4	0.2	0.5	0.6	0.6	0.7
% GRASS	17	8.5	30	19	19	16
% FORB	2.4	2.3	1.5	14	9	18
% SHRUB	0	4.2	3.5	0	0	0
No. PLOTS	30	30	30	40	30	50

WEIGHTED HSI = 0.4 X 3.122 = 1249 Total Habitat Units

HELLSGATE WINTER RANGE MITIGATION
BASELINE HEP ANALYSIS 1993

MOURNING DOVE HABITAT UNITS = **682 Total**

LOCATION : Agriculture Cover Habitat 1,137 Total Acres

Weighted HSI = HSIX Acres / Total Acres

SITE NUMBER	1.	2.	3.	4.	5.
HSI per Site	0.4	0.8	0.7	0.6	0.7
Acres per Site	135	79	387	207	257

VARIABLES

Vl : Seed Source Availability	A	A	M	A	A
Abundant = 1 .0	1.0	1.0	0.6	1.0	0.8
Moderate = 0.0 - 0.7					
No Seeds = 0.1 - 0.0					
V2 : Distance to Water	< mi.	< mi	< mi	< mi	< mi
1 - 6 mi. = 1.0	1.0	1.0	1.0	1.0	1.0
6 - 8 mi. = 1.0 - 0.0					
V3 : Interspersion	C	B	B	B	A
A. Forest contiguous with peninsulas = 1 .0	0.5	1.0	0.8	0.8	0.9
B. Forest contiguous no peninsulas, = 1.0 - 0.8					
C. Forest not contiguous = 0.6 - 0.0					
V4 : % Canopy Closure	20%	31%	21%	20%	30%
0 - 20 % = 0.4 - 0.5	0.4	0.6	0.5	0.4	0.6
21 - 30 % = 0.6 - 1.0					
31 - 60 % = 1.0					
61 - 75 % = 0.9 - 0.2					
76 - 100% = 0.2 - 0.0					

WEIGHTED HSI = 0.6 X 1137 = 682 Total Habitat Units

HELLSGATE WINTER RANGE MITIGATION
BASELINE HEP ANALYSIS 1993

BLUE GROUSE HABITAT UNITS = **949 Total**
LOCATION : Coniferous and Mixed Forest Cover Habitat 1050 + 4 = 1054 Total Acres

SITE NUMBER	1	2.	3.	4.	5.	6.	7.	8.	9.	10
HSI per Site	0.5	0.8	1.0	0.6	0.7	0.6	0.6	0.7	0.5	0.5
Acres per Site	504	504	174	174	122	122	112	80	57	4

VARIABLES

Vl : % Canopy Cover Entire Area — Vl value for all 10 sites = 0.9
- 0 - 19 % = 0.0 - 0.9
- 20 - 50 % = 1.0
- 51 - 75 % = 0.9 - 0.1
- 76 - 100 % = 0.1 - 0.0

V2 : % Shrub Crown Cover — V2 value = 1.0 for all, but Site 9 = 0.3
- 0 - 10 % = 0.0 - 1.0
- 10 - 30 % = 1.0
- 30 - 75 % = 1.0 - 0.0
- > 75 % = 0.0

V3 : Ave. Height Shrub Canopy — V3 value = 1.0 for all Sites
- 0 - 10 in. = 0.0 - 0.9
- > 11 in. = 1.0

V4 : % Herbaceous Canopy Cover — V4 value = 0.4, 0.5, 0.9, 0.4, 0.5, 0.4, 0.4, 0.5, 0.2, and 0.4.
- 0 - 40 % = 0.0 - 1.0
- 40 - 75 % = 1.0
- 76 - 100 % = 1.0 - 0.1

V5 : Ave. Height Herb. Canopy — V5 value = 0.7, 0.7, 1.0, 1.0, 1.0, 1.0, 1.0, 0.9, 0.2, and 0.7.
- 0 - 8 in, = 0.0 - 1.0
- 8 - 20 in. = 1.0
- 20 - 60 in. = 1.0 - 0.1

V6 : Diversity of Herb. Veg. — V6 value = 1.0 for all except 0.7 Site 7 and 0.8 Site 9
- 1 = 0.4
- > 1 = 0.5 - 1.0

V7 : Dist. to Forest Cover Type — V7 value = 1.0 for all except 0.8 Site 5.
- 0 - 1/4 mi. = 1.0
- 1/4 - 2 mi. = 1.0 - 0.0

HSI Determination for Blue Book Model = 0.9 for all areas sampled
Weighted HSI = 0.9 x 1050 + 4 = 949 Total Habitat Units

HELLSGATE WINTER RANGE MITIGATION
BASELINE HEP ANALYSIS 1993

MINK YEAR ROUND SYNOPSIS HABITAT UNITS = 44 Total

LOCATION : Riparian Cover Habitat 147 Total Acres Weighted HSI = HSIX Acres
Total Acres

SITE NUMBER 1 (19 ac)	2. (13 ac)	3. (30 ac)	4. (27 ac)	5. (14 ac)	6. (4 ac)	7. (8 ac)
H Spe**I**r site	**0.5**	**0.4**	**0.8**	**0.1**	**0.5**	**0.3**
VARIABLES	1.	2.	3.	4.	5.	6:	7
V1 : % Yr. Water							
0 - 24% = 0.0	50%	50%	30%	100%	25%	100%	75%
25 - 74% = .1-.9	0.5	0.6	0.2	1.0	0.1	1.0	1.0
75- 100% = 1.0							
V2 : % Canopy							
0- 24% = .1-.3							
25- 74% = .4-.9	75%	30%	37%	60%	40%	20%	25%
75-100% = 1.0	1.0	0.5	0.5	0.8	0.5	0.2	0.4
V3 : % Shoreline Cover							
0- 24% = 0.0-.1							
25- 74% = .4-.9	75%	40%	35%	75%	25%	40%	30%
75-100% = 1.0	1.0	0.6	0.5	0.8	0.3	0.7	0.3

WEIGHTED HSI = 0.3 X 147 = 44 Total Habitat Units

HELLSGATE WINTER RANGE WILDLIFE MITIGATION
BASELINE HEP ANALYSIS 1993

BOBCAT HABITAT UNITS = **21 Total**

LOCATION: Rock Cover Habitat 35 Total Acres Weighted HSI = HSI x Acres / Total Acres

SITE NUMBER	1.	2.	3.	4.
HSI per Site	0.6	0.6	0.4	0.7
Acres per Site	13	20	1	4
VARIABLES	30%	40%	40%	15%
Vl : % Canopy Cover Herb Veg.	0.5	0.6	0.6	0.2
0 - 25 % = 0.0 - 0.4				
26 - 50 % = 0.4 - 0.8				
65-lOO%=l.O				
V2 : Shrub Distribution				
Assumes: (1) Dense shrub provide winter food, escape cover, burrow sites, and protection from weather. (2) Dense stands of shrubs provide concealment for bobcat stalking and ambushing				
A. None to few shrubs = 0.0 - 0.2	C	C	C	D
B. Scattered single shrubs = 0.0 - 0.5	0.6	0.6	0.6	1.0
C. Scattered groups of shrubs = 0.0 - 0.8				
D. Continuous dense shrub cover = 0.0 - 1.0				
V3 : % Canopy cover of shrubs	40%	40%	36%	100%
Assumes: (1) 100% shrub cover / not limit use.	0.4	0.4	0.4	1.0
(2) Increasing cover is directly related to optimum cover.				
20 % = 0.2 40 % = 0.4 60% = 0.6 80 % = 0.8 100% = 1.0				
V4 : % Area structure (rocky ledges, talus slopes, cliffs,and rock outcrops)				
0 - 5 % = 0.0 - 0.2				
6 - 10 % = 0.4	25%	30%	10%	30%
11 -20%=0.8	0.7	1.0	0.4	1.0
21 - 30 % = 1.0				

HSI EQUATION :

Food value SI 1 $= \frac{V1 + 2V2}{3}$ Cover/reproduction value SI 2 $= \frac{V3 + 2V4}{3}$

Weighted HSI = 0.6 X 35 = 21 Total Habitat Units

HELLSGATE WINTER RANGE MITIGATION
BASELINE HEP ANALYSIS 1993

SPOTTED SANDPIPER HABITAT UNITS = **10** Total

LOCATION : Shoreline Cover Habitat 14 Total Acres

SITE NUMBER **1.**
HSI per site **0.7**

VARIABLES

Vl : % Herb. < 2 ft. 6.3% = 0.5
0 - 9% = 0.1 -0.9
10 - 59 % = 1.0
60 - 75 % = 0.1 -0.9
76 - 100 % = 0.0

V2 : Nest. Dist. to Water 195 ft = 0.6
0 - 75 fl. = 1.0
76-300ft.=O.l-0.9
> 300 ft. = 0.0

V3 : % Organic 24% = 1.0
0 - 49 % = 1.0
50 - 100 % = 1.0-0.0

HSI EQUATION : = $\frac{V1 + V2 + V3}{3}$ = 0.7 X 14 ac = 10 Total Habitat Units

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