

Study



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**WILDLIFE HABITAT MANAGEMENT PLAN
FOR BOULDER GREENBELT
HABITAT MANAGEMENT DEMONSTRATION AREA**

**Prepared by
Ron Gosnell
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Julie Etra**

In partial fulfillment of the requirements for

**Wildlife Habitat Management (FW677)
Dr. Dwight R. Smith**

**Colorado State University
Fort Collins, Colorado**

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INTRODUCTION

This document is a wildlife habitat management plan which was developed for a 48 hectare (120 acre) tract of the Boulder Greenbelt. It is the last tract scheduled to receive silvicultural work under the Green Slope Project, a cooperative forest management program between the City of Boulder and the Colorado State Forest Service. The Green Slope Project was designed to control pine bark beetle and reduce wildfire hazard, though providing habitat for wildlife was addressed. The silvicultural work which is to be implemented on this tract has been designed primarily for wildlife habitat improvement. This tract provides an excellent opportunity to demonstrate beneficial practices for wildlife which could be implemented on other City of Boulder lands.

As a part of Project Greenslope, practices are planned for completion prior to May 1981. Plan revision is necessary in ten years. During these ten years, monitoring and any maintenance practices should be designed and conducted by the City of Boulder Parks and Open Space staff.

MANAGEMENT OBJECTIVES

The planning team has identified the following objectives of the wildlife habitat management plan:

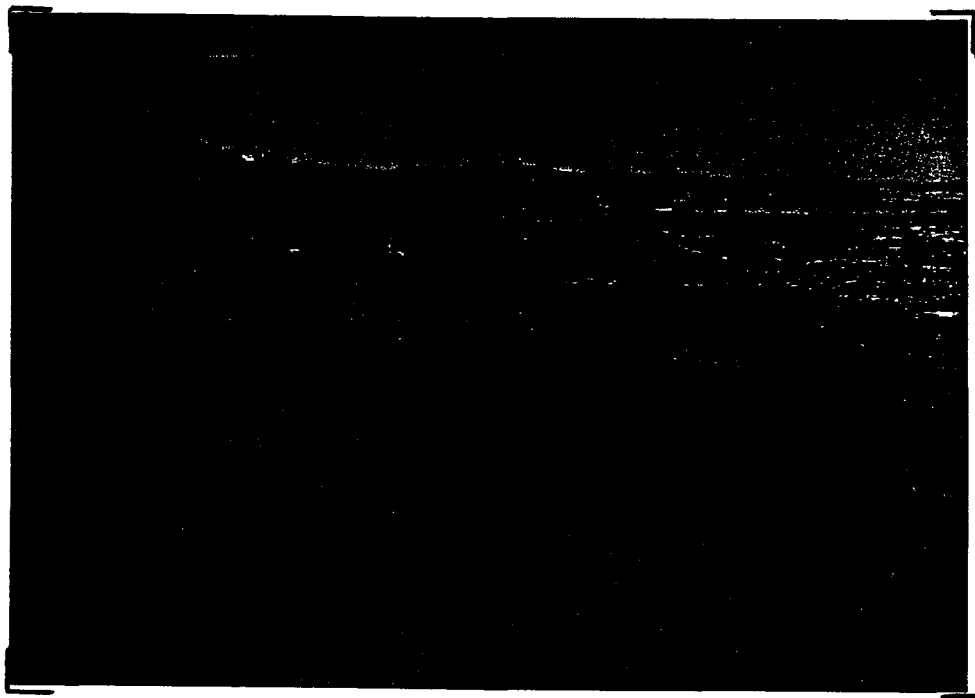
1. To prescribe vegetative and other management practices to benefit wildlife on a 48 hectare (120 acre) wildlife habitat management demonstration area. These prescriptions will be implemented by May 1981, as part of Project Greenslope.
2. To provide a guide for City of Boulder foresters and park managers to conduct future management practices which will
 - a. Create wildlife habitat diversity, thereby providing opportunity for increasing species richness.
 - b. Maintain or increase populations of locally important species by reducing or eliminating known limiting factors and increasing known welfare factors for these species.
3. To establish a data base providing information on species' habitat requirements and preferences in the Rocky Mountain west. This data base can be used as a reference source for future management activities and recommendations in the western region.
4. To provide a method for recording practices and their results on wildlife over a ten year period, at which time a plan revision/update will be necessary.
5. To inform Boulder residents of activities being executed on the tract to benefit wildlife, and gain their feedback. This can be accomplished by:
 - a. Erecting signs on the area informing the public what is being done on the area and who to contact for more information (see Appendix B);

- b. Conducting a radio talk show to inform Boulder residents where the area is located, what the habitat management plan's purposes and objectives are, and who to contact for more information;
- c. Providing above information to all local newspapers;
- d. Informing ecology and biology instructors at University of Colorado about the management plan. This information could then be communicated to the students, and their assistance could be employed to conduct inventories and make observations; and
- e. Producing a public information brochure for release to public. (This activity contingent upon budget allowance.) This brochure could be designed by Boulder Mountain Parks personnel, or outdoor recreation interpretation students at Colorado State University.

DESCRIPTION OF AREA

Location

The 48 ha (120 acre) management area is located within the city limits of Boulder, Colorado, and is a part of the Boulder Greenbelt System. Figure 1 shows the proximity of the area to Denver and Boulder. The area includes portions of Section 18 and Section 19, T1S, R70W, of the 6th. P.M. Figure 2 shows the area boundary. The area is easily defined by a powerline on the west, an unnamed natural intermittent drainage on the north, a fence along the east, and another unnamed intermittent natural drainage to the south. Picture below shows the area as photographed in October 1980.



The management area is outlined in ink.

Oblique Aerial Photograph

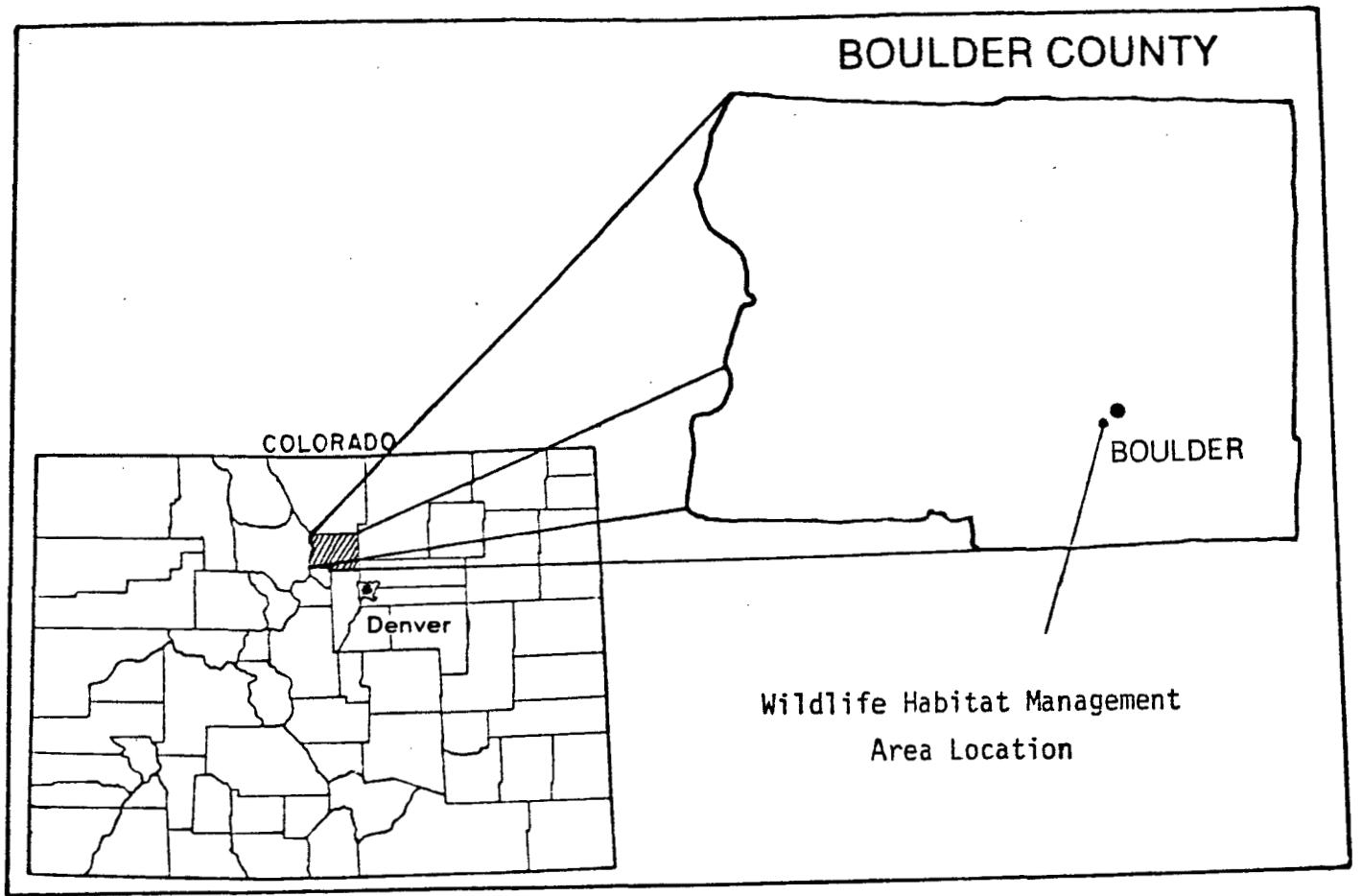
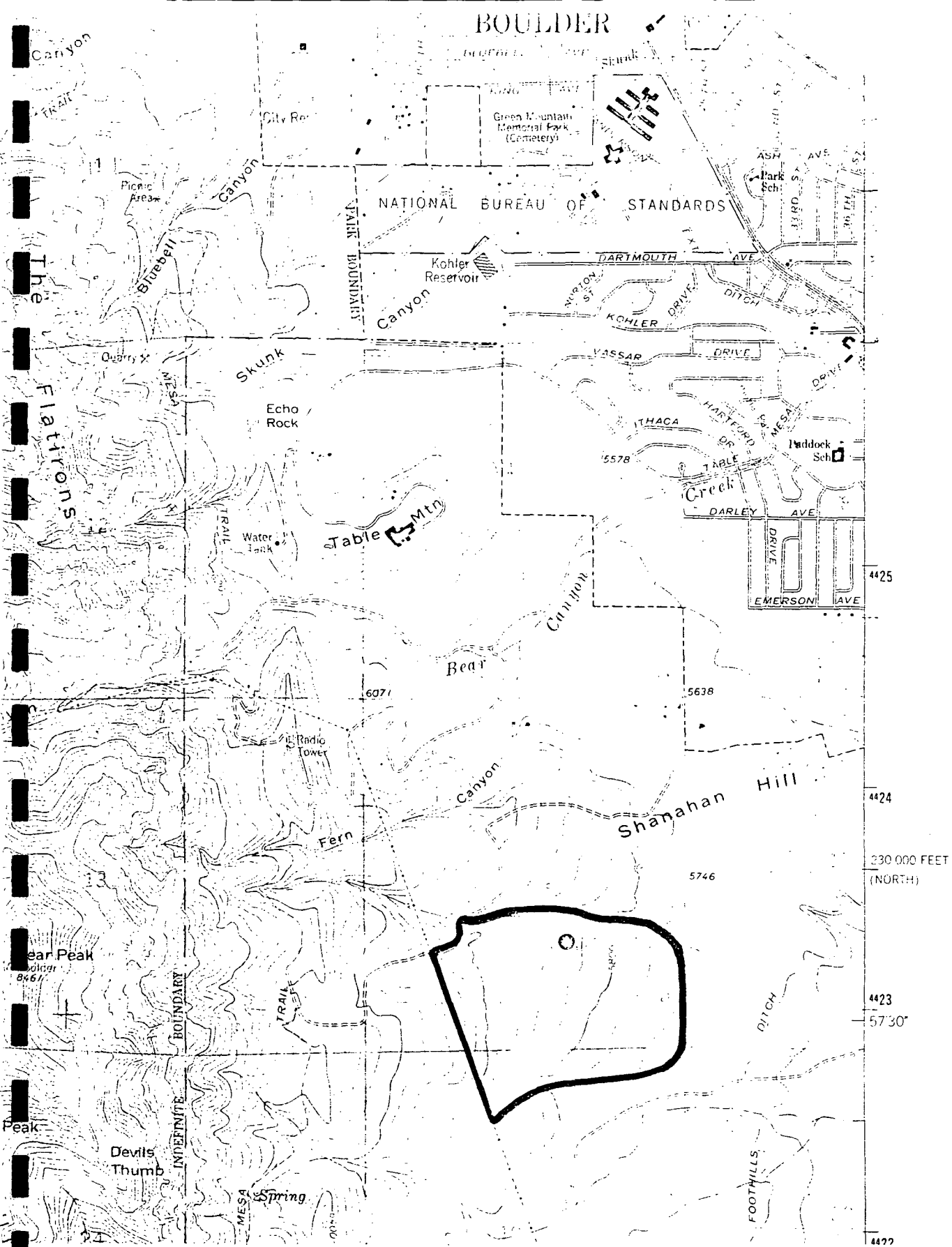


Figure 1 Management Area Location



Base Map - Eldorado Springs Quadrangle 7.5 Minute Series



Management Area Boundary

Figure 2 Area Boundary

Climate

The area is characterized by extreme changes in weather. This is due to the different types and origins of air movement patterns as they encounter the mountains. Extreme changes in temperature and precipitation can take place on a daily and seasonal basis.

Precipitation averages 33 centimeters (13 inches) yearly but most of it occurs in the spring as rain or wet snow (Marr 1957).

Classic up-slope conditions, created by gulf air masses rising along the mountains, are primarily responsible for the majority of the precipitation. Convection-induced summer storms are short but often intense. The fall season is usually dry, continuing into winter. Snow accumulation occurs in the winter, but rarely at depths greater than 0.3 meters (Mutel 1976).

The average annual temperature is 5.5°C (42°F) but the summers are typically hot.

Another unique weather feature is the high-intensity wind storm, or chinook winds. These warm air storms are caused by Pacific air masses descending through the mountains and are most common from November through March.

Geography, Geology, Soils

Slope varies throughout the area with the eastern portion having the lowest grade as it extends toward the plains. Maximum slope occurs to the west, and is about 35°. Elevation varies from 1754 meters (5700 feet) to 1883 meters (6120 feet) and is therefore classified as a lower montane ecosystem (Marr 1967).

The bedrock of the mountains due west of the area (the Boulder batholith) are primarily granites in composition. However, the unique "flatirons" which can be seen from the area and provide a backdrop for Boulder are of sedimentary origin. The Flatirons Formation consists of arkose, a loosely cemented, irregular sandstone and is an erosional remnant of the ancestral Rocky Mountains. The formation was subsequently pushed up and tilted by more recent (70 million years ago) orogenic processes that formed the existing Rocky Mountains.

Soils vary but are generally coarse in texture and can be classified as a sandy loam (Marr 1967). Though generally shallow (15 centimeters), soil depths increase with decreases in slope, particularly in the eastern portion of the area. Soil water content is usually low. Soil profile development is generally poor, the greatest accumulation of humus occurring in the meadows.

Vegetation

Although the area is dominated by ponderosa pine (*Pinus ponderosa*), it has developed several unique characteristics as a result of human use through time. The two major aspects of human impact have been fire suppression and, more recently, recreation.

The area has few mature to over-mature trees (greater than 150 years) but is predominated by individuals in the 80-90 year class. This roughly coincides with increased human population and subsequent fire prevention in Boulder. The eastern section has a lower tree density (individuals/acre) and the broad-crowned trees are interspersed with grassy meadows. Shrubs are more abundant here.

Tree density throughout the section varies. Areas of highest density typically support trees of smaller d.b.h. Recent thinning operations by the Colorado State Forest Service have decreased tree densities but they are still thin and belong to approximately the same age class. Much of the down timber and slash has been left.

Many of the forbs are introduced species that are good colonizers and competitors. These plants indicate human impact and disturbance and include such species as Yarrow. Numerous other weedy species predominate the road shoulders and trails, including Gumweed and sunflowers. Wiskbroom parsley and Sticky geranium are other common herbs.

Shrubs and grasses are not common in the ponderosa pine on this site, especially in the dense stands. Litter accumulation and shading have inhibited herbaceous growth. The predominant shrub is skunkbrush. Ground cover is also infrequent, represented by sparse patches of Oregon grape.

Stands of ponderosa pine are interspersed with grass-covered meadows of varying sizes. These meadows dominate the southeastern portion of the area. Unable to compete, few forbs interrupt the grass sod and the area could be called a grass climax community. There is a scarcity of down timber and slash, giving the sites clean appearances. Wax currant and Snowberry are two shrub species found with some frequency.

Another feature of the tract that is thought to be related to fire suppression is the presence of the Pine Bark beetle, *Dendroctonus ponderosa* Hook. Although its outbreak has reached epidemic proportion in neighboring communities of similar vegetation, the beetle population here remains relatively low. It is not considered to be a problem.

Past Management Practices and Present Uses

The earliest photographs of the Boulder area show the area east of the flatirons sparsely timbered. It is felt that this was largely due to natural fire, fire set by Indians, and early cattlemen who are reported to have uprooted young pines with grub hooks to prevent trees from competing with grass. Domestic livestock grazing was important.

Later the demand for mine props, fuel for boilers and lumber for homes in the Boulder area resulted in the clearing of much of what little timber was in this area.

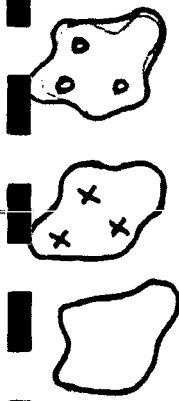
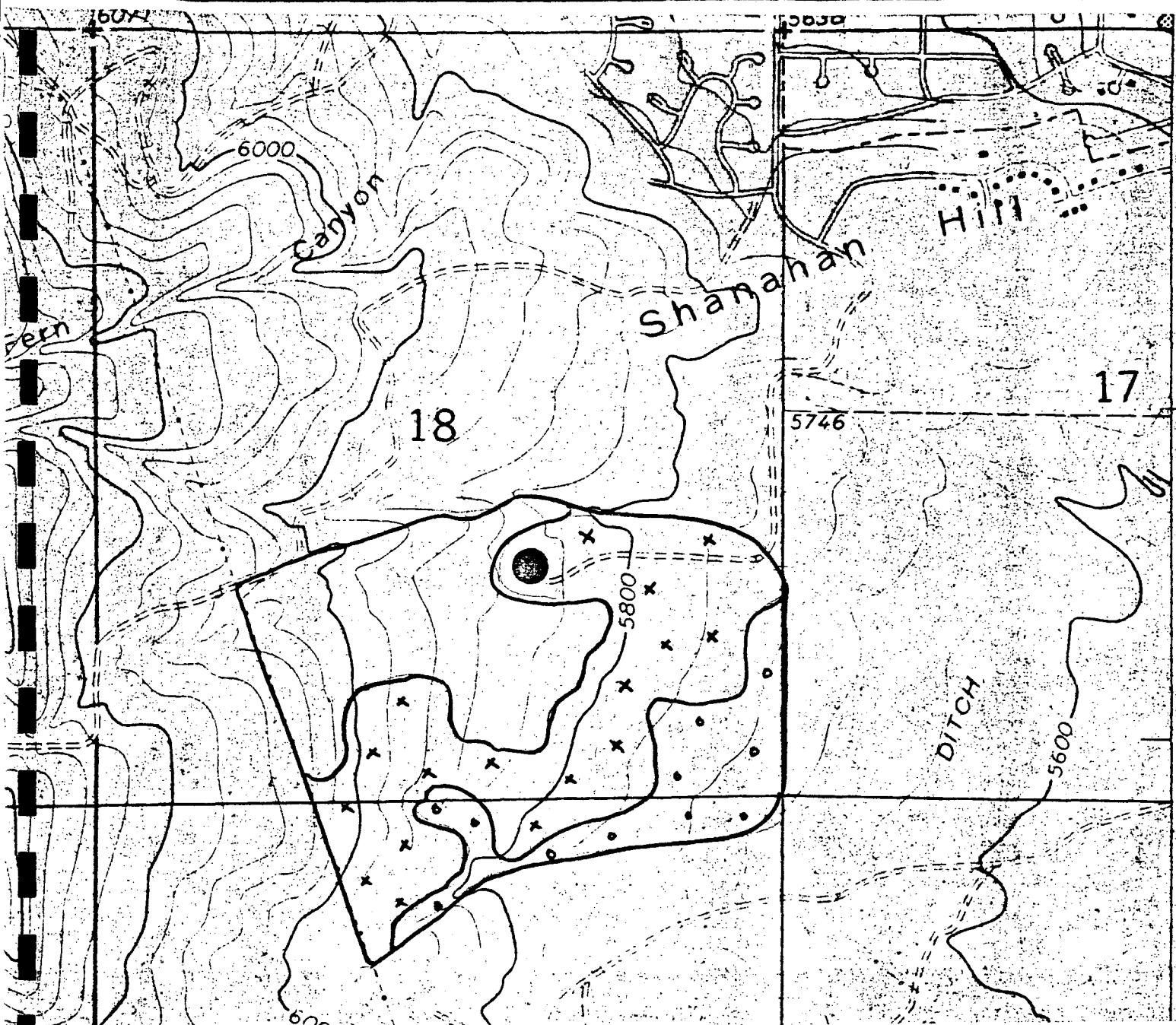
Periodic utilization occurred as trees grew into harvestable size. Dating of tree stumps in the area indicate that the last harvest cutting was conducted in the late 1930's.

The conservation movement and excellent fire protection from the 1940's to 1980 favored growth of the very dense, even-aged, overstocked stands of ponderosa pine, characteristic of much of Colorado's northern front range forest before the pine beetle epidemic in the 1970's. Some tree cutting, for pine beetle control, was conducted in this area from 1975 to the present.

Tree sizes and stand densities vary. Growing Stock Levels are presented by Figure 3 .

A thorough inventory of vegetation, soils, climate, topography, and uses are contained in the Open Space Resource Management Plan: Boulder, Colorado, 1975.

Present use is passive, non-consumptive recreation. Forest management work is being conducted under Project Greenslope. A feature article on Project Greenslope, appearing in the Sunday, November 16, 1980 issue of the Boulder Camera is included as Appendix E.



Open grassland scattered Ponderosa GSL* less than 20

Patchy, open stands of Ponderosa Pine GSL 20-70

Dense stands Ponderosa Pine GSL 71-150

*GSL as defined in Meyers, 1974

Figure 3. Timber Growing Stock Levels

1 inch = 1/4 mile

SPECIES AND MANAGEMENT CONSIDERATIONS

ALL ANIMALS

In addition to improving habitat for selected target species, certain practices will increase diversity in the area, and hopefully contribute to species richness. That is, a greater variety of animals will find the area suitable and take up residence because a desirable environment has been created or enhanced in the effort to create diversity. Diversity will increase the probability that known or unknown limiting factors will be eliminated and known or unknown welfare factors will increase, simply because of an increase in the variety of habitat conditions. Care must be exercised not to eliminate one or more conditions. Elimination of conditions could actually create a limiting factor or reduce welfare factors. A list of practices that could increase diversity are in Appendix A .

Plans for creating diversity must consider the concepts of interspersions and juxtaposition. Interspersion is the intermixing of plant species and plant communities that provide habitat for animals in a defined area. Juxtaposition is the act of arranging stands in consideration of species' home range or territory requirements. See Appendix D for species' range or territories. In many cases, range and territory information was not found or is not available.

If an animal with a 1 ha (2.47 acre) home range requires both dense timber and open areas, creating 25 ha (61.8 acre) openings in dense timber will not necessarily benefit that animal, unless of course both conditions occur within that animal's home range.

Figure 3 (p. 15) shows interspersions for diversity under a prescription

calling for patches of openings and dense timber from a tract that was once all dense timber.

Diversity, interspersed, and juxtaposition of prescriptions in this plan should benefit some non-target species animals, and hopefully will increase the numbers (carrying capacity) and types (species richness) of animals using the area.

Another consideration in increasing utilization potential over the area is the presence of water. We have attempted to develop water as much as seems practical.

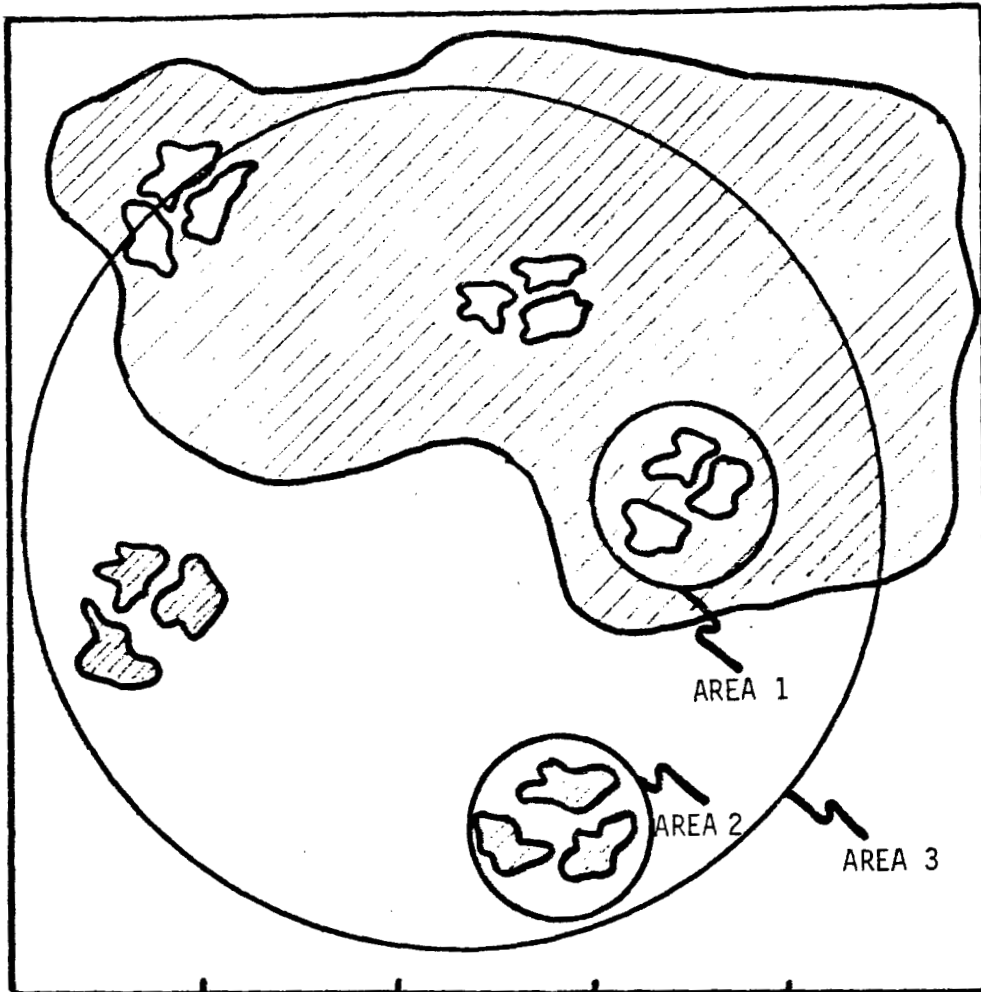
Water development or containment structures require engineering considerations, however minor they may seem. For all greenbelt areas Boulder City Engineering should develop specifications for ponds and any structures which must handle water flows of .28 m³/Sec. (10 cu. ft./Sec.).

Rock and soil water retention barriers keep water on site after flow has stopped. The more barriers placed in natural drainages, the more water that can be retained on site. See Figure 7 (p. 46). Retention barriers called for in this plan will not require engineering due to low flow rates at recommended sites.

Although not addressed in this plan's prescriptions, gully reclamation (erosion control) will actually increase soil moisture resulting in the increase in vegetation which could aid wildlife.

Small catchment basins for rain and snow can be easily constructed by hollowing shallow depressions in the soil, mixing concrete in the back of a pickup truck driven to the site, and pouring the mix about 2" thick. See Figure 8 (p. 47).

↑ not suitable in O.S. conditions
+ develop



Scale 1" = 200'



Dense Timber



Grassy Opening

Dense timber and grassy openings are interspersed in areas 1, 2, and 3.

Figure 4 . Interspersion for diversity.

Finally, some consideration should be given to the tremendous human pressures which may be occurring due to the high recreation use the area receives. And due to the area's close proximity to Boulder, restricting people from certain areas during breeding seasons for some species may be advisable. No such recommendations are made at this time.

↑
— unenforceable
— and not a realistic recommendation
— of some species

SMALL MAMMALS

Abert Squirrel

Sciurus aberti

The character of most timber in this tract is not usually identified with prime Abert habitat. In general, the trees are short and bushy. Cone production appears below average, but this varies from year to year. There is, however, an identifiable stand of trees (area 5&6 figure 5 , p. 44) that could be good Abert habitat. The area starts just south of the water tank and runs west to the power line. Some squirrel activity was observed here, with cone caches and twig tips on the ground. No Aberts were observed. If there is a limiting factor for Aberts, it may be poor cone production related to poor tree vigor. And it is for this well-stocked stand that the following discussion applies.

To favor Aberts, first identify prime feeding and nesting trees to be protected and favored through silviculture. Identify at least 10 potential Abert nest trees. Look for good to excellent formed crowns (Keen's classification), relatively clear bole, interior, co-dominant trees, 35-41 cm (14-16") DBH. There should be at least 80% canopy coverage and less than 10% slope. Most of this area is less than 10% slope. Based upon reconnaissance, it is felt there are now at least 10 good potential nest trees in this area.

Next, choose 10 more trees which have good to excellent form, clear boles less than 35 cm (14") DBH but which will grow to size for nest trees within 10 years. These 10 future trees should not be in the immediate vicinity of any of the first 10 nest trees. Determine the condition of the stands around the 20 present and future potential

Handwritten notes:
...
(...)

nest trees. The idea is to ensure good feeding trees around the nest trees. Feeding trees are good cone producers, 20-88 cm (8-34") DBH, and at a density of between 75 and 175 square feet of basal area per acre. It appears that about half of the area selected for Aberts could make good feeding areas now, and the other half be prime by the time the second 10 nesting trees reach size. From the number of feeding and nest trees available now, it is felt the area would support three or four Abert pairs.

Thinning to develop the area into prime Abert habitat over the next 20 years could be done in one entry and should be done so as to:

- (1) favor growth of existing nest trees yet retain 80% crown closure;
- (2) favor growth of future nest trees so they will reach size with 80% crown closure in 10 years;
- (3) increase vigor of feeding area trees for cone production on about half the area to achieve good cone producing trees, 35-56 cm (14-22") DBH at 100-150 square feet of basal area;
- (4) retain densities of about half the area as existing feeding sites at 20-35 cm (8-35") DBH, 75-175 square feet of basal area per acre;
- (5) preserve some understory trees in present and future feeding areas to get vertical continuity in the crowns. Favor understory trees which will create continuous vertical crown closure in 10 years.

Some other things can be done to favor Aberts. Avoid mechanical disturbance and scarification of the duff so as to enhance fungus growth which provides additional food for the Aberts. And avoid silvicultural work and other activities in the area during March and April breeding periods (Patton, 1975).

Boulder Park Rangers should determine if Aberts do or will utilize the area. If, by Summer 1982 no Aberts have been observed during routine visits into the area, in cooperation with Colorado Division of Wildlife personnel, live-trap at least two Abert pairs from Enchanted Mesa or other areas of Boulder County. Release these animals in this area. Observe their habits to determine if they choose selected nest trees and developed feeding areas. Look for Aberts during routine visits into the area. If Aberts take up residence in selected nest trees and feeding areas, Abert habitat development should be considered for other areas to broaden the population base in the Greenbelt forests. Should no Aberts take up residence, or the transplants fail, try to determine why. Guidelines for making and recording observations are provided in the monitoring section of this plan.

These recommendations should result in prime Abert habitat for 20 years based upon latest research in what Aberts prefer. But Aberts have been observed in other areas of Boulder County where conditions are much less than ideal, such as in Sugarloaf and Allenspark near the Bunce School. For this reason, it is felt Aberts should do well in this area.

Yellow-Bellied Marmot

Marmota flaviventris

The marmot was chosen as a target species in that it, like the Abert squirrel, is an enjoyable species to observe. No marmots were seen while conducting reconnaissance over the area.

Marmots have been observed at ponderosa pine and grassy locations near Lyons. If there are limiting factors to marmots, it may be proximity to humans and urban development, and roaming dogs.

There are two areas (areas X, figure 5 , p.44) where habitat development for marmots may be worthwhile. The first is in the far east central part of the tract near the existing pond, and in the southwest end along the power line, south of where the construction of a second pond is recommended. Discussion thus is limited to these areas because of the large grassy openings and presence of rocks which marmots prefer.

To favor marmots, preserve the old rock fences and foundations near the existing pond. In the large grassy clearing south of the pond, locate several large boulders. These boulders, to serve as lookouts, should be at least 3' high. Two or three together would also provide a den site. Attempt to locate boulders at an active quarry or construction site so as to not use boulders which are presently being used by wildlife in some other area.

Locate large boulders for lookouts and dens, in the same manner, in the large grassy clearing south of the proposed site for a second pond. Choose the most rocky area just east of the power line. See Figure 10 (p. 49) for boulder dens and lookout.

Park Rangers should monitor the two "marmot" areas during routine visits to the area to see if marmots or other animals take up residence in the man-made rock dens. If no marmots have been observed by September 1981 live-trap two pairs, again in cooperation with the Division of Wildlife personnel, and release them at the "marmot" areas.

Golden Mantled Ground Squirrel
Thirteen-Lined Ground Squirrel
Colorado Chipmunk

These three species were chosen as target species due to their non-consumptive observation value, and also as a food supply for raptors and carnivores.

Lock up one side on a turn or lower the blade and drag it across the surface. The idea is to remove only the grass mat and only on a portion of the area to re-initiate succession. The Parks and Open Space staff should develop a plan for making the periodic disturbances over the 10 year period of this management plan. The amount and location of scarification should be decided upon by the staff based on practicle ways to accomplish scarification, after initial work is completed.

Cottontail Rabbit

Cottontails were observed in several locations while conducting reconnaissance for the plan. The absence of ponderosa pine reproduction for food and cover may be a limiting factor (Costa, Ffolliott, Patton, 1976).

To improve cottontail habitat, choose two areas in the northeast part of the tract (areas 4 , figure 5 , p. 44) to patch cut or enlarge into one-acre clearings. Scarify the entire area to expose mineral soil. If possible choose areas bounded by relatively good cone producing trees, to enhance natural ponderosa reproduction. Several 1/10-acre plots within each acre patch could be hand-seeded with ponderosa pine if it is determined that a good cone crop is not likely for the growing season following scarification. Follow accepted procedures for hand-seeding ponderosa pine. It is expected that each one-acre tract would provide excellent ponderosa seedling food and cover habitat for 10 years, should a good stand of tree reproduction get established.

Within the two areas patch cut, construct windrows of slash. Use heavy, strong branches to form interior "chambers," and use lighter

fuller branches on the top and sides for protection. Construct the windrows at various locations -- near the edge and inside the interior for diversity. If ponderosa pine reproduction is not established by fall of 1982, rescarify and "clump" seed with ponderosa pine. Attempt to obtain ponderosa pine seed treated with rodent repellent.

Deer Mouse
Kangaroo Rat

These two species were selected as target species primarily to increase their numbers as food sources for other animals, although some people may enjoy observing them in the wild.

Deer mouse and wood rat populations have been found to be directly correlated to the amount of dead and down woody material in the forest. This may be a limiting factor (Goodwin and Hungerford, 1979).

Thus to enhance increasing numbers of these rodents, retain as much down woody material as possible, consistent with wildfire hazard limitations - a maximum of 18 metric tons/ha (20 tons per acre).

Some of the things that can be done is retain large cut trees on the forest floor. The still air and protection they afford provide excellent nesting sites. Construct small compact brush piles from slash. Make the piles very dense and intersperse them throughout the area anywhere cutting is conducted. Lopping and scattering of slash is desirable. To avoid continuous fuels, lop and scatter in places and pile slash in adjacent places. This arrangement of fuels will reduce wildfire hazard.

Porcupines

Porcupines are not a target species; however, their presence in the area deserves addressing. Signs of porcupines were observed in

several locations. Although the area is not suited for high quality timber production, it would be desirable to keep porcupines out of the Abert squirrel areas to retain good formed trees which Aberts seem to prefer. Since trees along the eastern part of the area are already bushy, porcupines here may actually add character to the area's appearance and provide spike tops as roosting sites for birds.

Porcupines like salt, and since their range is generally restricted to about five acres, placement of a salt lick in the southeastern corner of the area, well away from the pond to prevent overcompaction by deer and elk use of the lick, may keep porcupines restricted to the east part of the area. Placement of a salt lick should be made only if damage to pines in the Abert area increases from present damage. The salt lick should be moved around by Park's personnel every month during a routine visit into the area. Discontinue use of salt lick if problems associated with the salt licks develop.

2/10/70

2/10/70

NONGAME BIRDS

Management for nongame birds is directed at guilds, not at individual species. A guild can be defined as ". . . a group of species that explore the same class of environmental resources in a similar way without regard to taxonomic position" (Root 1967). Guilds can be classified in several ways: by nesting sites, foraging sites, diet, or use of successional stages. Management prescriptions will be designed to improve and diversify existing plant communities and thereby benefit the associated guilds.

Provision of various seral stages is one way of creating habitat diversity. Birds use all seral stages, although not equally. This diversity can be accomplished by breaking up the presently homogeneous ponderosa pine stands.

Diversity and density can also be increased by improving and maintaining existing habitat. In heavily forested areas, snags that have been removed by past management practices can be replaced by artificial means (girdling, etc.). Existing meadows can be expanded rather than patch-cutting new areas. Natural aging processes can be allowed to continue, creating old-growth stands preferred by some species.

Although the objective of nongame bird management for this site is to increase diversity and density by changing the present vegetation structure, it must be understood that such change that favors a new set of birds will have an adverse effect on the original residents. Nesting sites and food sources will change accordingly. For example, expanding an existing meadow by cutting ponderosa pine may benefit ground-nesters but it will decrease nesting opportunities for tree-nesters.

Richness of the breeding and resident avian population is presently low. This is due, in part, to the inherent nature of the lower montane ponderosa pine community and in part to the vegetation structure that characterizes this particular site. Limiting factors include food, water, and cover. For example, the availability (or scarcity in this area) of fruit-bearing shrubs and seed-bearing forbs influence populations of those birds dependent upon them.

General objectives are as follows:

- Handwritten:*
 1. 2. 3.
- (1) Maintain some ponderosa pine as is and provide an undisturbed environment. This is directed at guilds using ponderosa pines for nesting and/or feeding, but not necessarily cavity-nesters. A stand(s) should be left to mature and high tree densities should be retained. No timber cutting should be conducted. A few species of birds are dependent on older trees, as a major component of their diet is ponderosa pine seeds. These trees begin seed production at approximately 20 years of age.
 - (2) Snag management. This is directed primarily at primary and secondary cavity-nesters who require snags. It is estimated that 30-45% of all ponderosa pine nesting species are cavity-nesters (Scott 1980). This is quite apparent on the study site, as the visitor sees these species most often. Management for maximum snag density, snag type and snag location can be accomplished by maintaining snags and/or creating new ones. Optimum density is 7/hectare. - acres?
 - (3) Meadow management. Birds using forbs and grasses for nesting and feeding would benefit by increasing this

resource. Although this early seral stage does not support many nesting species (ground-nesters), it provides diverse food sources, i.e., seeds, nectar, and insects. Expansion of some meadows and creation of new ones by patch cutting will increase meadow habitat (see Figure 5, page 44).

- (4) Shrub management. Many birds use this habitat for nesting, feeding, and perching. Natural regeneration of small patch cuts may eventually allow establishment of some shrubs. Plantings of shrub seedlings are not recommended.
- (5) Water management. Developing a water source should benefit several guilds, including shrub- and tree-nesters, insectivores, frugivores, and granivores. Introduction of water should stimulate establishment of native deciduous growth, some of which bears fruit. Stagnant water provides habitat for insect populations. Warblers and flycatchers (insectivores) and waxwings (frugivores) are a few of the many birds that would benefit from this type of development.
A small pond would be appropriate (see Figure 6, page 45).

Snag Management

As previously mentioned, the main objective for snag management is to optimize the nesting habitat for cavity-nesting birds and provide hunting perches for raptors. Snags are also used for feeding, singing, preening, roosting, anviling (wedging of seeds in cracks and using the beak to crack them open), and perching by song birds.

Primary cavity-nesting birds are able to excavate their own cavities. They characteristically have heavy bills. Secondary cavity-nesters use natural cavities and those created but abandoned

by primary cavity-nesters. Some species are flexible, and can pursue either course depending on the availability of suitable nest sites. For example, brown creepers nest behind loose bark but will use old woodpecker holes.

Soft snags contain heart rot while hard snags do not (Balda 1975). Hard snags are rarely excavated, heart rot being essential for beak penetration.

Secondary cavity-nesters prefer trees that have died fairly recently, those 20 years or younger, with a marked preference for snags in the 5-15 year range (Cunningham 1980).

Pine bark beetle populations should not be controlled unless epidemic proportions are reached (100% increase/year). Beetles aid in snag creation and would decrease the number of snags that would have to be artificially created in order to maintain maximum density. Beetles provide food for numerous bird species.

Meadow Management

Increasing meadow acreage should increase species richness, not density, as few species breed there. Meadows can be very rich food sources and are used by species nesting or perching elsewhere. The existing meadows are relatively small (.8-1.2 ha) and are dominated by grasses in a climax-like community. Grasses may provide some seed and some nesting sites, although most ground-nesters prefer some backdrop and rarely nest on open ground. The absence of shrubbery and slash in these meadows limits suitable nesting habitat.

The absence of seed-bearing forbs in meadows also limits the food source. Forbs in this tract are mainly restricted to disturbed areas (natural or unnatural) where the sod is broken and the dominant grasses have not yet invaded.

Increasing the size of existing meadows and creating new clearings (see Figure 5, page) should provide the opportunity for weeds to invade and slash will provide more nesting opportunities. Unfortunately, it is doubtful that many of the native forbs will become established. There is presently a large population of weedy forbs that are good colonizers and produce large quantities of seeds. Native plant populations are not high and there simply is not a large seed base to provide for their establishment. Hummingbirds, dependent on such nectar-producing species as Penstemon secundiflorus, will probably not be noticeably benefited.

Enhancement of this habitat will also increase the amount of edge, an area used by many species for feeding.

Shrub Management

Shrub communities are another important seral stage used by many birds for feeding, nesting, and perching. Few resident species use this habitat for nesting, but many transitory breeders, such as the warblers, and visiting birds, such as the waxwing, do. Many of the native shrub species bear edible fruits (Currant, Snowberry, Raspberry) but again, most birds using fruit for a large part of their diet are not residents (see Appendix D). Dried fruits can be particularly important for many birds during winter months, when insects are not available. Many shrubs adapted to the lower montane zone prefer more xeric sites and occur most often on south-facing slopes (Common juniper). Other species are restricted to high-moisture areas, particularly drainages. Few occur in the ponderosa pine (Skunkbrush).

No specific prescription has been recommended for shrub establishment and enhancement. The difficulty of acquiring and generating

native seeds has precluded employment of this technique. Shrub seedlings are subject to additional problems, such as browsing pressure from deer.

It is expected that shrub species will eventually invade patch cuts where natural succession is allowed to progress, and where conditions for their establishment are suitable.

Water Management

Water is a limiting factor for birds along the Front Range, in that it supports a different type of vegetation which in turn provides additional nest sites and food resources. Water also promotes breeding populations of numerous invertebrates essential to the diet of insectivores. Water is rarely imbibed, as birds obtain an adequate supply from the foods they eat and have a physiology adapted accordingly. Many birds use open water to "bathe."

Development of a pond in the southwest section of the area provides the opportunity for the growth of deciduous, water-limited vegetation around its borders. Establishment of trees will take some time and may be inhibited or prevented by heavy use from other wildlife and people (see Figure 6, page 45).

RAPTORS

There are two major factors which limit the degree to which the area can be improved for raptors. The first of these is that the shy nature of many of the raptors precludes their use of an area that receives a high degree of human use, as this tract does. The second is that the study area is extremely small in relation to the size of the larger raptors' territories. For this reason, the benefits which they would receive from improvement of the area for them is minimal.

Proposed management prescriptions are designed to accomplish the following for raptors:

1. Increase prey base. This includes small mammals, small birds, and insects. The mammals and birds will be increased by providing greater interspersion and diversity of habitat, and increasing food, water and cover. Insects will be increased by providing snags for many to live, and by providing water bodies which may serve as reproductive sites. Two types of water bodies are proposed: (1) a pond, and (2) small pools in the drainages formed by water retention barriers.
2. Improve hunting terrain. The accipiters (Coopers, goshawk, and sharp-shinned hawks) will utilize various areas for hunting, but prefer dense stands of timber. A two-storied stand is greatly preferred by all accipiters, and may be required for the goshawk (Mayo 1978).

The tract is currently covered by an even-aged timber stand. A management prescription is proposed which would create a two-storied stand. This prescription requires a thinning cut on eight

hectares (20 acres). Sixteen evenly distributed, 1/4 ha plots (total four ha of 8 ha thinned area) should be scarified. Scarification should decrease competition from grass, thus allowing ponderosa pine seedlings to become established. In 20 years, this area should contain a two-storied stand of approximately 16.5 m and six m (65 ft and 13 ft).

Early successional stages after scarification should support abundant forb growth. This will provide food for smaller birds and mammals, thus increasing their numbers. Therefore, raptors will benefit by an increased prey base during the interval required for growth of ponderosa pine seedlings into the lower story of the double-storied stand.

The buteos (red-tailed and rough-legged hawks), kestrel and small owls prefer open areas in which to hunt due to ease of maneuverability. The eastern 1/3 portion of the tract is currently an open area with clumps of trees, providing open hunting terrain. However the trees are small here (average diameter 20 cm) and not well suited for cavity nesters. For this reason, interspersion of hunting terrain and nesting sites is poor for the small owls and the kestrel who have very small territories.

Proposed small patch cuts and thinning cuts would provide open hunting terrain interspersed with suitable nesting habitat for these species.

Perching sites are required for all raptors, and snags will be provided for this purpose.

3. Provide nesting habitat for small raptors. Because the kestrel and small owls have very small territories, their numbers can be increased

by providing nest sites at a greater density than currently exists.

All of the small raptors are secondary cavity nesters, utilizing cavities in snags created and subsequently abandoned by woodpeckers, or created naturally through heart rot.

Snags will be provided, as discussed in previous section addressing management considerations for nongame birds. Many will be located in open timber stands or on the periphery of clearings, areas preferred for nesting by the small raptors.

Kestrel nesting boxes are recommended for placement in the southeastern portion of the tract, an area possessing clumps of ponderosa pine interspersed with grassy meadows. Suitable nest sites appears to be the most limiting factor for the kestrel in this area. This bird is known to nest at densities as high as four/ha, but is found more commonly at a density of two/ha (Orde 1980). Providing nest sites at a density of two/ha thus insures maximum use potential. Due to the small size and low density of the trees in this area, snag creation for potential excavation by cavity-nesters is not recommended. Nesting boxes are a reasonable alternative since kestrels adapt easily to them (Hammerstrom et al 1973, Scott et al 1977).

The management team recognizes the artificiality of this prescription may be undesirable. However, it is felt that the esthetic quality of the kestrel, and the nature of the area as a public park on the periphery of Boulder, justifies its application.

The boxes are designed to minimize contrast with the natural appearance of the area.

This area however is not a developed area as public parks are. This area is not used as a classic public park just as "open space"

PREDATORS

Due to the tract's proximity to Boulder, it is undesirable to increase use of the area by the larger predators by improving habitat for them. For this reason, proposed management prescriptions are directed at habitat improvement for the small predators. Small predators for which the habitat is suitable include the long-tailed weasel, spotted skunk, and badger. The area is only marginally suitable for the striped skunk due to lack of water.

The most limiting factor for the small predators on the area is the amount of available food. These species would benefit from any management prescriptions which would increase small mammals, their primary prey base.

Long-tailed weasel

It is desirable to increase the long-tailed weasel population due to the animal's esthetic value and its disinterest in humans. It is unafraid of humans, and its activities are not interrupted by the presence of people (Armstrong 1975). This is a desirable trait in this area, which is heavily used by the public, both for the comfort of the weasels and for the pleasure people experience from observing this species.

The long-tailed weasel can utilize various habitat types, however some preference is exhibited for rocky, shrubby areas near water. The area lacks permanent water sources, and a minimal amount of shrubs and rocks are present. Due to these limitations, such areas are difficult to establish. Shrubs may become established in the clearing in which a small pond is proposed for construction. Some rocks are present, and rocks available in the immediate surrounding area could also be brought in and piled. This area could thus be improved for the weasel.

The pond currently in existence on the eastern border of the tract is not very attractive to the weasel due to a lack of shrubs.

Possible den sites could be increased by allowing felled trees to remain on the area, which are useful when hollowed by rot. However, den sites are probably not limiting since the weasel most frequently utilizes old ground squirrel or pocket gopher burrows.

Spotted skunk

Preferred habitat of the spotted skunk is rocky, shrubby areas, especially in canyons. Where rocks are available in the immediate vicinity, these could be situated in piles in proposed clearings created by patch cuts. These may be revegetated by shrubs, however shrub establishment and success in these clearings cannot be determined.

Abandoned ground squirrel burrows, logs and brushpiles are utilized by the spotted skunk as dens. Brushpiles should be created and felled trees allowed to remain during proposed timber harvest activities to provide more potential den sites.

Badger

Badgers require open areas, available in the eastern portion of the tract. This species has been reported to utilize small isolated clearings in timber (Armstrong 1975), therefore recommended patch cuts could also be utilized. *The patch cuts recommended for weasels*

Striped skunk

Use of the area by striped skunk is undesirable since this species is known to be carriers of rabies and parasites, which could be transmitted to Boulder residents and their pets. However, proposed water developments would enhance the area for this species. If use of the area by striped skunks increases and proves a problem to Boulder residents,

... to ...
they should be trapped and transported to an area receiving less public use and which is suitable to them. The Division of Wildlife could be contracted to trap and transport these skunks.

Large predators

An increase in prey will benefit all predators, both desirable and undesirable species. Regular use of the area by large predators is not anticipated due to their avoidance of man, though the coyote may be an exception to this. There are no known large predators present on the area now.

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BIG GAME

There are two species of big game on the tract - mule deer and elk. The mule deer population is very high over the entire greenbelt. However, preliminary studies of the Greenbelt by park rangers show no over-utilization of the browse or malnourishment in the deer. There are two main problems associated with the abundance of deer. These include: (1) deer mortality on roads, and (2) complaints from Boulder homeowners regarding consumption of their shrubs by deer.

*deer
by Park Dept
problems
to
homeowners*

The only technique which could be employed to keep the deer out of the Boulder residential area is a fence. This possibility was rejected due to anticipated strong opposition of Boulder residents and the high cost of fence construction and maintenance.

Elk numbers on the area are currently low. If the habitat were improved to attract elk, problems similar to those currently in existence with the deer are anticipated.

For these reasons, no attempt is made in this plan to enhance the area for deer and elk. Instead, management recommendations are aimed at dispersing these animals throughout the tract. They are currently concentrated around the only available water source on the area, a pond on the eastern border. Because this portion of the tract is closest to Boulder, existing problems could be decreased if the deer could be drawn away from this area. In addition, dispersal would provide an opportunity for trampled vegetation near the pond to recover.

Dispersal could be accomplished by (1) increasing water available throughout the tract, and (2) improving interspersion and increasing available food on the area.

Two methods are prescribed to provide usable water for deer:

- (1) construction of a pond in the southwestern quarter of the tract,
- and (2) construction of water retention barriers in drainages throughout the tract.

Proposed small patchcuts would provide an increase in forbs and shrubs for feeding in close proximity to timbered areas for thermal and hiding cover. A selective thinning cut would also increase understory for utilization as food by deer. Amount of shrub colonization can not be accurately predicted, however good shrub production is expected in the clearing containing the pond and may occur in other areas as well. There is a possibility that the deer will prevent successful shrub establishment through heavy utilization of shrub

seedlings. — *Shrub production is expected to be good in the area — see observation.*

— comment & question — all the patchcuts which have been recommended seem excessive for so small an area. extensive meadow exists to the west, south, and east. are all the meadow creations necessary? Is it desirable from a total mgmt standpoint to try and manage for all species? Can the recommendations for each particular animal coincide with those of other animals? It seems maybe not.

SUGGESTED MANAGEMENT PRESCRIPTIONS

Management Prescriptions	Suggested Location	Species Benefited
<p><u>Maintenance:</u></p> <ul style="list-style-type: none"> Maintain 16 ha (40 ac) dense ponderosa pine timber. Average heights of stand 12 m (40') and average diameter 25 cm (10"). 	<p>Northwestern one-third of tract, from western boundary east to the water tower. (See figure 5)</p>	<p>Abert's squirrel, red squirrel, big brown bat, silver-haired bat, mule deer, elk, Cassin's finch, red cross-bill, pine siskin, accipiters.</p>
<ul style="list-style-type: none"> Maintain 12 ha (30 ac) open ponderosa pine. Average height of stand 9 m (30') and average diameter 20 cm (8"). 	<p>Eastern one-fourth of tract. (See figure 5).</p>	<p>Small mammals, mule deer, elk, non-game birds, kestrel, buteos, owls, badger.</p>
<p><u>Silviculture Treatments:</u></p> <ul style="list-style-type: none"> Patch cuts. Total of eight of following sizes: <ul style="list-style-type: none"> (1) 2.0 ha (5 ac) (1) 1.2 ha (3 ac) (4) 0.8 ha (2 ac) (2) 0.4 ha (1 ac) <p>Various sizes recommended in order to evaluate wildlife utilization and gain data on size preference. The cuts should be an irregular shape with the maximum amount of edge possible. Small clearings currently in existence should be enlarged where possible. 0.4 ha clearings should be scarified to 80%+ mineral soil</p>	<p>See figure 5.</p>	<p>Cottontail rabbits are targeted species for 0.4 ha clearings. Species benefiting from all clearings include: small mammals, mule deer, elk, nongame birds, kestrel, owls, buteos, and accipiters. All these species will benefit from an increased food base. Kestrel, owls and buteos will also benefit from an improved hunting terrain.</p>
<ul style="list-style-type: none"> Selective thinning cut. 12 ha (30 ac) should be thinned to GSL = 90. 	<p>South central to southwestern portion of tract. (See figure 5)</p>	<p>Small mammals, nongame birds, mule deer, elk, kestrel, owls and buteo benefit from opening the area.</p>

Management Prescriptions	Suggested Location	Species Benefited
<p>2/3 of the 12 ha thinned (8 ha) should receive scarification treatment. Within this 8 ha, 16 evenly distributed 1/4 ha plots should be scarified. Scarification should reduce competition from grass and allow ponderosa pine seedlings to become established. This should create a two-storied stand as seedlings mature. Scarification should temporarily increase forb production also.</p>	<p>See figure 5.</p>	<p>Increased forb production will benefit weedy seed-eating and insectivorous birds (including small raptors), deer, elk and small mammals. All hawks and predators benefit from increased prey base. accipiters, Cassin's finch, red crossbill and pine siskin will benefit from establishment of dense, two-storied stand.</p>
<p>Select and preserve 20 nest trees (10 immediate and 10 future). Thin and preserve feeding trees (half area for present and half area for future). Retain duff layer. All slash should be piled and retained. Management activity should be avoided during breeding season. Area approximately 10 ha (25 ac).</p>	<p>East of water tank to western border. (See figure 5)</p>	<p>Abert's squirrel.</p>
<p><u>Water Developments:</u></p> <p>Pond construction. Should be approximately 6 m (20') diameter and 3 m (10') deep. Engineer consultation and subsequent specifications should be employed. Situated in major water drainage site.</p> <p><i>Construction 1980</i></p>	<p>Inside 1.2 ha clearing. See figure 6.</p>	<p>All species benefited.</p>

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Suggested Management Prescriptions, continued:

Management Prescriptions	Suggested Location	Species Benefited
<p>2</p> <ul style="list-style-type: none"> Water retention barriers. Shallow depressions dug in drainages and reinforced with logs. Would catch and retain annual spring overland flow for animal use (See figure 7) 	<p>Drainages. (See figure 6)</p>	<p>All species benefited.</p>
<p>101</p> <p>41</p> <ul style="list-style-type: none"> Water catchment basins. Made of concrete mixed with iron oxide. This will produce brown concrete which will blend well with earth color. Should be placed in natural depressions. Dimensions should be 60 cm diameter and 30 cm deep. Concrete should have rough finish for traction, so small mammals can utilize any water level (see Figure 8) 	<p>Natural depressions dispersed throughout portion of area lacking drainages. (See figure 6)</p>	<p>Small mammals main beneficiaries, since only small amount of water will be provided. Deer, elk, and small predators could also utilize.</p>

Snag Management:

<ul style="list-style-type: none"> Existing snags should be retained and new snags created to produce density of 8/ha (3/ac). In park-like eastern portion where trees are more widely spaced, creation of snags is not recommended. Possible methods for snag creation from live trees include girdling, herbicides and fungal inoculation (Bull, 1980). Trees selected should be sturdy, and greater than 33 cm (13") where possible. Bark cover should be $\geq 40\%$. <p>(cont. on next page)</p>	<p>Evenly distributed throughout western 2/3rd of tract to maximize use by territorial birds. Should locate on edges or within all clearings.</p>	<p>All primary and secondary cavity-nesters. Snags associated with clearings will benefit species which prefer open areas. All raptors benefit from snag use for perching sites. Many nongame birds benefit from use as roosting sites.</p>
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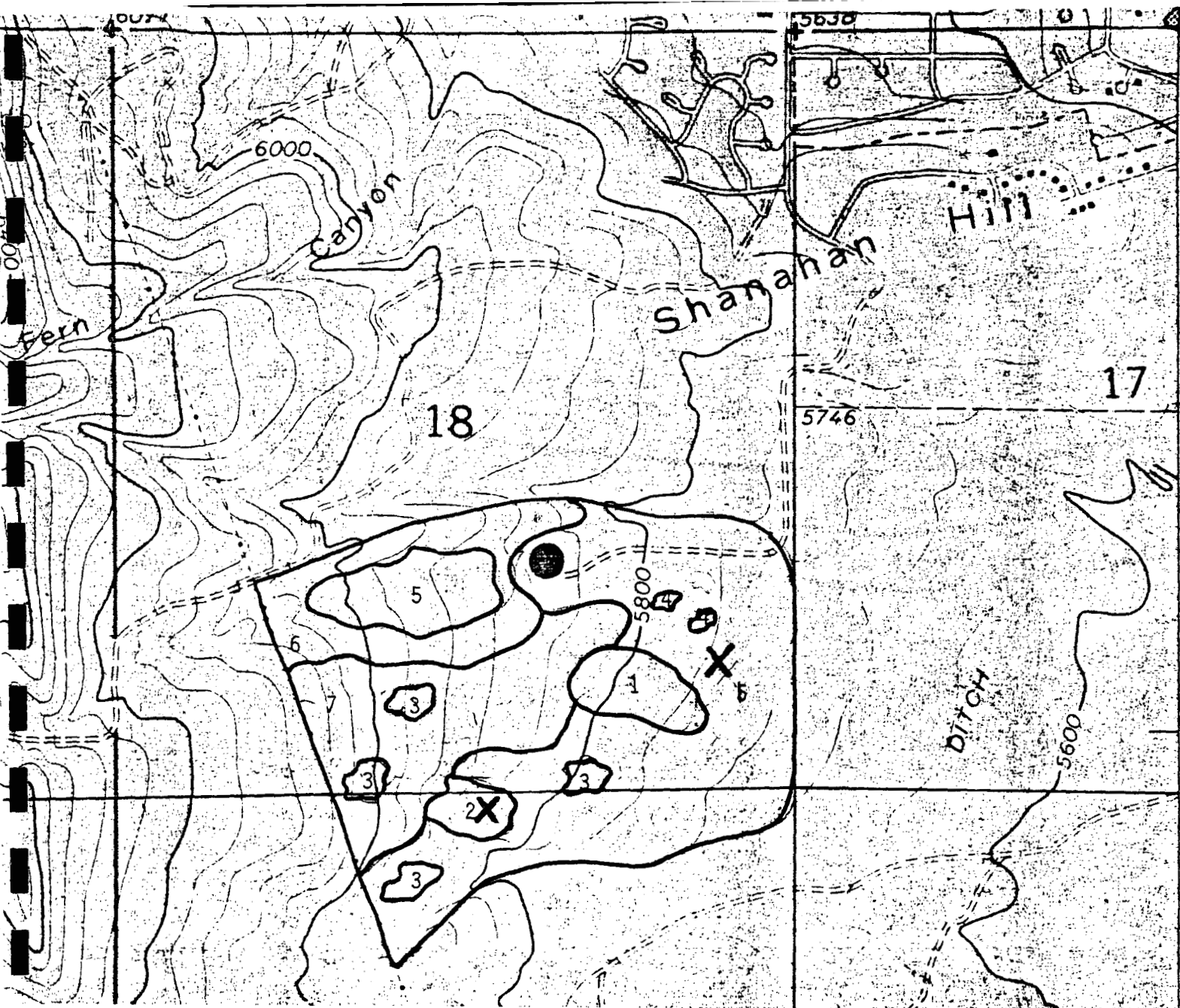
Management Prescriptions	Suggested Location	Species Benefited
<p>Soft snags should be maintained or created. Can be created by breaking tops off hard snags to encourage heart rot. A greater portion of soft snags than hard snags is desired.</p> <p>Snags should be monitored, and fallen snags should be replaced with newly-created snags (naturally or artificially).</p>		
<p><u>Special Feature Construction:</u></p> <p>42 Kestrel artificial nesting boxes. Recommend 30 at a density of 2/ha (1/ac). Should be placed 3.0-10.5 m (10-35') above ground (Scott, 1977). Recommend greater than 6 m to discourage vandalism. Box entrances should face south or southeast.</p> <p>Weathered scrap lumber from city sawmill should be used to construct. Could be constructed at city wood shop. Box dimensions are 10"x10" base, 15" height in front and 18" height in back with slanted roof. Round Entrance 3" dia, located approximately three-fourths the way up the front of the box. (See Figure 9)</p>	<p>In southeastern portion of tract, within or bordering open areas.</p>	<p>kestrels.</p>
<p>Salt block should be located on tract, <u>only in event of resource damage by porcupine</u> on the area. Should be periodically replaced as prior block is consumed.</p>	<p>Southeastern corner of area, away from existing pond, in area of low tree density.</p>	<p>Abert's squirrel benefitted by preventing porcupine damage to their habitat.</p>

Suggested Management Prescriptions, continued:

Management Prescriptions	Suggested Location	Species Benefited
<p>• Create rock piles, approximately 60-90 cm (2-3') in diameter, and roughly 60 cm (2') high. Pile loosely, providing entrances for animals. Could also be arranged in rows. (See Figure</p>	<p>Where rock materials exist, along western border, near existing and proposed pond, northern portion of area.</p>	<p>Yellow-bellied marmot, small mammals, long-tailed weasel, spotted skunk, nongame birds. Raptors benefited through increase in prey base.</p>
<p>• Create two rock lookouts. Consists of three large boulders arranged adjacently (see Figure 10,</p>	<p>Near existing and proposed ponds.</p>	<p>Small mammals, long-tailed weasel, spotted skunk, nongame birds.</p>
<p>Retain three log decks currently located on tract.</p>	<p>South, southeast and southwest of water tower.</p>	<p>Currently receiving high use by small mammals and nongame birds.</p>
<p>• Create log dens. At least two per prescribed clearings. Consist of two logs aligned parallel to each other with large ends flush (see Figure 10</p>	<p>All clearings.</p>	<p>Provides nesting habitat for small mammals, ong-tailed weasel, and potted skunk. Perching for all birds. Increase prey base of raptors and small predators.</p>
<p>• Large felled trees and uprooted trees allowed to remain with limbs attached. At least three in 0.4 ha clearings, five in 0.8 ha clearings, seven in 1.2 ha clearing and 10 in 2 ha clearing should be retained. A similar density should be left from selective cut.</p>	<p>All clearings, selective cut.</p>	<p>Small mammals, nongame birds, long-tailed weasel, spotted skunk. All raptors could utilize newly felled trees for perching, and use decreases in proportion to aging (sinking to ground) of logs. Increase prey base of raptors, small predators.</p>
<p>• Brush piles and windrows constructed from slash. Remaining slash should be lopped and scattered. All dead and down material should be retained on area at largest amount possible without increasing fire hazard.</p>	<p>All clearings.</p>	<p>Small mammals, nongame birds, spotted skunk. Increase prey base of raptors, small predators.</p>

Times
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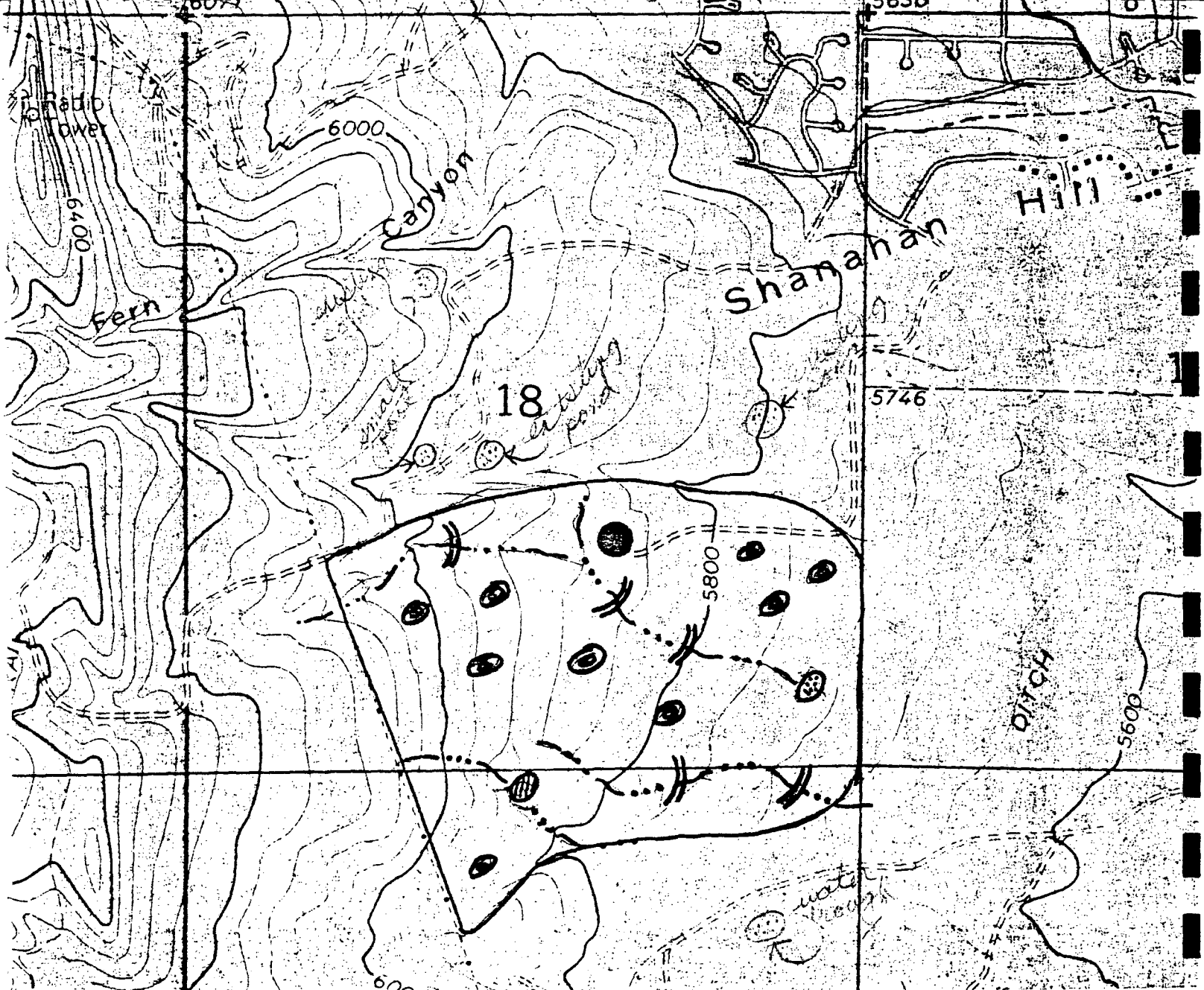


KEY

1. 5 acre patch cut
 2. 3 acre patch cut
 3. 2 acre patch cut
 4. 1 acre patch cut
 5. Retain density, no thinning *(Potential for the Bottom)*
 6. Thin as per Abert thinning prescriptions, retain at least GSL 110
 7. Thin to GSL 90
- X Rock den areas

Figure 5. Silviculture treatments.

1 inch = 1/2 mile









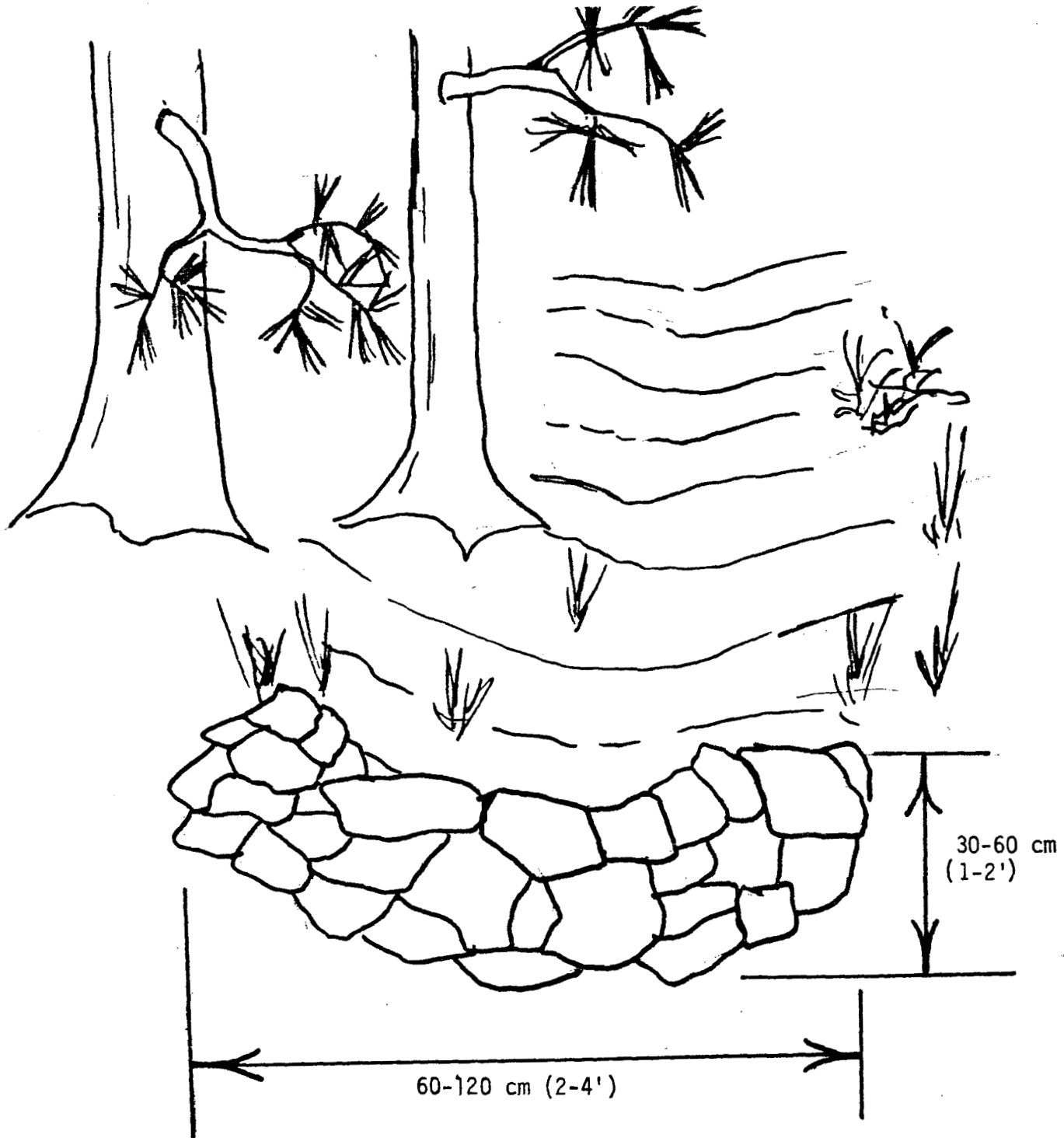
-  Drainage
-  Existing Pond (see survey)
-  Proposed New Pond Location
-  Water Retention Barriers
-  Catchment Basins

Figure 6. Water Development Structures


1 inch = 1/4 mile



Side View

Figure 7. Water Retention Check Dam



Use iron oxides
in mix to soften
concrete color.

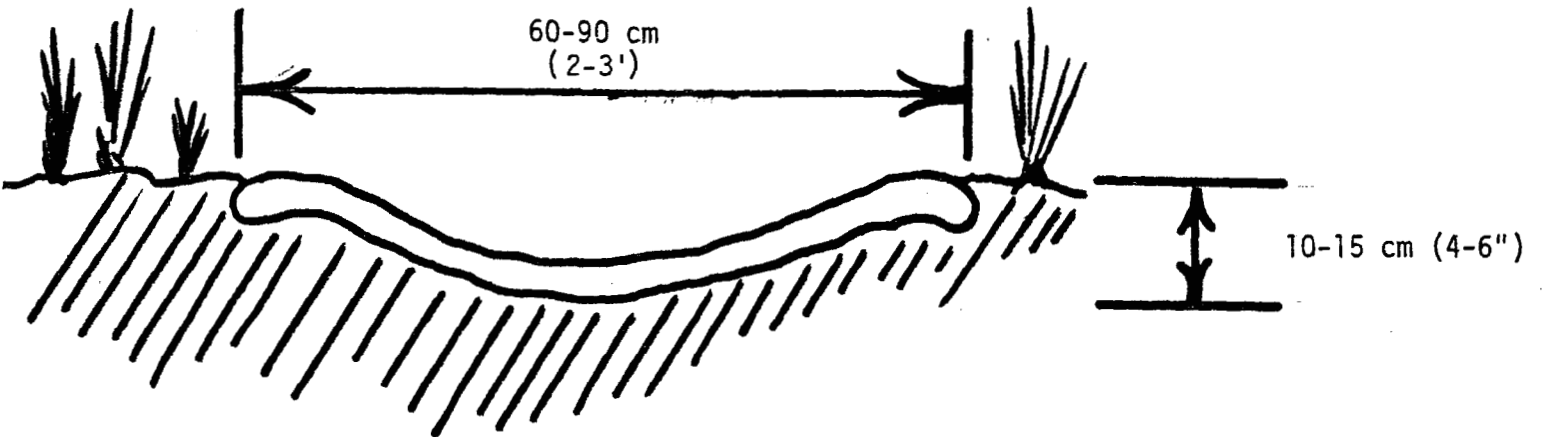


Figure 8. Snow or Rain Concrete Catchment Basin

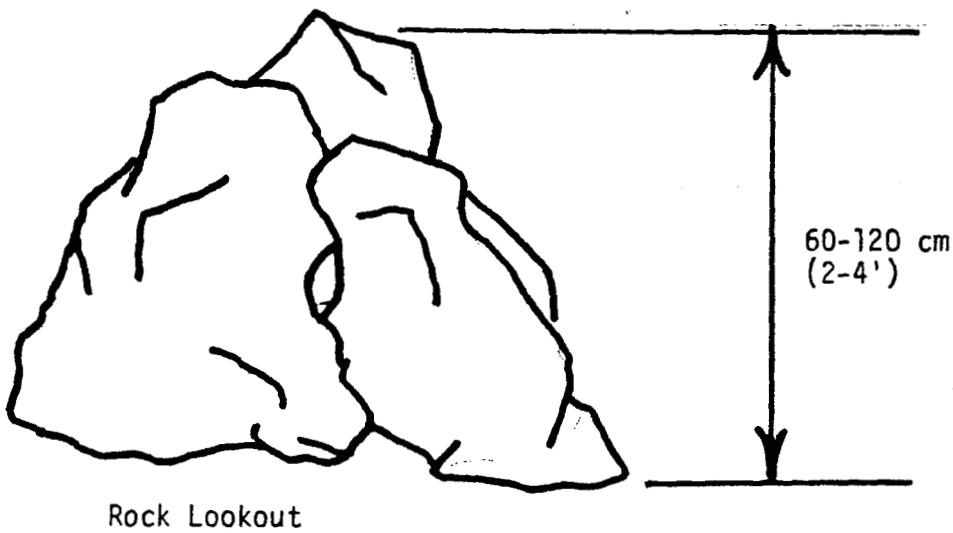
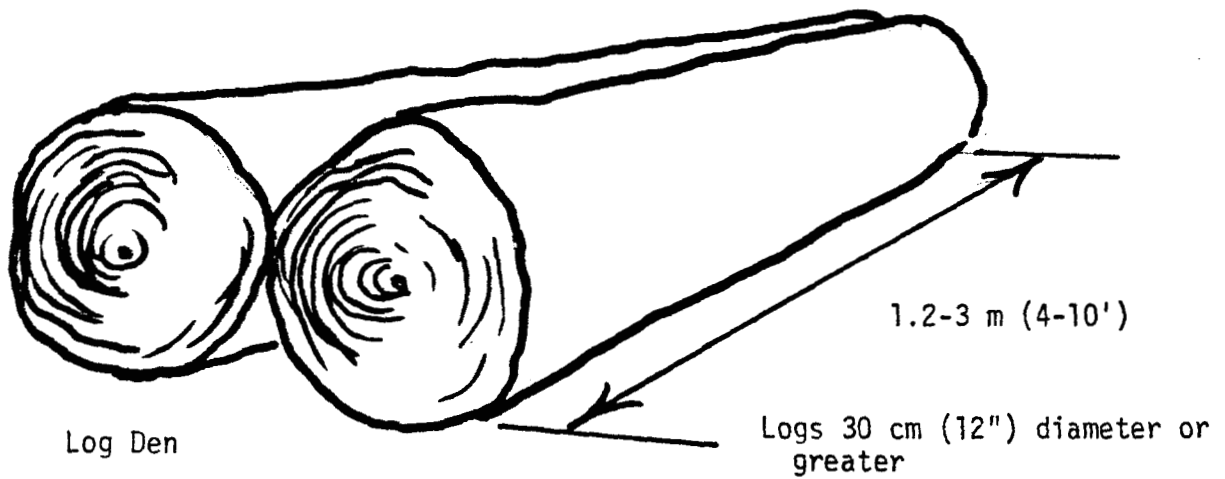
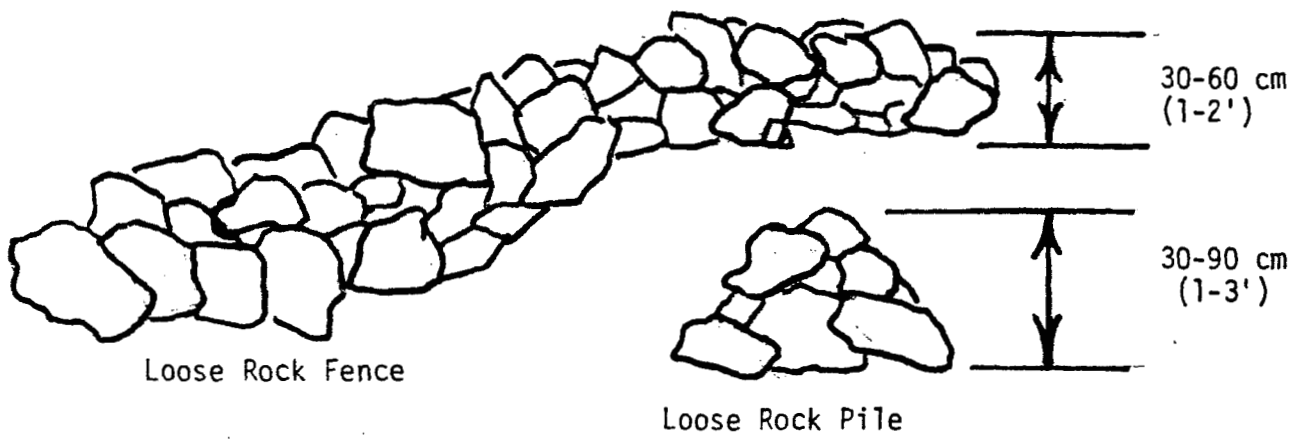


Figure 10. Man Made Rock and Log Structures

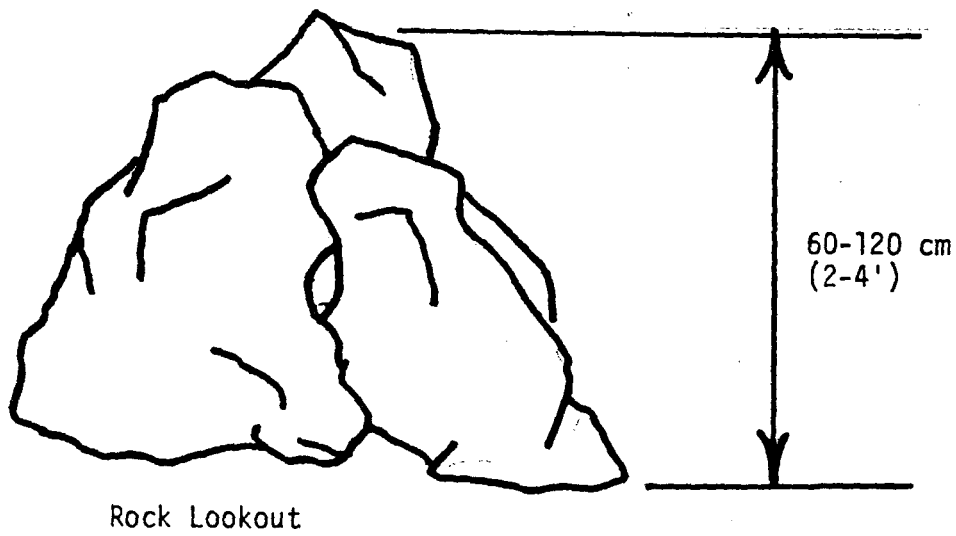
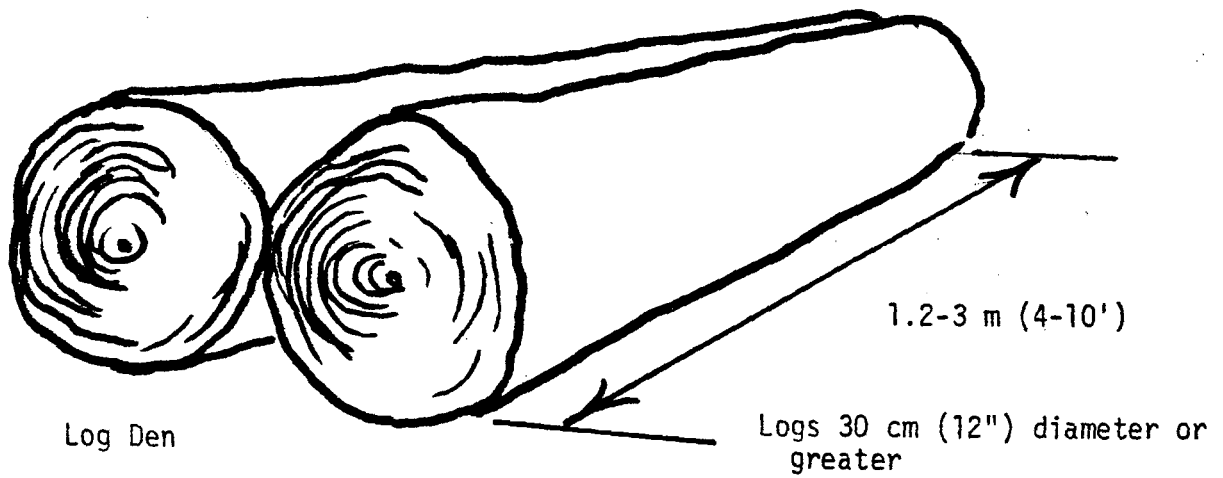
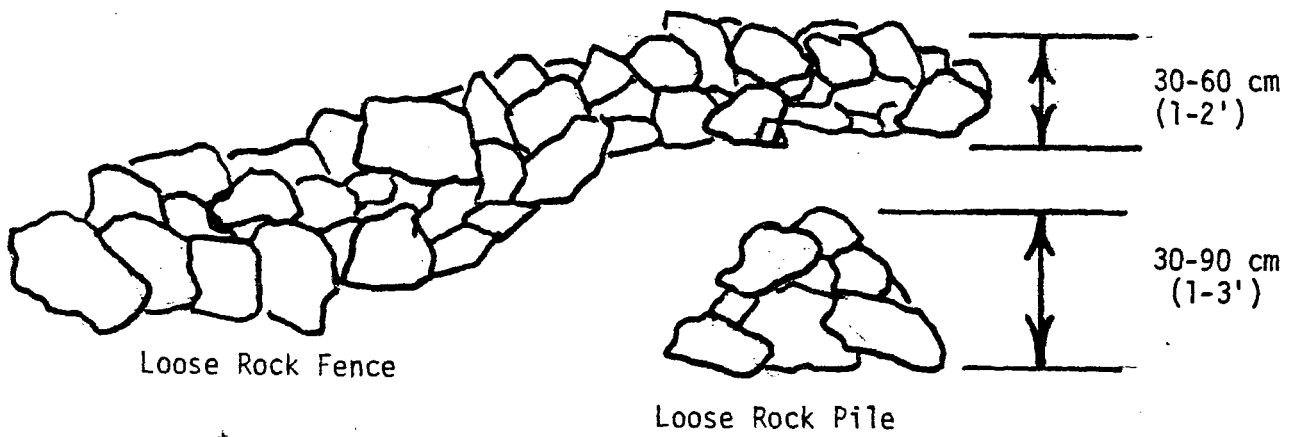


Figure 10. Man Made Rock and Log Structures

MONITORING TECHNIQUES

It is essential to monitor wildlife populations in order to analyze the results of habitat manipulation. Without this type of evaluation, the benefits to wildlife will remain unknown. Monitoring techniques vary according to the populations to be sampled and the resources available to do the sampling. Boulder Park personnel should conduct the prescribed evaluations. All observations should be recorded on the data sheets outlined in the appendices.

Since the management prescriptions are scheduled for the spring of 1981, time is limited and unfortunately no pre-treatment data can be collected. However, this type of habitat is not unique to the lower montane zone of the Front Range and qualitative comparisons to similar sites may be desired. Monitoring should continue throughout the 10-year plan. At the end of this period personnel may want to alter prescribed monitoring techniques in accordance with the revision schedule for the management plan. Monitoring should begin the first season after treatment (Fall, 1981).

Small Mammals

1. Permanent trap lines (De Blase and Martin, 1974) should be established in the five managed areas: (1) thinned, (2) patch cuts, (3) meadows, (4) near a water source, and (5) heavy timber (control). These can be chosen by monitoring personnel.
2. Abert's squirrels should be marked by color dyeing (Tabler and Cowan, 1969), in order to evaluate population changes.
3. Particular attention should be paid to the "special features" (see Figure 10, page 49) constructed for small mammals.

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Big Game

1. Biannual pellet group counts should be conducted (Overton, 1971).
2. Browse-utilization transects completed biannually (De Vos, 1971).
3. Routine observations should be recorded, giving special attention to areas of heaviest use.

Predators

1. Winter snow tracks should be identified and recorded.
2. Record all observations.

Raptors

1. Census techniques for nongame birds can be used for raptors (snag inventory, quadrat census).
2. Conduct a systematic search of stream or drainage bottoms (limited on this tract). This is best done in June to mid-July to accommodate late nesting accipiters.
3. All routine entries by Park employees and interested parties should include raptor observations.
4. Raptor sign (owl pellets) should be recorded.

Data Analysis

Data analysis is recommended for all population information collected using appropriate statistical methods chosen by the sampler to test the validity of population trends. It is important to compare data collected at different seasons but data must also be compared from year to year, as the communities change over time and not just seasonally.

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CONCLUSION

This tract is difficult to "manage" for wildlife enhancement for several reasons. Size is a limiting factor. By how much the resident/breeding populations can be increased and diversified is not known, as territorial requirements are not known for all species, and populations have yet to be inventoried. At some point inter- and intra-specific competition will certainly become pronounced and limit the population.

The resident population of most species is not large due to a low carrying capacity and small area. Management is directed at maintaining and improving their habitat, thereby increasing their numbers. Much of the vegetation that could support larger populations of breeding birds and mammals and attract visitors has been out-competed by either grass, colonizing forbs (some of which are used for food), and ponderosa pine.

Economics, lack of scientific knowledge, and pressure from wildlife makes re-introduction of native shrubs and forbs impractical. The area is no longer in a "native" state and it would be presumptuous, if not folly, to try to restore it as such.

A cost/benefit analysis has not been conducted due to the extreme difficulty encountered in trying to assign a dollar value to wildlife, their habitat and the appreciative public. This kind of analysis can sometimes be useful, especially where funds needed for an area's protection or purchase are generated by tourist dollars. It would also be an incredible task to try to determine what percentage of Boulder's tourist revenue can be directly attributed to its greenbelt, disregarding this particular site.

Another major problem is the heavy recreational use the area currently receives. Even though most recreationists seem to be respectful of the environment, the sheer numbers of people using the area disturb many species of wildlife, particularly "sensitive" species. This problem is compounded during breeding season. The area is known to suffer from free-roaming and domestic dogs. These activities are expected to increase, especially in view of new construction. However, this property is part of the Boulder Greenbelt and was established in part for the enjoyment of city residents. Our concern for ensuring habitat for wildlife must not prevent us from realizing the needs and rights of the human community.

Responsibilities of Team Members

Shared by team:

- Integration of individual prescriptions
- Plan write-up and editing
- Input-feedback review
- Public presentation of plan
- Cost estimates

Denise Newbould:

- Raptors, predators, big game:
 - Research species requirements
 - Identify factors limiting abundance of species
 - Formulate management prescriptions
 - Develop methods of monitoring and evaluation

Julie Etra:

- Nongame birds
 - Research species requirements
 - Identify factors limiting abundance of species
 - Formulate management prescriptions
 - Develop methods of monitoring and evaluation

Ron Gosnell:

- Small mammals
 - Research species requirements
 - Identify factors limiting abundance of species
 - Formulate management prescriptions
 - Develop methods of monitoring and evaluation

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APPENDIX A

Activities For City Lands Which Could Improve Wildlife Habitat If Properly Designed and Implemented (Merit Depends On Management Objectives)

1. Retain some broken top trees after thinning or harvest operation.
2. Retain "rub trees" after skidding operation completed.
3. Create standing "hard" snags by girdling or herbicides.
4. Break out tops of some forked or diseased trees.
5. Retain a low percentage of bark beetle trees untreated.
6. Leave some sound logs on ground for insects and to rot over time.
7. Patch cut at different sizes and shape patches in the same stand.
8. Thin to various levels in the same stand.
9. Leave areas unthinned or unharvested.
10. Protect the existing soft, hard, broken top, and half dead roost trees.
11. Create and retain brush piles and slash windrows.
12. Lop and scatter slash.
13. Prescribe burn (hot or cool); vary size and season.
14. Protect some areas completely undisturbed.
15. Scarify surface; expose mineral soil during good pine seed periods.
16. Periodically disturb (burn or scarify) grassy areas to encourage herb and forb (weed) invasion.
17. Plant cover or food grasses, forbs, or shrubs.
18. Plant native or introduced conifers and deciduous trees.
19. Leave log piles or individual large logs for cover.
20. Create log dens by rolling large logs adjacent and parallel.
21. Develop water sources (springs and ponds).
22. Construct catch basins for rain and snow.
23. Construct check dams in natural drainages.

24. Locate salt or mineral licks.
25. Protect percentage of old growth trees.
26. Create uneven boundaries between treatment areas; maximize edge.
27. Retain existing inherent edge between vegetative types.
28. Create a mosaic with treatments according to desired juxtaposition.
29. Jackstraw timber in small areas or gullies.
30. Dig or blast artificial burrows or caves into hillsides.
31. Identify critical or unique habitats.
32. Construct artificial nesting sites according to species preference.
33. Create rock lookouts.
34. Create rock piles and rock fences.
35. Create potholes or depressions by digging or blasting.
36. Retain a variety of shapes and form class trees.
37. Maximize contrasts; clear-cut next to mature timber, reproduction next to small sawtimber and so forth.
38. Shear vegetation to stimulate sprouting.
39. Prune roost trees for openness and strength.
40. Control fire, insects, and diseases to protect habitat.

APPENDIX B
PUBLIC INFORMATION SIGN

Sign: You are within a Wildlife Habitat Management Demonstration Area. The tree cutting and associated management activities you see have been designed primarily to benefit wildlife. Persons interested in this work are encouraged to contact the Boulder Park Rangers or City Forester. Public input and assistance is needed in the evaluation of this work.

Thank you.

APPENDIX C

List of Species Confirmed* or Likely to Inhabit Area

Small Mammals

Bats	Little Brown	<i>Myotis lucifugus</i>
	*Long Eared	<i>Myotis evotis</i>
	Silver Haired	<i>Lasionycteris noctivagans</i>
	*Big Brown	<i>Eptesicus fuscus</i>
	Hoary	<i>Lasiurus cinereus</i>
	Western Big Eared	<i>Plecotus townsendi</i>
Rabbits	*Eastern Cottontail	<i>Sylvilagus floridanus</i>
	Blacktailed Jackrabbit	<i>Lepus californicus</i>
	Whitetailed Jackrabbit	<i>Lepus townsendi</i>
	*Desert Cottontail	<i>Sylvilagus auduboni</i>
Rodents	*Colorado Chipmunk	<i>Eutamias quadrivittatus</i>
	*Least Chipmunk	<i>Eutamias minimus</i>
	*Richardson Ground Squirrel	<i>Citellus richardsoni</i>
	Thirteen Lined Ground Squirrel	<i>Citellus tredecemlineatus</i>
	Golden Mantled Ground Squirrel	<i>Citellus lateralis</i>
	*Red Squirrel	<i>Tamiasciurus hudsonicus</i>
	Rock Squirrel	<i>Citellus variegatus</i>
	Abert Squirrel	<i>Sciurus aberti</i>
	*Northern Pocket Gopher	<i>Thomomys talpoides</i>
	Western Harvest Mouse	<i>Reithrodontomys megalotis</i>
	*Deer Mouse	<i>Peromyscus maniculatus</i>
	*Plains Harvest Mouse	<i>Reithrodontomys montanus</i>
	Rock Mouse	<i>Peromyscus difficilis</i>
	*Masked Shrew	<i>Sorex cinereus</i>
	Dusley Shrew	<i>Sorex obscurus</i>

Dwarf Shrew	<i>Sorex nanus</i>
Merriam Shrew	<i>Sorex merriami</i>
*Northern Grasshopper Mouse	<i>Onychomys leucogaster</i>
Mexican Woodrat	<i>Neotoma mexicana</i>
Bushytail Woodrat	<i>Neotoma cinerea</i>
Meadow Vole	<i>Microtus pennsylvanicus</i>
Prairie Vole	<i>Microtus ochrogaster</i>
Western Jumping Mouse	<i>Zapus princeps</i>
Whitetail Prairie Dog	<i>Cynomys gunnisoni</i>
Blacktail Prairie Dog	<i>Cynomys ludovicianus</i>
Fur Bearers	
Yellow Bellied Marmot	<i>Marmota flaviventris</i>
*Raccoon	<i>Procyon lotor</i>
*Porcupine	<i>Erethiyon dorsatum</i>

For non-game birds, raptors, predators and big game, see Appendix D.

SPECIES INFORMATION

Species	Food Requirements	SMALL MAMMALS Cover Requirements	Population Densities/ Range/Territory	Comments
Abert squirrel (<i>Sciurus aberti</i>)	Feed trees 8-34" DBH, 14-22" preferred. 75-175 square feet basal area per acre. 100-150 preferred. Ponderosa pine seeds (cones), and ponderosa pine twigs. Fungi. 20-ii cm. DBH, 35-56 pre.	Average ponderosa pine stand DBH 30 cm (12" with small groups of larger trees. 150-200 square feet basal area per acre for 8" DBH trees and >80% litter cover. 20 cm. DBH	Several pairs per 10 acres plus. 6/4 ha	Nest trees are co-dominant interior pine 14-16" DBH. Good to excellent form. 80 canopy coverage or >10' slope or < .
Yellow-bellied marmot (<i>Marmota flaviventris</i>)	Wood and herbaceous plants. Grasses (50% or >). Apple. Locoweed. Serviceberry. Blackberry. Alfalfa. All vegetarian.	Denning habitat -- rock piles in grassy areas, mountain meadows, large boulder as lookout.	Often makes colonies in same vicinity.	Will inhabit lower elevations. Diurnal.
Raccoon (<i>Procyon lotor</i>)	Omnivorous. Frogs, crayfish, grasshoppers, all large insects, any small vertebrates (including muskrats and rabbits), fleshy fruits, corn, fish, wild grape, mulberry, clover, alfalfa, bird eggs, chickens, eggs.	Open woodlands, one mile within stream, rocky cliffs. Dens -- hollow trees or logs, rock crevices, ground burrows.	1/acre (highest) to 1/15 acre (high). 1/.4 ha to 1/6 ha	Chiefly nocturnal. Born 2-7 young in April-May; average 4.
Plains pocket gopher (<i>Geomys bursarius</i>)	Roots and tubers. Some pine seedlings (winter).	Burrows to 300' long nests in underground tunnels, create mounds of earth. Prefer moist soil -- easy to work, some rocky sites.	Solitary. Range 2,200 square feet, some territorial behavior. 8-10/acre (high). 20/25 ha	Polygamous. Population decreases with amount of surface rock. Are attracted by abundant forbs.
Northern pocket gopher (<i>Thomomys talpoides</i>)	Sagebrush, grasses, Russian thistle, dandelion root (67%), spring bulbs, starwort tuber, dogtooth violet bulb.	Grassy prairies, alpine meadows, brushy areas and open pine forests.		Two litters a year. Soil-forming agents.
Desert cottontail rabbit (<i>Sylvilagus auduboni</i>)	Young ponderosa pine trees. Green vegetation in summer.	Open plains. Dense ponderosa pine reproduction affords good hiding and breeding cover and food (young trees). Burrow in ground like brush piles.		Clear-cutting provides best habitat for longest term (up to 10 years). May live two years wild.
Mountain cottontail rabbit (<i>Sylvilagus nuttalli</i>)	Grape, rose, willow, clover, buckthorn.	Loose rocks and cliffs.	Home range 3-20 acres. 7-50 ha	
Eastern cottontail rabbit (<i>Sylvilagus floridanus</i>)	Bark and twigs in winter.	Heavy brush, strips of forest. Ground depressions.	One/4 acres to several/acre. 1/ha to 8/ ha	

SPECIES INFORMATION

APPENDIX D

SMALL MAMMALS, continued:

Species	Food Requirements	Cover Requirements	Population Densities/ Range/Territory	Comments
White-tailed jack rabbit (<i>Lepus americanus</i>)	Grasses and green vegetables, buds, bark, small twigs, weedy plants, any available green plant.	Open grassland.		Nocturnal.
Black-tailed rabbit (<i>L. californicus</i>)	12 rabbits eat as much as 1 sheep and 59 rabbits as much as 1 cow. Prickly pear, gramagrass.			
Ord kangaroo rat (<i>Dysodomys ordi</i>)	Mostly seeds, grasses. Stores seeds, occasionally foliage (forbs). Lycium, prickly pear and ragweed.	Prefers sandy soils, burrows.		Nocturnal. Will drink water when available.
Thirteen-lined ground squirrel (<i>Citellus oridecemlineatus</i>)	Seeds, insects and larva. Occasionally meat. Ragweed, sunflower, prickly pear, occus mire or birds, and grasshoppers. Dandelion and cinquefoil.	Short grassy prairies. Concealed burrows.	4-8/acre. 10-20/ha	
Red squirrel (<i>Tameasciurus hudsonicus</i>)	Variety of seeds, nuts, eggs, fungi. Stores cones in caches. Stores fungi in tree crotches. Serviceberry.	Pine forests. Has favorite feeding sites in tree cavity or outside nest of twigs and bark, near trunk.	<200 yard home range. <183 m 2-3/acre; as high as 10/acre. 5-7/ha 25/ha	Diurnal. Tunnels in snow.
Rock squirrel (<i>Citellus variegatus</i>)	Seeds, fruits, nuts, eggs, meat. Stores food in den.	Likes boulders as lookouts, rocky canyons, rocky boulder-strewn slopes. Den beneath boulders.		
Deer mouse (<i>Peromyscus maniculatus</i>)	Seeds (ponderosa pine, grass, fruits and weeds), nuts, root tubers, insects. Stores food. Grasshoppers, beetles, moths, caterpillars, cocoons, snails, centipedes, occas small mammals or birds.	Dry land habitat - forest, grassland and mixture. Nests in trees, stumps, old logs. Perfect correlation between number of deer mice and square feet of stumps and downed logs available for hiding or nesting. Nests are inbetween loose bark and log.	2 mice/acre at 25 square feet debris per acre. 19 mice/acre at 335 square feet debris per acre. Range 1/2-3 acres. .2-.7 ha	Fallen logs create spaces for good nesting sites. Seldom nests in ground in ponderosa pine type. Can use 10" diameter logs for cover.
Mexican woodrat (<i>Neotoma mexicana</i>) (packrat)	Nuts, seeds, fruits, mushrooms, prickly pear cactus; may store some food.	In rock slides, rocks, cliffs; rocky cover preferred; windrow slash.	2-11/acre. 5/27/ha	Well adapted to a variety of pine forest habitats.
Bush-tailed woodrat (<i>Neotoma cinerea</i>)	Green vegetation, twigs and shoots.	Pines, rimrock and rock slides.		

SMALL MAMMALS, continued:

Species	Food Requirements	Cover Requirements	Population Densities/ Range/Territory	Comments
Golden mantled ground squirrel (<u>Citellus lateralis</u>)	Seeds, fruits, insects, eggs and meat.	Seen on open pine forests. Burrows near bushes; trees, rocks or logs. Prefers dense, mature forests.	Range less than 200 yards. 2-5/acre densities. 1-4/acre in dense forests and 1-20/acre in open stands. <183 m; 5-12/ha av. density	Stores food.
Colorado chipmunk (<u>Eutamias quadrivittatus</u>)	Feeds mostly on ground.	Rocky slopes, ridges and pine forests.	1/20 acres in dense forests. 1/2 acres in thin stands. 1/5 ha dense 1/.8 ha thin	Increasing biomass on ground (logs and slash) seems to help increase population.
Least chipmunk (<u>E. minimus</u>)	Weed seeds, nuts, fruits, some insects, meat, sagebrush. Blackberry. Cinquefoil. Ragweed. Rice grass. Wild geranium. Buffaloberry and bitterbrush.	Nests beneath stumps, logs, rocks, makes own burrow.		Readily climbs trees.
Little brown bat (<u>Myotis lucifugus</u>)	Feeds on insects on the wing. Flies. Moths. Flying ants. Mosquitoes. Ground beetles.	Forested areas. Caves. Mines. Tunnels. Hollow trees and buildings.	Migrates south for the winter.	Beneficial
Long-ear bat (<u>M. evotis</u>)		Thinly forested areas.	Not known in large colonies.	High altitude flier.
Big brown bat (<u>Eptesicus fuscus</u>)	Insects, mostly beetles.	Forested areas.		Most common of all bats.
Meadow vole (<u>Microtus pennsylvanicus</u>)	Grasses, sedges, seeds, grain, bark including roots, bulbs.	Good matted grass cover near moisture.	1/10 to 1 acre home range. 25-.4 ha	High population fluctuation.
Porcupine (<u>Erethizon dorsatum</u>)	Pine bark. Poplar. Wild plum. Buds. Fond of salt.	Usually forested but in brush if available. Hollow tree dens and natural rock caves.	1-4/10 acres is common. 1-4/4 ha	Nocturnal. Can cause extensive damage to pines.
Masked shrew (<u>Sorex cinereus</u>)	Insects. Earthworms. Beetles. Larva. Ants. Snails. Spiders. Grasshoppers. Mice.	Moist habitat. In forests. Nests in dry leaves and grasses, in stumps and under logs and in brush piles.	Observed in concentration.	
Merriam shrew (<u>S. merriami</u>)		Arid areas. Bunch grass. Can utilize 5" diameter trees for cover.		

RESIDENT SPECIES

NON - GAME BIRDS

Habitat Evaluation According to Nesting Sites

Species	Frequency/Distribution	Diet	Comments
<u>Ponderosa Pine Primary Cavity-Nesters</u>			
Hairy woodpecker	Abundant.	80% insects including larvae. Some fruits, acorns.	Often excavates undersides of limbs.
Downy woodpecker	Abundant.	75% insects. Some fruits.	Prefers open stands.
Common flicker	Abundant.	75% insects. Grains, weed seeds. Fruits (especially in winter).	Often found in edge habitats where it nests.
<u>Secondary Cavity- Nesters</u>			
Black-capped chickadee	Abundant in ponderosa pine and aspen.	70% insects, mast of pines. Fruits, some weed seeds.	Will excavate their own nests if necessary. Flexible. Will nest anywhere convenient.
Mountain chickadee	Abundant.	Mostly insects. Some seeds, buds, fruits.	Uses abandoned woodpecker holes.
Brown creeper	Moderately common; more at higher altitudes.	Mostly insects, mast.	Generally nests behind loose bark; will use woodpecker cavities.
Pygmy nuthatch	Abundant; most common of the three nut- hatches.	80% insects, especially wasps, spittle bugs. Conifer seeds.	Will excavate if needed.

Resident Species, continued:

Species	Frequency/Distribution	Diet	Comments
<u>Ponderosa Pine Secondary Cavity- Nesters, continued:</u>			
Red-breasted nuthatch	Moderately common; also in aspen.	Mostly insects. Some seeds.	Will excavate. Nests in trees 6-40' high.
White-breasted nuthatch	Common; also in aspen.	Mostly insects, plant material in winter.	Natural cavities in live trees, mature forests. Will use woodpecker holes.
<u>Foliage-Nesters</u>			
Pine siskin	Common; higher summer concentrations.	Seed-eater. Weeds, seeds of pines and alders.	Nest in thick branches of conifers.
Cassin's finch	Moderately common; into mountains.	Seed-eater.	Will nest anywhere.
Red crossbill <i>10. 11. 11</i>	Moderately common; more at higher elevations (eco- tonal).	Almost exclusively conifer seeds and pulp.	Needs mature forests.
Steller's jay	Abundant.	Insects, fruits, seeds.	Also nest in spruce trees.
Gray jay <i>11</i>	Abundant.	Insects, fruits, seeds.	Also nest in spruce trees.
<u>Grass - Forb</u>			
Grey-headed junco	Abundant.	Seed-eater, especially weed seeds.	Nests in grass at base of down timber or shrubs.

NON-GAME BIRDS

Resident Species, continued:

Species	Frequency/Distribution	Diet	Comments
Shrub American goldfinch	Abundant; more so on plains.	Weed seeds (thistle, ragweed) and other seeds.	Prefers deciduous vegetation in moist areas.
Townsend's solitaire	Abundant in summer; a few through winter.	Chiefly insectivorous - fruits of shrubs, a lot of juniper berries especially in winter.	Also ground-nester under sod of steep cuts.
Other Vegetation Black-billed magpie	Abundant.	Insects, carrion, small mammals, fruiting shrubs.	Nests in a variety of trees.
House sparrow	Common; more on plains and in town.	Seeds.	Trees, buildings. Flexible-nester.
House finch	Common; more on plains and in town.	Some insects, mostly weed seeds.	Flexible-nester. Trees, shrubs, thickets, buildings.
BREEDING BIRDS Ponderosa pine <u>Cavity-Nesters</u> Violet-green swallow	Abundant; mid-May through September.	Insectivorous.	Nests in a variety of trees including aspen and willow.
Tree swallow	Moderately common; mid-May to early September.	Insectivorous.	Nests in aspen, spruce; usually near water.

NON-GAME BIRDS

Breeding Birds, continued:

Species	Frequency/Distribution	Diet	Comments
<u>Ponderosa Pine Cavity-Nesters</u>			
Mountain bluebird	Abundant; mid-May through September.	Insects, fleshy fruits.	Nests 7-11,000'; found in all timber types but prefers ponderosa pine snags.
Western bluebird	Common; early-April through October.	Insects, 30% plant material, mostly fleshy fruits.	Prefers open stands of ponderosa pine, pinon-juniper, oakbrush habitat.
Olive-sided flycatcher	Common; mid-May to September.	Insectivorous.	Few nests found; not necessar- ily in cavities; uses other conifers.
Western flycatcher	Abundant; mid-May to mid-September.	Insectivorous.	Variety of nest sites -- mine shafts, tunnels, ledges, usually near water.
House wren	Abundant; mid-April to Mid-October.	Insectivorous.	Prefers cavities of cotton- woods and aspen; uses ponderosa pine if nothing else available.
<u>Foliage-Nesters</u>			
Ruby-crowned knight	Abundant; mid-April or mid-May to mid-Sept. to mid-November.	Mostly insectivorous. Fruits and galls.	Usually nests at higher elevations in any tree. Some winter in Colorado.
Audubon's warbler	Abundant; most common warbler. Mid-May through September.	Mostly insects. Fruits in fall and winter.	Occasional winter resident.

NON-GAME BIRDS
Breeding Birds, continued:

Species	Frequency/Distribution	Diet	Comments
<u>Foliage-Nesters</u>			
Myrtle warbler	Abundant; late-April or May.	Insects, fruits in fall and winter.	
Western wood peewee	Abundant; mid-May to mid-September.	Insects.	Horizontal limbs; all successional stages; also aspen.
→ Evening grosbeak	Intermittently common.	Exclusively fruits and seeds.	Nests in various age classes, not exclusively ponderosa pine. Common in town.
Black-headed grosbeak	Abundant; end of May through September.	Seed-eaters. Fleshy fruits and some insects.	Dense foliage including thickets and shrubs.
<u>Shrub</u>			
Brewer's sparrow	Moderately common; mid-May to mid-September.	Seeds.	Low shrubs, more on the western slope.
Lazuli bunting	Common; early-May through September.	Seeds of weedy plants and some insects.	Low shrubs, willows and alders.
Lesser goldfinch	Abundant; early-May through October.		Ecotonal. More common in scrub oak and ponderosa pine.
Hermit thrush	Abundant; mid-April to mid-May to mid-September to mid-October.	Mostly insects. Fruits in cool seasons.	Shrubs or low trees 4-8' from the ground. Ecotonal.

NON-GAME BIRDS

Breeding Birds, continued:

Species	Frequency/Distribution	Diet	Comments
<u>Shrub</u> , continued:			
Swainson's thrush	Abundant; May to mid-September or mid-October.	Mostly insects. Fruits in cool seasons.	Prefers moist areas; willows, alder. Found in mature stands.
Solitary vireo	Abundant; end of May to mid-September.	Mostly insects and some fleshy fruits.	More common in scrub oak; also in ponderosa pine.
Virginia's warbler	Common; mid-May to mid-September.	Insectivorous (mostly); some fruits.	More common on the western slope. Nests in roots of scraggly growth, transition zones.
MacGillivray's warbler	Moderately common; May to early-September.	Insectivorous (mostly); some fruits.	Prefers moist areas.
Broad-tailed hummingbird	Abundant; April through September.	Nectar.	Ponderosa pine and other trees along canyon walls.
<u>Ground-Nesters</u>			
Vesper sparrow	Abundant; mid-April to mid-October.	Weed seeds, sunflowers.	Open parks and meadows.
Lark sparrow	Abundant; mid-April through September.	Weed seeds; loves grasshoppers.	
Green-tailed towhee	Abundant; mid-May to mid-September.	Insects, weedy seeds, fleshy fruits.	Rests on the ground at the base of shrubs; more common in oak brush.

Breeding Birds, continued:

Species	Frequency/Distribution	Diet	Comments
<u>Ground-Nesters,</u> continued: Rufous-sided towhee	Abundant; end of April to mid-September.	Insects, weedy seeds, fleshy fruits.	Nests on the ground at the base of shrubs; more common in oak brush.
<u>Other (includes</u> <u>deciduous trees)</u> Western tanager	Abundant; end of April to mid-September.	Insects. Primarily fleshy fruits, particularly cherries.	Nests in thick branches, upper canopy of mature but open woodlands.
Warbling vireo	Moderately common; mid-May to mid- September.	Primarily insects and some fleshy fruits.	Deciduous trees. Aspen.
Robin	Abundant; early- March through October.	Insects, fleshy fruits; loves cherries.	Bushes, small trees of any type.
Orange-crowned warbler	Abundant; late-April then May to September to mid-October.	Insectivorous.	Nests in willows and aspen.

VISITING SPECIES

Species	Comments
Canyon wren	Common visitor. Not prime habitat.
Dipper	Not common in foothills. Requires water.
Olivaceous fly-catcher	Rare.
Dusky flycatcher	Common in summer.
Hammond's fly-catcher	Common in summer, primarily at higher elevations.
Traill's fly-catcher	Visitor. Primarily found in willows by streams in foothills.
Western kingbird	Very common plains bird. Nests in Boulder.
Blue-grey gnatcatcher	Rare visitor.
Barn swallow	Common visitor. Building-nester.
Cliff swallow	Common visitor. Nests on cliffs.
Bank swallow	Common on plains. Irregular foothills visitor.
Rough-winged swallow	Common on plains. Irregular foothills visitor.
White-winged junco	Very common. Winter residents.
Slate-colored junco	Very common. Winter residents.
Oregon junco	Dominant winter bird.
Golden-crowned kinglet	Uncommon visitor.
Northern shrike	Not common in Colorado

Visiting Species, continued:

Species	Comments
Loggerhead shrike	Visitor. Primarily a plains bird.
Starling	Common. Prefers fields, urban areas.
Chipping sparrow	Very common visitor. Prefers plains.
Clay-colored sparrow	Very common visitor. Prefers plains.
Lincoln's sparrow	Very common visitor. Nests at higher elevations.
White-crowned sparrow	Moderately common visitor. Primarily plains bird.
Harris' sparrow	Uncommon visitor. Plains species.
Song sparrow	Primarily a plains species.
Tree sparrow	Primarily a plains species.
Savannah sparrow	Plains species. Uncommon visitor.
White-throated sparrow	Plains winter resident. Uncommon in foothills.
Golden-crowned sparrow	Rare visitor.
Pine grosbeak	Uncommon.
Rose-breasted grosbeak	Uncommon.
Grey-crowned rosy finch	Not a common visitor.
Black rosy finch	Rare.
Brown -capped rosy finch	Common visitor.
Summer tanager	Rare visitor.
Scarlet tanager	Rare visitor.

Non-Visiting Species, continued:

Species	Comments
Common redpoll	Uncommon.
Western meadowlark	Primarily a plains species.
Red-winged blackbird	Primarily a plains species.
Bullock's oriole	Visitor. Prefers riparian habitat.
Brewer's blackbird	Common plains species.
Brown-headed cowbird	Common plains species.
Wilson's warbler	Common summer visitor. Found earlier and later on plains.
Townsend's warbler	Rare visitor.
Black-throated grey warbler	Uncommon visitor.
Blue-throated green warbler	Uncommon visitor.
Chesnut-sided warbler	Uncommon visitor.
Bay-breasted warbler	Uncommon visitor.
Palm warbler	Uncommon visitor.
Black and white warbler	Uncommon visitor.
Tennessee warbler	Uncommon visitor.
Nashville warbler	Uncommon visitor.
Black-throated blue warbler	Uncommon visitor.
Yellow-breasted chat	Uncommon visitor.

Visiting Species, continued:

Species	Comments
Cedar waxwing	Common visitor. Irregular resident -- more often in winter.
Bohemian waxwing	Winter visitor. Uncommon.
Say's phoebe	Common on plains. Irregular foothills visitor.
Clark's nutcracker	Primarily found at higher elevations.
American redstart	Rare breed but common visitor.
Common grackle	Primarily a plains species. Common visitor.
Common crow	Plains resident. Foothills visitor.
White-throated swift	Common visitor.
Common night hawk	Common visitor. Prefers open terrain.
Rufous-sided hummingbird	Very common visitor. Needs further study.

R A P T O R S

Spp	Food	Hab. Requirements	Nest Description*	Territory Size*
<p><u>ACCIPTERS</u> Cooper's hawk (<u>Accipiter cooperi</u>)</p>	Small birds, doves, quail, grouse, poultry, some rodents.	Requires dense stands of coniferous forests, preferably uniform trunk diameter. Likes to be near streams and rivers. Will occupy various successional stages, but prefers mature forests. Will feed in any successional stage from grass to old forest. Requires 6 ha (15 ac) of undisturbed timber to nest.	Large nest structured from sticks and twigs with pine bark, or any bark available, used to line the nest. Nest is usually located in the lower part of the canopy, on limbs or against the trunk. Will also nest in cottonwoods along streams.	(2.5-7.7 km ²) (1-3 mi ²)
<p>Goshawk (<u>Accipiter gentilis</u>)</p>	Small birds, some rodents.	Occupies mature stands of coniferous forests of varying densities. Will feed in various successional stages. Likes areas with secondary canopies, which it uses for plucking posts (pull hair/feathers from kill), but will also utilize fallen or arched trees (Doerr 1968, Call 1978). 10 ha of undisturbed timber required for nesting. Proximity to permanent water source is an important factor in nest site selection.	Nests in lower part of mature canopy, against trunk or in branches. Small twigs used to construct nest, which is usually about 61 cm in diameter. Will also nest in cottonwoods along streams.	2.5-10.0 km ² (1-4 mi ²)
<p>Sharp-shinned hawk (<u>Accipiter striatus</u>)</p>	Small birds, some rodents.	Dense stands of coniferous forests, prefers trunk diameter of 20-38 cm (8-15") DBH. Will utilize dense stands of deciduous trees or brush for nesting when conifers are absent. Requires 4 ha (10 ac) of undisturbed vegetation for nesting.	A platform of small sticks and twigs, about 30-45 cm in diameter, near trunk. Lined with pine needles, leaves, or debris.	2.5-7.7 km ² (1-3 mi ²)
<p><u>EAGLES</u> Golden eagle (<u>Aquila chrysaetos</u>)</p>	Rabbits, large rodents.	Reproduces in stands of mature or old growth ponderosa pine or other conifers. Feeds in wide variety of habitat types from grass to forest.	Prefers cliffs, but will nest in trees occasionally. Tree nests range from 3 to 30 m (10-100') elevation. Alternate nests used various years. Nest may be up to 2.4 to 3.0 m (8-10') diameter and over 1.2 m (4') deep.	20-25 km ² (8-10 mi ²)
<p><u>BUTEOS</u> Rough-legged hawk (<u>Buteo lagopus</u>)</p>	Small mammals, rodents, some birds.	Winters in Colorado. Requires open areas for feeding.	Exposed cliffs and mountains with few trees in tundra.	

* From Call 1980

RAPTORS, continued:

Spp	Food	Hab. Requirements	Nest Description	Territory Size
<u>BUTEOS, continued:</u>				
Red-tailed hawk (<u>Buteo jamaicensis</u>)	Rodents and rabbits, some small birds.	A mixture of open areas for hunting interspersed with woodland for nesting is required. Snags or limbs on fallen trees are desirable for perches from which to hunt. Prefers to nest near waterways.	Nests on cliffs or in various trees. Nests usually greater than 7.5 m (25') above ground, near the top of the canopy. May be placed adjacent to trunk or on thick branches. Sticks up to 2.5 cm (1") in diameter used for the nest. Small clumps or a single tree most commonly selected for nest sites.	2.5-9.0 km ² (1-3.5 mi ²)
<u>VULTURES</u>				
Turkey vulture (<u>Cathartes aura</u>)	Carrion.	Will utilize a wide variety of types, including grassland, desert, canyon and forest.	Prefers cliffs, caves, rimrock, talus. Will nest on ground occasionally in well-concealed sites. Communal roosts in winter.	
<u>FALCONS</u>				
American kestrel (<u>Falco sparverius</u>)	Insects and small mammals.	Open areas for hunting are required, and since this sp. hunts part of the time from a perch, open trees, snags, or branches on fallen trees are needed. Trees are needed for nesting, though holes in cliffs or clay banks may be used if trees absent. Will nest at densities up to 5/ha (2/ac). Migratory, present in summer only.	Cavities which were abandoned by flickers, or natural cavities formed from heart rot. Readily utilizes artificial nesting structures.	51-154 ha (0.2-0.6 mi ²)
<u>LARGE OWLS</u>				
Great-horned owl (<u>Bubo virginianus</u>)	Rabbits, rodents, some birds.	Found in virtually every habitat type -- grassland, desert, canyon, forest and alpine meadow. Extremely versatile in its nesting requirements and utilizes a universal food source.	Does not build own nest. Utilizes any old nest structures which will support its weight, including old hawk, raven and magpie nests. Cavities formed by broken tree tops or branches, heart rot or cliff cavities also used.	3.8-5.0 km ² (1.5-2 mi ²)
Long-eared owl (<u>Asio otus</u>)	Rodents.	Likes to be near open country, but requires concealment in the day and shelter for its nest, and is found in any area affording sufficient tree or brush growth for these purposes. Shows a preference for dense brush.	Uses abandoned nests of hawks, ravens, magpies and squirrels.	1.3-2.5 km ² (0.5-1 mi ²)

RAPTORS, continued:

Spp	Food	Hab. Requirements	Nest Description	Territory Size
<u>MEDIUM OWLS</u> Barn owl (<u>Tyto alba</u>)	Rats, mice, meadow vole.	Inhabits a wide variety of areas, including savannah, woodlands, farmlands, and suburbs. Trees required for perching.	Natural cavities in trees, holes, and cavities in cliffs and clay banks, and human structures such as old wells and mining shafts, silos, barns and abandoned houses.	0.8-2.5 km ² (0.3-1.0 mi ²)
<u>SMALL OWLS</u> Screech owl (<u>Otus asio</u>)	Mice and meadow voles.	Widely spaced trees interspersed with grassy openings. Likes moist areas and are commonly found in wooded areas along stream bottoms. Occupies coniferous woodland and juniper up to 2400 m (8,000') elevation. Nonmigratory.	Nests in cavities. These are not self-excavated and often old woodpecker holes are utilized, sometimes natural cavities.	≥5 ha (13 ac)
Saw-whet owl (<u>Aegolius acadicus</u>)	Small mammals, insects, occasional small bird.	Coniferous and deciduous forests of foothills. Requires clumps of pines, cottonwoods, willows or cavities for roosting in daytime. Prefers open timber stands.	Abandoned flicker or other woodpecker cavities as well as natural cavities.	
Pygmy owl (<u>Calucidium gnoma</u>)	Small mammals and birds, some amphibians.	Found in open, coniferous forests, up to 3,600 m (12,000') elevation, though some may move down in winter. Nests in any successional stage from young to old forest, but preferred feeding ground is grassy areas with small trees or no trees.	Abandoned woodpecker holes or natural cavities, usually ranging from 2.4 to 22.5 m (8 to 75') above ground.	
Flammulated owl (<u>Otus flammeolus</u>)	Mostly insects, some small mammals and birds.	Coniferous forests preferred with ponderosa pine a favorite. Greatest density between 1,800-3,000 m (6,000 to 10,000'). Phillips (1964) reports need for oak understory. Requires cavities for roosting in daytime.	Abandoned woodpecker holes or natural cavities.	6-12 ha (15-30 ac)

P R E D A T O R S

Spp	Food	Hab. Requirements	Den Sites	Territory Size
Long-tailed weasel (<u>Mustela frenata</u>)	Small mammals up to rabbit size, some birds and eggs.	Euryecious (wide range of tolerance for habitat types). Some preference for rocky, shrubby areas near water.	Excavates own burrow, or uses abandoned ground squirrel or pocket gopher burrows. Will also use hollow logs.	14-16 ha (30-40 ac)
Badger (<u>Taxidea taxidus</u>)	Small mammals, including ground squirrels, chipmunks, and pocket gophers. Insects eaten in summer.	Prefers open country, but will utilize small, isolated clearings.	Self-excavated burrows on open slopes. Often south or south-eastern exposure.	
Spotted skunk (<u>Spilogale putorius</u>)	Small mammals and birds, insects in summer, carrion in winter, some vegetable matter and fruit.	Broken, rocky country with a shrubby cover, usually in open woodland. Preference for canyons.	Burrows abandoned by ground squirrels, badgers or coyotes, brushpiles or hollow logs, under rock piles.	64 ha (160 ac)

B I G G A M E

Spp	Food	Hab. Requirements
Mule deer (<u>Odocoileus hemionus</u>)	Browses extensively on trees and shrubs, especially in winter. Grasses and forbs important, especially in spring and summer.	Varies from wooded uplands to desert plateaus. Prefers open, broken country. Seasonal migration from high altitudes in summer to lower altitudes in winter occurs throughout much of range. Avoids heavy woodlands but requires some wooded areas for thermal and hiding cover. These should be interspersed with open areas for feeding.
Elk (<u>Cervus canadensis</u>)	Browse from trees and shrubs, forage from grasses and forbs. Browse is largest portion of diet in winter (>50%), grasses and forbs comprise ~75% of diet in summer.	Elk migrate annually from high summer ranges to lower winter ranges, though they may be found on lower elevation ranges year-round. Evidence that thermal cover in cold weather may not be required (Murie, 1951), but hiding cover is important. Good diversity and interspersed of wooded areas and open foraging areas required.

APPENDIX E
VEGETATION LIST

Cherry	<u>Prunus sp.</u>
Common juniper	<u>Juniperus communis</u>
Gunweed	<u>Grindelia squarrosa</u>
Oregon grape	<u>Mahonia repens</u>
Penstemon	<u>Penstemon secundiflorus</u>
Ponderosa pine	<u>Pinus ponderosa</u>
Ragweed	<u>Ambrosia sp.</u>
Scrub oak	<u>Quercus gambelii</u>
Skunkbrush	<u>Rhus trilobata</u>
Snowberry	<u>Symphoricarpos occidentalis</u>
Spruce: blue	<u>Picea pungens</u>
engelmann	<u>Picea engelmannii</u>
Sticky geranium	<u>Geranium fremontii</u>
Sunflower	<u>Helianthus sp.</u>
Thistle	<u>Cirsium sp.</u>
Wax currant	<u>Ribes cereum</u>
Yarrow	<u>Achillea lanulosa</u>

APPENDIX F
GREENSLOPE NEWS ARTICLE

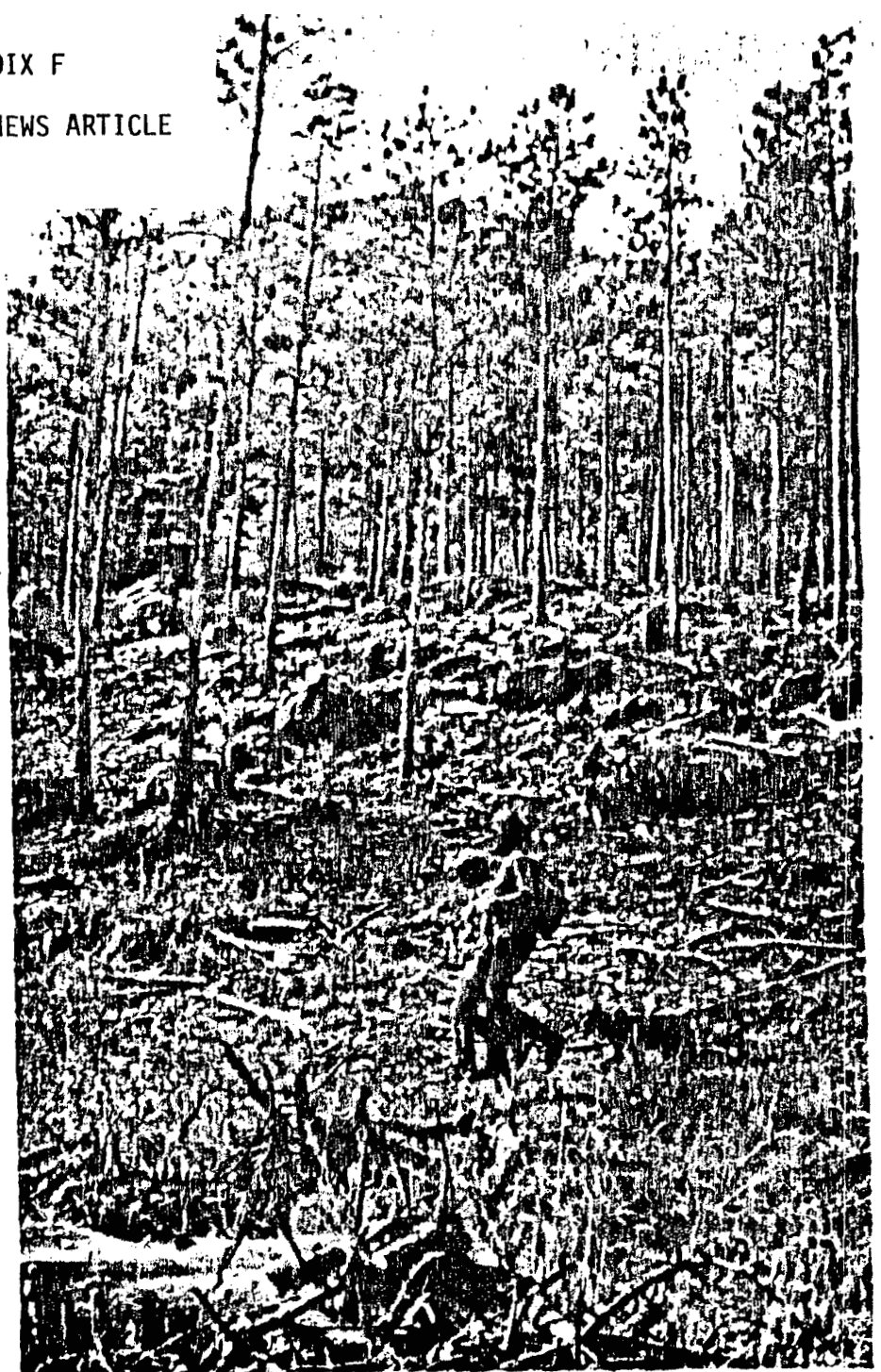


Camera staff photos by Vern Walker

Dick Shannon, the Boulder city forester, looks at a small ponderosa pine in a plot of foothill's forest that will soon be thinned as part of Greenslope, the city's forest management project. The city and Colorado State Forest Service are combining to manage the city parklands.

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Project Greenslope: responsibility for practical forest management



Two hikers walk through a portion of the Boulder Mountain Parks that has already been thinned as part of a forest management project. The goal is a healthier forest less susceptible to fire and insect damage.

Greenslope project

By TODD MALMSBURY
Camera Staff Writer

When settlers first came to the Front Range of Colorado, the ponderosa pine forests bore little resemblance to the dense stands that now cover the foothills.

Unlike the eastern U.S. where hardwood forests gave way to cities, roads and farms, the stands of pine are actually thicker now along the foothills because of man's impact.

The main reason is fire.

"Before the white man, forest fires were rampant," said Tom Borden, the state forester. "The fires would begin in the spring and burn until the fall. They kept a lot of tree growth pushed back. Much of the land didn't traditionally have tree growth."

According to the accounts of some early settlers, said Borden, Indians may have deliberately set fires because the fire thinned the forests and improved hunting.

"Now, man is making a conscious decision that he can't allow fires to burn," said Borden.

Clear cutting of timber during the 1800s also was a factor. "From the Peak to Peak Highway east to Boulder, almost every tree was cut," said John Oppenlander, a technician with the National Forest Service in Boulder. He said he based that conclusion "on old photos and what I've seen on the ground."

What Oppenlander has seen on the ground is uniform growth that took the place of the healthier staggered mixture of mature trees and saplings.

Suppression of fires and the clear cutting has led to this even-aged growth in most forests. The result is thick stands of stunted trees competing against each other for moisture, light and nutrients. A thick pile of "duff" — matted pine needles and branches — prevent seeds from reaching the rich soil, resulting in a "biological desert" where few things grow.

Because man's influence has profoundly affected the forest, foresters now say that it is up to man to manage the stands of timber. Despite objections from some wilderness groups, forest management projects are now underway along the Front Range. And one of

the biggest is right at our doorstep in the Boulder Mountain Parks just west of the city.

□ □ □

The project, Greenslope, is a joint effort of the City of Boulder and the Colorado State Forest Service, said Ken Dart, a forester with the state. More than 900 acres of timber and brush have already been thinned, and pine beetle-infested trees have been cut on approximately 1,000 acres of mountain park land. Another 600 acres will be thinned this year and next.

Greenslope is an outgrowth of the effort to combat the mountain pine beetle epidemic that devastated thousands of acres of ponderosa pine in the 1970s. Millions of dollars, much of it in federal grants, were invested in forest management programs designed to stop the beetle. Thanks in part to the programs, the epidemic finally ran its course.

But foresters are anxious to continue forest management to make the forests less vulnerable to fire and insect infestation and more accessible for hikers.

"By doing this work now, you are effectively stopping a beetle epidemic 20 years from now," said Oppenlander.

While forest management projects are going on elsewhere in the state, the Boulder project is the only one of its size. "Boulder is rather unique," said Dick Shannon, the city forester. "I don't think there's another project like this in any other city."

The \$300,000 program is concentrated in the forests just west of the city, much of it around the National Center for Atmospheric Research. There, ponderosa pine at least 70 years old that should be a foot or more in diameter aren't much bigger than saplings.

By cutting and removing some of the trees, explained Shannon, the remaining trees will hopefully "release" — recover from the stressed condition and begin normal growth.

The mountain park land is divided into plots, and the state forest service receives bids from private contractors who are anxious to cut the trees for firewood. The money collected from the contractors is plowed back into the project. According to Dart, 7 percent of the cost of the project has been recovered through the sales of firewood.

Continued on next page

Greenslope project

Continued from page 4

"Foresters walk through the plots before the contractors and mark the trees to be cut," said Shannon. In some of the thicker stands, more than two-thirds of the trees are cut.

Shannon and Dart are anxious to show the plots that have been thinned and compare them with plots where cutting hasn't yet taken place. From a vantage point in a thinned stand, said Dart, there is a clear view of the Flatirons, one of the "aesthetic qualities" that makes hiking more pleasurable in the mountain parks.

"Besides preservation, the main reason for the project is passive recreation," said Shannon. But a healthier forest offers more than a pleasant place to spend an afternoon.

Unhealthy ponderosa pine are more susceptible to the pine beetle, and in the mid 1970s, the insect has a perfect habitat in the dense forests. In a healthy forest, the trees are better able to repel the beetle's attack.

Thinning the forest also improves the habitat for game, including Boulder County's large population of mule deer. The dense layer of pine needles and debris that accumulate on the forest floor prevent seeds from reaching the rich soil. In the thinned areas, the grass will grow next summer, providing forage for browsing deer.

But perhaps the most compelling reason in Boulder Country for a healthier forest is fire. With homes scattered throughout the foothills, said Shannon, fires can't be allowed to burn. And the forested areas that have not been managed are often ripe for a rapidly-spreading fire that could endanger mountain subdivisions.

"The public attitude has gone from clear cutting to total preservation, and now it's come back a little bit," said Shannon. "We can satisfy most of the people by taking a broad management approach," he said.

But forest management is not a one-time thing. "Once we've started, we'll never stop," said city park ranger Dick Lyman. "The forest is thinned down now, but we'll have to go back into it again."

"It's a dynamic system that we have to manage in perpetuity," said Shannon. ■

APPENDIX G

OBSERVATION/RECORDING FORM

Following is the suggested information which should be observed and recorded. It is recommended that Boulder park ranger staff design their own field data form in consultation with a computer programmer. In this manner, data could be entered in a computer and analyzed for future reference.

Observer: _____ Date: _____ Time: _____ Weather: _____

Location: _____

DESCRIPTION OF AREA

1. Vegetation

Forbs		Grasses		Trees				Shrubs			
spp.	Estimated Density	spp.	Estimated Density	spp.	Estimated Density	Avg. Ht.	Average Diameter	spp.	Estimated Density	Avg. Ht.	% Browse Utilization

2. Amount litter: _____ 3. General Characteristics: _____

WILDLIFE OBSERVED spp.	Activity					Micro-habitat Location								Abert's Squirrel Only		Comments
	Feed'g Hunt'g	Perch'g Rest'g	Vocal.	Other	Tree	Snag	Log	Rock	Ground	Air	Near Water	Other	Marked	Unmarked		

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ANIMAL SIGN OBSERVED

Scat	Raptor Pellets	Nest or Burrow*	Rodent Trails	Food Caches	Tracks	Other	Exact Location	spp. (if known)	Description and Comments

* See next section

Nest Description:	Nest Site				Nest Description			spp. (if known)	Comments/Special Characteristics				
	Trunk	Tree Limb	Branch	Other	Shrub	Ground	Cavity			Diameter	Height Above Ground	Eggs or Hatchlings	

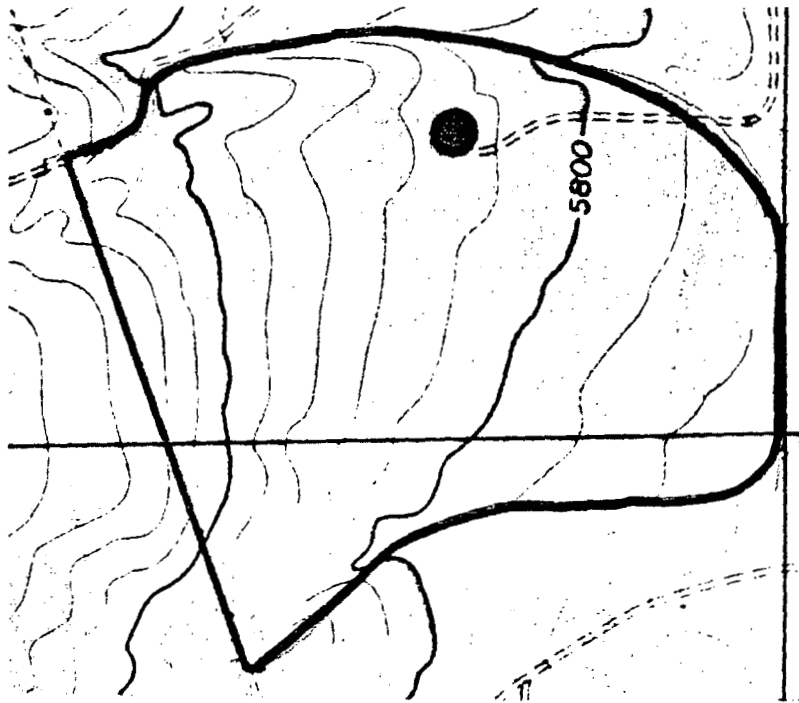
Burrow/Den Description:	Diameter	Slope	Aspect	Cover	spp. (if known)	Comments

APPENDIX H
PRACTICE RECORD FORMS

Management practices should be recorded on the following practice record forms or a record form of the Boulder park ranger's own design. Location of the management practices should be placed on the map provided.

PRACTICE RECORD

THINNING



type of cut _____

date _____ size _____

slash treatment _____

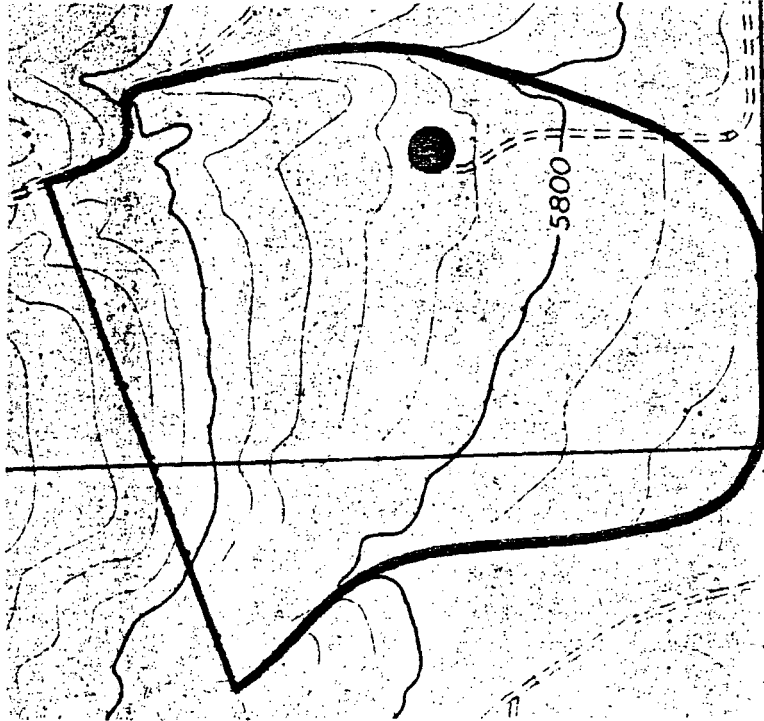
special treatments _____

next entry or maintenance needs _____

practice objective _____

PRACTICE RECORD

SNAG MANAGEMENT



total # _____ # natural _____ # created _____

density (#/unit area) _____

soundness (hard, soft) _____

average height _____ average diameter (dbh) _____

method used to create snags _____

PRACTICE RECORD
WATER IMPROVEMENT AND SPECIAL FEATURE CONSTRUCTION



Water

structure installed _____

date _____

pre-treatment condition _____

maintenance needs _____

Special Feature

feature _____

date _____ # installed _____

pre-treatment condition _____

maintenance needs _____

**WILDLIFE HABITAT MANAGEMENT PLAN
FOR BOULDER GREENBELT
HABITAT MANAGEMENT DEMONSTRATION AREA**

**Prepared by
Ron Gosnell
Nenise Newbould
Julie Etra**

In partial fulfillment of the requirements for

**Wildlife Habitat Management (FW677)
Dr. Swight R. Smith**

**Colorado State University
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