

Fig 9 - pg 22

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Rocky Mountain  
Forest and Range  
Experiment Station

Fort Collins,  
Colorado 80526

General Technical  
Report RM-217



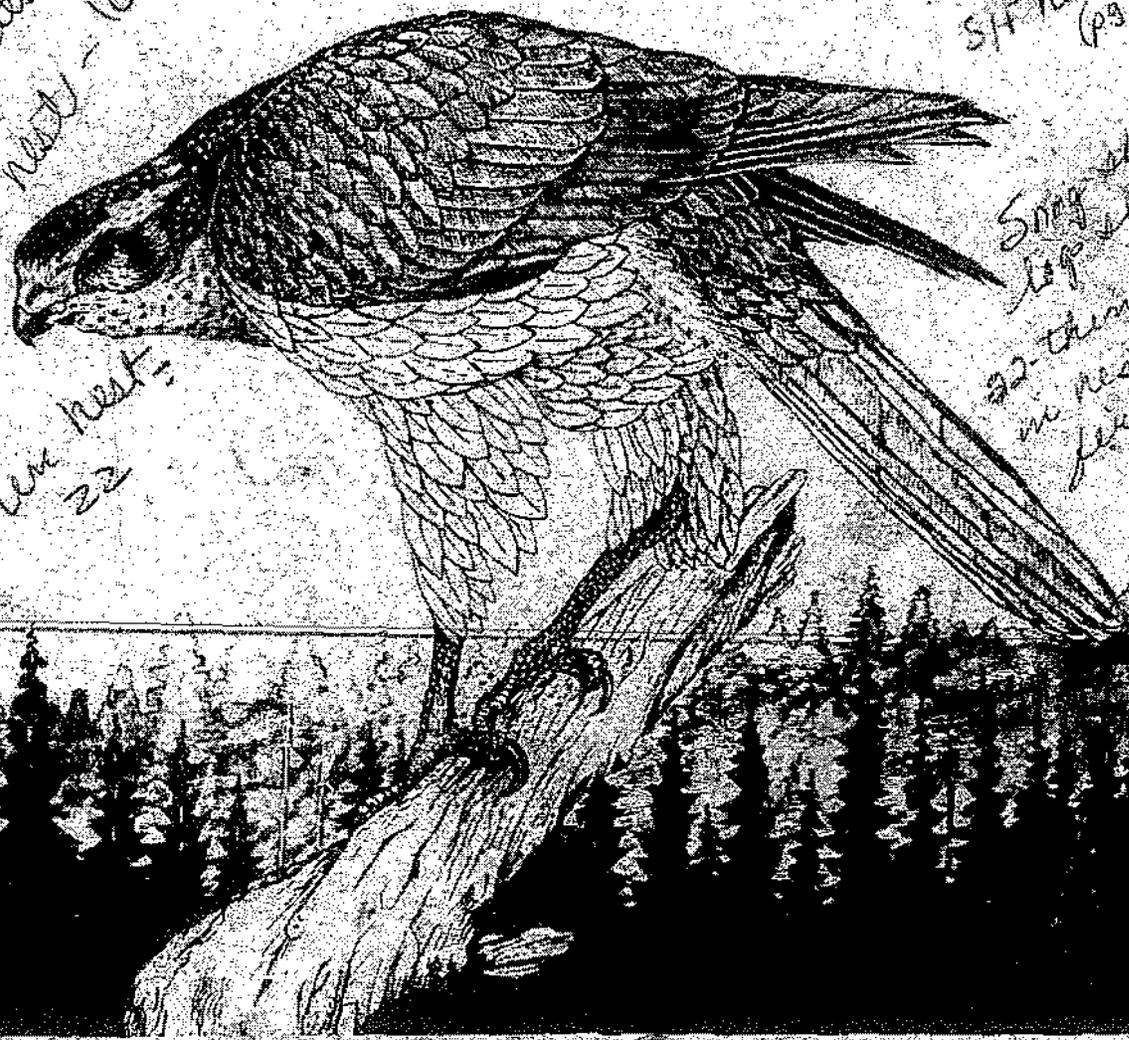
# Management Recommendations for the Northern Goshawk in the Southwestern United States

Forest health - 79  
Saw all nests - 10  
them nest - 22

Forage mixed S/F =  
60% in SS to  
(pg 28)  
10,000 yf =  
30

Coona  
PFA mixed = 60+  
S/F = 70+  
Forage mixed = 60+ m  
S/F nest BA = 140  
(pg 14)  
OG

5mg should be 18"  
19" should be 12"  
32-thin from below  
in nest or below  
few on



3/13  
A. G. ...

Forage - 6  
19  
m  
m  
Old

Diversity = 32

snags = 17  
ppage - 83

# Management Recommendations for the Northern Goshawk in the Southwestern United States

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**VEGETATIVE STRUCTURAL STAGES:**  
*Successional stages for a mixed-species forest ecosystem*

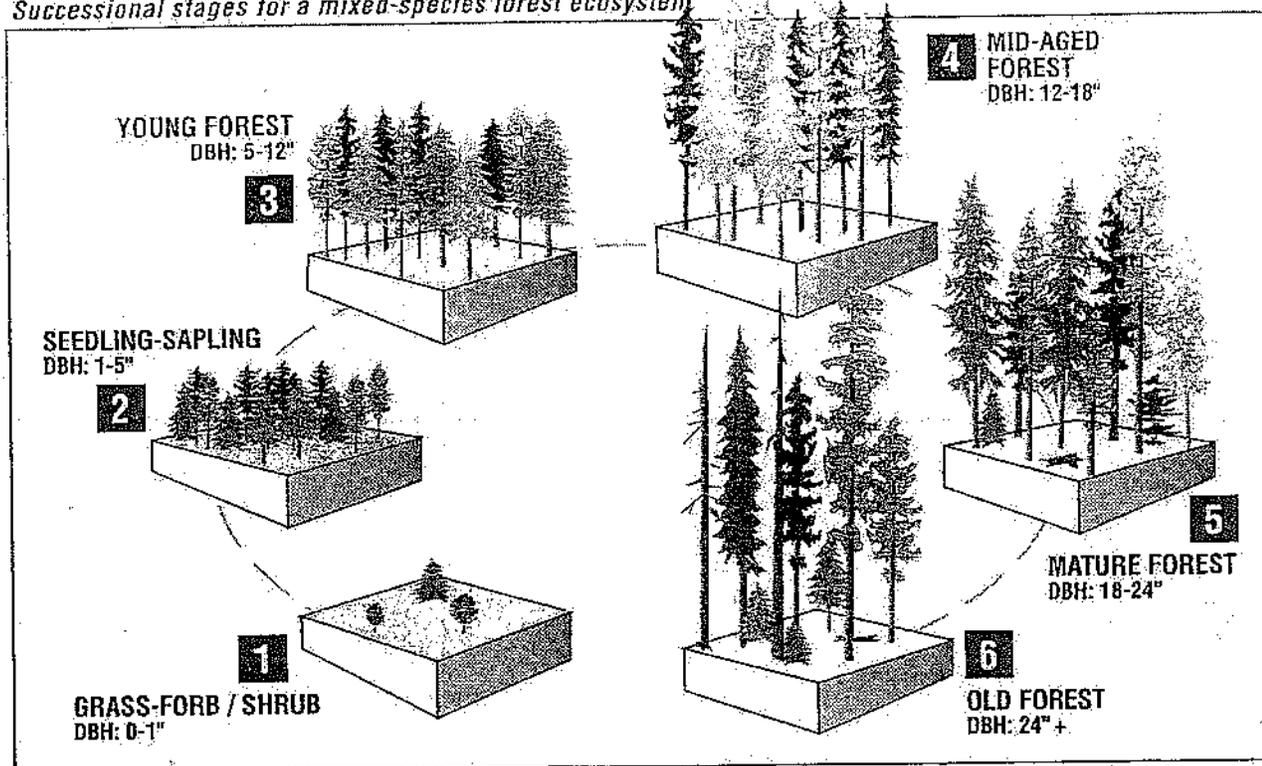


Figure 1. Forest vegetation structural stages and their associated diameter breast height (DBH) ranges.

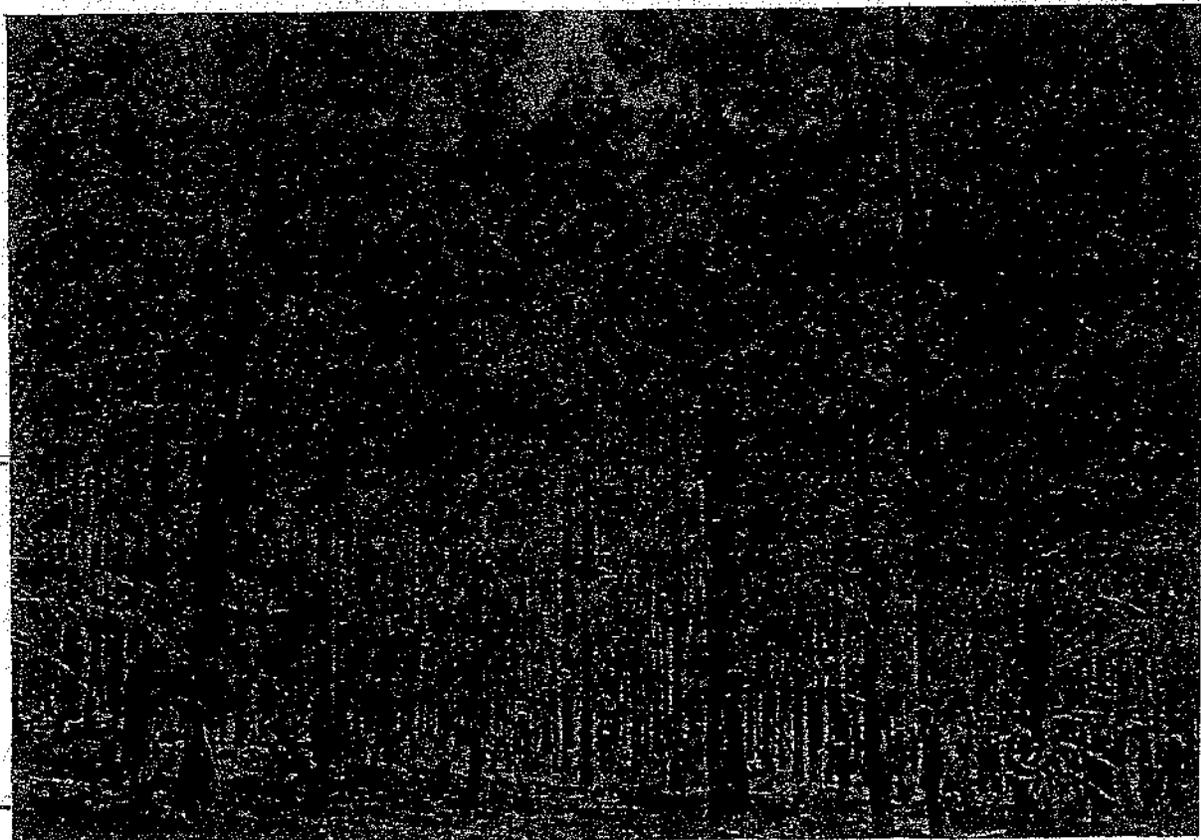


Figure 2. Dense "thicket" of small-diameter trees.

Table 1. Desired forest conditions in three forest types for sustaining northern goshawks and their principal prey species in the Southwest.

Attribute	Nest Area <sup>a</sup>	Home-Range Components			Foraging Area		
		Ponderosa Pine	Mixed-Species	Spruce-fir	Ponderosa Pine	Mixed-Species	Spruce-fir
VSS distribution <sup>b</sup>							
grass/forb/shrub VSS 1 (%)	0 <sup>c</sup>	10 <sup>c</sup>	10 <sup>c</sup>	10 <sup>c</sup>	10 <sup>c</sup>	10 <sup>c</sup>	10 <sup>c</sup>
seedling-sapling VSS 2 (%)	0	10	10	10	10	10	10
young forest VSS 3 (%)	0	20	20	20	20	20	20
mid-aged forest VSS 4 (%)	0	20	20	20	20	20	20
mature forest VSS 5 (%)	100	20	20	20	20	20	20
old forest VSS 6 (%)	100	20	20	20	20	20	20
Canopy cover							
mid-aged forest VSS 4 <sup>c</sup>	NA <sup>d</sup>	1/3 60+ 2/3 50+	60+	60+	40+	1/3 60+ 2/3 40+	1/3 60+ 2/3 40+
mature forest VSS 5 (%)	50-70+	50+	60+	70+	40+	50+	60+
old forest VSS 6 (%)	50-70+	50+	60+	70+	40+	50+	60+
Years to mid-aged VSS 6	200-300	200-250	200-300	200-300	200-250	200-300	200-300
Opening size							
maximum size (acre)	NA	2	2	1	4	4	1
width-maximum (ft)	NA	200	150	125	200	200	125
Reserve trees <sup>e</sup>							
number of groups/acre	A <sup>f</sup>	1	1	2 <sup>h</sup>	1	1	2 <sup>h</sup>
number (per group)	NA	3-5	6	6	3-5	6	6
opening threshold <sup>g</sup> (acres)	NA	>1	>1	>0.5	>1	>1	>0.5
Snags (no/acre)	NR <sup>i</sup>	2	3	3	2	3	3
Downed logs (acre)	NR	3	5	5	3	5	5
Woody debris (tons/acre)	NR	5-7	10-15	10-15	5-7	10-15	10-15

<sup>a</sup> Suitable nest areas only; attribute values may vary by forest type.

<sup>b</sup> VSS; Vegetation Structural Stages, a forest description based on the tree diameter distribution within a stand. For example, if the majority of the stems of a stand (based on basal area) were located in the 12-18 inch diameter class, the stand would be classified as a VSS 4. General diameter limits are: VSS 1= 0-1" DBH; VSS 2= 1-5" DBH; VSS 3= 5-12" DBH; VSS 4= 12-18" DBH; VSS 5= 18-24" DBH; VSS 6 = 24"+ DBH. DBH = Diameter at Breast Height (4.5 ft.).

<sup>c</sup> Proportion of the area.

<sup>d</sup> NA; not applicable.

<sup>e</sup> Reserve trees; standing trees left after harvesting that will be allowed to become snags and downed logs.

<sup>f</sup> A; applicable, clumpiness, or groups of large trees is also desirable.

<sup>g</sup> When threshold size is exceeded, reserve trees are necessary.

<sup>h</sup> One group per 0.5 acres.

<sup>i</sup> NR; not required, but presence of these features are not detrimental.

*Majority of stems based area*

Table 2. Management recommendations for sustaining habitat for northern goshawks and its principal prey species in the Southwest.

Attribute	Home Range Components <sup>a</sup>		
	Nest Area	PFA	Foraging Area
Number of areas	6	1	1
Suitable <sup>a</sup>	3	NA	NA
Replacement <sup>a</sup>	3	NA	NA
Size (acre)	30 (Total = 180)	420	5,400
Management season <sup>b</sup>	Oct-Feb	Oct-Feb	Year-long
Regeneration of forest			
Conifer	None	Yes	Yes
Aspen & Oak	None	Yes	Yes
Planting	None	Yes	Yes
Thinning from below <sup>a</sup>	Non-uniform spacing	Non-uniform spacing	Non-uniform spacing
Transportation system			
Road	Minimum density	Minimum density	Minimum density
Skid trails	Permanent	Permanent	Permanent
Forage utilization <sup>a</sup> (%)	20/40 <sup>c</sup>	20/40 <sup>c</sup>	20/40 <sup>c</sup>
Woody debris treatment	In Order of Preference		
Prescribed burning <sup>a,d</sup>	1	1	1
Lopping & Scattering <sup>a</sup>	2	2	2
Hand piling <sup>a</sup>	3	3	3
Machine grapple piling <sup>a</sup>	None	3	3
Dozer piling <sup>a</sup>	None	4	4

<sup>a</sup> Refer to glossary of terms.

<sup>b</sup> For PFAs surrounding active nest areas, months in which management activities are allowed.

<sup>c</sup> Average forage utilization (percent by weight) in herbaceous layer/shrub layer; utilization should not exceed 40% of grasses and forbs and 60% of shrubs.

<sup>d</sup> Not applicable in spruce-fir forest type.

*Richard*

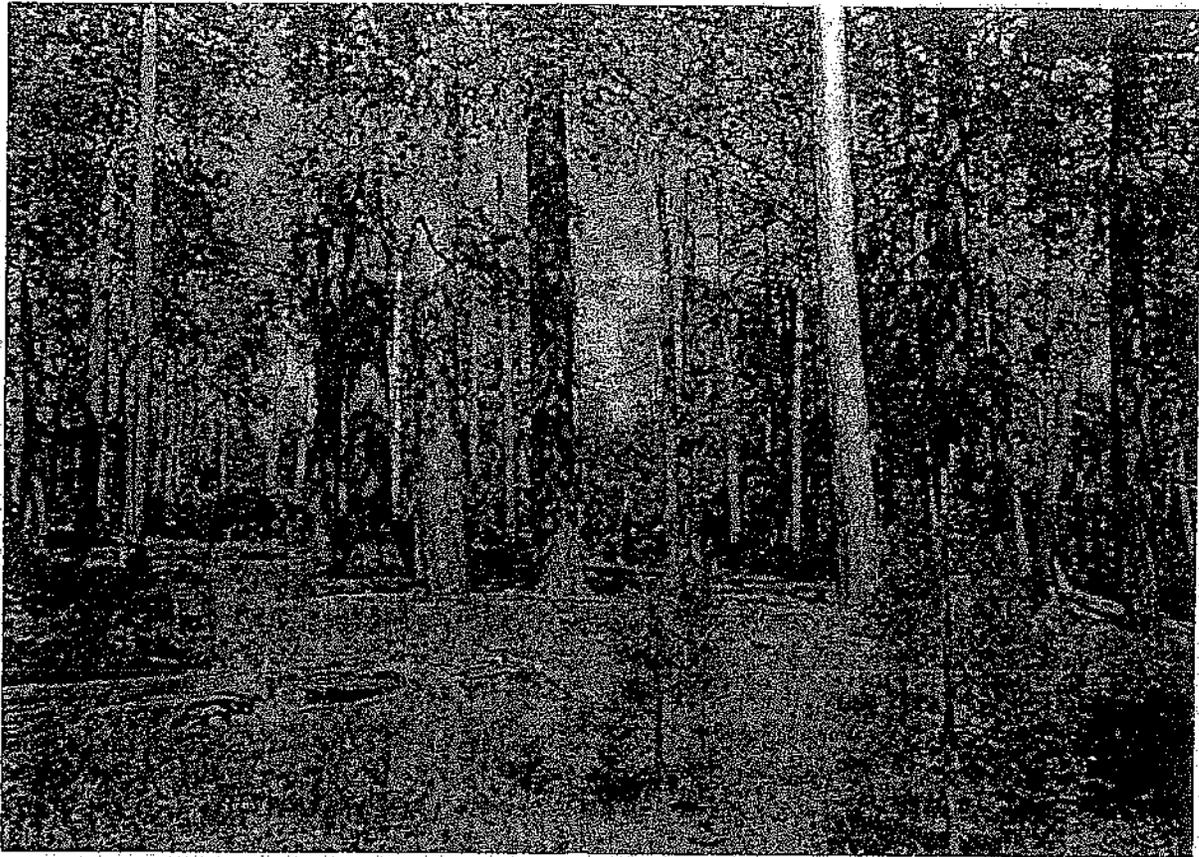


Figure 5. Because of visual limitations in dense forest environments, an open understory enhances detection and capture of prey by goshawks.

downed logs, woody debris, large trees, openings, herbaceous and shrubby understories, and an intermixture of various forest vegetative structural stages. Prey populations within goshawk foraging areas will be abundant and sustainable when:

- 1) the specific habitat attributes are provided,
- 2) forests contain large trees and have relatively open tree understories,
- 3) forest openings are small (1/3 - 2 acres) to medium (2-4 acres) in size,
- 4) patches of dense, mid-aged forests are scattered throughout, and
- 5) the majority of forests are in the "mid-aged," "mature," and "old" structural stages.

### Present Forest Conditions

Southwestern forests have been altered from pre-settlement conditions by fire suppression, timber harvesting, livestock grazing, mining, and recreational uses. Prior to fire suppression in the western United States, ponderosa pine forests were burned by low-intensity surface fires at 2- to 15-year intervals. Fires burned at lesser frequencies in

mixed-species forests (5-22 years). These fires maintained forests that were relatively open and dominated by mature trees by regularly burning and killing small trees. In spruce-fir forests, fire intervals were much longer (60-400 years) and fires were often catastrophic, stand-replacing events.

Habitat changes resulting from fire suppression in ponderosa pine and mixed-species, and to a lesser extent spruce-fir forests, are:

- 1) the replacement of open, single-storied stands by dense multistoried stands through tree regeneration,
- 2) loss of natural openings by tree invasion, and
- 3) changes in the abundance and composition of plant species in both the understory and overstory due to plant succession.

Accumulated fuels and dense forest conditions resulting from fire suppression have also increased the potential loss of goshawk habitat through catastrophic wildfire and epidemic infestations of insects and diseases. Increased shading from the dense regeneration has also reduced herbaceous and shrubby understories that provide important foods and cover for goshawk prey. Livestock and wildlife

## Executive Summary

The northern goshawk (*Accipiter gentilis atricapillus*) (hereafter called the "goshawk") is the largest North American member of the genus *Accipiter*, which includes both the sharp-shinned hawk (*Accipiter striatus*) and the Cooper's hawk (*Accipiter cooperii*). It breeds in coniferous, deciduous, and mixed forests throughout much of North America.

The goshawk is a forest habitat generalist that uses a variety of forest types, forest ages, structural conditions, and successional stages. It preys on small- to medium-sized birds and mammals (robins and chipmunks to grouse and hares), which it captures on the ground, in trees, or in the air. A single goshawk may consume one-to-two prey per day.

The principal forest types occupied by the goshawk in the Southwest are ponderosa pine, mixed-species, and spruce-fir. There is a concern that populations and reproduction of the goshawk are declining in these forests and elsewhere in the western United States. These declines may be associated with forest changes caused by timber harvesting. However, fire suppression, livestock grazing, drought, and toxic chemicals may be involved. Because of the concerns over the effects of timber harvesting, the goshawk was listed as a "sensitive species" by the Southwestern Region of the Forest Service, U.S. Department of Agriculture in 1982.

### The Northern Goshawk Scientific Committee

The Northern Goshawk Scientific Committee (GSC) was established by the Regional Forester of the Southwestern Region in the fall of 1990. Its charter was to develop a credible management strategy to conserve the goshawk in the southwestern United States. This report describes the process used, findings, and recommendations of the scientific committee. In developing the recommendations, we used available information on goshawk biology, behavior, diet, and habitat. Information about goshawk foraging habitat was augmented with information on the habitat and foods of its main prey species. From this the GSC developed a set of "desired forest conditions" that, in their best estimate, will sustain goshawk populations in the Southwestern Region.

Because information on goshawk biology is limited, and our ability to produce and sustain certain forest conditions over long periods is unknown, the

development of the "desired forest conditions" for the goshawk and its prey required certain assumptions:

- 1) goshawks and their prey populations are limited by the availability of their foods and habitats,
- 2) the availability of abundant, sustainable prey populations reduces the probability that food is limiting,
- 3) extreme fluctuations of goshawk populations caused by changes in the abundance of one or more prey will be dampened when a wider variety of prey species are available,
- 4) the foods and habitats of goshawk prey in southwestern forests are similar in adjacent regions, and
- 5) the forest attributes and age-classes of southwestern forests described herein can be sustained with scientific management.

These assumptions reveal areas where research is needed on goshawk and forest ecology.

The following are key concepts fundamental to the GSC recommendations:

- Forests within goshawk nesting home ranges should be an interspersed mosaic of structural stages – young to old forests – to increase the diversity of habitat for goshawks and their many prey species. Six vegetation structural stages (VSS) were used to describe regeneration, growth, and development of forests in the Southwest (Fig. 1). The proportions of the VSS and their interspersion in the forest is how the GSC described the forest mosaic.
- The extent to which southwestern forests were modified by Native Americans before European settlement is not well known. Since European settlement, management practices (such as timber harvesting, livestock grazing, and fire control) have changed the structure and species composition of forests. Today, much forested area consists of dense "thickets" of small-diameter trees (Fig. 2). Forests containing these thickets are prone to catastrophic, tree-killing fire, and insect and disease outbreaks. Because of inter-tree competition for moisture, nutrients, and light, these thickets will not mature into large trees. To accelerate the

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development of mature forests and large trees, tree cutting and prescribed fire should be used to thin forest stands, concentrating growth on the remaining trees.

- Large trees, snags, and large downed logs provide important habitats for many plants and animals, and provide organic matter to the soil resource. Every acre of a goshawk nesting home range should contain a few large trees in clumps that are never removed. These trees live out their lives, die (become snags), fall, and decompose.
- Forest regeneration, growth, and development varies among locations because site specific productivity differs greatly throughout the Southwest. Therefore, no single management prescription is likely to develop or sustain the desired forest conditions on all sites within a landscape. In fact, the desired forest conditions may not be attainable on sites with low productivity, and may be easily attained on sites with high productivity.

## Components of the Nesting Home Range

Three components of a goshawk's nesting home range (about 6,000 acres) were identified: nest area, post fledging-family area (PFA), and foraging area. The size of these home range components has been determined from behavioral and radio-telemetry studies of goshawks.

The nest area (approximately 30 acres), which may include more than one nest, is typically located on a northerly aspect in a drainage or canyon, and is often near a stream. Nest areas contain one or more stands of large, old trees with a dense canopy cover (Fig. 3). A goshawk pair occupies its nest area from early March until late September. The nest area is the center of all movements and behaviors associated with breeding from courtship through fledging. Most goshawks have two to four alternate nest areas within their home range; alternate nest areas may be used in different years, and some may be used for decades.

The post fledging-family area (PFA) (approximately 420 acres) surrounds the nest area. Because of its size, it typically includes a variety of forest types and conditions. The PFA appears to correspond to the territory (defended area) of a

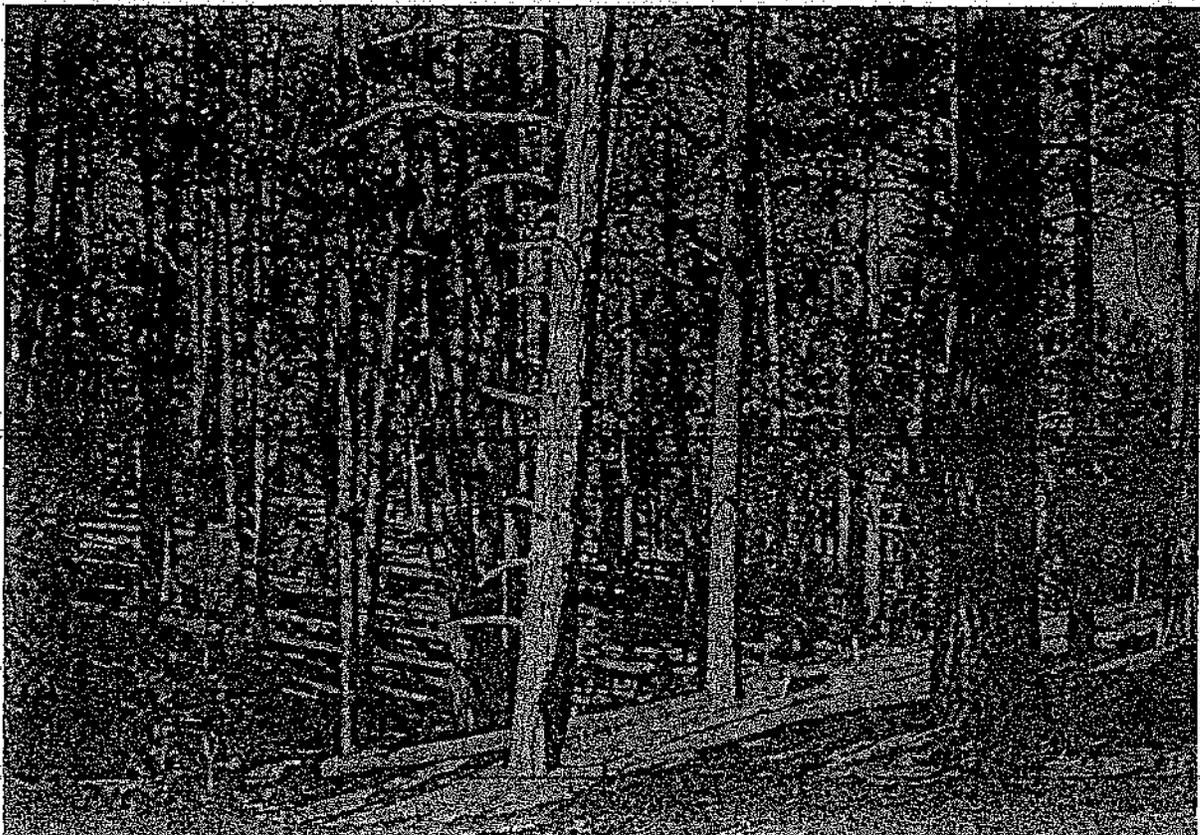


Figure 3. Nest areas contain one or more stands of large, old trees with a dense canopy.

PFA  
4/10

goshawk pair, and represents an area of concentrated use by the family from the time the young leave the nest until they are no longer dependent on the adults for food (up to two months). These areas are important for fledglings; they provide hiding cover and prey on which to develop hunting skills. PFAs have patches of dense trees, developed herbaceous and/or shrubby understories, and habitat attributes (snags, downed logs, small openings) that are critical for many goshawk prey (Fig. 4).

The foraging area is approximately 5,400 acres in size, and surrounds the PFA. Hunting goshawks evidently use available habitats opportunistically. This opportunism suggests that the choice of foraging habitat by goshawks may be as closely tied to prey availability as to habitat structure and composition. Goshawks hunt from tree perches by scanning lower portions of the forest (ground, lower canopy) for prey. Because of visual limitations in dense forest environments, an open understory enhances detection and capture of prey (Fig. 5). Raptor (hawks, falcons, owls) populations are often limited by availability and abundance of their prey. The recommendations presented here are based on information available on how foraging goshawks use

their habitat, and was supplemented with information on the habitats, foods, and cover of important goshawk prey.

### Goshawk Prey

A comparison of goshawk diets from disparate areas within North America showed that, while as many as 50 species are eaten, about 20 are common in the diets. Fourteen species were important in the diet of southwestern goshawks. Information on the distribution, habitat, special habitat needs, home range size, and populations of these 14 prey species were gleaned from the literature. A synthesis of this information provided a set of "desired forest conditions" that would result in sustainable populations of each prey. Because no single prey species is likely to be abundant enough to support goshawks, especially during the winter and extreme environmental fluctuations (periods of drought), habitats for and populations of all 14 prey are necessary.

14  
PFA  
desired  
forest  
conditions

Selected goshawk prey include squirrels, rabbits, woodpeckers, jays, and grouse. Specific habitat attributes used by these species include: snags,



Figure 4. PFAs have patches of dense trees, developed herbaceous and/or shrubby understories, and habitat attributes (snags, downed logs, small openings) that are critical for many goshawk prey.



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browsing and grazing have accentuated this loss. In addition to these changes, timber harvesting, which began in the 1800s, has focused on large trees, resulting in few remaining mature and old forests and associated habitat attributes.

## Management Recommendations

The present conditions in southwestern ponderosa pine and mixed-species forests reflect the extent of human interference with natural processes. Given the improbability of returning to the previous frequencies of natural disturbances, some active management (mainly thinning and prescribed fire) will be necessary to produce and maintain the desired conditions for sustaining goshawks and their prey. In some spruce-fir forests, natural processes are still functioning and little or no management may be necessary to maintain the desired conditions.

These recommendations were specifically designed to provide breeding season habitat for the goshawk and its prey. It is not known whether goshawks in the Southwest winter on their nesting home ranges; if they do winter there, then these recommendations will provide habitat and food year-round.

### Nest Areas (30 acres each)

Three suitable nest areas should be maintained per home range. In addition, three replacement nest areas per home range should be in a development phase, using intermediate treatment and prescribed fire. Suitable areas may be lost because of insect epidemics, catastrophic fire, or other factors. Nest areas are typified by one or more stands of mature or old trees and dense forest canopies. No adverse management activities should occur at any time in suitable nest areas. Desired forest conditions for the nest stands and management recommendations for maintaining and developing nest stands within nest areas are presented in Tables 1 and 2.

### Post Fledging Family Areas (PFA) (420 acres)

The PFA contains a variety of forest conditions and prey habitat attributes. Interspersed small openings, snags, downed logs, and woody debris are critical PFA attributes. To sustain the desired canopy cover, size of trees, and the specified portions of different forest ages within the PFA, regeneration of 10 percent of the PFA may be required every 20 years. Other management tools, such as prescribed fire and removing understory trees, are suggested for sustaining other critical elements of goshawk habitat

(Table 2).

Small openings in the forest are desired habitat for some prey species and are required for forest regeneration (Fig. 6). If forested openings are 1 acre or greater in Ponderosa pine and mixed species then 3 to 6 large mature and/or reserve old trees acre should be left in groups. If spruce-fir forest openings are 0.5 acres or greater, a group of 6 reserve trees are required per 0.5 acres. Reserve trees are not necessary in smaller openings; this component can be met in adjacent forested areas. Ponderosa pine and other seral conifers can be planted, and, depending on forest type, aspen and oak regeneration are encouraged. Snags, downed logs, and woody debris should be present throughout the PFA.

All management activities in the PFA should be limited to the period from October through February. Prescribed burning is the preferred method for management of woody debris. Thinning from below (removing understory trees) is preferred for maintaining desired forest structures, and a variable spacing of trees is preferred for developing group trees with interlocking crowns. Road densities should be minimized, and permanent skid trails should be used in lieu of permanent roads. Forage utilization should average 20 percent by weight and should not exceed 40 percent in any area to maintain grass and forb layer. Browse utilization should average 40 percent by weight (Table 2). These recommendations are designed to provide foods (leafy material, berries) and cover for goshawk prey.

### Foraging Area (5,400 acres)

Both the desired conditions and the management recommendations for the foraging area are similar to the PFA. The distribution and proportion of vegetative structural stages and the requirements for habitat attributes such as reserve trees, snags, and downed logs are the same as the PFA. Because the foraging area need not provide hiding cover for fledging goshawks, a more open canopy is preferred -- 40 percent in the mid-aged forests and 40 to 60 percent in the mature and old forests, depending on the forest type. Openings (up to 4 acres), for herbaceous and shrubby understory development and tree regeneration, are desired in ponderosa pine and mixed-species forests; smaller openings are desired in spruce-fir forests (Table 1). Specific management recommendations to obtain the desired conditions for the foraging area are identical to the PFA (Table 2).