

**Northern Goshawk (*Accipiter gentilis*):  
Species Assessment - Draft**



**Prepared for the  
Grand Mesa, Uncompahgre, and Gunnison National Forest  
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Cover photos are of juvenile goshawks at three different nest sites composed of mature lodgepole pine, pure aspen, and mixed conifer/aspen habitat types, respectively. Gunnison Ranger District, GMUG NF. Photos by M. Vasquez.

## INTRODUCTION

In 2005, the Grand Mesa, Uncompahgre and Gunnison National Forests (Forest) amended the Forest Plan for MIS; subsequently northern goshawk (hereafter referred to as goshawk) was determined to be suitable as an MIS and therefore selected. The northern goshawk is a focus of an assessment because it is a Management Indicator Species (MIS) on the Forest, in addition to multiple national forests in Region 2. The northern goshawk is also listed as a sensitive species by the USFS in Region 2. As a MIS, the northern goshawk serves as a barometer for species viability at the forest level. MIS have a dual functionality: 1) to estimate the effects of planning alternatives on fish and wildlife populations (36 CFR 219.19 (a) (1)) and 2) to monitor the effects of management activities on species via changes in population trends (36 CFR 219.19 (a) (6)) (Keith 2003). In the Amended Forest Plan, goshawks were selected as an MIS because they are good indicator to address the effects of management activities on mature to old aspen, spruce-fir and mixed conifer-aspen vegetation types.

Kennedy (2003) has written a Technical Conservation Assessment on the goshawk that was prepared for Region 2 (USDA Forest Service, Rocky Mountain Region) as part of the Rocky Mountain Region's Species Conservation Project. In addition, Jim Le Fevre (2004) has written a Species Assessment of the Northern Goshawk for the Forest that updated previous work completed in 2001 (USDA Forest Service 2001). This Assessment updates earlier Forest-level Assessments by incorporating findings from the Regional Assessment and it provides detailed information on the species management status and natural history, biology, distribution, abundance, habitat, and ecology on the Forest.

Peer reviewed scientific literature and summarized data are the primary information sources used in this report. Local data sources (District wildlife biologists and technicians) were used to provide information on distribution, localized abundance, and habitat condition for the Forest. This assessment provides recommendations for the current Forest Plan revision in terms of integrating goshawk habitat requirements into forest management planning. This report is a working document that will be updated periodically as new information becomes available from peer-reviewed scientific literature and through monitoring of this species on the Forest.

## SUMMARY OF KEY FINDINGS

Goshawk habitat use varies geographically, but they typically use a variety of boreal and montane forests habitats, which include coniferous, deciduous and mixed species forests (Johngard 1990, Reynolds et al. 1992, Squires, Reynolds 1997, USFWS 1988b). All montane forest types are used in the west (Reynolds et al. 1982). In Colorado goshawk nests have been observed in quaking aspen (*Populus tremuloides*), ponderosa pine (*Pinus ponderosa*), lodgepole pine (*Pinus contorta*) and aspen/mixed conifer stands (Shuster 1980, Le Fevre 2004). Kennedy (2003) provides a detailed description of goshawk habitat use in Region 2, although information regarding goshawk presence and habitat use on the Forest was not incorporated into Kennedy's Regional Assessment.

On the Forest, a total of 110 known or suspected goshawk nests have been found; over 90% of the nests are in aspen trees. On the Norwood and Ouray Ranger Districts, nest trees are often found in pure, mature aspen stands. In contrast, on the Gunnison, Grand Valley, and Paonia Ranger Districts, nests are found primarily in mature aspen dominated stands that contain a conifer component or mixed conifer dominated stands that contain an aspen component. Out of 72 nest trees used for data analysis, 17 of those occurred in pure aspen stands ranging in size from 32 – 1,059 acres. Twenty-three nest trees occurred in aspen dominated stands that contained a conifer component including Engelmann spruce, subalpine fir, and Douglas-fir. Eleven nest sites were dominated by conifers (spruce-fir, lodgepole pine, and ponderosa pine), but contained an aspen component. Overall, aspen was either the dominant habitat type or a component of nesting habitat at 71% of the 72 nest sites used for data analysis.

The role of aspen as an important component for territory and nest site selection has received less attention from researchers (Shuster 1976 and 1980, Younk and Bechard 1994, Squires and Ruggerio 1996, Graham et al. 1999, Schaffer et al. 1999). The majority of research examining the habitat used by goshawks in the western U.S. has been conducted in ponderosa pine, lodgepole pine, western larch, Douglas-fir, grand, white, red, and subalpine fir, and Engelmann spruce habitat types.

Goshawk surveys, using Region 3 protocol, are conducted annually and some monitoring of known goshawk nests takes place on each of the Districts. Surveys for goshawks are project driven (primarily timber and

prescribed fire). Across the Forest, an average of 15,000 acres has been surveyed each year over the past 10 years. These surveys have provided the majority of information on the activities and numbers of goshawks present on the Forest. There are an estimated 37 goshawk territories on the Forest, and over the last 20 years, there have been 254 goshawk observations. Fifty-six percent ( $n = 142$ ) of those goshawk detections fell within one mile of known goshawk nest sites and the majority of those observations were associated with active nests. There is a strong need to survey outside of analysis areas, into areas where biologists either suspect or have observed habitats that could provide adequate nesting sites. Obtaining this information would provide greater insight on goshawk distribution across the Forest.

Kennedy (2003) sums up threats influencing the viability of goshawks in Region 2. These include habitat alteration, direct human disturbance, pesticides and other contaminants, and harvest for falconry. The primary concern throughout the range of the goshawk is habitat alteration due to timber and fire management practices (Kennedy 2003). Goshawks require a mosaic of forest structural stage conditions within their home range as described by Reynolds et al. to meet their nesting, post-family fledging area, and foraging habitat requirements. Silvicultural treatments that cause forest fragmentation, create even-aged and monotypic stands, increase younger age classes, and decrease tree species diversity have been recognized as potential threats to goshawks (Kennedy 2003). Specific threats affecting goshawk occupancy on the Forest are primarily related to timber harvesting activities that alter the composition and structure of mature aspen and mixed conifer stands, or harvesting forest stands near or within goshawk nest areas.

## HABITAT CRITERIA USED IN FOREST-WIDE HABITAT EVALUATION

### 2001 MIS Habitat Criteria

In 2001, potential goshawk habitat was modeled for the Forest using existing vegetation data from the Forest Integrated Resource Inventory (IRI). At that time IRI data was available for 77% of the Forest. GAP vegetation data from the Colorado Division of Wildlife was utilized for the remaining 23% of the Forest. The criteria used to model habitat were vegetation cover type and habitat structural stage. Primary habitat was identified as mature aspen and mature mixed conifer/aspen forests in the 4B and 4C habitat structural stages. Mature mixed conifer/aspen forests were defined as 4B or 4C conifer forests with an aspen component in the species mix. In addition, overall suitable goshawk habitat was identified that included mature lodgepole pine, ponderosa pine, spruce-fir, aspen, blue spruce, Douglas-fir, pinyon-juniper, limber pine, and mixed conifer forest types. Goshawk nesting habitat, post-fledging family areas (PFA), and foraging habitat were also identified using the above habitat types. The above criteria used to model goshawk habitat in 2001 were based on recommendations from Reynolds et al. (1992)

#### Rationale

On the Forest, there appears to be a strong association between the goshawk and mature aspen habitat, whether aspen is a dominant species in a forest stand, or a remnant component in other coniferous forest sites (USDA Forest Service 2001). This association with mature aspen is tied primarily to nesting habitat. Research indicates that breeding habitat for this species is dependent on mature and old forest stands (USDA Forest Service 2001). Goshawk population trends are influenced by the availability of suitable nesting habitat in conjunction with prey abundance. For this reason, emphasis was placed on mature forest habitat that was either dominated by aspen, or contained an aspen component within coniferous forests.

### 2005 MIS Habitat Criteria

Following publication of the 2001 MIS Assessment, vegetation data (R2-Veg) now exists for all areas of the Forest. This database is continuously being updated. Similarly to the 2001 MIS habitat modeling criteria, goshawk habitat was identified based on recommendations by Reynolds et al. (1992) with appropriate modifications that take into consideration the habitat types present on the Forest (Table 1). The habitat modeling parameters presented in this document are specific to the Forest and address the sum of all factors affecting the goshawk's chance to survive and reproduce on the Forest, specifically in terms of primary habitat and secondary habitat. Patton (1992) describes primary habitat as all the combined habitat areas and environmental factors necessary to support a viable population of the species. Secondary habitat comprises the area in which an organism may spend part of its time, but does not meet all its life requirements (Harris 1984). Secondary habitat may function as a travel corridor or provide connectivity to more suitable habitat, or it may meet a specific

habitat need by a species such as food or cover. While a species may spend part of its time in secondary habitat, secondary habitat alone is not capable of meeting all of species life requirements. Thus, a species may utilize a combination of primary and secondary habitat depending on food availability and abundance, time of year, and inter-specific or intra-specific interactions.

**Table 1.** Habitat parameters for modeling northern goshawk habitat on the Forest.

Habitat Parameter <sup>1</sup>	Primary Habitat		Secondary Habitat	
	High Quality (Optimum 1.0)	Moderate Quality (Marginal 0.5)	Low Quality (Minimal 0.2)	
<b>Amount and Types of Habitat Required Within a 12,355 Acre Home Range Area</b>				
Nesting Habitat	>1,483 ac	>890-1,483 ac	≥297-890 ac	
Nesting Habitat Composition and Structure	4b, 4c, 5 Aspen, spruce-fir/aspen mixes, lodgepole pine, ponderosa pine, Douglas-fir, or mixed conifer species with an aspen component	4b, 4c, 5 Aspen, spruce-fir/aspen mixes, lodgepole pine, ponderosa pine, Douglas-fir, or mixed conifer species with an aspen component	4b, 4c, 5 Aspen, spruce-fir/aspen mixes, lodgepole pine, ponderosa pine, Douglas-fir, or mixed conifer species with an aspen component	
Nest Areas	6 contiguous blocks <sup>2</sup> containing 30 ac each w/in a 1km radius circle, or spaced ≤ 0.5 mi apart	At least 3 contiguous blocks containing 30 ac each w/in a 1km radius circle, or spaced ≤ 0.5 mi apart	At least 1 contiguous 30 ac block	
Nest Area Location	< ¼ mi from drainages and base ; mesic sites	W/in ¼ - ½ mi of drainages; mesic sites	> ½ mi from drainages; mesic sites	
Foraging Habitat	>5,931 ac w/in 1km of nest stands	>5,189-5,931 ac w/in 1km of nest stands	≥4,448 -5,189 ac w/in 1km of nest stands	
Foraging Habitat Composition and Structure	60% 4a, 4b, 4c, 5; 20% 3b, 3c; 10% 3a, 2t; 10% grass/forb/shrub (1m, 1t, 2s, 2t); all forest types	60% 4a, 4b, 4c, 5; 20% 3b, 3c; 10% 3a, 2t; 10% grass/forb/shrub (1m, 1t 2s, 2t); all forest types	60% 4a, 4b, 4c, 5; 20% 3b, 3c; 10% 3a, 2t; 10% grass/forb/shrub (1m, 1t, 2s, 2t); all forest types	
Foraging Habitat Canopy Cover	Minimum canopy cover of 50-60% in mixed species and 60% in spruce-fir for those portions of the foraging area in the mature (4b, 4c) and old structural stages. In the portion of the foraging area in the mid-age stages (3b, 3c), one-third of the area should have a canopy cover of 60%, and the remaining two-thirds should have a minimum canopy cover of 40%.			
Additional Foraging Habitat Requirements	The stand structure should consist of a mosaic of vegetation structural stages interspersed throughout the foraging area in small patches. The large tree component throughout the foraging area should include: snags, downed logs, and mature and old live trees in clumps or stringers with interlocking crowns.			
Size of Openings w/in Foraging Habitat	In mixed species forests, openings should be ≤4 ac in size, irregular in shape, and no greater than 200 ft in width. In spruce-fir forests, openings should be ≤1 ac in size, irregular in shape, and no greater than 125 ft in width.			
Post-Family Fledging Area (PFA)	≥420 ac, approximately centered around nest areas	≥420 ac, approximately centered around nest areas	≥420 ac, approximately centered on nest areas.	
PFA Stand Structure	60% 4a, 4b, 4c, 5; 20% 3b, 3c; 10% 3a, 2t; 10% grass/forb (1m, 1t)	60% 4a, 4b, 4c, 5; 20% 3b, 3c; 10% 3a, 2t; 10% grass/forb (1m, 1t)	60% 4a, 4b, 4c, 5; 20% 3b, 3c; 10% 3a, 2t; 10% grass/forb (1m, 1t)	
PFA Canopy Cover	Minimum canopy cover of 60% in mixed species and 70% in spruce-fir for those portions of the PFA in the mature (4b, 4c) and old structural stages. Minimum canopy cover of 60% for mixed species and spruce-fir forests for mid-aged (3b, 3c) portions of the PFA.			
Size of Openings w/in the PFA	In mixed species forests, openings should be ≤2 ac in size, irregular in shape, and no greater than 150 ft in width. In spruce-fir forests, openings should be ≤1 ac in size, irregular in shape, and no greater than 125 ft in width.			
Additional PFA Requirements	The large tree component throughout the PFA should include: snags, downed logs, and mature and old live trees in clumps or stringers with interlocking crowns.			

**Table 1.** Continued

<b>Nesting Habitat Attributes</b>			
Tree Canopy Height	≥20 m	16-19 m	>12-15 m
Tree Canopy Closure	≥79%	61-78%	≤60% <sup>3</sup>
Deciduous in Tree Canopy	10-90%	5-9% or 91-100%	1-4%
Distance to Human Disturbance <sup>4</sup>	>100 m	50-100 m	<50 m
<b>Foraging Habitat Attributes</b>			
Tree Canopy Height	≥16 m	12-15 m	>8-11 m
Tree Canopy Closure	20-100%	12-19%	8-11%
Deciduous in Tree Canopy	10-90%	2-9% or 91-100%	<2%

<sup>1</sup> Habitat parameters for northern goshawk were identified based on literature review and known goshawk nest site characteristics on the Forest. Primary literature sources include: Reynolds et al. 1992-Management recommendations for the Northern Goshawk in the southwestern United States, Kennedy 2003-Northern Goshawk (*Accipiter gentilis atricapillus*) a technical conservation assessment, Schaffer et al. 1999-Northern Goshawk reproductive habitat: habitat suitability index model version 3, and Le Fevre 2004-A species assessment of the Northern Goshawk (*Accipiter gentilis atricapillus*) on the Grand Mesa, Uncompahgre, and Gunnison National Forest.

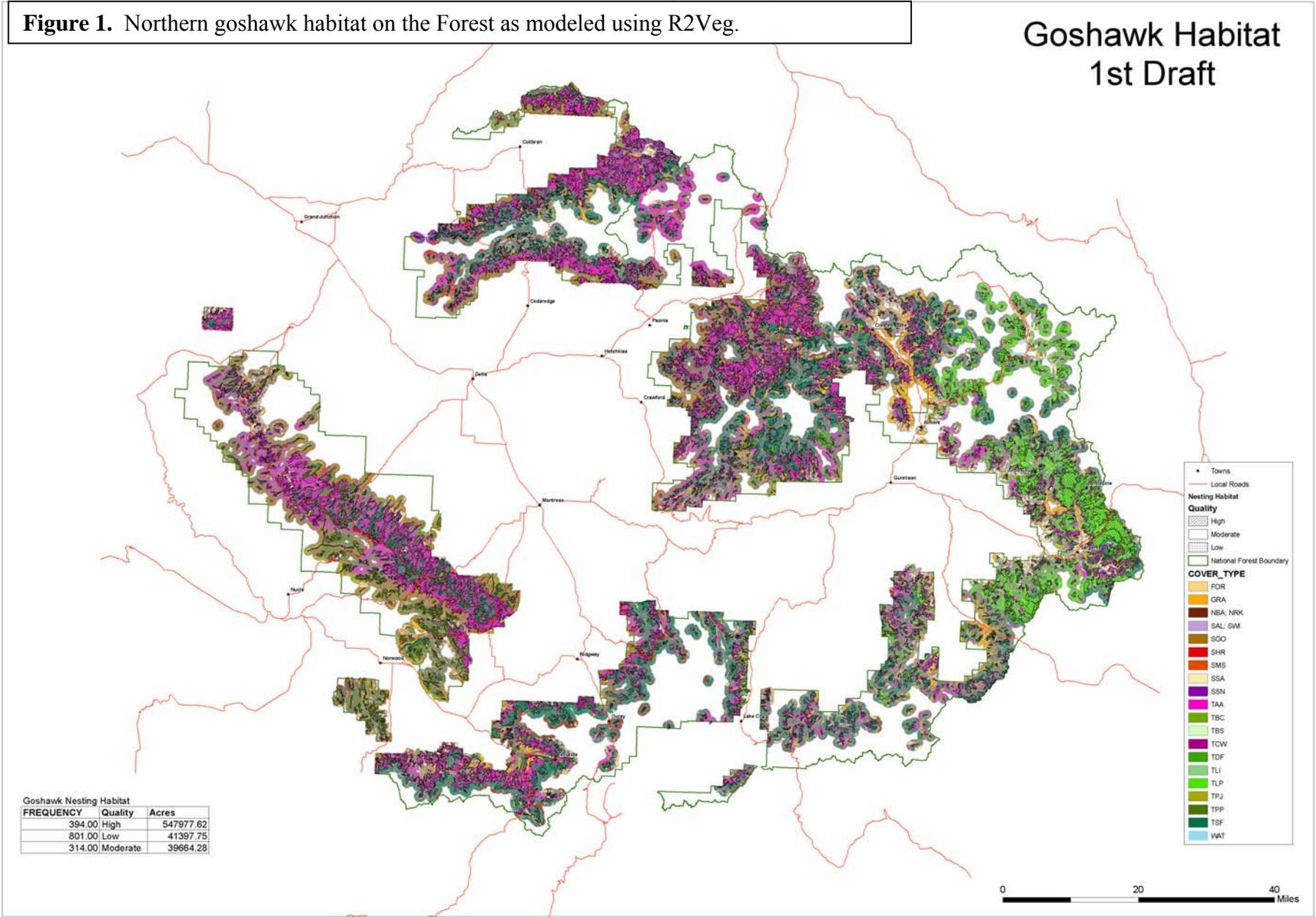
<sup>2</sup> Based on recommendations by Reynolds et al. (1992); 3 nest areas and 3 alternate nest areas should be maintained within a goshawk territory.

<sup>3</sup> Based on available research, goshawks typically do not utilize stands with less than 50% canopy closure for nesting (Reynolds et al. 1992, Kennedy 2003). Stands less than or equal to 30% canopy closure are considered to be too open for nesting habitat.

<sup>4</sup> The literature reports that to be considered fully suitable, nesting habitat must be farther than 50 m from human disturbances such as roads, camps, active well sites, or gas plants, but does not specify levels of disturbance such as frequency of road or trail use (Schaffer 1999). As a result, an additional 50 m was added to the minimum distance specified in the literature. This category is included to determine a zone of influence in terms of high integrity areas (areas not affected by management activities) and low integrity areas (areas affected by management activities) associated primarily with goshawk nesting habitat proximity to roads and trails. Effects of human disturbance to nesting goshawks will vary based on the type and amount of disturbances. It is important to note that standards and guidelines for goshawks in the 1991 Amended Land and Resource Management Plan for the Forest states that no activities shall be allowed within ¼ mile of an active goshawk nest from March 1 to July 31 if they would cause nesting failure or abandonment.

Primary and secondary habitat for goshawks was modeled for the Forest (Figure 1). Differences in primary and secondary habitat are due to habitat structural stages, acreage amounts, distance of nesting habitat from perennial and intermittent drainages and water sources, distance of foraging habitat from nesting habitat, and nesting habitat attributes such as canopy closure, and percent deciduous (aspen) in tree canopy. Habitat modeling using R2-Veg focused on vegetation cover type, tree species composition, and habitat structural stage.

Since aspen appears to be an important habitat component of goshawk nest sites on the Forest, mature (4B and 4C) coniferous dominated forests with an aspen component were identified, in addition to mature aspen dominated stands. Goshawks have been documented nesting in mature lodgepole pine, ponderosa pine, Douglas-fir, and mixed conifer forests on the Forest. Pure stands of these types have been identified, in addition to these types containing an aspen component. An important feature of aspen dominated nest sites appears to be the presence of conifers, typically spruce-fir, lodgepole pine, or Douglas-fir, within the stand. Possible hypotheses for the presence of conifers within aspen dominated nest sites include increased protection in terms



of cover within nest stands, or encroachment of conifers within aspen stands and a lack of aspen regeneration. . On some parts of the Forest, goshawks have nested in pure aspen stands. Mature aspen trees generally have large branches that provide suitable nest sites for goshawks. High quality nesting habitat occurs within ¼ mi of drainages; moderate quality occurs between ¼ - ½ mi from drainages and low quality occurs greater than ½ mi from drainages.

Foraging habitat encompasses approximately 5,400 acres and occurs within 0.6 mi (1km) of nesting habitat. Reynolds et al. (1992) recommends a mosaic of vegetative structural stages interspersed throughout the foraging area in small patches. Foraging habitat consists predominantly of mature (4A, 4B, and 4C) forests with lesser amounts of mid-age and young forest structural conditions and small openings. The canopy cover should be a minimum of 50% for mixed species forest and a minimum of 60% in spruce-fir for those portions of the foraging area in the 4B and 4C habitat structural stages. One-third of the foraging area in the mid-age structural stages (3B and 3C) should have a minimum canopy cover of 60%, and the remaining two-thirds should have a canopy cover of at least 40%. Where foraging habitat consists of mixed species forests, openings should be less than or equal to 4 acres in size, irregular in shape, and no greater than 200 ft in width. In spruce-fir forests, openings should be less than or equal to 1 acre in size, irregular in shape, and not greater than 125 ft in width. The PFA comprises an area of approximately 420 acres and is part of the foraging area. The PFA is typically centered on nest sites and contains similar forest characteristics as the overall foraging area. Refer to Table 2 for a complete description of foraging habitat and PFA habitat parameters and attributes.

### Rationale

The 2001 MIS habitat modeling criteria were restricted primarily to mature habitat structural stages. However, there is some debate about whether goshawks are indeed dependent upon old-growth forest habitats (Kennedy 1997, 1998). The USFWS status review (1998) suggested that goshawks are forest generalists capable of utilizing small patches of mature habitats to meet its nesting requirements within a mosaic of habitats of different age classes. Research by Reynolds et al. (1992) supports the 1998 status review by the USFWS. On the Forest, goshawk nest sites are often found in mature forest patches as small as two acres in size. These small mature forest stands are typically inclusions of mature forest within a matrix of younger forest conditions. In addition, post-fledging family areas (PFA) and foraging habitat often encompass a mosaic of habitat structural stages that surround, or are adjacent to, nest sites. For these reasons, the 2005 habitat modeling criteria include inclusions of grass, forb, shrubland, and sapling/pole habitat structural stages within mature forest types to analyze potential available habitat for all life requirements for goshawks. Emphasis is placed on mature aspen dominated habitats and mature coniferous forests that contain an aspen component. Habitat data at goshawk detection sites during the breeding season (March 1-September 30; Reynolds et al. 1992) and goshawk nest site data provides evidence that goshawks are strongly associated with aspen. Available information supports that goshawks select for aspen dominated nest sites or other forested cover types that contain an aspen component. In addition, mature aspen appears to be the preferred nest tree type. Aspen trees provide a branching structure capable of supporting large stick nests. Out of 110 known nest sites on the Forest, 90.9% occur in aspen trees (Le Fevre 2003).

## MANAGEMENT STATUS AND NATURAL HISTORY

### Management Status

- **USDA Forest Service:** All regions, including Region 2, have designated the goshawk as a sensitive species, one for which population viability is a concern, as evidenced by a current or predicted downward trend in population numbers or habitat (Forest Service Manual 2670.5).
- Ten National Forests list the goshawk as a Management Indicator Species.
- **USDI Bureau of Land Management:** Six State Offices, including the Colorado State Office, lists the goshawk as a Sensitive Species.
- **USDI Fish and Wildlife Service:** The goshawk is listed as a Species of Concern in all regions of the USFWS, but is not listed under the Endangered Species Act.
- **Natural Heritage Program Ranking:** The goshawk has a global status of G5; it is demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery. The goshawk also has a

status of SZN; a migrant whose occurrences are too irregular, transitory, or dispersed to be reliably identified, mapped, and protected. The ranking for the state of Colorado is S3B; rare, 21-100 occurrences during the breeding season.

- The Partners in Flight Prioritization Score for the goshawk is 17 (possible score of 7-35); the Area of Importance and Population Trend Score (AI + PT) is 6 (scores of 8 and above are considered significant).

Kennedy (2003) provides a more complete picture of goshawk management status within Region 2 at Federal and state levels.

**Existing Regulatory Mechanisms, Management Plans, and Conservation Strategies**

- USFS Southwest Region – Management Recommendations for the Northern Goshawk in the Southwestern United States (Reynolds et al. 1992). Guidelines for managing goshawks in ponderosa pine, mixed conifer, and spruce-fir habitats were incorporated into Forest Plans in Region 3.
- Goshawk management on USFS lands is covered under The National Forest Management Act (NFMA)
- Grand Mesa, Uncompahgre, and Gunnison National Forests Amended Land and Resource Management Plan, 1991.
- U.S. Fish and Wildlife Service: The goshawk is protected under the Migratory Bird Treaty Act.

The Forest 1991 Amended Land and Resource Management Plan provide standards and guidelines for managing habitat for goshawks (Table 2).

**Table 2.** 1991 Land and Resource Management Plan standards and guidelines for the northern goshawk.

Management Activities	General Direction	Standards and Guidelines
Aquatic and Terrestrial Habitat Management	Manage for habitat needs of indicator Species.	<p>e. Goshawk (mature aspen): Provide 20% of pole or mature tree stands adjacent to nesting sites with at least 150 ft<sup>2</sup> of basal area. Provide at least one class 1 log adjacent to nesting sites.</p> <p>k. Deer, Elk, Black Bear, and Goshawk: In areas of historic shortage of dry season water, where there is less than one source per section, create one source per section.</p>
	Maintain habitat for viable population of all existing vertebrate wildlife species.	<p>a. Maintain habitat capability at a level at least 40% of potential capability<sup>1</sup>.</p> <p>b. No activities shall be allowed within ¼ mile of an active ferruginous hawk, Swainson’s hawk, goshawk, osprey, or prairie falcon nest from March 1 to July 31 if they would cause nesting failure or abandonment.</p>

<sup>1</sup> This standard and guideline varies with specific Management Area direction.

## Biology and Ecology

### Systematics

- Common Name: Northern Goshawk
- Scientific Name: *Accipiter gentilis* (Linnaeus 1758)

### Taxonomy

- Order: Falconiformes
- Suborder: Accipitres
- Superfamily: Accipitroidea
- Family: Accipitridae
- Subfamily: Accipitrinae (American Ornithologists' Union (AOU) 1998)
- Genus: *Accipiter*
- Species: *gentilis*
- Subspecies: 8-12 recognized worldwide, depending on the source. The American Ornithologists' Union (1983) recognizes two species in North America, which are *Accipiter gentilis atricapillus* and *Accipiter gentilis laingi*.

### General Species Description

Several authorities (Phillips et al. 1964, Wattel 1973, Hubbard 1992, and Whaley and White 1994) recognize a third subspecies, *A. g. apache*. However, this subspecies is not recognized by the American Ornithologists Union. This report discusses *A. g. atricapillus*, which is the subspecies present on the Forest.

The goshawk is the largest and heaviest bodied of the three North America accipiters (Kennedy 2003). In adult plumage (Squires and Reynolds 1997), dorsal markings are brown-gray to slate gray, sometimes bluish. Adult females may appear more brownish above. The head has a distinctive white superciliary line separating a black cap from the whitish sides of the crown (Kennedy 2003). The iris is dark red to mahogany (Palmer 1988, Johnsgard 1990). Under parts are uniformly whitish to pale gray with fine horizontal vermiculations and vertical stripes. The tail is dark gray on top, lighter underneath, with fluffy under tail coverts and three to five broad, black bands. It has a rounded shape that is marked at the tip with a thin white terminal band (USFWS 1998). Female goshawks are up to one-third bigger than the males, with wingspans averaging 105-155 cm (46 inches) and 98-104 cm (42 inches), respectively.

Juvenile goshawks have dark brown to brownish black backs that are streaked with white and cinnamon. The belly is off-white with brown streaking on the throat. The head is brown and the white superciliary stripe, which is so prominent in adults, is just a narrow white streak in immature birds. The iris is pale yellow and turns bright yellow during the first year, then becomes orange during the second year before turning red as adults (Kennedy 2003). The tail is dark brown with wavy dark bands that are bordered in white (Johnsgard 1990).

### Distribution and Abundance

The northern goshawk is a forest dwelling raptor, occurring in low densities throughout its Holarctic distribution. The northern goshawk's (*A. g. atricapillus*) range extends from the boreal forests in Alaska and Canada to Newfoundland, south to the montane forests of the west, and into the mountains of western and northwestern Mexico (Squires and Reynolds 1997). *A. g. atricapillus* is known to winter throughout its breeding range and as far south as southern California, northern Mexico, Texas, and the northern portions of the Gulf states, rarely including Florida (Johnsgard 1990, Squires and Reynolds 1997).

There is thought to be little change in the distribution of this species across its range in North America (Squires and Reynolds 1997), although there are few data regarding historical changes. Bent (1937) suggests that the extinction of the passenger pigeon may have reduced this species presence in eastern North America. Extensive logging in eastern forests that extended into the Midwest in the 1800s may also have reduced population levels. The return of mature forests to these areas appears to coincide with a return of goshawks (Johnsgard 1990, Squires and Reynolds 1997), however, evidence that eastern goshawk populations may be expanding or reoccupying their former range should be interpreted cautiously; such reports could merely reflect increased search effort (Kennedy 1997).

Migration data analyzed by Hoffman and Smith (2003) from six sites in the Intermountain and Rocky Mountain flyways found substantial decreases in the productivity of populations in portions of northern Utah, eastern Idaho, and western Montana during the 1980s that has not yet recovered. Reasons for the observed decline were not provided.

In Colorado, goshawks are found in the forested mountains across the state (Kingery 1998). Kingery (1998) reports them well distributed in the San Juan Mountains, across the Uncompahgre Plateau, and the northern mountains. According to Kingery, there appears to be a large gap in goshawk presence in the central and south-central portions of Colorado that Kingery describes as holes in the distribution of this species. However, goshawks are known to occur and appear well distributed on the Forest based on the distribution of known nest sites and goshawk sightings, although knowledge of the distribution and abundance of this species across the Forest is limited.

Activity Pattern and Movements

Kennedy (2003) provides details on circadian, seasonal and circannual, migrations, irruptions and dispersal patterns:

- Circadian patterns – Thought not to move much during the night although radio-tagged birds have not been followed into the night
- Seasonal and Circannual patterns – Annual cycle similar to other raptors with breeding season beginning in mid-February through April and ending when the young are independent in early August or September.
- Migration/Irruptions – Limited information on this behavior, thought to be a partial migrant, moving less than 500 kilometers (310 miles). Irruptions may be due to declines in prey populations, primarily those of snowshoe hare and ruffed grouse where available.
- Dispersal – Divided into Natal dispersal, which is the movement to and establishment of new territories by young from their natal areas; and Breeding dispersal, which is the movement of adults from one breeding site to another, which includes movements between alternate nest sites.

The goshawk’s life cycle includes breeding and non-breeding home ranges, which may or may not be separated by migration (Table 3). Residency patterns for goshawks are not well understood (Sonsthagen 2002). Overall, goshawks are considered a partial migrant (Squires and Reynolds 1997) moving short distances between breeding and non-breeding home ranges. In Utah, Sonsthagen (2002) found that migration distances were less than 310 miles (500 m) for 32 of 34 satellite tracked female goshawks. Irruption migrations occur in goshawk populations in the northern areas of their range. Rapid declines in prey base are believed to be the causative factor driving irruptive migrations (Mueller and Berger 1968 in USFWS 1998a, Doyle and Smith 1994). Migration counts in some areas have suggested that irruptions occur in 10 year cycles with declines in prey population on breeding grounds while in other areas counts indicate irruptions every 4 years (Mueller and Berger 1968, Mueller et al. 1977, Nagy 1975). Fall migration usually occurs between mid-September and mid-December depending on geographic location (Heintzelman 1976, Bosakowski 1999). The majority of goshawks return to their breeding grounds during March (Reynolds and Wight 1978, Widen 1984).

**Table 3.** Life history stages of northern goshawks.

Life History Stage	Fall			Winter			Spring			Summer		
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Courtship and nest building						X	X	X				
Egg Laying									X			
Incubation									X	X		
Nest Rearing										X	X	
Fledgling Period											X	X
Post-fledgling Dependence	X											X
Dispersal	X	X	X	X	X							

There is no information on the migratory movements of goshawks on the Forest. Goshawks likely move relatively short distances, down in elevation to occupy pinyon-juniper, mountain shrub habitats, and valley bottoms. Some individuals may stay on their home ranges year round if food supplies are adequate. There is also no information on when adults

return to their territories and begin breeding activities, but it is likely they return sometime in March or later depending upon snow conditions.

### Breeding Biology

Reynolds et al. (1992) describes the three components of a goshawks nesting home range:

- Nest Area – Approximately 30 acres and may include multiple nest trees. The nest area contains stands of older trees, high canopy cover, and often times are near some type of water. The nest area is the center of breeding activity and is occupied from March to September.
- Post-Fledging Family Area (PFA) – Approximately 420 acres surrounding the nest area, the PFA is the area defended by a goshawk pair. It is an area of concentrated use by the family from the time the young leave the nest until they learn to hunt for themselves and are no longer dependent upon the adults for food. It is an important component for fledglings as it provides suitable habitat for goshawk prey, upon which the fledglings can develop their hunting skills.
- Foraging Area – This component encompasses approximately 5,400 acres and surrounds the PFA. Goshawks are opportunistic, sit and wait hunters. Their selection of habitats to forage in is dictated by the composition and structure of the habitat. Prey abundance is important to goshawks at the landscape scale, but when selecting foraging habitat within the nesting territory, habitat characteristics that lead to higher prey availability in terms of accessibility becomes more important than prey abundance.

Goshawks likely return to their territories during March and early April. On the Forest, goshawks have been observed at nest sites in mid and late April. New nests are constructed or old nests are repaired usually by the female (Schnell 1958). There is little data available on the longevity of pair bonds. Goshawks are generally monogamous, forming life-long pairs. They will seek out a new mate upon death of a mate (Johnsgard 1990, Squires and Reynolds 1997). Studies in Arizona (R. T. Reynolds and S. M. Joy unpublished data in Squires and Reynolds 1997) found mate retention over a six year period equaled 91.3% (this is based upon the recapture of both pair members in 21 of 23 instances). In only one case did they find a male and female, who had nested together previously, divorced and with new mates. In California, (Detrich and Woodbridge 1994) found that 72% of the time both mates were retained. They also found a higher incidence of divorce with 2 males and 2 females breeding in three different combinations over a five-year period.

Goshawk pairs do not breed every year (Speiser and Bosakowski 1984, Bloom et al. 1986, DeStefano et al. 1994, Doyle and Smith 1994). Males and females can breed at one year of age but success rates are low (Nielsen et al. 2003). Goshawks show high nest site fidelity (Detrich and Woodbridge 1994). On the Gunnison Ranger District, a single nest in a lodgepole pine within a mature lodgepole pine dominated stand was used consecutively for 5 years.

On breeding ranges female goshawks select the nest site, which is typically in a forest stand with a high density of large trees, fairly high canopy cover (>60%), on a moderate slope, bench or in a drainage protected by slopes, and relatively close to a water source. In some areas throughout the western U.S. goshawk nest sites are commonly on north-facing slopes. On the Forest, nest sites have been found on all aspects, with a slightly higher number of nest sites on north facing slopes. Characteristics of the nest stand include: large diameter trees, well spaced, with an open understory, a small opening near the nest tree, and water generally well within 0.25 mi in the form of permanent and ephemeral small ponds, perennial or intermittent streams, and small creeks.

Aspen trees are the preferred nesting sites for goshawks on the Forest. These nests are built in tall, straight, large diameter, old aspen trees that contain forked tops generally located in stands of mature Engelmann spruce and subalpine fir or lodgepole pine. Some aspen nest sites are present in stands of pure aspen. Other tree species selected for nest sites, but to a much less degree, include ponderosa pine, lodgepole pine, and Douglas-fir.

In the western U.S. goshawk pairs may have as many as 9 nests in an established nest area. Alternate nests are usually within a few hundreds yards of one another. Occasionally alternate nests are as far apart as 1.3 miles (Woodbridge and Detrich 1994). Data on the Forest indicate alternate nests range from 60 ft to 1mi apart.

At the beginning of the breeding season, the female goshawk attracts the male by calling (Jones 1979, Reynolds et al. 1982, Saunders 1982, Speiser and Bosakowski 1987, Reynolds et al. 1992). Pairs build the nest with the female doing most of the construction (Lee 1981). The female becomes sedentary after copulation. The male delivers food to the

female during this period. Eggs are laid two to three days apart. Egg laying is usually complete by mid-May. Clutch size averaged 3.2 and 2.7 eggs in Oregon and Ontario, respectively (Reynolds and Wight 1978, Peck and James in Johnsgard 1990). The incubation period is estimated at 30-44 days. Hatching is asynchronous and can occur from late May through June (Reynolds and Wight 1978, Lee 1981). Post-hatching, pairs defend a territory around the nest site, which Reynolds et al. (1999) suggests may range from 300-600 acres in size and correspond to the size of the post-fledging family area (PFA). The female does most of the incubating and brooding as well as the actual feeding of the young. The male does most of the hunting until the late nestling period (Squires and Reynolds 1997, Dewey and Kennedy 2001). Fledging dates vary but generally take place between 34 and 42 days (Reynolds and Wight 1978, Johnsgard 1990). Males develop faster than females and fledge sooner (Reynolds and Wight 1978, Kenward et al. 1993, Boal 1994). The parents continue to feed the young for up to six weeks or more following fledging (Marshall 1992).

Nesting activities have been followed on three different nesting territories over seven years on the Paonia Ranger District to determine egg laying, hatching, and fledging dates (A. Wang and J. Le Fevre unpublished data). All three territories are located in similar habitats consisting of mature spruce-fir stands with old aspen. To determine the timing of egg-laying and hatching, a timeline was developed based upon the ages of nestlings using Boal (1994). An average incubation period of 34 days was used. The timeline shows egg laying occurring between May 21<sup>st</sup> and 28<sup>th</sup> with hatching occurring between June 17<sup>th</sup> and 24<sup>th</sup>.

Fledging has been observed to occur between July 22<sup>nd</sup> and August 1<sup>st</sup>. Fledging dates were obtained from field visits to nests at the time fledging was suspected to occur. If the birds were already out of the nest, an estimate of the fledging date was made based upon the location, agility, flight ability of the young, and time of previous visit.

Data available on the average number of young fledged per year (averaging 1.4 young per nest) on the Forest is incomplete. The Norwood/Ouray and Paonia Ranger Districts average 2 young per active nest. Gunnison District records show lower nesting success rates, but a greater number of active nests. The data also show wide variations in the number of active nests in territories on the Forest versus the number of known territories (Table 4).

**Table 4.** Active goshawk nests and territories, by year and District 1992-2004

Year	Gunnison	Grand Valley	Norwood/ Ouray	Paonia	TOTAL
1992	1	0	5	2	8
1993	2	0	1	1	4
1994	0	0	2	2	4
1995	2	0	0	2	4
1996	4	0	0	1	5
1997	0	0	3	3	6
1998	4	0	1	3	8
1999	2	0	--	0	2
2000	7	0	--	1	8
2001	2	0	--	0	2
2002	2	0	0	2	4
2003	3	0	0	0	3
2004	6	0	1	--	7
Average Number of Active Nests/Territories per year	2.7	0	1.3	1.4	5
Known Number of Territories	15	0	17	5	37

### Demography

Goshawks of both sexes generally begin breeding between 2 and 4 years of age. Clutch size ranges from 3.2 eggs in Alaska (McGowan 1975) to 3.75 eggs in Utah (Reynolds and Wight 1978). Nest success (nests with at least 1 fledged young) varies considerably, ranging from 8-94% (Squires and Reynolds 1997). In Arizona, Reynolds et al. (1994)

found 85 % of nests successfully fledged young, 6% percent of clutches were lost during incubation, and 6% failed during the nestling period. Only one brood is reared each season.

The following data on fledge success comes from the Paonia Ranger District and the Gunnison Ranger District, respectively. This data was gathered through monitoring of known nest sites until fledging was confirmed (Tables 5 and 6).

**Table 5.** Nest productivity, Paonia Ranger District

Year	Number of Fledges	Number of Active Nests	Nest Productivity
1992	Unknown	2	Unknown
1993	1	1	1
1995	3	1	3
1996	2	1	2
1997	5	3	1.7
1998	4	2	2
2000	3	1	3
2002	2	2	1
7-year average	2.8	1.9	<b>1.8</b>

**Table 6.** Nest productivity, Gunnison Ranger District

Year	Number of Fledges	Number of Active Nests	Nest Productivity
1998	8	4	2
1999	3	2	1.5
2000	10	7	1.4
2001	0	2	0
2002	4	2	2
2003	6	4	1.5
2004	8	6	1.3
7-year average	5.6	3.9	<b>1.4</b>

Nest productivity on the Paonia Ranger District equals 1.8 fledges per active nest. On the Gunnison Ranger District, nest productivity is 1.4 fledges per active nest. Productivity may be affected by several factors. Kennedy (2003) reports that some nest areas consistently produce more fledglings than others, by a few females (breeding in high quality nest areas) producing the majority of fledglings in the population. Factors that influence productivity include the age of the female when breeding and weather conditions, primarily during May. In Germany, Squires and Reynolds (1997) report the number of goshawk pairs laying eggs was negatively correlated with rainfall amounts during March and April. Fledge success was positively correlated with temperature in April and May and negatively correlated with rainfall amounts in May. Cold, wet springs caused chicks to develop slowly. Weather conditions during the spring likely have a strong influence on nesting success. On the Gunnison Ranger District During the first week of June, 2001, two goshawk nests were confirmed active with females incubating the eggs. On June 15, a snowstorm occurred, accumulating several inches of snow. Following the snowstorm, goshawks were no longer observed at the nest sites and nest failure was documented. During years with warm, dry spring conditions, a greater number of active goshawk nests are typically observed on the Forest. There is little data on the percent of goshawk pairs that breed annually (USFWS 1998). The proportion of pairs breeding each year on the Forest is likewise unknown.

The lifespan of goshawks in the wild is at least 11 years. One captive bird reportedly lived to be 19 years old (USFWS 1998). Survivorship of male goshawks < 1 year old was 68.8 % in Arizona and for females it was 86.6 % (Squires and Reynolds 1997).

### Food Habits

Goshawks are prey generalists, preying on a wide variety of birds and mammals depending on region, season and availability. More than 53 avian species and 30 mammal species have been identified in diets of North American goshawks (Squires and Reynolds 1997, USFWS 1998b). In many areas of western and boreal North America, mammals are dominant or are a major component of goshawk diets (Bosakowski 1999). Goshawks generally hunt opportunistically using a “sit and wait” method, moving its perch site in the forest every few minutes (Kenward 1982). Goshawks occasionally hunt forest edges and across openings (Squires and Reynolds 1997). The availability and abundance of prey are potential limiting factors for goshawks, affecting adult survivorship and reproduction (Reynolds et al. 1992, Kennedy 2003). Abundance of prey though, does not necessarily correspond to availability of prey. A regenerating aspen stand might contain abundant snowshoe hare habitat but the density of the trees limits the ability of the goshawk to fly and hunt the area (Kennedy 2003).

Reynolds et al. (1992) lists 14 species that goshawks prey upon in the southwest U.S. These include chipmunk, cottontail, golden mantled ground squirrel, red squirrel, tassel-eared squirrel, American robin, band-tailed pigeon, blue grouse, hairy woodpecker, mourning dove, northern flicker, red-naped sapsucker, Stellar’s jay and Williamson’s sapsucker. Reynolds also provides a review of the habitat needs of these species and incorporates management recommendations for these 14 key prey species.

Boal and Mannan (1994) observed a delivery rate of one prey item every 4 hours during the nesting season. Mammals accounted for 76% and birds comprised 24% of the prey delivered to the nest. Other observers found less mammalian

prey in goshawk diets for goshawks inhabiting southern regions versus those in more northern regions (Squires and Reynolds 1997).

Schnell (1958) observed a male goshawk capturing 85% of the prey that was brought to the nest and fed to the young. Prey items included numerous Stellar's jays and robin nestlings of all ages. The female often cached food when the nestlings were too young to consume large amounts of prey. Many of the cached items were retrieved later the same day but some were left for several days (Schnell 1958).

In Colorado, there is limited information about prey selection and preferences but it is likely similar to those in other areas of the west. Shuster (1980) found Richardson's ground squirrels and thirteen lined ground squirrels to be the preferred food item. Prey remains found around the base of nest trees or at plucking posts on the Paonia Ranger District and the Gunnison Ranger District include snowshoe hare, red squirrel, chipmunk, blue grouse, northern flicker, Stellar's jay, gray jay, various woodpeckers, boreal owl, and dark-eyed junco. At goshawk nest sites on the Gunnison Ranger District, Stellar's jay and gray jay feathers are commonly found at the base of nest trees or by coarse woody debris within the nest stand that was used as plucking posts.

## **Species-Habitat Relationships**

### General Habitat Use

Goshawk habitat use varies geographically, but they typically use a variety of boreal and montane forests habitats, which include coniferous, deciduous and mixed species forests (Johngard 1990, Reynolds et al. 1992, Squires, Reynolds 1997, USFWS 1988b). All montane forest types are used in the west (Reynolds et al. 1982). In Colorado goshawk nests have been observed in quaking aspen (*Populus tremuloides*), ponderosa pine (*Pinus ponderosa*), lodgepole pine (*Pinus contorta*) and aspen/mixed conifer stands (Shuster 1980, Le Fevre 2004). Kennedy (2003) provides a detailed description of goshawk habitat use in Region 2, although information regarding goshawk presence and habitat use on the Forest was not incorporated into Kennedy's Regional Assessment.

Le Fevre (2004) states that data provided by Region 2 for Kennedy's assessment analyzed only the combined amount of mature ponderosa pine and Douglas-fir present on the Forest. However, these two forest types only represent approximately 7% of the Forest and comprise less than 4% of the nest tree types selected by goshawks. Ninety-one percent of nest tree types selected by goshawks on the Forest were aspen, and 6% were lodgepole pine. Observations of goshawks occurred in aspen 39% (n = 96) of the time; observations in lodgepole pine occurred 28% (n = 70) of the time; observations in spruce-fir occurred 18% (n = 45) of the time, and combined observations in both ponderosa pine and Douglas-fir were less than 3% (n = 8) of the time. Ten percent of goshawk observations were in grassland or shrubland habitat types (n = 25).

Kingery (1998) reports a significant shift in observed habitat types used by goshawks in Colorado from north to south. Goshawk observations in the northern three-fourths of Colorado were in aspen 32% of the time. In the southwest and south-central part of the state, primarily the San Juan and Sangre de Cristo mountains, goshawks were observed in aspen only 11% of the time.

### Home Range

In North America breeding home ranges have been estimated at 1,235 – 9,885 acres, depending on sex, habitat and methodology of data collection (Austin 1993, Hargis et al. 1994, Kennedy et al. 1994, Iverson et al. 1996, Boal et al. in review). Limited information is available for winter home range estimates. Typically they are larger than breeding ranges (Kennedy 2003), although winter ranges can be highly variable depending on sex and geographic location. In Arizona, Drennan and Beier (2003) reported that most females (n = 6) continued to use their breeding-season home ranges in ponderosa pine forests during winter, while males (n = 7) moved to lower elevation pinyon-pine forest outside the breeding-season home range. Conversely, two female goshawks that nested in south-central Wyoming initiated fall migrations to a mountainous area in Colorado approximately 185 km and 140 km from their nest sites, respectively; two males migrated 65 and 70 km from their nest sites, respectively (Squires and Ruggiero 1995). Stephens (2001) also found that winter range size was highly variable. Based on 12 goshawks studied in Utah, winter range size ranged from 2,471 – 19,644.8 acres (1,000-7,950 ha).

Reynolds (1983) and Kennedy (1989) estimated that goshawk nesting home ranges ranged from 5,000 – 6,000 acres. Reynolds et al. (1992) describes the goshawk's nesting home range in terms of three components: the nest area, post

fledging-family area (PFA) and the foraging area. Based on studies of goshawk activity during the breeding season, the nesting area consists of approximately 30 acres, the PFA comprises 420 acres centered on nest sites, and the foraging area encompasses 5,400 acres. Descriptions of these nesting home range components are provided in the Breeding Biology section of this document and are discussed by Kennedy (2003) in greater detail.

### Nesting Habitat

Suitable nesting habitat is a limiting factor in the spacing of goshawks (Reynolds et al. 1992). Nest site selection occurs in mature to old growth forests that contain a narrow range of vegetation structural conditions (Shuster 1980, Hayward and Escano 1989, Reynolds et al. 1992, Squires and Reynolds 1997, Schaffer et al. 1999). This narrow range of vegetative structural conditions includes open understories and a relatively closed canopy (60-90%) with large trees of moderate density (Speiser and Bosakowski 1987, Kennedy 1988, Reynolds et al. 1992, Daw et al. 1998, Bosakowski 1999). Reich et al. (In press) concluded that important forest predictors for nest locations included canopy closure, total basal area, proportion of basal area in ponderosa pine, spruce, fir, and aspen, maximum height of the understory vegetation, and presence/absence of seedlings and saplings.

Reynolds et al. (1992) found that in Arizona, most nest stands are on slopes with a NW-NE exposure or occur within drainages or canyon bottoms. On the Forest, nest stands have been found on all aspects; thus aspect should not be used as a predictor of nest site occurrence on the Forest. An important topographic feature of nest sites on the Forest appears to be slopes associated with intermittent drainages. Nest trees may also occur on a bench, lower portion of moderate slopes, or drainage bottoms and they are often adjacent to a canopy break (Shuster 1980, Reynolds et al. 1982, Hayward and Escano 1989, Squires and Reynolds 1997).

Nests may be in snags or live trees and are constructed just below the canopy in the upper one third of the tree (Shuster 1980, Reynolds et al. 1982, Dick and Plumpton 1998). The nest tree is usually the largest or one of the largest trees in the nest stand. The size of the nest stand may also be important in the quality of the nest site (Woodbridge and Detrich 1994). Though not typical for many areas, snag nesting is common in the Ashley National Forest in Utah (Dewey and Kennedy unpublished data). Goshawks on the Forest rarely nest in snags although snag nesting has occurred. In 2004, on the Gunnison Ranger District, a pair of goshawks nested in a lodgepole pine snag with almost no overhead canopy and successfully fledged 3 young.

The majority of studies on goshawk nesting habits have been conducted in ponderosa pine and other conifer types (Schnell 1958, Hayward and Escano 1989, Reynolds et al. 1992, DeStefano et al. 1994, Bright-Smith and Mannan 1994, Kennedy et al. 1994, Mahon and Doyle 2003). Fewer studies have been conducted in aspen or aspen/mixed conifer habitat (Shuster 1976 and 1980, Younk and Bechard 1994, Squires and Ruggerio 1996, Graham et al. 1999, Schaffer et al. 1999).

Bosakowski (1999) summarized nesting habitat characteristics for goshawks in North America. Average nest tree dbh ranged from 12.4 – 35.8 inches (n= 171), nest tree stand average dbh ranged from 8.6 – 22.8 inches (n=156) and average basal area ranged from 124.2 – 392.2 ft<sup>2</sup> per acre (n=128) for multiple habitat types across five to seven western states. High canopy closure and tree basal area were the most uniform characteristics in nest areas between study sites in northern Idaho and western Montana (Hayward and Escano 1989). Shuster (1980) compiled habitat characteristics for 20 nest sites in Northern Colorado. Basal area in aspen ranged from 99-152 ft<sup>2</sup> per acre. Nests were seldom farther than 902 feet (275 m) from water (typically quite streams), occurred on gentle north and east facing slopes or benches, and elevation was seldom lower than 7,546 feet. Nest tree dbh was 9.8 inches or greater in aspen (n = 10). There was little to no understory vegetation at nest stands.

On the Forest, 110 active, alternate or suspected goshawks nests have been found in mature (4B, 4C habitat structural stages) aspen, aspen/mixed conifer, ponderosa pine, Douglas-fir and lodgepole pine stands. Based on data for 110 nest sites, nest site preference is for larger aspen trees. Table 7 summarizes the nest site characteristics for nest tree species across the forest (Le Fevre 2004).

**Table 7.** Goshawk nest site characteristics on the Forest.

Goshawk Nest Tree	Average DBH (inches)	Average Tree Height (feet)	Average Nest Height (feet)	Average Elevation (feet)	Average Canopy Closure	Average Slope
<b>Aspen</b>	<b>14.7</b> range: 9"-28" n=73	<b>70</b> range: 44-97 n=74	<b>49</b> range: 26-68 n=75	<b>9,352</b> range: 8,480-10,642 n=100	<b>64%</b> range: 15%-100% n=78	<b>10%</b> range: 1%-45% n=70
<b>Ponderosa Pine</b>	<b>16.5</b> range: 16-17 n=2	<b>63</b> range: 55-69 n=2	<b>45</b> range: 40-50 n=2	<b>9,508</b> range: 9,400-9,615 n=2	<b>46 %</b> range: 37%-55% n=2	<b>24%</b> range: 1%-45% n=70
<b>Lodgepole Pine</b>	<b>11.8</b> range: 9-15 n=5	<b>62</b> range: 55-69 n=5	<b>36</b> range: 28-50 n=5	<b>10,118</b> range: 9,650-10,720 n=6	<b>68%</b> range: 50%-92% n=5	<b>16%</b> range: 10%-19% n=5
<b>Douglas Fir</b>	<b>12</b> range: 10-14 n=2	<b>57</b> range: 50-63 n=2	<b>39</b> range: 35-42 n=2	<b>9,290</b> range: 9060-9,520 n=2	<b>65%</b> range: 65% n=2	<b>8%</b> range: 7%-9% n=2

### Post-fledging Family Area

The post-fledging family area (PFA) surrounds the nest site. After fledging, juvenile goshawks use the PFA from the time they leave the nest until they are no longer dependent on their parents (Reynolds 1992, Kennedy 1989). PFAs may range in size from 300-600 acres (121.4-242.8 ha) (Reynolds 1992). Reynolds describes habitat within the PFA as similar to the nest stand, although it includes a variety of forest conditions. He suggests the PFA should contain an overstory of > 50% with well developed understories, a mosaic of vegetative structural stages consisting of 60% mature, 20% young forest, 10% seedling/sapling and 10% in the grass, forb, or shrub stage. Coarse woody debris throughout the PFA provides habitat for prey species, in addition to plucking posts where goshawks pluck their prey. The PFA should be approximately centered on nesting habitat and provide prey and hiding cover for fledglings.

### Foraging Habitat

Foraging habitat within the nesting home range has been defined in a number of ways in various studies. Studies suggest goshawks use a mosaic of forest types and structural conditions. When hunting, goshawks select forests with a high basal area, high density of large trees, high canopy closure, and relatively open understories that are commonly found within mature forest conditions (Hargis et al.1994, Beier and Drennan 1997). These habitat characteristics facilitate goshawk maneuverability, which leads to a greater availability of prey for goshawks. Researchers have observed goshawks hunting along edges, clearcuts and openings but it is not known how important these habitats are for goshawk foraging (Shuster 1980, Kenward 1982). Beier and Drennan (1997) found that foraging sites were selected by radio-tagged goshawks based on favored habitat structure rather than local prey abundance. Bosakowski (1999) feels that based on the studies to date, most hunting occurs in habitat similar in structure to that selected for nest sites. Reynolds (1992) has recommended that desired foraging habitat should encompass 5,400 acres (not including any openings, PFA and nest site), surround the PFA and contain the same structural stages and vegetation characteristics as those within the PFA.

### **Available Habitat, Habitat Use, Local Distribution and Abundance**

Goshawks appear to be well distributed across the Forest. The majority of goshawk detections and nest sites were documented during goshawk survey efforts, incidentally by Forest Service personnel engaged in fieldwork, or by the public. Suitable (primary and secondary) habitat appears to be well-distributed across the Forest, encompassing approximately 79% of the Forest (Table 8). Primary habitat (high quality) also appears well-distributed, encompassing approximately 34% of the Forest.

**Table 8.** Potentially suitable northern goshawk habitat on the Forest<sup>1</sup>

Cover Type		Secondary Habitat						Primary Habitat		Total Acres	% of Overall Habitat <sup>2</sup>	% of GMUG <sup>3</sup>
		1	2	3A	3B	3C	4A	4B	4C			
Primary Habitat	Aspen	0	4,743	55,301	211,399	41,446	23,567	<b>227,148</b>	<b>176,308</b>	739,912	28	22
	Lodgepole Pine	0	758	7,100	124,674	54,741	4,658	<b>49,472</b>	<b>38,887</b>	280,290	11	8
	Spruce-fir	0	269	38,910	99,888	11,933	72,923	<b>322,729</b>	<b>201,388</b>	748,040	28	22
	Ponderosa Pine	0	251	10,530	13,060	94	42,180	<b>44,102</b>	<b>965</b>	111,182	4	3
	Douglas-fir	0	0	3,396	8,226	2,416	8,848	<b>16,192</b>	<b>6,590</b>	45,668	2	1
	Blue Spruce	0	0	101	242	560	234	<b>597</b>	<b>836</b>	2,570	0	0
	<b>Cottonwood Riparian</b>	0	0	248	100	0	2,530	<b>1,532</b>	<b>42</b>	4,452	0	0
Secondary Habitat	Pinyon-Juniper	0	0	28,542	37,171	625	29,956	39,064	1,554	136,912	5	4
	Gambel Oak	0	291,855	82	0	0	416	0	0	292,353	11	9
	Mountain Shrub	12	165,019	0	0	0	0	0	0	165,031	6	5
	Sagebrush	0	101,833	0	0	0	0	0	0	101,833	4	3
	Wet Meadow	4,574	0	0	0	0	0	0	0	4,574	0	0
Total Acres		4,586	564,728	144,210	494,760	111,815	185,312	700,836	426,570	2,632,817	100	79
<b>Primary Habitat</b>		0	0	0	0	0	0	<b>700,836</b>	<b>426,570</b>	<b>1,127,406</b>	<b>43</b>	<b>34</b>
<b>Secondary Habitat</b>		4,586	564,728	144,210	494,760	111,815	185,312	39,064	1,554	1,546,029	59	46

Indicates habitat designated as primary for both the breeding season and during winter.

Indicates habitat designated as primary for winter only.

<sup>1</sup> This table displays acreage estimates for cover types and habitat structural stages that have been documented to be used by goshawks, particularly on the Forest. Primary habitat is capable of providing the habitat needs necessary to meet all life requirements of goshawks; secondary habitat is capable of meeting one or more, but not all, life requirements of goshawks.

<sup>2</sup> Overall habitat includes the habitat cover types that have been documented to be utilized by northern goshawks based on literature review and known goshawk distribution on the Forest.

<sup>3</sup> Grand Mesa, Uncompahgre, and Gunnison National Forests R2-Veg CVU Total Acres: 3,334,709 acres (includes approximately 381,210 acres that fall outside the Forest boundary)

Table 9 below summarizes the distribution of goshawk detections by cover type, topography, and habitat structural stage for the Forest. Refer to Appendix A for the distribution of goshawk detections by cover type, topography, and habitat structural stage for each Geographic Area on the Forest.

**Table 9.** Distribution of goshawk detections by cover type, topography, and habitat structural stage on the Forest.

Total Sample Size	Cover Type Percentages	Mean Stand Size and Range (ac)	Mean Elevation and Range (ft)	Aspect Percentages	Mean Slope and Range (%)	Habitat Structural Stage Percentages
<b>n = 247</b>	<b>39% TAA (n = 96)</b>	301	9,334	<b>41% Northerly (n = 102)</b>	18	<b>51% Mature (n = 125)</b>
	28% Lodgepole (n = 70)	Range: 3 - 1,734	Range: 6,467 - 11,940	38% Southerly (n = 93)	Range: 1 - 55	38% Sapling/Pole (n = 95)
	18% Spruce-fir (n = 45)			13% East (n = 33)		11% Meadow/Shrubland (n = 27)
	10% Grass/Forb/Shrubland (n = 25)			8% West (n = 19)		
	2% Ponderosa (n = 6)					
	< 1% Douglas-fir (n = 2)					
	< 1% Pinyon-pine (n = 2)					
	< 1% Bristlecone (n = 1)					

Known goshawk nest sites occur predominantly in the 4B and 4C habitat structural stages (60% of nest sites). Nest sites were often found in mature stands as small as two acres in size that were inclusions within a larger sapling/pole or mid-aged (3A, 3B, or 3C) dominated stand, which is reflected in Table 10. Goshawks appear to select for aspen dominated sites for nesting on the Forest. The aspen cover type comprised 64% of known nest sites. Where nests occurred in spruce-fir dominated stands, mature or senescent aspen trees were often a component of those nest sites and nests were typically in aspen trees. There have been no documented occurrences of goshawk nests in Engelmann spruce or subalpine fir trees on the Forest.

**Table 10.** Distribution of known goshawk nest sites by cover type and habitat structural stage on the Forest.

Cover Type	2	3A	3B	3C	4A	4B	4C	Total
Aspen	2*	1	11	4		12	16	46
Lodgepole Pine			2			2	1	5
Spruce-fir			3	1		3	6	13
Ponderosa Pine					4	3		7
Snowberry	1							1
<b>Total</b>	<b>3</b>	<b>1</b>	<b>16</b>	<b>5</b>	<b>4</b>	<b>20</b>	<b>23</b>	<b>72</b>

\* Aspen clearcut area, Uncompahgre Plateau

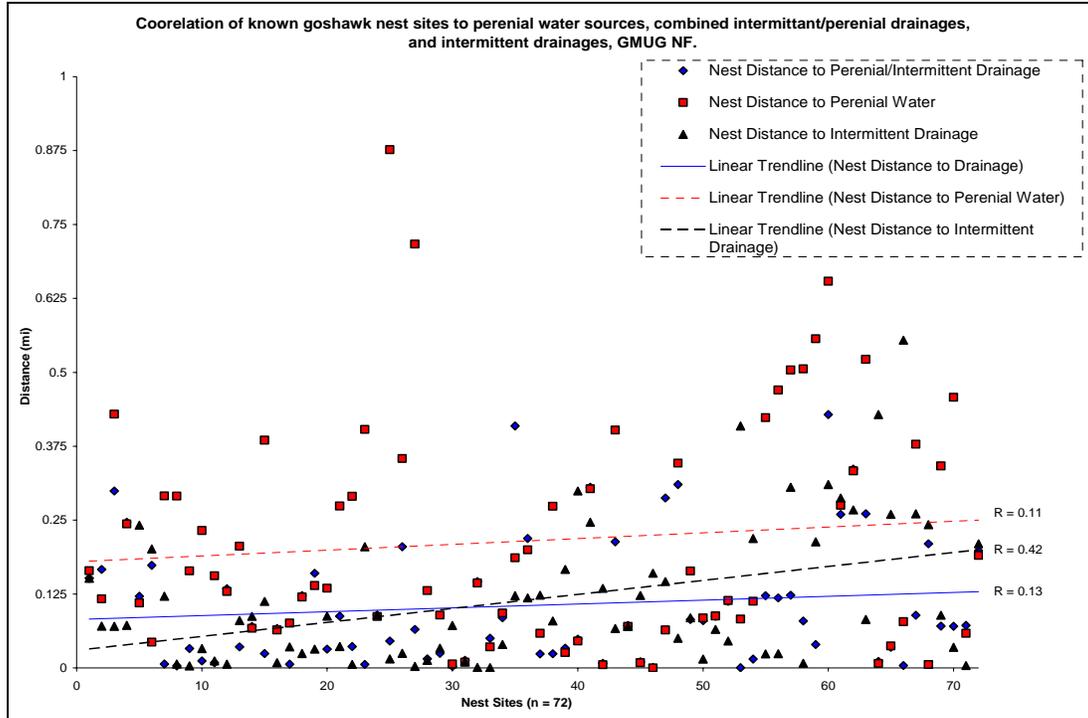
Similarly to nest sites, goshawk detections during the breeding season were often in mature forests, with 50% occurring in areas that were in the 4A, 4B, and 4C habitat structural stages. Goshawks were found using predominantly three cover types, listed by order of importance: 39% aspen, 28% lodgepole pine, and 18% spruce-fir. All detections in lodgepole pine occurred within the Gunnison Basin Geographic Area. Thirty-nine percent of detections were in sapling/pole or mid-aged forests; however 35 of those detections occurred in the Taylor Park Area of the Gunnison Ranger District where much of the lodgepole pine is actually in the 4B habitat structural stage. Due to the narrower crown width of lodgepole pine compared to other conifer types, much of the lodgepole pine in Taylor Park was typed out as 3B stands during the aerial photo interpretation. Thus, goshawks utilized mature forests to a greater extent during the breeding season than what is indicated in Table 11.

**Table 11.** Distribution of goshawk detections during the breeding season by cover type and habitat structural stage for the Forest. Refer to Appendix A for detection distribution by cover type and habitat structural stage for each Geographic Area.

Cover Type	1	2	3A	3B	3C	4A	4B	4C	Total
Aspen		2*	2	27	3	3	21	38	96
Lodgepole Pine			1	35	5		23	6	70
Spruce-fir			3	14	2		11	15	45
Ponderosa Pine						3	3		6
Douglas-fir				1			1		2
Pinyon-juniper			2						2
Bristlecone Pine				1					1
Gambel Oak		4							4
Sagebrush		6							6
Willow		2							2
Snowberry		1							1
Grassland	8								8
Forbland	3								3
Bluegrass	1								1
<b>Total</b>	<b>12</b>	<b>15</b>	<b>8</b>	<b>78</b>	<b>10</b>	<b>6</b>	<b>59</b>	<b>59</b>	<b>247</b>

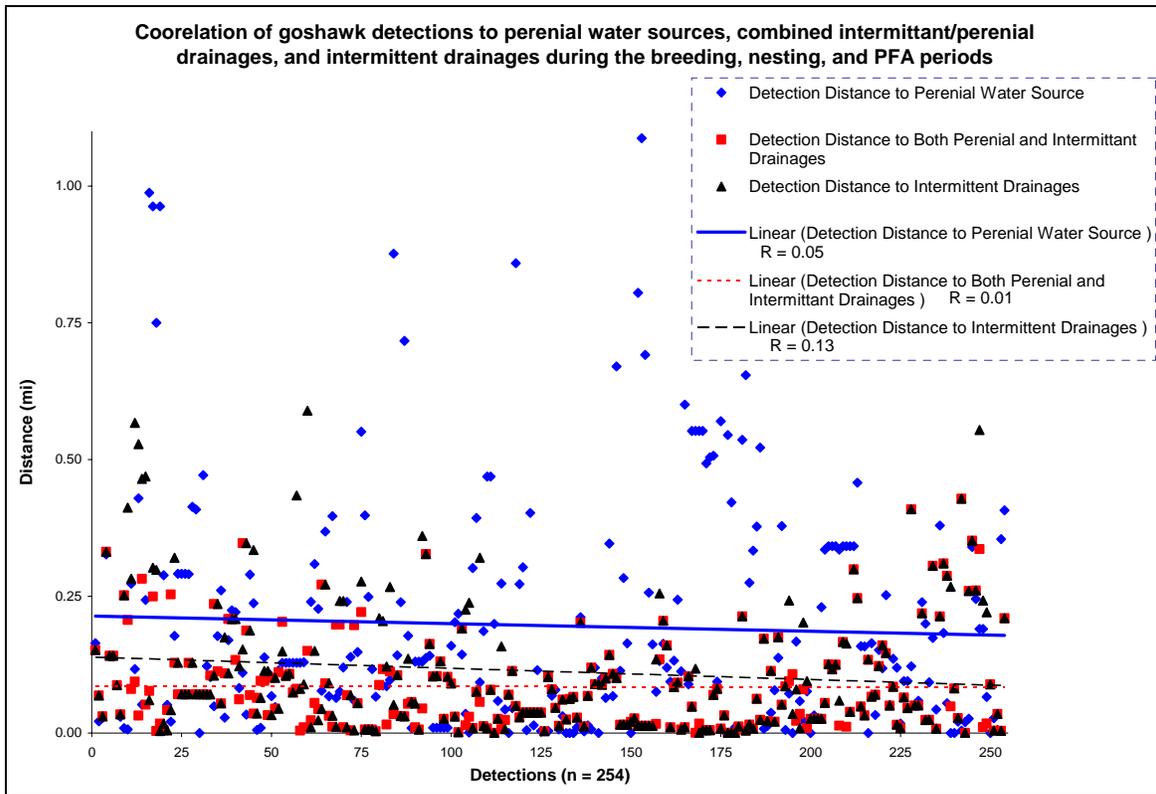
\* Aspen clearcut area, Uncompahgre Plateau

In addition to similarities between habitat use found at goshawk nest sites and goshawk detections during the breeding season, distance of goshawk nest sites and goshawk detections to permanent water sources and intermittent or perennial drainages was also similar. Available data indicates that the farther away from a drainage or permanent water source, the less likely a goshawk nest will be found and the less likely goshawks will be detected. Importantly, the topographic feature associated with drainages appears to be more important to goshawks than the presence of water when selecting nest sites. All known goshawk nest sites (n = 72) were within one mile of a perennial water source (range: 0.0 – 0.88 mi) and within 0.5 mi of a perennial or intermittent drainage (range: 0.0 – 0.43 mi). Sixty-four percent and 88% were within 0.25 mi from a perennial water source and an intermittent or perennial drainage, respectively. When examining distance of goshawk nest sites to intermittent drainages only, all 72 nest sites were within 0.6 mi of a drainage (range: 0.0-0.55) and 86% (n = 62) were within 0.25 mi of a drainage. Figure 2 displays the correlation between nest sites and drainages.



**Figure 2.** Correlation of known goshawk nest sites to perennial water sources, combined intermittent/perennial drainages, and intermittent drainages, GMUG NF.

We observed a similar trend when compiling data for goshawk detections that occurred during the breeding season. With the exception of one, all goshawk detections were within one mile of a perennial water source (range: 0.0-1.09 mi). All goshawk detections were within 0.5 mi of a perennial or intermittent drainage (range: 0.0-0.43 mi). Seventy-one percent and 93% were within 0.25 mi from a perennial water source and an intermittent or perennial drainage, respectively. When examining distance of goshawk detections to intermittent drainages only, all 254 detections were within 0.6 mi of a drainage (range: 0.0-0.59 mi) and 87% (n = 221) were within 0.25 mi of a drainage. Figure 3 displays the correlation between goshawk detection locations during the breeding season and drainages.



**Figure 3.** Correlation of goshawk detections to perennial water sources, combined intermittent/perennial drainages, and intermittent drainages during breeding, nesting, and PFA periods.

### Population Information

Currently, there are no long-term indices of trends or estimates of goshawk breeding population size in North America (Braun et al. 1996, Kennedy 1997). In the Regional Assessment, Kennedy (2003) states that there is not sufficient information available to make a status determination for the entire breeding range within Region 2, or for any state within the region. Breeding Bird Survey (BBS) and Christmas Bird Count (CBC) data are inadequate to provide reliable estimates of goshawk population trends at the regional, state, and forest scale because goshawks are encountered on too few routes and the number of goshawks detected on a particular route is also low. Crocker-Bedford (1998) stated that the rate of population change for goshawk populations in the U.S. may be impossible to calculate because the species is sparsely distributed, measurements of population parameters vary with prey cycles and weather, and immigration, emigration, and survival are difficult to estimate. According to Kennedy (2003), there is no demographic evidence in North America (including Region 2) that the goshawk is declining. It is possible that goshawks are declining but there is a lack of sufficient information to detect the declines (Kennedy 2003).

Goshawk nest monitoring and broadcast surveys combined with foot surveys have been conducted on the Forest using the Northern Goshawk management guidelines established by Reynolds et al. (1992), and inventory protocols developed by Kennedy and Stahlecker (1993), Joy et al. (1994), Bosakowski (1999) and Kennedy (2003). Fifty-six percent ( $n = 142$ ) of goshawk detections fell within one mile of known goshawk nest sites and the majority of those observations were associated with active nests (Table 12). To estimate territories, we applied a one mile radius buffer around 72 known goshawk nest sites on the Forest to determine the number of goshawk detections that may have been associated with known nest sites versus number of detections not associated with known nest sites. GIS analysis revealed an estimated 37 goshawk territories associated with goshawk detections that were within one mile of known nest sites. The remaining 44% ( $n = 112$ ) of goshawk detections were not associated with known nest sites but likely encompassed additional territories as these detections occurred during the breeding season. Based on 254 goshawk detections observed during the breeding season within the last 20 years, a total of 71 territories may have been occupied at some point in time over that 20-year period.

**Table 12.** Goshawk territory estimates for the Forest.

Territory Estimation Method	Geographic Area					Total
	Gunnison Basin	Uncompahgre Plateau	San Juan	North Fork Valley	Grand Mesa	
Estimated Number of Known Territories Based on Known Nest Sites and Goshawk Detections Associated With Those Nest Sites	15	12	5	4	1	37
Estimated Number of Territories Based on Goshawk Detections During the Breeding Season Not Associated With Known Nest Sites	24	4	0	3	3	34
Total Estimated Number of Territories	39	16	5	7	4	71

While many goshawk territories have been confirmed on the Forest over the last 20 years, usually less than 22% (less than 8) of known territories are active each year (refer to Table 4). Reasons for variability in nest occupancy on the Forest are unknown. DeStefano et al. (1994) and Squires and Reynolds (1997) suggest breeding activity may be affected by cold, wet springs. When examining goshawk distribution for the last 20 years, goshawks appear to be well-distributed on the Forest. However, distribution data is limited on large portions of the Forest because most inventory work that has been completed is in areas actively managed, leaving “un-managed” portions of the Forest under represented. Many nest locations in a given year have been regularly distributed at a minimum distance of 0.9 mi between active nests; however, as distance between nests increases, the degree of regularity decreases. Overall active territory density on a yearly basis may reflect the abundance, quality, and accessibility of prey on the Forest.

## CONSERVATION

### Limiting and/or Controlling Factors

Factors that increase the vulnerability of goshawk populations include a low reproductive rate, delayed maturity, and goshawk occurrence at low densities. Predators such as golden eagles, great-horned owls, and American martens may kill young, and occasionally adults. The extent to which predation on goshawks occurs is poorly understood and restricted largely to anecdotal reports (Kennedy 2003). Kennedy references one study of the effects of great-horned owl predation on goshawk nestlings that revealed predation rates as high as 49% (Luttich et al. 1971). Kennedy also reports that several studies indicated that predation on goshawk nestlings may increase during periods of low goshawk food availability because female goshawks may be required to spend more time away from the nest foraging, instead of protecting young (Zachel 1985, Rohner and Doyle 1992, Ward and Kennedy 1996, Dewey and Kennedy 2001).

Interspecific competition for habitat and prey between goshawks, great-horned owls, and red-tailed hawks is not well understood. Habitat fragmentation due to timber management or fire can increase the accessibility and attractiveness of these areas to red-tailed hawks and great-horned owls, thereby potentially decreasing the amount of habitat available to goshawks (USFWS 1998). In addition, goshawks may be excluded from nest areas by other raptors, although it is not uncommon for goshawks and other raptors to nest close to one another (Reynolds and Wight 1978). Great-horned owls often use nests previously built by goshawks or other raptors, and may exclude goshawks from nest sites since great-horned owls begin nesting earlier than goshawks. On the Forest, red-tailed hawks have been observed using nests previously occupied by goshawks (M. Vasquez, personal observation).

Disease has been documented in wild goshawks (Redig et al. 1980, Ward and Kennedy 1996, Lierz et al. 2002), but Kennedy (2003) reports that diseases are not believed to be a primary threat to goshawk populations. However, disease ecology is poorly understood and mortality by disease is difficult to identify without detailed necropsy data (Kennedy 2003). Of recent concern is West Nile virus, a newly observed disease in North America that has affected avian species, including raptors. The potential impact of West Nile virus on goshawk populations is unknown. Mortality from diseases may be exacerbated by changes in other limiting factors, such as food shortage (Newton 1979). Some diseases

may result from increased stress on goshawks due to competition, reduced prey availability, and migration (Redig et al. 1980).

### Threats

Kennedy (2003) sums up threats influencing the viability of goshawks in Region 2. These include habitat alteration, direct human disturbance, pesticides and other contaminants, and harvest for falconry. The primary concern throughout the range of the goshawk is habitat alteration due to timber and fire management practices (Kennedy 2003). Goshawks require a mosaic of forest structural stage conditions within their home range as described by Reynolds et al. to meet their nesting, post-family fledging area, and foraging habitat requirements. Silvicultural treatments that cause forest fragmentation, create even-aged and monotypic stands, increase younger age classes, and decrease tree species diversity have been recognized as potential threats to goshawks (Kennedy 2003). The primary road influence to goshawks is related to disturbance during nesting periods.

Specific threats affecting goshawk occupancy on the Forest are primarily related to timber harvesting activities that alter the composition and structure of mature aspen and mixed conifer stands, or harvesting forest stands near or within goshawk nest areas. Harvesting timber over large areas in a way that compromises or diminishes a mosaic of habitat structural stages required for nesting, post-family fledging, and foraging habitat as recommended by Reynolds et al. (1992). Although the literature supports that goshawks use a mosaic of habitat structural stages within home ranges, the literature also reports a higher use of mature forest types within a mosaic of forest structural conditions. Mature forests become increasingly important to goshawks during the breeding season, particularly for nesting and foraging habitat. Beier and Drennan (1997) found that during the breeding season goshawks selected foraging sites not for higher prey abundance but for higher canopy closure, greater tree density, and greater density of trees >40.6 cm diameter at breast height (dbh). Forest structure that is suited to goshawk maneuverability and hunting behavior provides for greater prey availability (i.e. more accessible and easier for goshawks to catch), which is more important than prey abundance (Drennan and Beier 2003). Prey abundance is an important component of goshawk habitat at the landscape level, but at the level of selecting a foraging site within a home range and habitat type (third-order selection, Johnson 1980), habitat structure becomes more important than prey abundance (Drennan and Beier 2003).

### Management Considerations and Information Needs

Information on goshawk habitat use, primarily during the breeding season and on nest site characteristics, is available on the Forest. However, there is a lack of information on goshawk demography, specifically reproductive success. Districts on the Forest typically survey project sites for new nests, monitor territory occupancy and/or reproductive success of known nest sites, and provide protection measures for active goshawk nests.

Current Forest Plan direction requires a 30-acre buffer around all active and alternative nest sites, and exclude activities within a 0.25 mi of active nest sites during the breeding season (March 1 – July 30). The current Forest Plan does not provide direction for management of the foraging area or the PFA; both are key components of the goshawk home range. Future management direction should include the Forest Plan habitat management direction using a modification of the recommendations made by Reynolds et al. (1992) that takes into consideration the habitat types available and used on the Forest. While the concepts presented by Reynolds et al. (1992) were used as a model for managing goshawk habitat on the Forest, all available information presented by Reynolds et al. (1992) still remains a untested hypothesis (Kennedy 2003). Additionally, there may be substantial geographic variation between forest conditions on the Forest compared to southwestern forests where Reynolds direction was developed. . Importantly, management activities may affect goshawks indirectly by impacting goshawk prey species in terms of their abundance and availability (Kennedy 2003)

Goshawk nest site monitoring and data collection on nest success and general habitat characteristics should occur consistently and annually across all districts on the Forest. The data should be housed in a central location on the Forest and updated yearly to better facilitate analysis. Where feasible, goshawk surveys should occur in suitable habitat outside project analysis areas to provide a better understanding of goshawk distribution on the Forest. Consistent monitoring of nest sites and obtaining data on nest success, particularly where management activities alter forest structure and composition, will provide insight and a better understanding of the effects of habitat alteration on goshawks

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**Appendix A.** Distribution of Goshawk Detections by Cover Type, Topography, and Habitat Structural Stage For Each Geographic Area on the Forest.

Geographic Area	Cover Type	Mean Stand Size and Range (ac)	Mean Elevation and Range (ft)	Aspect	Mean Slope and Range (%)	Habitat Structural Stage
Gunnison Basin (n = 187)	37% TLP (n = 70)	717	10,000	41% Southerly (n = 76)	23	48% Mature (n = 89)
	35% TAA (n = 65)	4 - 1,734	8,791-11,940	36% Northerly (n = 67)	1 - 55	44% Sapling/pole (n = 83)
	18% TSF (n = 33)			16% East (n = 30)		8% meadow or shrubland (n = 15)
	4% GRA/FOR (n = 8)			7% West (n = 14)		
	3% SSA (n = 6)					
	1% TDF (n = 2)					
	0.5 % SWI (n = 1)					
	0.5% TBC (n = 1)					
Uncompahgre Plateau (n = 25)	36% TAA (n = 9)	324	8,440	52% Northerly (n = 13)	13	56% Mature (n = 14)
	20% TPP (n = 5)	3 - 1,059	6,467-9,268	36% Southerly (n = 9)	2-31	24% Shrubland (n = 6)
	16% SGO (n = 4)			12% West (n = 3)		12% Sapling/Pole (n = 3)
	12% TSF (n = 3)					8% Meadow (n = 2)
	8% TPJ (n = 2)					
	4% FOR (n = 1)					
	4% GPO (n = 1)					
San Juan (n = 15)	67% TAA (n = 10)	185	9,657	67% Northerly (n = 10)	20	60% mature (n = 9)
	20% TSF (n = 3)	7 - 527	8,905-10,109	20% Southerly (n = 3)	7 - 38	27% Sapling/Pole (n = 4)
	7% SWI (n = 1)			13% East (n = 2)		13% Meadow or Shrubland (n = 2)
	7% FOR (n = 1)					
North Fork Valley (n = 11)	45% TAA (n = 5)	194	9,292	55% Northerly (n = 6)	14	45% Mature (n = 5)
	45% TSF (n = 5)	40 - 473	8,345-10,359	27% Southerly (n = 3)	9 - 29	45% Sapling/Pole (n = 5)
	9% GRA (n = 1)			18% West (n = 2)		9% Meadow (n = 1)
Grand Mesa (n = 9)	78% TAA (n = 7)	84	9,282	67% Northerly (n = 6)	18	89% Mature (n = 8)
	11% TSF (n = 1)	9 - 273	8,699-10,234	22% Southerly (n = 2)	8 - 28	11% shrubland (n = 1)
	11% SSN (n = 1)			11% East (n = 1)		

**Appendix B.** Distribution of goshawk detections during the breeding season by cover type and habitat structural stage for each Geographic Area on the Forest.

Cover Type	1	2	3A	3B	3C	4A	4B	4C	Total
<b>Gunnison Basin</b>									
Lodgepole Pine			1	35 <sup>1</sup>	5	0	23	6	<b>70</b>
Aspen			1	21	3	2	7	31	<b>65</b>
Spruce-fir			3	12	1		6	11	<b>33</b>
Ponderosa Pine							1		<b>1</b>
Douglas-fir				1			1		<b>2</b>
Bristlecone Pine				1					<b>1</b>
Sagebrush		6							<b>6</b>
Willow		1							<b>1</b>
Grassland	7								<b>7</b>
Forbland	1								<b>1</b>
<b>Total</b>	<b>8</b>	<b>7</b>	<b>5</b>	<b>70</b>	<b>9</b>	<b>2</b>	<b>38</b>	<b>48</b>	<b>187</b>
<b>Uncompahgre Plateau</b>									
Aspen		2 <sup>2</sup>					6	1	<b>9</b>
Ponderosa Pine						3	2		<b>5</b>
Spruce-fir				1			1	1	<b>3</b>
Pinyon-juniper			2						<b>2</b>
Gambel Oak		4							<b>4</b>
Forbland	1								<b>1</b>
Bluegrass Scabland	1								<b>1</b>
<b>Total</b>	<b>2</b>	<b>6</b>	<b>2</b>	<b>1</b>		<b>3</b>	<b>9</b>	<b>2</b>	<b>25</b>
<b>San Juan</b>									
Aspen			1	3			5	1	<b>10</b>
Spruce-fir								3	<b>3</b>
Willow		1							<b>1</b>
Forbland	1								<b>1</b>
<b>Total</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>3</b>			<b>5</b>	<b>4</b>	<b>15</b>
<b>North Fork Valley</b>									
Aspen				3				2	<b>5</b>
Spruce-fir				1	1		3		<b>5</b>
Grassland	1								<b>1</b>
<b>Total</b>	<b>1</b>			<b>4</b>	<b>1</b>		<b>3</b>	<b>2</b>	<b>11</b>
<b>Grand Mesa</b>									
Aspen						1	3	3	<b>7</b>
Spruce-fir							1		<b>1</b>
Snowberry		1							<b>1</b>
<b>Total</b>		<b>1</b>				<b>1</b>	<b>4</b>	<b>3</b>	<b>9</b>
<b>Overall Total</b>	<b>12</b>	<b>15</b>	<b>8</b>	<b>78</b>	<b>10</b>	<b>6</b>	<b>59</b>	<b>59</b>	<b>247</b>

<sup>1</sup> The majority of these observations occur in the Taylor Park Area of the Gunnison Ranger District where much of the lodgepole pine is actually in the 4B habitat structural stage. Due to the narrower crown width of lodgepole pine compared to other conifer types, much of the lodgepole pine in Taylor Park was typed out as 3B stands during the aerial photo interpretation.

<sup>2</sup> Aspen clearcut area

**Appendix C.** Geographic Areas for the Forest.

