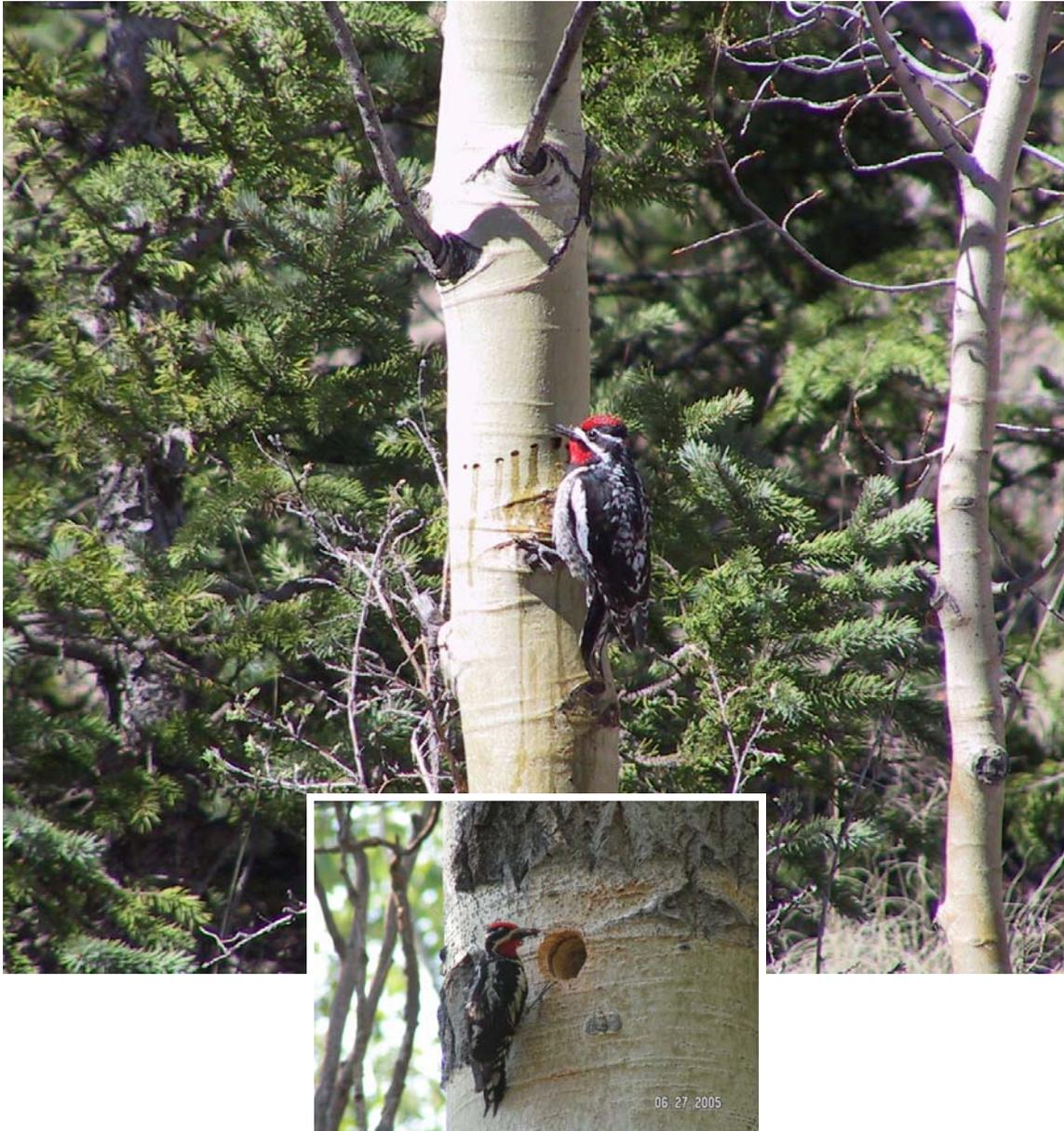


**Red-naped Sapsucker (*Sphyrapicus nuchalis*)
Species Assessment
Draft**



**Prepared for the Grand Mesa, Uncompahgre, and Gunnison National Forests
September 2005**

Matt Vasquez
Biological Science Technician (Wildlife)
216 North Colorado
Gunnison, CO 81230

Reviewed and Edited by: Clay Speas, Forest Fisheries Biologist and Tom Holland, Forest Wildlife Biologist

Photo Credits: Red-naped sapsucker creating sap wells in aspen by Debbie Valliere, GMUG NF, Gunnison Ranger District.
Red-naped sapsucker at cavity nest in aspen by Matt Vasquez, GMUG NF, Gunnison Ranger District

TABLE OF CONTENTS

INTRODUCTION	5
SUMMARY OF KEY FINDINGS	5
HABITAT CRITERIA USED IN FOREST-WIDE HABITAT EVALUATION	6
Rationale for Habitat Criteria Selection	9
MANAGEMENT STATUS AND NATURAL HISTORY	9
Management Status	9
Existing Regulatory Mechanisms, Management Plans, and Conservation Strategies	9
Biology and Ecology	10
Systematics and General Species Description	10
Associated Species	10
Distribution and Abundance	10
Population Status	12
Activity Pattern and Movements	18
Food Habits	18
Breeding Biology	19
Demography	19
Spacing and Territoriality	19
Reproductive Success	20
Survivorship	20
Community Ecology	20
Species-Habitat Relationships	21
General Habitat Use	21
Landscape-Level Habitat Characteristics	22
CONSERVATION	24
Threats	24
MANAGEMENT RECOMMENDATIONS	24
Grazing	24
Prescribed Fire	24
Timber Harvest	25
LITERATURE CITED	27
APPENDICES	31

LIST OF TABLES

Table 1. Habitat parameters for modeling red-naped sapsucker habitat on the Forest	6
Table 2. 1991 Amended Land and Resource Management Plan general standards and guidelines for MIS	10
Table 3. Estimated densities of red-naped sapsucker for the state of Colorado	12
Table 4. Breeding Bird Survey trend data for the red-naped sapsucker from 1966 to 2003	13
Table 5. Breeding Bird Survey trend data for the red-naped sapsucker for all routes that occur on the Forest	13
Table 6. Proportion of aspen habitats within individual Geographic Areas relative to representation of aspen habitats sampled on Breeding Bird Survey routes	14
Table 7. Monitoring Colorado's Birds (MCB), Rocky Mountain Bird Observatory Red-naped sapsucker data for all transects that occur on National Forest, BLM, State, or private land within the Geographic Areas	16
Table 8. Monitoring Colorado's Birds (MCB), Rocky Mountain Bird Observatory red-naped sapsucker data for all years for each Geographic Area of the Forest	16
Table 9. Monitoring Colorado's Birds (MCB), Rocky Mountain Bird Observatory red-naped sapsucker data by year for all transects that occur in GA on the Forest	16
Table 10. Monitoring Colorado's Birds (MCB), Rocky Mountain Bird Observatory red-naped	17

	sapsucker data by year for all transects that occur on the Forest.....	
Table 11.	Proportion of aspen habitats within GA relative to representation of aspen habitats on the Forest.....	19
Table 12.	Annual and lifetime reproductive success rates for red-naped sapsuckers.....	21
Table 13.	Number of red-naped sapsucker detections by dominate vegetative cover type and habitat structural stage.....	24

LIST OF FIGURES

Figure 1.	Red napped sapsucker habitat on the Forest as modeled by R2Veg.....	7
Figure 2.	LEFT: Relative breeding season abundance of the red-naped sapsucker based on average number of birds per route, Breeding Bird Survey, RIGHT: Percent change per year in red-naped sapsucker abundance during the breeding season, Breeding Bird Survey data.....	11
Figure 3.	Red-naped sapsucker counts from BBS routes on the Forest from 1994-2003.....	14
Figure 4.	Red-naped sapsucker counts from MCB point-count transects	15
Figure 5.	Average number of red-naped sapsuckers per transect from 1998 to 2004 for the Forest.	17
Figure 6.	Average number of red-naped sapsacukers per transect from 1998-2004.....	18
Figure 7.	Photograph of phloem sap wells in willow.....	19
Figure 8.	Photograph of cavity nest depredation on the Forest, presumably by a black bear.....	22
Figure 9.	Photograph of a representation of red-naped sapsucker nesting and foraging habitat on the Forest.....	23
Figure 10.	Distance of red-naped sapsuckers detected in aspen patches and riparian areas.....	24

INTRODUCTION

The red-naped sapsucker is a focus of an assessment because it has been identified as a Management Indicator Species (MIS) on the Grand Mesa, Uncompahgre, and Gunnison National Forest (Forest). As a MIS, the red-naped sapsucker serves as a barometer for species viability at the forest level particularly within the mature aspen ecosystems. 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)).

The red-naped sapsucker was selected as a new MIS for aspen habitat, particularly mature aspen associated with riparian areas containing a willow component. The northern goshawk is also used as a MIS for mature aspen due to their dependency upon mature aspen for nesting habitat on the Forest, however goshawks are not limited to aspen and they are often associated with aspen/conifer mixes where aspen may not always be the dominant tree type. The red-naped sapsucker is more closely associated with pure aspen stands for cavity nesting and they create sap wells in both aspen and willow for foraging. Further, researchers consider the red-naped sapsucker as a “keystone” species in that their sap wells provide an important food resource for numerous other species and their excavated nesting cavities are used by secondary cavity nesters (Dobkin and Wilcox 1986, Ehrlich and Daily 1988, Daily et al. 1993, Walters et al. 2002).

This report is the first species assessment prepared for the red-naped sapsucker on the Forest. The goal of this assessment is to summarize historical and current literature on the red-naped sapsucker to provide land managers and the public with an objective overview of this species within the Forest. Peer reviewed scientific literature and summarized data are the primary information sources used in this report. Local data sources (Rocky Mountain Bird Observatory, and Forest GIS databases – R2-Veg) were utilized to provide information on distribution, localized abundance, and habitat conditions. This assessment provides recommendations for the current Forest Plan revision in terms of integrating red-naped sapsucker 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.

SUMMARY OF KEY FINDINGS

The abundance and distribution of the red-naped sapsucker is largely tied to the availability of deciduous woody vegetation, especially aspen and willows on the Forest. This species is a primary cavity nester dependant on aspen stands or the aspen component of mixed stands for nesting and summer foraging, particularly when these habitat types occur in or adjacent to riparian areas. Primary habitat includes areas dominated by aspen, cottonwood, and willow vegetation, encompassing approximately 25 percent (830,462 acres) of the Forest. Secondary habitat consists of approximately 21 percent (704,772 acres) and is comprised of Douglas-fir, lodgepole pine, and ponderosa pine (both pure stands and stands with an aspen component), in addition to immature (3A, 3B, and 3C) stands of both aspen and cottonwood.

The red-naped sapsucker is considered globally “secure” by the Natural Heritage Program due to its wide distribution across North America. According to the Breeding Bird Survey (BBS), populations appear to be stable to increasing in the United States, with areas of local declines. Local declines may be related to a loss of cottonwood and aspen nesting habitats. Based on BBS trend data for the period 1966 to 2004, red-naped sapsuckers have exhibited a significant positive population trend of 4.43 percent. However, BBS trend estimates may be confounded by recent changes in sapsucker taxonomy splitting the red-naped from the yellow-bellied sapsucker. Within the state of Colorado and the Southern Rockies physiographic region, red-naped sapsucker populations have exhibited similar upward trends, exceeding national trends.

Red-naped sapsuckers have been detected on nine BBS routes on the Forest, with insignificant negative trends observed on three out of four routes within the Uncompahgre Plateau Geographic Area, a significant positive trend observed within the North Fork Valley and Grand Mesa Geographic Areas, and positive upward trends observed on three routes within the Gunnison Basin Geographic Area, one which was significant. Single site analysis on BBS

routes within the Forest may not be statistically valid due to low sample sizes and the amount of suitable red-naped sapsucker habitat sampled by the routes: from 1966 to 2004, only 0.92 percent (6,806 ac) of all aspen habitat on the Forest (738,515 ac) was sampled by the BBS.

From 1998 to 2004, Monitoring Colorado's Birds (MCB; a program implemented by the Rocky Mountain Bird Observatory) detected 186 red-naped sapsuckers on 25 transects between 1998 and 2004 on the Forest. Most of the observations occurred in aspen and high elevation riparian dominated habitat types. Interestingly, 62 percent of all red-naped sapsucker observations throughout the MCB survey area were on the Forest. Based on MCB data, red-naped sapsuckers appear to be in an upward trend on the Forest. The average number of red-naped sapsuckers per transect range from 2.2 birds in 2001 to 4.15 birds in 2004.

Although red-naped sapsucker populations appear to be stable to increasing at the national, regional, and forest levels, their habitats have and continue to be impacted by land management activities. On the Forest, some aspen stands are susceptible to conifer invasion and there is little aspen regeneration, which is likely attributed to fire suppression. Over half (65%) of the aspen dominated habitats on the Forest are in a mature to decadent condition and are declining in vigor. While decadent aspen (aspen > 100 yrs old) may be beneficial to red-naped sapsuckers in the short term, lack of regeneration and conversion to conifer dominated aspen stands may adversely affect the species in the long term. Degradation and loss of willow riparian habitat due to livestock and elk use (foraging on aspen seedlings, saplings, and bark feeding) could also reduce habitat for the red-naped sapsucker.

HABITAT CRITERIA USED IN FOREST-WIDE HABITAT EVALUATION

2005 MIS Habitat Criteria

Habitat modeling parameters for the red-naped sapsucker on the Forest address the sum of all factors affecting the red-naped sapsucker's chance to survive and reproduce on the Forest, specifically in terms of primary habitat and secondary habitat. Primary and secondary habitat was further delineated based on habitat quality, categorized as high, marginal, or low. Patton (1997) 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 be utilized by a species to avoid intraspecific interactions when all primary habitat is saturated; serve as a travel corridor providing 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 a 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 interspecific or intraspecific interactions.

Red-naped sapsuckers breed in North America and they have been confirmed breeding in suitable habitat on the Forest. Because red naped sapsuckers are migratory and winter primarily out of the range of the Forest, we focused on nesting and foraging habitat requirements as a basis for habitat modeling (Table 1). Geographic Information System vegetation data, R2-Veg, was used to create a potential habitat distribution map for the red-naped sapsucker on the Forest (Figure 1). The R2-Veg database was produced by aerial photo interpretation in conjunction with some field verification; this is a working database with updates taking place periodically. At the Forest-level, R2-Veg should reliably depict suitable red-naped sapsucker habitat on the Forest. R2-Veg attributes used for habitat modeling included vegetation cover type, vegetation species mix, and habitat structural stage. Field verification, particularly for project-level analysis, may be required to determine the reliability of habitat modeling at the stand level.

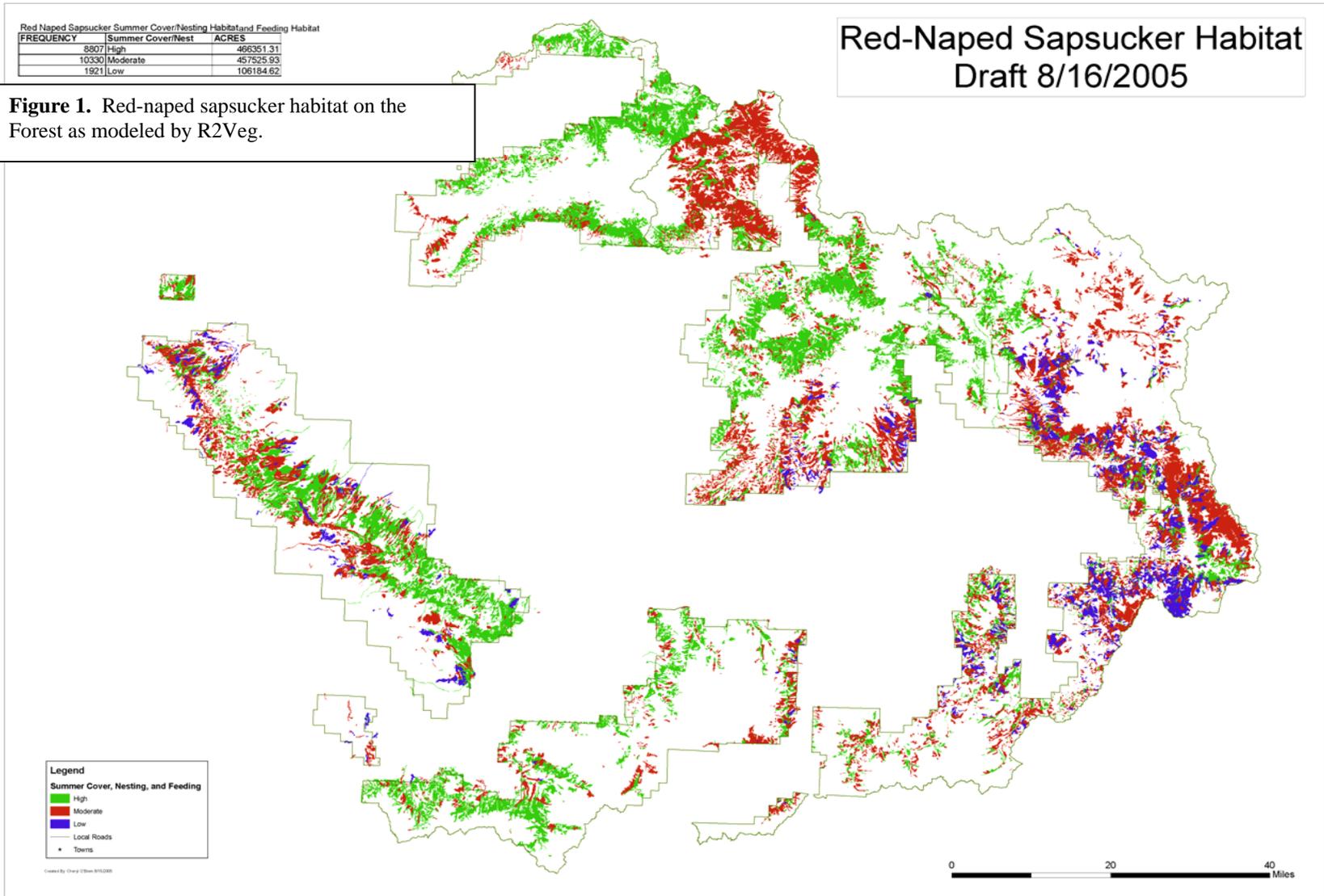


Table 1. Habitat parameters for modeling red-naped sapsucker habitat on the Forest.

Habitat Parameter	Primary Habitat	Secondary Habitat	
		Marginal Quality	Low Quality
Summer Cover and Nesting	<p><u>High Quality</u></p> <ul style="list-style-type: none"> • Aspen ➤ 4a, 4b, 4c • Cottonwood ➤ 4a, 4b, 4c • Willow Cover type if mature aspen or cottonwood is adjacent to willow dominated areas 	<p><u>Marginal Quality</u></p> <ul style="list-style-type: none"> • Aspen ➤ 3a, 3b, 3c ▪ Cottonwood ➤ 3a, 3b, 3c • Douglas-fir w/aspen in the species mix ➤ 4a, 4b, 4c • Lodgepole Pine w/aspen in the species mix ➤ 4a, 4b, 4c • Ponderosa Pine w/aspen in the species mix ➤ 4b, 4c • Willow cover type if any of the above cover types and structural stages are adjacent to willow dominated areas 	<p><u>Low Quality</u></p> <ul style="list-style-type: none"> • Douglas-fir w/aspen in the species mix ➤ 3a, 3b, 3c • Lodgepole Pine w/aspen in the species mix ➤ 3a, 3b, 3c • Ponderosa Pine w/aspen in the species mix ➤ 3a, 3b, 3c, 4a
Summer Feeding	<ul style="list-style-type: none"> • Aspen ➤ 3a, 3b, 3c, 4a, 4b, 4c • Cottonwood ➤ 3a, 3b, 3c, 4a, 4b, 4c • Willow cover type if any of the above cover types and structural stages are adjacent to willow dominated areas 	<ul style="list-style-type: none"> • Douglas-fir ➤ 3a, 3b, 3c, 4a, 4b, 4c • Lodgepole Pine ➤ 3a, 3b, 3c, 4a, 4b, 4c • Ponderosa Pine ➤ 3a, 3b, 3c, 4a, 4b, 4c • Willow cover type if any of the above cover types and structural stages are adjacent to willow dominated areas 	

Primary (high quality) red-naped sapsucker nesting habitat was identified as mature aspen and cottonwood, especially aspen and cottonwood habitat types associated with riparian areas containing a willow component. Red-naped sapsuckers typically nest in close proximity to willow vegetation; consequently willow was included as one of the habitat components of nesting habitat. Primary foraging habitat includes sapling/pole, mid-age, and mature aspen and cottonwood, in addition to willow riparian associations. The location of high quality foraging habitat, such as willow riparian areas, may dictate the location of red-naped sapsucker nest trees.

Secondary habitat was categorized as marginal or low quality based on its suitability for red-naped sapsuckers and the likelihood of red-naped sapsucker occurrence within those areas. Marginal nesting habitat was identified as aspen and cottonwood in the 3A, 3B, and 3C habitat structural stages. Aspen-conifer associations, including mature Douglas-fir, lodgepole pine, and ponderosa pine were also identified as marginal nesting habitat. Low quality nesting habitat is comprised of aspen-conifer associations consisting of 3A, 3B, and 3C Douglas-fir and lodgepole pine, and 3A, 3B, 3C, and 4A ponderosa pine. Marginal foraging habitat consists of Douglas-fir, lodgepole pine, and ponderosa pine in the sapling/pole, mid-age, and mature structural stages.

Rationale for Habitat Criteria Selection

The literature documents that red-naped sapsuckers occur primarily in deciduous habitats and in coniferous forests that have a deciduous component (Bate 1999). On the Forest, red-naped sapsuckers are most strongly associated with mature aspen, particularly aspen-riparian associations with a willow component types (Gunnison Ranger District Wildlife Survey Records). This woodpecker is a primary cavity nester that preferentially nests in live mature aspen trees and in denser stands relative to their availability, and greatly over utilizes aspen compared to its availability even when conifer snags are available. In a northern Colorado study area, researchers found that a stand of aspen within a spruce, fir, or lodgepole pine forest, or along a river in the floor of an open valley, almost invariably contained red-naped sapsuckers (Crockett and Hadow 1975). In addition, the Colorado Land Bird Conservation Plan (Biedleman 2000) identifies the red-naped sapsucker as one of the priority species for conservation in aspen dominated habitats in Colorado.

MANAGEMENT STATUS AND NATURAL HISTORY

Management Status

- **Migratory Bird Treaty Act:** species is protected from “take” in the U.S. and Canada (Walters et al. 2002).
- **U.S. Fish and Wildlife Service (USFWS) Birds of Conservation Concern:** species is considered a bird of conservation concern in BCR 17 (Badlands and Prairies Region), which includes the Black Hills National Forest within Region 2.
- **USFS Rocky Mountain Region:** the red-naped sapsucker has recently been identified as a MIS on the Forest as part of the 2005 Forest Plan MIS Amendment.
- **Natural Heritage Program (NHP) Conservation Status:** global rank of G5; it is demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.
- **State of Colorado Natural Heritage Program Conservation Status:** species is ranked S5; secure across the state (www.natureserve.org).
- **Partners in Flight (PIF) Land Bird Conservation Plan:**
 - Colorado Land Bird Conservation Plan (Biedleman 2000): Priority species for the Southern Rocky Mountain Physiographic Area in the Priority Habitat Aspen.

Existing Regulatory Mechanisms, Management Plans, and Conservation Strategies

The red-naped sapsucker is protected under the Migratory Bird Treaty Act of 1918, which prohibits “take” of migratory birds unless permitted by regulations (Walters et al. 2002).

The current 1991 Amended Land and Resource Management Plan provides direction and includes standards and guidelines for management of habitat for MIS, which are summarized in Table 2 below.

Table 2. 1991 Amended Land and Resource Management Plan general standards and guidelines for MIS.

Management Activities	General Direction	Standards and Guidelines
Aquatic and Terrestrial Habitat Management	Manage for habitat needs of indicator species (FP III-24).	
	Manage habitat for viable populations of all existing vertebrate wildlife species (FP-III-26).	Maintain habitat capability at a level at least 40% of potential capability ¹

¹ This standard and guideline varies with specific Management Area direction.

The 2005 Forest Plan MIS Amendment will provide general direction for MIS with new language that states: “manage for habitat needs of selected wildlife species for a given area” (USDA 2005). The Monitoring and Evaluation Program, which is the management control system for the Forest Plan, will provide language regarding monitoring and evaluation for MIS that states:

“Use the best available science, data and analysis to estimate the effects of habitat changes and other management activities on MIS. Incorporate species population data from various sources, if available. In accordance with the 2004 Planning Rule, 36 CFR 219.14(f), obligations relating to management indicator species [may be met] by considering data and analysis relating to habitat; and site-specific monitoring or surveying of a proposed project or activity area is not required, but may be conducted at the discretion of the Responsible Official for specific projects.”

Partners in Flight (PIF) have identified the red-naped sapsucker and its habitat within the Southern Rocky Mountains in USFS Region 2 as priorities for conservation. The Colorado Land Bird Conservation Plan (Biedleman 2000) lists the red-naped sapsucker as a Priority Species for the Southern Rocky Mountain Physiographic Area in the Priority Habitat Aspen. For red-naped sapsuckers and their associated habitat of aspen forests, the Plan calls for maintaining the species’ distribution and abundance, based upon results of the Breeding Bird Survey and Monitoring Colorado’s Birds (Rocky Mountain Bird Observatory) programs.

Biology and Ecology

Systematics and General Species Description

The red-naped, yellow-bellied, and red-breasted sapsuckers collectively were long treated as forms of a single species, the yellow-bellied sapsucker, until 1983 when systematic studies showed distinctions sufficient to warrant taxonomic treatment as separate species (Walters et al. 2002). Although the biology of these three species appears to be quite similar, evidence from distribution, ecology, plumage, assortive mating, and genetics support treating this complex as three distinctly separate species making up the superspecies *Sphyrapicus varius* (Short 1969, 1982; Am. Ornithol. Union 1983, 1985, 1998; Johnson and Zink 1983, Johnson and Johnson 1985, Cicero and Johnson 1995, Walters et al. 2002). Hybridization is known to occur among these three species where their ranges overlap, and hybrids between red-naped and Williamson’s sapsuckers (*S. thyroideus*) have been documented (Short and Morony 1970, Walters et al. 2002). The red-naped sapsucker (*S. nuchalis*) breeds on the Forest. The Forest is not within the range distribution of the yellow-bellied and red-breasted sapsuckers.

The red-naped sapsucker is a small to medium sized woodpecker, averaging eight inches in length. Key distinguishing field marks include a black and white streaked face, a red patch on the forehead, and a separate red patch on the nape. They have an elongated white patch on a shoulder of black wings and yellow on the central belly. The male has a red chin; the female has a white chin that is edged with red at the base. Additional key field marks include a white rump and white shoulder patches that are distinct when this bird is in flight.

Associated Species

Other species that may use habitat in a similar way and/or respond similarly to threats, management, and conservation activities include the violet-green swallow, purple martin, and mountain bluebird (Biedleman 2000). On the Forest, other species that are also associated with mature aspen stands include the northern goshawk, Cooper’s hawk, broad-tailed hummingbird, western wood-pewee, warbling vireo, and house wren. Many of these species benefit from red-naped sapsuckers by utilizing the cavities and sap wells that the sapsuckers create, and this species is also a prey item of goshawks and Cooper’s hawks.

Distribution and Abundance

The Forest is well within the breeding distribution range of the red-naped sapsucker. Throughout western and central Colorado, they breed regularly within deciduous woodlands, especially where deciduous woodlands are

associated with riparian areas that contain a willow component. On the Forest, red-naped sapsuckers are primarily associated with mature aspen forests, mature aspen and conifer mixes, and aspen riparian areas with a willow component. Figure 2 shows the relative breeding season abundances for the red-naped sapsucker within their regional distribution, and reflects the percent change per year, based on Breeding Bird Survey data. According to the Breeding Bird Survey, where routes occur on the Forest, red-naped sapsuckers average from 0.71 to 2.25 individuals per route each year.

The Rocky Mountain Bird Observatory has developed a program entitled Monitoring Colorado's Birds (MCB), which they have implemented on a yearly basis since 1998 to obtain density estimates for bird species in Colorado. Their data will provide population trend estimates when counts have been obtained over a sufficient number of years, and for some species trends will be determined in as little as 12 years (trend data potentially available for some species by 2010). MCB data has shown relative abundances for red-naped sapsuckers in Colorado ranging from 0.04 to 9.35 birds per hectare. Table 3 below displays estimated densities of red-naped sapsuckers for the state of Colorado, and portions of Wyoming, New Mexico, and Montana (Deer Lodge County) by habitat type.

Table 3 provides density estimates obtained from MCB surveys by dominant habitat types. Highest densities of red-naped sapsucker occur in high elevation riparian areas that contained aspen and willow habitat components followed by aspen habitats. Densities range from a high of 0.602 birds/hectare in high elevation riparian to a low of 0.08 birds/hectare in lodgepole.

Table 3. Estimated densities of red-naped sapsucker for the state of Colorado and portions of Wyoming and New Mexico. Data obtained from Monitoring Colorado's Birds (MCB), Rocky Mountain Bird Observatory.

Year	D	LCL	UCL	CV%	P	K	n
Aspen Habitat							
1999	4.810	a	a	359.90	a	6	27
2000	0.050	a	a	59.50	a	9	22
2001	0.040	0.020	0.080	32.00	0.39	a	28
2002	0.123	0.065	0.229	32.00	0.15	14	33
2003	0.110	0.046	0.263	45.60	0.15	16	29
2004	0.314	0.135	0.735	44.60	0.06	19	52
High Elevation Riparian							
1999	9.350	a	a	72.80	a	5	20
2000	0.040	a	a	25.80	a	10	27
2004	0.602	0.225	1.612	52.50	0.01	15	51
Lodgepole Pine							
2001	0.08	a	a	65.7	a	5	9

D = density in birds/hectare; **LCL** = lower and upper 95% confidence limits on D; **CV** = coefficient of variation of D; **P** = probability of detection; **K** = number of transects on which the species was recorded; **n** = number of observations used to estimate D; **a** = no data.

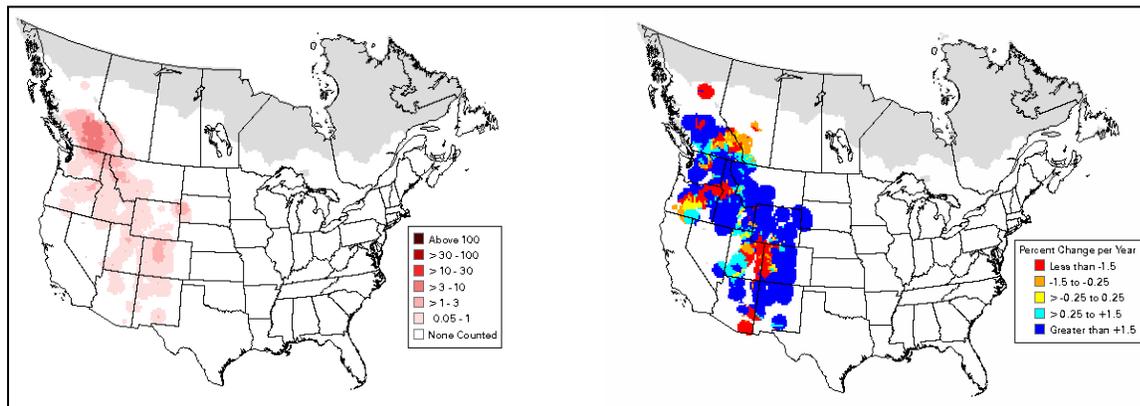


Figure 2. LEFT: Relative breeding season abundance of the red-naped sapsucker based on average number of birds per route, obtained from Breeding Bird Survey data (Sauer et al. 2005). RIGHT: Percent change per year in red-naped sapsucker abundance during the breeding season, obtained from Breeding Bird Survey data (Sauer et al. 2005).

Population Status

North American Breeding Bird Survey (reference period 1966 to 2004)

The Breeding Bird Survey (BBS) monitors bird populations over large geographic areas and tracks the status and trends of North American bird populations. This program was initiated in 1966 and is coordinated by the USGS Patuxent Wildlife Research Center, and the Canadian Wildlife Service and National Wildlife Research Center. The BBS is capable of informing researchers and wildlife managers of significant changes in bird populations. Roadside survey routes are conducted during the avian breeding season each year. Each route is 24.5 miles long with stops at 0.5-mi intervals, totaling 50 point-count stations per route. A three-minute point count is conducted at each station, whereby every bird heard or seen within a 0.25-mi radius is recorded. Table 4 displays BBS trend data for the red-naped sapsucker survey wide (United States and Canada). Within the southern rocky ecosystem and the state of Colorado, red-naped counts have gradually increased since the 1960's on the routes surveyed.

Table 4. Breeding Bird Survey trend data for the Red-naped sapsucker from 1966 to 2004 (From Sauer et al. 2005).

Location	1966-2004			1966-1979			1980-2004		
	Trend	P value	N routes	Trend	P value	N routes	Trend	P value	N routes
Survey wide	4.43	0.00006	267	5.26	0.47366	29	4.26	0.00126	202
Western Region	0.77	0.52833	253	2.48	0.54196	46	1.50	0.19911	246
Colorado	5.50	0.02296	50*	16.00	0.21320	7	8.15	0.02315	48
Southern Rockies	6.66	0.00459	59*	15.78	0.22042	7	9.08	0.01142	58

N routes = number of routes this bird was detected on.

* Average count per route in the Southern Rockies and in Colorado was 1.82 and 1.39, respectively.

The Breeding Bird Survey has detected red-naped sapsuckers on nine BBS routes on the Forest. From 1966 to 2004, insignificant downward trends were observed on three out of four routes within the Uncompahgre Plateau Geographic Area. Only one route has been monitored on the North Fork and Grand Mesa Geographic Areas; these data, while probably insufficient, indicate sapsucker numbers are increasing. In the Gunnison Basin Geographic

Area, three routes have been monitored for 7 years and significant upward population trends occurred on a single route (Table 5). Refer to Appendix A for a map of Geographic Areas and BBS route locations on the Forest.

Table 5. Breeding Bird Survey trend data for the Red-naped sapsucker for all routes that occur on the Forest

Trend Period 1966-2004							
Geographic Area	Route Name	Trend Estimate	P value	N Years	Variance	Average Count/Year	Total Count for all Years Combined
North Fork Valley/Grand Mesa	Ragged Mtn.	37.31	0.04473	11	18.5877	0.82	9
Uncompahgre Plateau	Colona	-2.55	0.50333	33	3.8026	1.64	54
	Delta	-4.98	0.25075	23	4.3341	0.26	6
	Uncompahgre	-2.16	0.63659	9	4.5620	1.22	11
	Pinyon	15.70	0.43379	8	20.0550	2.25	18
Gunnison Basin	Castleton	42.40	0.01890	11	18.0534	2.09	23
	Parlin	10.46	0.17027	26	7.6302	1.50	39
	Marshall Pass	a	a	7	a	0.71	5
	Tincup	19.08	0.65130	8	42.2189	1.00	8

a = no data.

Only 1 % of the aspen habitat types on the Forest have been sampled in the 5 geographic areas on the Forest (Table 6). Most of the routes occur on the Uncompahgre Plateau and no sampling has occurred in the San Juan GA.

Table 6. Proportion of aspen habitats within individual Geographic Areas relative to representation of aspen habitats sampled on Breeding Bird Survey routes. Includes routes sampled from 1966-2003.

Geographic Area	National Forest (NF) area (ac)	Area of aspen ac (% of NF area)	Breeding Bird Survey Routes					Aspen area sampled by BBS routes ac (% of total aspen area)
			No. of BBS routes	BBS route length (mi)	No. of routes that include aspen	Length of routes that include aspen (mi)	Area of NF sampled by all BBS routes ac (% of NF) ¹	
Uncompahgre Plateau	570,932	153,334 (27)	4	67	4	21.9	13,595 (2.4)	4,274.54 (2.8)
San Juan	298,465	76,305 (26)	0	0	0	0	0 (0.0)	0 (0)
Gunnison Basin	1,281,118	197,888 (15)	4	53	3	5.04	10,124 (0.8)	1,247.445 (0.63)
North Fork Valley	483,094	214,253 (44)	2	14	1 ²	3.4	2,901 (0.6)	774.717 (0.36)
Grand Mesa	317,828	96,735 (30)	1	10	1 ²	1.5	1,634 (0.5)	509.415 (0.53)
Totals for the GMUG NF	2,951,437	738,515 (25)	11	144	8	31.84	28,254 (1)	6,806.117 (0.92)

¹ Estimated by buffering each Breeding Bird Survey route by 250 m along each side of transects that fell within the Forest.

² These two routes are the same, it occurs on both the Grand Mesa and North Fork Valley Geographic Areas.

An analysis was also performed on BBS routes containing counts that were conducted during the same years on the Forest. Not all BBS routes have been counted consistently each year. Out of nine routes with red-naped sapsucker detections, three were counted consistently from 1994 to 2004, excluding the year 1996. During this 10 year period, the number of red-naped sapsuckers detected on these routes increased (Figure 3). However, both the duration of counts (10 years) and low number of routes sampled are insufficient to obtain a reliable population trend estimate.

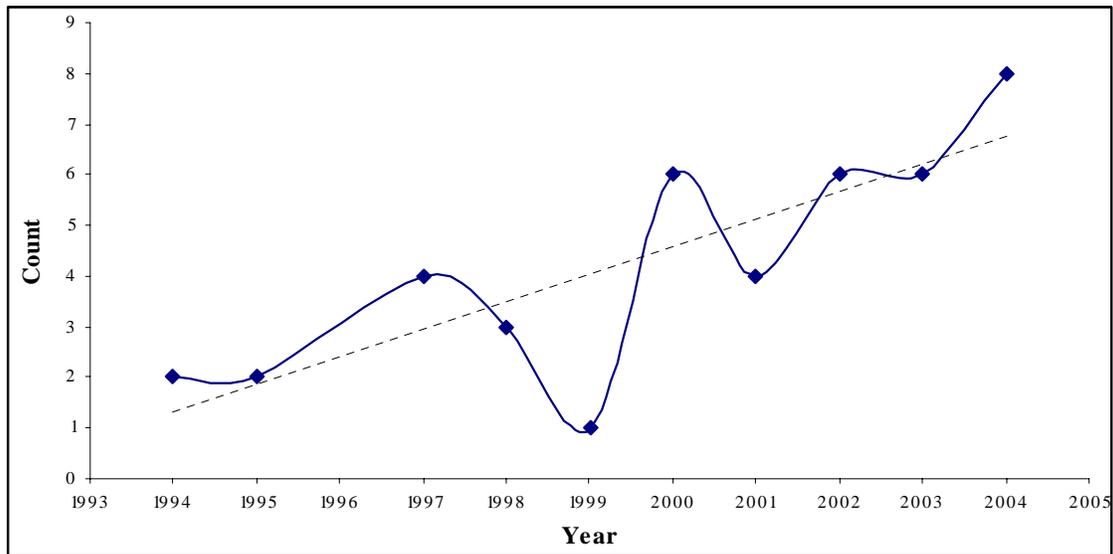


Figure 3. Red-naped sapsucker counts from BBS routes on the Forest from 1994-2003. These counts were obtained from one route on each management unit of the Forest; the routes selected for analysis were implemented during the same years.

Monitoring Colorado’s Birds (MCB), Rocky Mountain Bird Observatory

From 1999 to 2004 (excluding 2001 due to missing data) red-naped sapsuckers have been detected on an average of 18.8 transects per year (range: 11-34), with an average of 49.7 individuals counted each year. Counts ranged from 29 individuals in 2003 to 103 individuals in 2004, for a total of 298 observations. Figure 4 displays annual red-naped sapsucker counts in aspen (n = 191), high elevation riparian (n = 98), and lodgepole pine (n = 9) habitat types collectively within the MCB survey area.

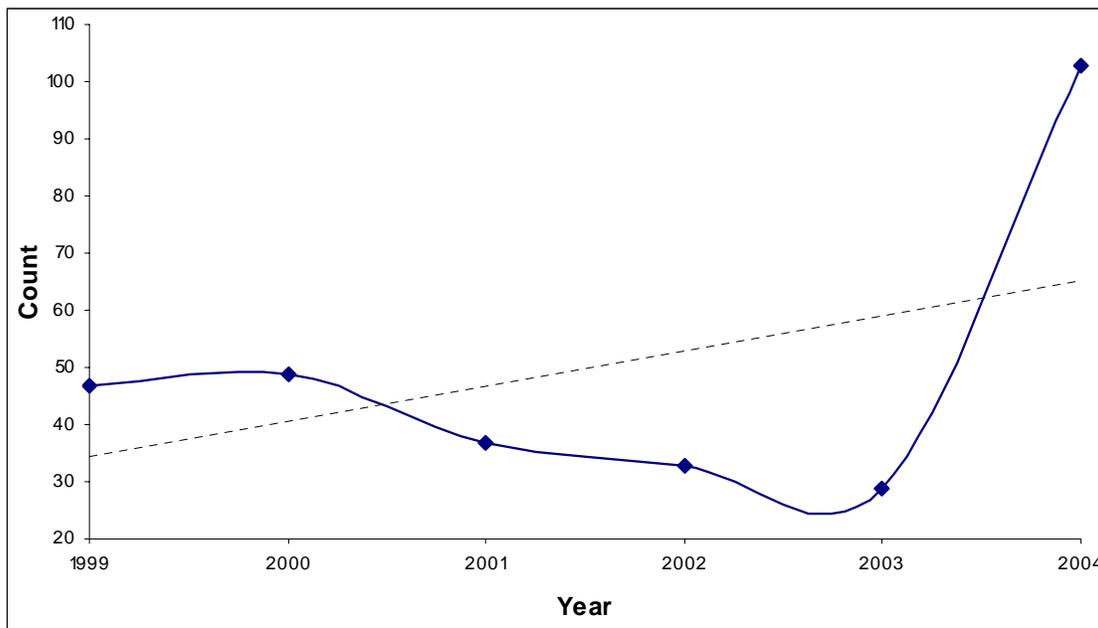


Figure 4. Red-naped sapsucker counts from MCB point-count transects.

At this time, MCB data for their entire survey area is insufficient to detect population trends due to the relatively short time period that data has been collected (7 years). We conducted an analysis of MCB point-count data for red-naped sapsuckers utilizing counts conducted on all transects within the Geographic Areas, regardless of land ownership, in addition to conducting a similar analysis for transects that fell within the Forest boundaries. From 1998 to 2004, MCB has detected a total of 218 red-naped sapsuckers on 32 transects that occur on National Forest, BLM, State, and private land within the five Geographic Areas (Table 7), which is 73 percent of all red-naped sapsucker observations detected throughout the RMBO survey area.

Table 7. Monitoring Colorado's Birds (MCB), Rocky Mountain Bird Observatory Red-naped Sapsucker (RNSS) data for all transects that occur on National Forest, BLM, State, or private land within the Geographic Areas.

Time Period 1998 - 2004				
Management Unit	No. of Transects	N Years	Average Count/Year	Total Count For All Years Combined
Gunnison NF	8	7	11.857	83
Uncompahgre NF	11	7	12.143	85
Grand Mesa NF	6	4	4.5	18
BLM	4	6	3	18
Paonia SRA	1	5	2.4	12
Private Land	2	2	1	2

On the Forest, MCB has detected 186 red-naped sapsuckers on 25 transects, primarily in aspen and high elevation riparian dominated habitat types. Interestingly, 62 percent of all red-naped sapsucker observations in the survey area were on the Forest (Table 8).

Table 8. Monitoring Colorado's Birds (MCB), Rocky Mountain Bird Observatory Red-naped Sapsucker (RNSS) detection data for all transects that occur on the Forest.

Time Period 1998 - 2004				
Management Unit	No. of Transects	N Years	Average Count/Year	Total Count For All Years Combined
Grand Mesa NF	6	4	4.5	18
Uncompahgre NF	11	7	12.143	85
Gunnison NF	8	7	11.857	83

Data was also used to examine general population trends within Geographical Areas, regardless of land ownership, by year. From 1998 to 2004, MCB detected approximately 31 red-naped sapsuckers per year, totaling 218 detections in seven years. These 218 detections occurred at 140 different locations, encompassing 32 point-count bird transects. Table 9 summarizes red-naped sapsucker detection data by year for all transects that occur within the five Geographic Areas. The number of red-naped observed on MCB transects in the 5 GAs has increased since counts began in 1998 (Figure 5). However, both the number of transects counted and the number of years (N=7) is insufficient to provide a statistically reliable population estimate.

Table 9. Monitoring Colorado's Birds (MCB), Rocky Mountain Bird Observatory red-naped sapsucker detection data by year for all transects that occur within the five Geographic Areas (Gunnison Basin, Grand Mesa, North Fork Valley, Uncompahgre Plateau, and San Juan), regardless of land ownership.

Year	Count	No. of Points RNSS Were Detected On	No. of Transects RNSS Were Detected On	Average No. of RNSS per Transect
1998	24	20	9	2.7
1999	11	11	5	2.2
2000	29	26	10	2.9
2001	25	23	12	2.083
2002	43	35	14	3.07
2003	27	19	11	2.45
2004	59	44	16	3.69

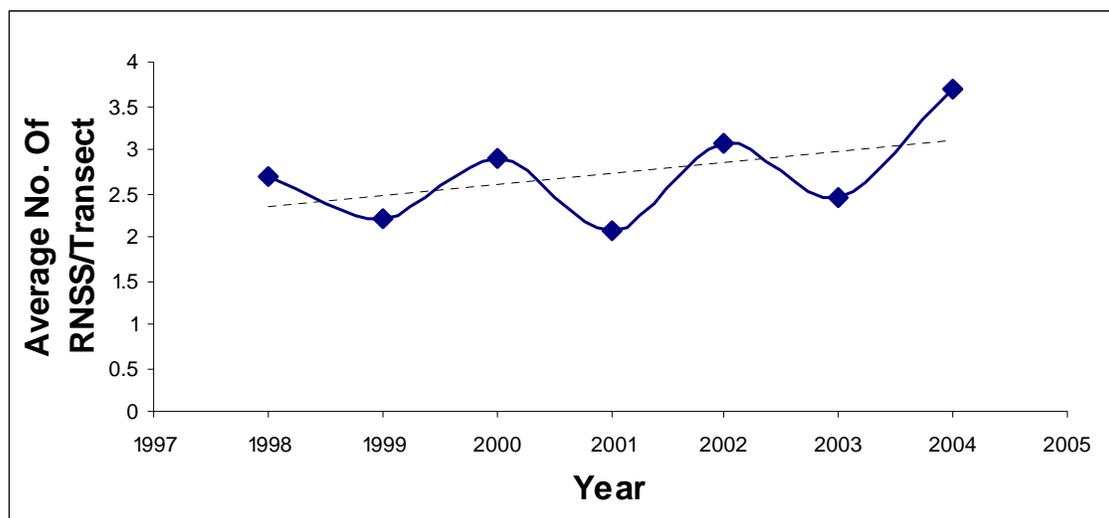


Figure 5. Average number of red-naped sapsuckers per transect (total of 32 transects) from 1998 to 2004 within the five Geographic Areas (includes all land ownerships).

The number of Red-naped sapsucker detected on the Forest was also examined (Table 10). Approximately 26.57 red-naped sapsuckers per year, totaling 186 detections in seven years, were observed. These 186 detections occurred at 114 different locations, encompassing 25 point-count bird transects. An average of 3.02 red-naped sapsuckers were detected on each transect each year. The number of red-naped observed on MCB transects on the National Forest remained somewhat constant since counts began in 1998 (Figure 6). However, both the number of transects counted and the number of years (N=7) is insufficient to provide a statistically reliable population estimate.

Table 10. Monitoring Colorado's Birds (MCB), Rocky Mountain Bird Observatory red-naped sapsucker detection data by year for all transects that occur on the Forest.

Year	Count	No. of Points RNSS Were Detected On	No. of Transects RNSS Were Detected On	Average No. of RNSS per Transect
1998	19	15	7	2.714
1999	6	6	2	3
2000	23	20	7	3.29
2001	22	20	10	2.2
2002	39	31	12	3.25
2003	23	15	9	2.56
2004	54	39	13	4.15

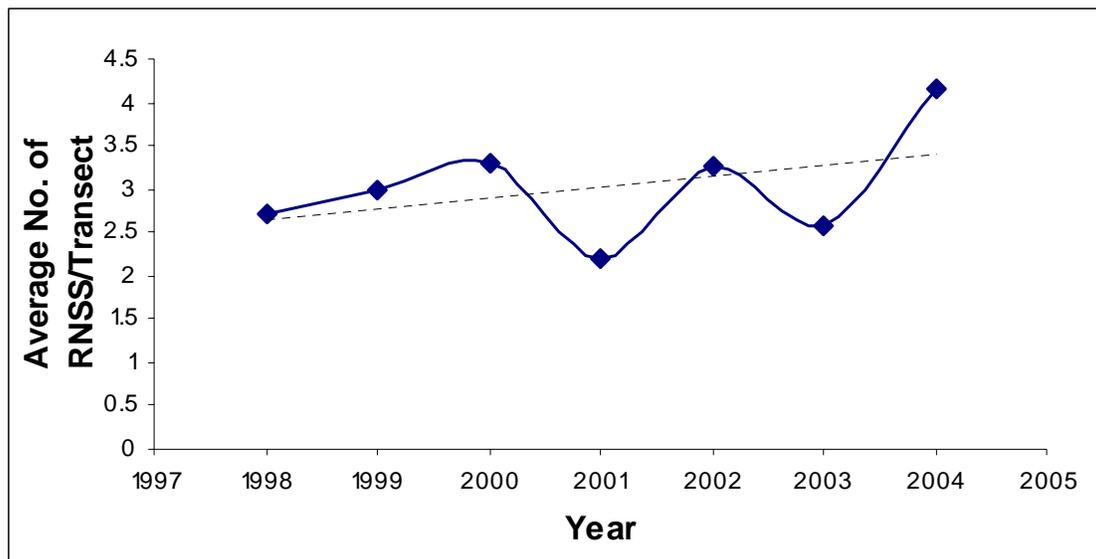


Figure 6. Average number of red-naped sapsuckers per transect (total of 25 transects) from 1998 to 2004 for the Forest.

Discussion

Forest-wide, there are 11 Breeding Bird Survey (BBS) routes encompassing 144 miles, with approximately 28,254 acres of the Forest sampled by the BBS (Table 6). The BBS is currently the best and most extensive bird-monitoring program for monitoring bird populations (Robbins et al. 1989, Sauer 1993) at large geographic scales. Unfortunately, many species and habitats are inadequately sampled by the BBS (Robbins et al. 1993, Sauer 2000). In addition, BBS data have limited use for determining responses of bird communities to environmental change and/or management activities and identifying causes of population change (Sauer and Cooper 2000), in part because habitat data are not recorded during BBS counts (Leukering et al. 2000). For these reasons, BBS data are generally insufficient to guide local or regional management decisions (Leukering et al. 2000).

Due to the limitations of BBS data to monitor bird populations at low geographic scales, Monitoring Colorado's Birds (MCB), which is a habitat-based bird monitoring program implemented by the Rocky Mountain Bird Observatory (RMBO), was used in this assessment to complement data generated by the BBS to analyze population status of red-naped sapsuckers on the Forest. Forest-wide, there are 43 MCB transects encompassing 449 points (Appendix C). The MCB program has sampled approximately 14,081 acres of the Forest, which was estimated by buffering each point-count transect by 250 meters. Further, the MCB program has sampled approximately 3,385 acres of aspen dominated habitat types (primary summer cover and foraging habitat for red-naped sapsuckers), which is 24 percent of the total acreage sampled by the MCB program on the Forest. Finally, the MCB program has sampled 1,906 acres of mature aspen (4A, 4B, and 4C; primary nesting habitat for red-naped sapsuckers), which is 56 percent of the total aspen area sampled by the MCB program and 14 percent of the total acreage sampled by the MCB program on the Forest. Table 11 shows an analysis of primary red-naped sapsucker habitat sampled by the MCB program on the Forest.

Table 11. Proportion of aspen habitats within individual Geographic Areas relative to representation of aspen habitats sampled by the MCB program. Includes all point-count transects and transect points that are within the Forest boundaries.

Geographic Area	National Forest (NF) area (ac)	Area of all aspen ac (% of NF area)	No. of MCB points	No. of MCB transects	Monitoring Colorado's Birds		Area of NF sampled by the MCB program ac (% of NF) ¹	Aspen area sampled by the MCB program ac (% of total aspen area)
					No. of points that include aspen	No. of transects that include aspen (mi)		
Uncompahgre Plateau	570,932	153,334 (27)	134	10	38	6	4,039 (0.7)	1,283 (0.8)
San Juan	298,465	76,305 (26)	54	4	16	4	1,660 (0.6)	555 (0.7)
Gunnison Basin	1,281,118	197,888 (15)	166	17	30	5	5,318 (0.4)	747 (0.4)
North Fork Valley	483,094	214,253 (44)	31	4	12	2	932 (0.2)	370 (0.2)
Grand Mesa	317,828	96,735 (30)	64	8	10	3	2,132 (0.7)	430 (0.4)
Totals for the GMUG NF	2,951,437	738,515 (25)	449	43	106	20	14,081 (0.5)	3,385 (0.5)

¹ Estimated by buffering each MCB transect by 250 m along each side of transects that fell within the Forest.

Activity Pattern and Movements

Red-naped sapsuckers are primarily a short-distance migrant. They move south from their breeding range into Mexico, Baja California, southern California, Arizona, and New Mexico, although some individuals winter within their breeding range in Arizona and New Mexico (Walters et al. 2002). In Colorado, transient Red-naped sapsuckers establish feeding territories during March in pinyon-juniper habitats before moving to breeding grounds at higher elevations in early April (Hadow 1977). The timing of territory establishment and pair formation may be delayed by colder than average temperatures or other inclement weather (Walters et al. 2002). Pair formation and nest excavation typically begins within three weeks of arrival to the breeding grounds (Hadow 1977). Following territory establishment and pair formation, the nesting season extends from mid or late April to early August, with most nesting activity concentrated between mid-May to mid-July in Colorado (Hadow 1977, Walters 2002). Fall migration takes place from early August to late October, typically peaking in September (Campbell et al. 1990, Gilligan et al. 1994, Lehman 1994, Russell and Monson 1998, Walters 2002). In Colorado, transient red-naped sapsuckers usually exhibit movements to lower elevations in pinyon pine–juniper habitats by early September (Hadow 1977) before migrating to winter ranges.

Food Habits

In early spring, the red-naped sapsucker feeds primarily in sap wells that they create in the xylem of trunks or stems of conifer trees, including Rocky Mountain juniper, Douglas-fir, lodgepole pine, and ponderosa pine. Xylem sap wells are characterized by a series of parallel circular holes that usually completely surround a stem or trunk (Walters et al. 2002). Once deciduous trees and shrubs leaf out, the red-naped sapsucker preferentially forages among aspen and cottonwood stands associated with willow riparian areas. During the breeding season, this species creates sap wells that tap the phloem tissue of stems or tree trunks, predominantly in aspen and willow vegetation, and less frequently in cottonwood riparian since cottonwood comprises a very minor component of forested habitat within the boundaries of the Forest (0.15%). Phloem sap wells are characterized by a rectangular shape and typically surround an aspen trunk (Cover photo) or willow stem (Figure 7).



Figure 7. Phloem sap wells in willow.

Walters (1996) reported nesting pairs defending a series of sap wells in a variety of deciduous shrub thickets, which included willow. In Colorado, Ehrlich and Daily (1988) found that 72 percent of willow bushes showed evidence of sapsucker foraging; within an individual willow bush, 28 percent of stems showed evidence of foraging, of which 98 percent were dead. Willow clumps are only used by red-naped sapsuckers for a single season, partly because many stems die from sapsucker damage (Walters 1996).

Although red-naped sapsuckers are specialized for sipping sap, their diet also includes insects, inner bark, fruit, and seeds (Walters et al. 2002). This species feeds on aspen buds and has been observed fly-catching exclusively in aspen and gleaning insects from aspen, Douglas-fir, and cottonwood (Walters 1996). During the breeding season, the red-naped sapsucker spends the majority of its time maintaining sap wells and searching for insects to feed nestlings (Walters et al. 2002). Adults often crush prey and sometimes mix insects with sap prior to feeding young (Wible 1960). Juvenile sapsuckers are capable of foraging on their own soon after they leave the nest (Crockett and Hansley 1977, Tobalske 1992).

Breeding Biology

Red-naped sapsuckers are apparently monogamous, with pair bonds maintained through the breeding season and usually re-established between years if mates survive (Walters et al. 2002). Mate fidelity may be attributable to general nest site fidelity; red-naped sapsuckers even reuse nest trees in subsequent years (Walters et al. 2002). Pair formation and nest excavation begins within three weeks of arrival to the breeding grounds, typically in early to mid-April. Nest sites may be chosen based on their proximity to suitable foraging habitat rather than on the characteristics of the nest stand itself (Crockett and Hadow 1975). Initially, the male performs most of the cavity excavation with female participation increasing as the season progresses. Cavity excavation varies from six days to four weeks (Howell 1952, Walters 2002).

Red-naped sapsuckers only raise one brood per season, although pairs sometimes re-nest if the first nest fails (Walters et al. 2002). Clutch size ranges from three to seven eggs (Koenig 1986, Walters et al. 2002). In a study conducted at Hat Creek, British Columbia, Walters et al. (2002) reported that mean clutch size was significantly larger in old cavities than mean clutch size in new cavities. The point at which incubation begins for red-naped sapsuckers is unknown, although Walters et al. (2002) assumes that incubation begins on the day that the last egg is laid. Incubation is estimated to last approximately eight to twelve days (Walters et al. 2002) with both parents incubating, although the male likely does most of the incubating (Short 1982). In Colorado, Hadow (1977) recorded red-naped sapsucker chicks hatching in early June and fledging during the second week of July. On the Flathead National Forest in northwestern Montana, Tobalske (1992) reported that adults were most active and the juveniles most vocal two weeks prior to fledging.

Demography

Spacing and Territoriality

Early in the breeding season, red-naped sapsuckers defend occupied space that includes the nest tree and sap wells (Walters et al. 2002). Later in the nesting cycle, red-naped sapsuckers will defend the immediate vicinity of nests or sap wells, but they do not advertise occupancy of space around these sites as they do early in the breeding cycle (Walters et al. 2002). After fledging, adults and young generally disperse from their home territory soon after the nest is evacuated (Tobalske 1992). In Colorado, average breeding territory size was estimated at 1.67 ha, ranging from 0.70 to 2.63 ha (Young 1975). Walters (1996) did not find differences in territory size between males and females. At Hat Creek, British Columbia, where territory sizes were larger (mean: 13.2 ha) than those measured in Colorado, Walters (1996) reported that 95 percent of movements were less than 500 m from the nest. In the Northern Rockies, McClelland (1977) documented that red-naped sapsucker territories were smaller (2 ha in size) when nest sites were near the edges of old-growth forest stands and open clearcuts where scattered birch had grown rapidly following timber harvest; conversely, he observed that territories were larger (8 – 10 ha in size) in dense old-growth habitat.

Reproductive Success

Red-naped sapsuckers breed annually, normally rearing one brood per season. First breeding can take place when red-naped sapsuckers are at one year of age, although some individuals do not reproduce until they are two years old (Fleury 2000, Walters et al. 2002). If the first brood fails, some individuals may lay a replacement clutch (Walters et al. 2002). Annual and lifetime reproductive success may be influenced by a combination of factors, including infertile eggs, predation, loss of parent, adverse weather conditions, and a lack of arthropods to feed young (Walters et al. 2002). Several studies documented annual and lifetime reproductive success for the red-naped sapsucker, as indicated below (Table 12).

Table 12. Annual and lifetime reproductive success rates for the red-naped sapsucker (Fleury 2000, Walters 2002).

Location	No. of Eggs Laid	No. of Nests	No. of Eggs Hatched	No. of Young Survived
Hat Creek, British Columbia	196	41	--	122 survived to 12 days of age
Nevada	266	56	214	34 survived to leave the nest

Several authors have also reported on nest success rates for the red-naped sapsucker. Over a three-year period in Nevada, Fleury observed 63 out of 85 red-naped sapsucker nests fledge at least one young with nest success rates of 77 to 92 percent; three-year-old sapsuckers had higher nest success than one-year-olds (Walters et al. 2002). Over a three-year period at Hat Creek, British Columbia, Walters (1996) observed 58 out of 67 red-naped sapsuckers produce young. In comparison to other species, woodpeckers have the highest mean rate of nest success (Johnson and Kermott 1994). As a group, cavity nesting excavators have significantly greater success than non-excavators (Johnson and Kermott 1994).

Survivorship

The maximum lifespan for this species was estimated to be at least six years (Fleury 2000). Fleury estimated survivorship for different age intervals as follows: survival for first year (from fledge date to one year old), 0.02-0.27; survival for third year (from two to three years old), 0.46-0.71; and survival for fourth year (from three to four years old), 0.40-0.60. While most adults that survive migration are presumed to return to their previous breeding grounds each year, most young do not return to their natal areas (Walters et al. 2002). Causes of mortality may be attributed to many factors, including exposure, predation, and competition with other species. McClelland (1977) recorded a loss of red-naped sapsucker nests when nest trees fell or broke at the cavity entrance. Predation losses at red-naped sapsucker nests in Arizona ranged from 0 (n = 18; Martin and Li 1992) to 3.4 percent (Martin 1995); and at Hat Creek, British Columbia, Walters and Miller (2001) recorded higher predation losses that ranged from 12 percent (n = 25) to 20 percent (n = 30).

Community Ecology

As indicated above, nest failure is often attributed to nest predation. Mammalian predators take adults, young, or eggs at the nest (Walters et al. 2002). On the Forest, bears are likely one of the main mammalian predators of red-naped sapsucker nestlings. Bears gain access to the cavity entrance by gnawing or clawing (Figure 8). Other predators of red-naped sapsuckers on the Forest include deer mice, weasels, and house wrens. Deer mice take eggs, weasels take roosting males or nestlings, and house wrens destroy eggs and will even place their own nest over red-naped sapsucker eggs or young (Walters and Miller 2001, Walters et al. 2002). Common avian predators of adult red-naped sapsuckers on the Forest and elsewhere are the accipiters (northern goshawk, Cooper's hawk, and sharp-shinned hawk). Remains (feathers) of red-naped sapsuckers and other woodpeckers have been found at the base of goshawk nest trees on the Forest. Walters and Miller (2001) found the remains of a radio-tagged adult red-naped sapsucker in the nest of a Cooper's hawk. Reynolds and Meslow (1984) and Squires (2000) documented predation

of red-naped sapsuckers by the northern goshawk and sharp-shinned hawk. Red-naped sapsuckers respond to threats by excitedly uttering “alarm” calls, and adults may swoop down and sometimes strike a potential predator (Walters et al. 2002). Howell (1952) reported that some individuals dodge to avoid attacks by house wrens, while others chase them away.



Figure 8. Cavity nest depredation on the Forest, presumably by a black bear.

Species-Habitat Relationships

General Habitat Use

Throughout their breeding range distribution, the red-naped sapsucker breeds primarily in deciduous woodlands including aspen groves in open ponderosa pine forests, aspen-fir parklands, logged forests where deciduous groves remain, and aspen or birch groves in open rangeland (Flanagan 1911, Hadow 1977, Short 1982, Campbell et al. 1990, Winkler et al. 1995, Walters et al. 2002). This species breeds less frequently in conifer-dominated forest habitats with a deciduous component; in northwestern Montana, McClelland and McClelland (2000) reported that red-naped sapsuckers were common nesters in old-growth coniferous forest, favoring western larch and paper birch. Nest sites are typically in close proximity to willow riparian vegetation that is used for foraging (Figure 8). The location of nest sites may be dependent on the location of high quality foraging habitat, rather than forest stand structural characteristics. The abundance and distribution of the red-naped sapsucker is largely tied to the availability of deciduous woody vegetation, particularly aspen and willow. This species is dependant on aspen stands or the aspen component of mixed stands for nesting and summer foraging, particularly when these habitat types occur in or adjacent to riparian areas. Red-naped sapsuckers are commonly observed in mature aspen stands within or adjacent to drainages and riparian areas containing willow vegetation; oftentimes these areas are surrounded by coniferous forests (Figure 9).



Figure 9. Representation of red-naped sapsucker nesting and foraging habitat on the Forest. An active red-naped sapsucker nest was found within the aspen stand located center right of photo. An adult pair was observed feeding insects to nestlings at their cavity nest in a mature live aspen tree (See cover photo of male at cavity nest). Adults were also observed sap sucking on willow stems at several locations within the riparian area adjacent to the nest site (Bottom of photo; see Figure 7 for close up of sap wells).

Landscape-Level Habitat Characteristics

A second-level analysis (habitat analysis based on dominant vegetation type and overstory canopy cover) using R2-Veg was conducted on 94 of 186 red-naped sapsucker locations on the Forest. Red-naped sapsucker detections were obtained from the Rocky Mountain Bird Observatory's (RMBO) Monitoring Colorado's Birds (MCB) database for the time period 1998 to 2004. Out of the 94 detections for which vegetation data was available, the majority (44%) of red-naped sapsucker detections were in aspen-dominated habitat types. Table 13 summarizes red-naped sapsucker detections by cover type and habitat structural stage for the Forest.

Table 13. No. of red-naped sapsucker detections by dominant vegetation cover type and habitat structural stage.

Cover Type	1M	1T	2S	2T	3A	3B	3C	4A	4B	4C	No Data	Total
Forbland	1	1										2
Grassland	15											15
Gambel Oak			11									11
Sagebrush			1									1
Snowberry			3									3
Willow			2									2
Aspen				1	6	15	2	3	11	3		41
Ponderosa Pine					1	2			5	3		11
Blue Spruce										3		3
Spruce-fir					1				2	2		5
No Data											92	92
Total	16	1	17	1	8	17	2	3	18	11	92	186

The Rocky Mountain Bird Observatory reported that red-naped sapsuckers appeared regularly on transects within small patches of aspen along the edges of streams flowing through coniferous forests. According to MCB data, red-naped sapsuckers were found almost exclusively within aspen and high elevation riparian habitat types on the Forest and throughout the state of Colorado. The R2-Veg database indicated that 53 detections occurred in nine vegetation cover types other than aspen, however aspen or high elevation riparian may have been a minor habitat component within these nine cover types. Further analysis revealed that aspen and high elevation riparian habitats were often near red-naped sapsucker detections that fell within a non-aspen vegetation cover type (Figure 10). Refer to Appendix D for a complete summarization of red-naped sapsucker landscape-level habitat characteristics on the Forest.

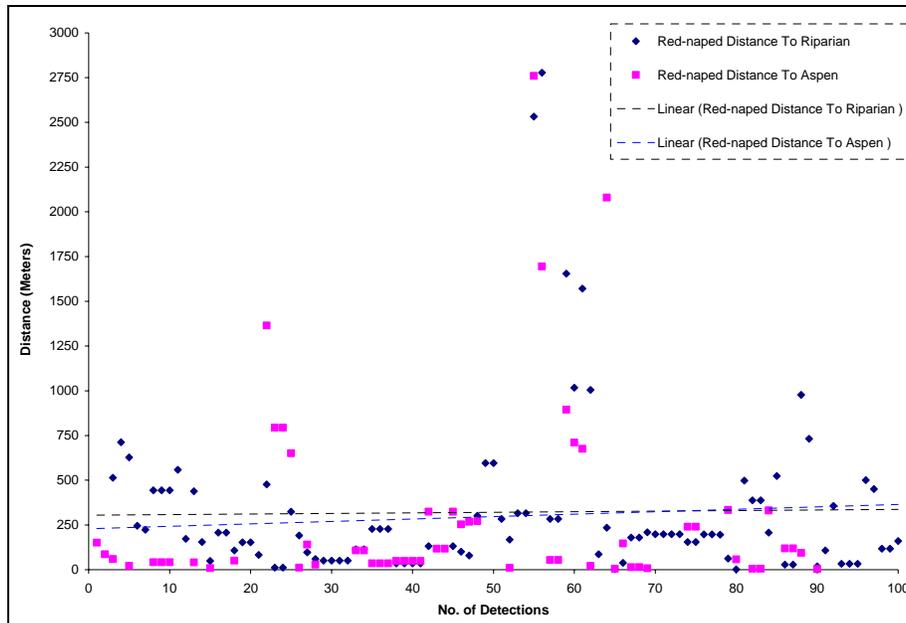


Figure 10. Distance of red-naped sapsucker detections to aspen patches and riparian areas. This graph only includes detections that do not occur within an aspen cover type or a riparian area. These data suggest that as distance increases from aspen stands and riparian habitats, the probability of detecting red-naped sapsuckers decreases. Mean distance of detections to riparian areas: 322 m, range: 1.7 - 2,777.9. Mean distance of detections to aspen patches: 292 m, range: 3.8 - 2,759.6. 72% and 76% of detections were within 322 m and 292 m of riparian areas and aspen stands, respectively.

CONSERVATION

Threats

Although red-naped sapsucker populations appear to be stable to increasing at the national, regional and possibly the Forest levels, their habitats have and continue to be affected by land management activities throughout their range. The Forest has approximately 741,000 acres of aspen which is approximately 22% of the land base (Comprehensive Assessment, in preparation) Approximately 70% of these acres are believed to have a spruce-fir-aspen Potential Natural Vegetation (PNV) climax community and 30% are believed to have an aspen PNV at climax. In these spruce-fir-aspen types, aspen currently dominates these stands and spruce-fir is secondary. Over time these stands are expected to convert from being aspen dominated to spruce-fir dominated in the absence of disturbance. Aspen PNV types are expected to remain aspen and are currently dominated by mid to late seral stages. The large acreage of mid to late seral in both spruce-fir-aspen and aspen PNV types will be beneficial to sapsuckers in the short term, but the lack of disturbance and potential loss of regeneration could affect sapsuckers negatively in the long-term. Red-naped sapsuckers also depend on willow riparian vegetation for foraging. The loss of woody riparian vegetation from overuse by domestic or wild ungulates could also negatively affect abundance of red-naped sapsuckers. Silvicultural practices that simulate natural disturbance regimes that promote regeneration could be beneficial to the species. Since aspen are dependent upon disturbance to stimulate regeneration, suppression of wildfires has also had an affect on the extent and age class of aspen on the Forest.

MANAGEMENT RECOMMENDATIONS

Grazing

Grazing may have detrimental effects on red-naped sapsucker habitat when the health and regeneration of aspen, cottonwood, and other preferred species is compromised (The Nature Conservancy 1999). Several authors note differences in abundances between grazed and ungrazed sites, and between lightly grazed and heavily grazed sites. In riparian habitat in Montana, Mosconi and Hutto (1982) observed that red-naped sapsuckers were significantly more abundant on lightly grazed sites than on heavily grazed sites where ground cover, shrub cover, mid-canopy cover, and number of small trees (less than 10 cm dbh) were significantly reduced in the heavily grazed areas. Page et al. (1978) also observed a negative response to grazing within aspen habitat in California and Nevada. Other authors (Medin and Clary 1991) did not find differences in abundance between grazed and ungrazed sites, but they also noted that the sites showed no significant differences in vegetative characteristics. Grazing primarily has the biggest impact on foraging habitat for the red-naped sapsucker, especially willow vegetation.

Prescribed Fire

Prescribed burning is an important management tool that can be used to regenerate aspen forests (Dieni and Anderson 1998). In the Wind River Range in Wyoming, Dieni and Anderson (1998) concluded that the loss of aspen stands through succession is probably more detrimental to birds associated with aspen communities than by treating such stands using prescribed fire. Dieni and Anderson (1998) detected significant relationships between the size of burns and the differences in red-naped sapsucker abundance between burned and unburned sites. Red-naped sapsuckers were significantly less abundant in the burned aspen stands (0.13 birds per 50-m radius point-count) compared to unburned stands (0.22 birds per 50-m radius point-count) when burn size or year was factored into the analysis (Dieni and Anderson 1998). However, small burns may have short-term negative affects to local populations of red-naped sapsuckers (Dieni and Anderson 1998). Burning aspen forests, whether seral or climax, essentially reverses succession and returns communities to an earlier seral stage, usually dominated by young aspen regeneration (Bradley et al. 1992, Dieni and Anderson 1998). In addition, burning creates snags that are important to cavity nesters, but red-naped sapsuckers primarily nest in live mature or decadent (>100 yrs old) aspen trees with heartwood decay. Therefore, the availability of suitable nest sites are likely not limiting in unburned, mature aspen forests (Dieni and Anderson 1998). Initially, burning aspen alters habitat for the red-naped sapsucker by reducing the mature tree component typically selected for cavity nesting; consequently bird abundances would be expected to decrease following fire. Yet, by using prescribed fire as a tool to stimulate aspen regeneration, habitat would be

sustained for the red-naped sapsucker in the long-term by providing future opportunities for nesting. Importantly, burning in a way that creates a mosaic of habitat structural stages will sustain habitat for many species that rely on aspen, including the red-naped sapsucker.

Timber Harvest

Drastic alterations of forest composition and structure that occur from logging may alter habitat quality for nesting woodpeckers (Tobalske 1992), yet a species may continue to use logged habitat as long as suitable nest trees are present (Hilden 1965). Furthermore, numerous studies show that some smaller woodpeckers will readily nest and forage in logged stands as long as some trees are left standing (Connor and Crawford 1974, Conner et al. 1975, Franzreb and Ohmart 1978, Dickson et al. 1983, Tobalske et al. 1991, Tobalske 1992). Tobalske (1992) examined the relative abundance of red-naped sapsuckers in unlogged and recently logged coniferous forest, augmented with an analysis of fledging success to determine whether such modified habitats provide suitable nesting opportunities for this species. He found that the relative abundance of red-naped sapsuckers and the number of young fledged per nest did not differ significantly between logged and unlogged stands. Moreover, Tobalske (1992) determined that forest management guidelines that require snag and live tree retention within cutting units provided useful nest sites for this species.

Even though Tobalske (1992) found that red-naped sapsuckers nested successfully in logged areas, he suggests that unlogged coniferous forest surrounding cutting units is probably essential to adult survival and productivity. Early in the spring when Red-naped sapsuckers first arrive to their breeding grounds following migration, they rely almost entirely upon conifer sap as a food source (Tate 1973, McClelland 1975, Tobalske 1992). The sap from aspen (and willow) becomes an important food source only after the buds open, and insects are not abundant until later in the season (Tobalske 1992). Therefore, red-naped sapsucker foraging and nesting requirements may be met by a habitat mosaic, including a combination of logged and unlogged areas. On the Forest, red-naped sapsuckers may respond well to timber sales that maintain a habitat mosaic containing mature aspen for nesting and foraging (when buds open), adjacent coniferous forests for early spring foraging, and nearby willow vegetation for foraging once leaves bud out.

The Colorado Partners in Flight Land Bird Conservation Plan (Biedleman 2000) states that red-naped sapsuckers respond well to partial harvesting with small to moderate sized patch clear-cuts. This species prefers decay-infected live aspen trees for cavity excavation, and they often reuse nest trees in consecutive years by excavating new cavities in a vertical distribution (Daily 1993). Heartwood decay incidence increases with age; consequently, habitat value to red-naped sapsuckers and other species is amplified in forests exhibiting old-growth characteristics (McClelland and McClelland 2000). The Colorado Partners in Flight Land Bird Conservation Plan (Biedleman 2000) provides management recommendations for the red-naped sapsucker in regard to timber harvests; for applicability to the Forest, slight modifications have been applied (*italic text*) based on known red-naped sapsucker habitat use on the Forest:

- Maintain at least 50 percent of management areas in uncut patches.
- Retain aspen snags greater than 25.4 cm (10 in) dbh, especially near riparian zones, water sources, and habitat edges. *In addition to snag retention, standards and guidelines for mature live tree retention within cutting units, particularly live trees with heartwood decay that are near riparian zones, water sources, and habitat edges, will benefit the red-naped sapsucker.*
- Snag densities in mature stands should exceed 15 per 4 ha (10 ac).
- Maintain disturbance regimes, natural and mechanical, and the dynamic nature of aspen communities at the landscape scale. Where natural disturbance mechanisms cannot be reintroduced, mechanical disturbance events should mimic, as closely as possible, the disturbance history of the local area and surrounding habitats.

- Self-generation or climax aspen stands provide important habitat areas for red napped. Since these stands are believed to be at PNV and self-regenerating, they should be retained in their present condition.

The above management recommendations, with emphasis on heartwood-decayed live tree retention, should benefit a multitude of species that are dependent on aspen habitats, including the red-naped sapsucker.

LITERATURE CITED

- American Ornithologists' Union.** 1983. Check-list of North American birds, 6th ed. Am. Ornithol. Union, Washington, D. C.
- American Ornithologists' Union.** 1985. Thirty-fifth supplement to the American Ornithologists' Union check-list of North American birds. Auk 102: 680-686.
- American Ornithologists' Union.** 1998. Check-list of North American birds, 7th ed. Am. Ornithol. Union, Washington, D. C.
- Bate, Lisa.** 1999. Draft Literature Review for Upper Columbia River Basin Ecosystem Management Project. Draft Report. Kalispell, MT. 8p.
- Bradley, A. F., W. C. Fischer, and N. V. Noste.** 1992. Fire ecology of the forest habitat types of eastern Idaho and western Wyoming. U. S. For. Serv. Gen. Tech. Rep. INT-290.
- Biedleman, C. A., editor.** 2000. Partners in Flight Land Bird Conservation Plan, Version 1.0. Colorado Partners in Flight, Estes Park, CO.
- Campbell, R. W., N. K. Dawe, I. McTaggart-Cowan, J. M. Cooper, G. W. Kaiser, and M. C. E. McNall.** 1990. The birds of British Columbia. Vol. 2: diurnal birds of prey through woodpeckers. R. Br. Columbia Mus., Victoria.
- Cicero, C., and N. K. Johnson.** 1995. Speciation in sapsuckers (*Sphyrapicus*): III. Mitochondrial-DNA sequence divergence at the cytochrome-B locus. Auk 112: 547-563.
- Connor, R. N., and H. S. Crawford.** 1974. Woodpecker foraging in Appalachian clearcuts. J. For. 72:564-566.
- Crockett, A. B., and H. H. Hadow.** 1975. Nest site selection by Williamson and red-naped sapsuckers. Condor 77: 365-368.
- Crockett, A. B., and P. L. Hansley.** 1977. Coition, nesting, and postfledging behavior of Williamson's Sapsucker in Colorado. Living Bird 16:7-19.
- Daily, G. C.** 1993. Heartwood decay and vertical distribution of red-naped sapsucker nest cavities. Wilson Bull., 105(4):674-679.
- Daily, G. C., P. R. Ehrlich, and N. M. Haddad.** 1993. Double keystone bird in a keystone species complex. Proc. Nat. Acad. Sci. U.S.A. 90: 592-594.
- Dickson, J. G., R. N. Connor, and J. H. Williamson.** 1983. Snag retention increases bird use of a clearcut. J. Wildl. Manage. 47:799-804.
- Dieni, J. S., and S. H. Anderson.** 1998. Effects of recent burning on breeding bird community structure in aspen forests. J. Field Ornithol., 70(4):491-503.
- Dobkin, D. S., and B. A. Wilcox.** 1986. Analysis of natural forest fragments: riparian birds in the Toiyabe Mountains, Nevada. Pp. 293-299 in Wildlife 2000: modeling habitat relationships of terrestrial vertebrates (J. Verner, M. L. Morrison, and C. J. Ralph, eds.). Univ. of Wisconsin Press, Madison.
- Ehrlich, P. R., and G. C. Daily.** 1988. Red-naped Sapsuckers feeding at willows: possible keystone herbivores. Am. Birds 42: 357-365.

- Flanagan, J. H.** 1911. Some Colorado woodpecker and sapsucker notes. *Oologist* 28:69-71.
- Fleury, S. A.** 2000. Population and community dynamics in western riparian avifauna: the role of the Red-naped Sapsucker (*Sphyrapicus nuchalis*). Ph.D. diss., Univ. of Nevada, Reno.
- Franzreb, K. E., and R. D. Ohmart.** 1978. The effects of timber harvesting on breeding birds in a mixed-coniferous forest. *Condor* 80:431-441.
- Gilligan, J., M. Smith, D. Rogers, and A. Contreras.** 1994. Birds of Oregon: status and distribution. Cinclus Publ., McMinnville, OR.
- Hadow, H. H.** 1977. Audible communication and its role in the species recognition of Red-naped and Williamson's sapsuckers (Aves: Piciformes). Ph.D. diss., Univ. of Colorado, Boulder.
- Harris, L.D.** 1984. The fragmented forest: Island biogeography theory and the preservation of biological diversity. Univ. of Chicago Press, Chicago, IL.
- Hilden, O.** 1965. Habitat selection in birds. *Ann. Zool. Fenn.* 2:53-75.
- Howell, T. R.** 1952. Natural history and differentiation in the Yellow-bellied Sapsucker. *Condor* 54: 237-282.
- Johnson, N. K., C. B. Johnson.** 1985. Speciation in sapsuckers (*Sphyrapicus*): II. Sympatry, hybridization, and mate preference in *S. rubber daggetti* and *S. nuchalis*. *Auk* 102: 1-15.
- Johnson, L. S. and L. H. Kermott.** 1994. Nesting success of cavity-nesting birds using natural tree cavities. *J. Field Ornithol.* 65(1):36-51.
- Johnson, N. K., R. M. Zink.** 1983. Speciation in sapsuckers (*Sphyrapicus*): I. Genetic differentiation. *Auk* 100: 871-884.
- Koenig, W. D.** 1986. Geographical ecology of clutch size variation in North American woodpeckers. *Condor* 88: 499-504.
- Lehman, P. E.** 1994. The birds of Santa Barbara County, California. Univ. of California at Santa Barbara Vertebr. Mus., Santa Barbara.
- Leukering, T., M. F. Carter, A. Panjabi, D. Faulkner, and R. Levad.** 2000. Monitoring Colorado's Birds: The Plan for Count-based Monitoring. Rocky Mountain Bird Observatory, Brighton, CO. 22 pages.
- Leukering, T., D. Faulkner, R. Levad, C. L. Wood, and J. Beason.** 2001. Monitoring Colorado's Birds: The 2000 Field Season. Rocky Mountain Bird Observatory, Brighton, CO. 27 pages.
- Martin, T. E.** 1995. Avian life history evolution in relation to nest sites, nest predation, and food. *Ecol. Monogr.* 65:101-127.
- Martin, T. E., and P. Li.** 1992. Life history traits of open - vs. cavity nesting birds. *Ecology* 73:579-592.
- McClelland, B. R.** 1977. Relationships between hole-nesting birds, forest snags, and decay in western larch-Douglas fir forests of the northern Rocky Mountains. P.h.D. diss., Univ. of Montana, Missoula.
- McClelland, B. R.** 1975. The use of snags by cavity nesting birds. Ph.D. diss., Univ. of Montana, Missoula, MT.

McClelland, B. R., and P. T. McClelland. 2000. Red-naped sapsucker nest trees in northern Rocky Mountain old-growth forest. *Wilson Bull.*, 112(1):44-50.

Medin, D. E., and W. P. Clary. 1991. Breeding bird populations in a grazed and ungrazed riparian habitat in Nevada. USDA Forest Service, Intermountain Research Station Research Paper INT-441. Ogden, UT.

Mosconi, S. L., and R. L. Hutto. 1982. The effect of grazing on the land birds of a western Montana riparian habitat. Proceedings of the wildlife-livestock relationships symposium. Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow, ID.

NatureServe. 2005. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: June 24, 2005).

Paige, J. L., N. Dodd, T. O. Osborne, and J. A. Carson. 1978. The influence of livestock grazing on non-game wildlife. *Cal. Nev. Wildl.* 1978:159-173.

Patton, D. R. 1997. Wildlife habitat relationships in forested ecosystems. Revised edition. Timber Press, Portland, Oregon, USA.

Peterjohn, B. G. 1989. The birds of Ohio. Indiana University Press, Bloomington, IN.

Reynolds, R. T., E. C. Meslow. 1984. Partitioning of food and niche characteristics of coexisting Accipiter during breeding. *Auk* 101:761-779.

Robins, C. S., J. R. Sauer, R. S. Greenburg, and S. Droege. 1989. Population declines in North American birds that migrate to the neotropics. *Proc. Natl. Acad. Sci., USA* 86:7658-7662.

Robbins, C. S., J. R. Sauer, and B. G. Peterjohn. 1993. Population trends and management opportunities for Neotropical migrants. In Finch, D. M. and P. W. Stangel (eds.), Status and Management of Neotropical Migratory Birds; 1992 Sept. 21-25; Estes Park, CO. Gen. Tech. Rep. RM-229. Fort Collins, CO. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. 422 pp.

Russell, S. M., and G. Monson. 1998. The birds of Sonora. Univ. of Arizona Press, Tucson.

Sauer, J. R. 1993. Monitoring Goals and Programs of the U. S. Fish and Wildlife Service. In Finch, D. M. and P. W. Stangel (eds.), Status and Management of Neotropical Migratory Birds; 1992 Sept. 21-25; Estes Park, CO. Gen. Tech. Rep. RM-229. Fort Collins, CO. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. 422 pp.

Sauer, J. R. 2000. Combining information from monitoring programs: complications associated with indices and geographic scale. In R. Bonney et al. (eds.), Strategies for Bird Conservation: The Partners in Flight Planning Process. Proceedings of the 3rd Partners In Flight Workshop; 1995 Oct. 1-5, Cape May, NJ. USDA Forest Service, Rocky Mountain Research Station. 281 pp.

Sauer, J. R., and R. Cooper. 2000. Population and habitat assessment: Monitoring bird populations over large areas. In R. Bonney et al. (eds.), Strategies for Bird Conservation: The Partners in Flight Planning Process. Proceedings of the 3rd Partners In Flight Workshop; 1995 Oct. 1-5, Cape May, NJ. USDA Forest Service, Rocky Mountain Research Station. 281 pp.

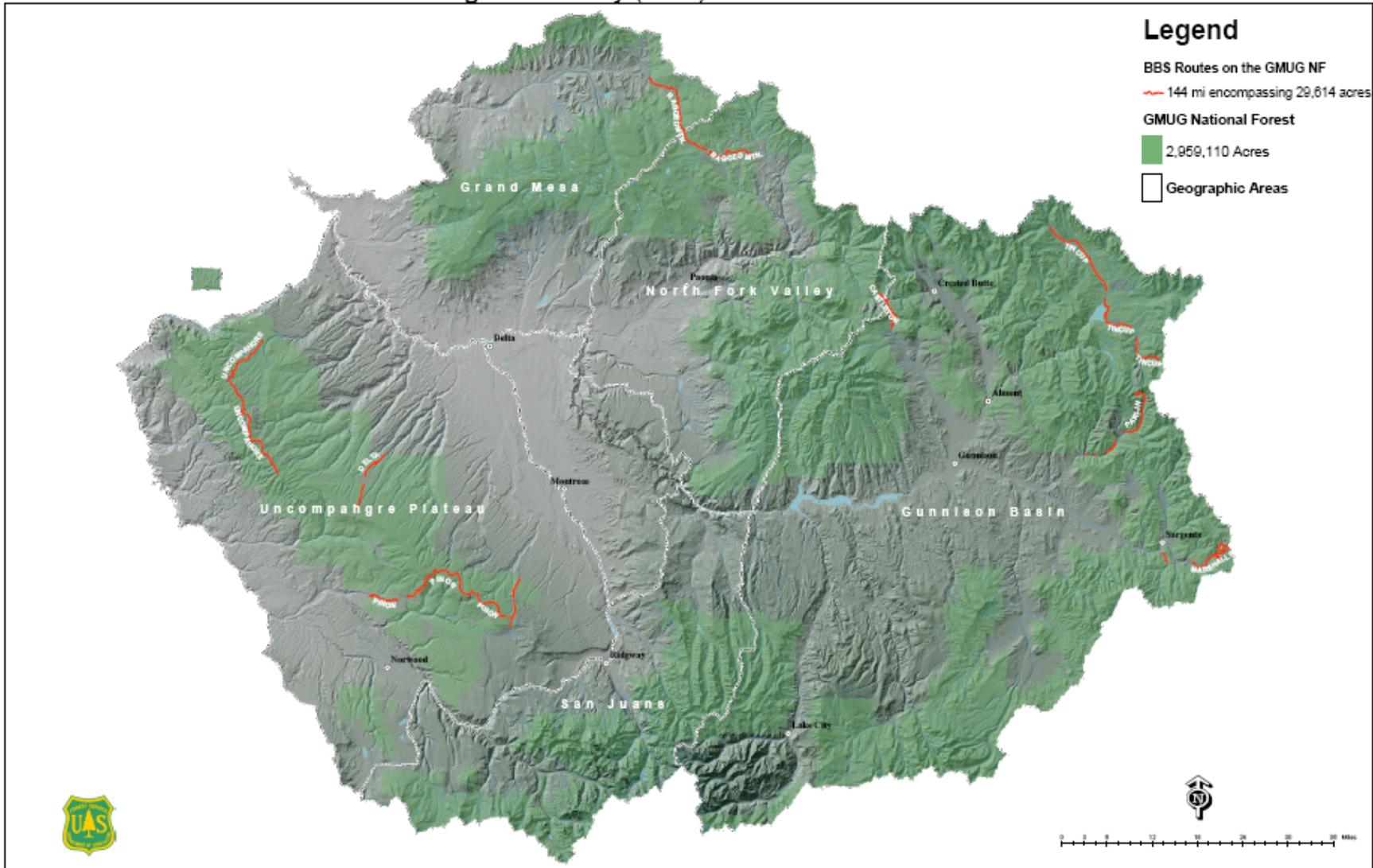
Sauer, J. R., J. E. Hines, and J. Fallon. 2005. *The North American Breeding Bird Survey, Results and Analysis 1966 - 2004. Version 2005.2.* USGS Patuxent Wildlife Research Center, Laurel, MD

Short, L. L. 1969. Taxonomic aspects of avian hybridization. *Auk* 86: 84-105.

- Short, L. L.** 1982. Woodpeckers of the world. Delaware Mus. Nat. Hist., Monogr. Ser. 4, Greenville.
- Short, L. L., and J. J. Morony, Jr.** 1970. A second hybrid Williamson's x Red-naped Sapsucker and an evolutionary history of sapsuckers. *Condor* 72: 310-315.
- Squires, J. R.** 2000. Food habits of Northern Goshawks nesting in south central Wyoming. *Wilson Bull.* 112:536-539.
- Tate, J., Jr.** 1973. Methods and annual sequence of foraging by the sapsucker. *Auk* 90:840-856.
- The Nature Conservancy.** 1999. The Nature Conservancy Species Management Abstract: Red-naped Sapsucker (*Sphyrapicus nuchalis*). Contributing authors: Paige, C., M. Koenen, and D. W. Mehlman. Arlington, VA. 11 Pp.
- Tobalske, B. W., R. C. Shearer, and R. L. Hutto.** 1991. Bird populations in logged and unlogged western larch/Douglas-fir forest in northwestern Montana. Res. Pap. INT-442. U.S. Dep. Agric., For. Ser.
- Tobalske, B. W.** 1992. Evaluating habitat suitability using relative abundance and fledging success of red-naped sapsuckers. The Cooper Ornithological Society. *Condor* 94:550-553.
- USDA Forest Service.** 2005. Forest Plan Amendment 2005-01. Management Indicator Species Amendment, May 2005. Appendix A-1 – A-17. Available: http://www.fs.fed.us/r2/gmug/policy/mis_amend/amended_plan_pages.pdf
- Walters, E. L.** 1996. Habitat and space use of the Red-naped Sapsucker, *Sphyrapicus nuchalis*, in the Hat Creek valley, south-central British Columbia. M. S. thesis, Univ. of Victoria, Victoria, BC.
- Walters, E. L., and E. H. Miller.** 2001. Predation on woodpeckers in British Columbia. *Can. Field-Nat.* 115:413-419.
- Walters, E. L., E. H. Miller, and P. E. Lowther.** 2002. Red-breasted Sapsucker (*Sphyrapicus ruber*) and Red-naped Sapsucker (*Sphyrapicus nuchalis*). In *The Birds of North America*, No. 663 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Wible, M.** 1960. Notes on feeding and fecal-sac disposal of sapsuckers. *Wilson Bull.* 72:399.
- Winkler, H., D. A. Christie, and D. Nurney.** 1995. Woodpeckers: an identification guide to the woodpeckers of the world. Houghton Mifflin Co., New York.
- Young, R. C.** 1975. Interspecific territoriality in Williamson's and Red-naped sapsuckers (*Sphyrapicus thyroideus* and *S. varius nuchalis*). M.S. thesis, Univ. of New Mexico, Albuquerque.

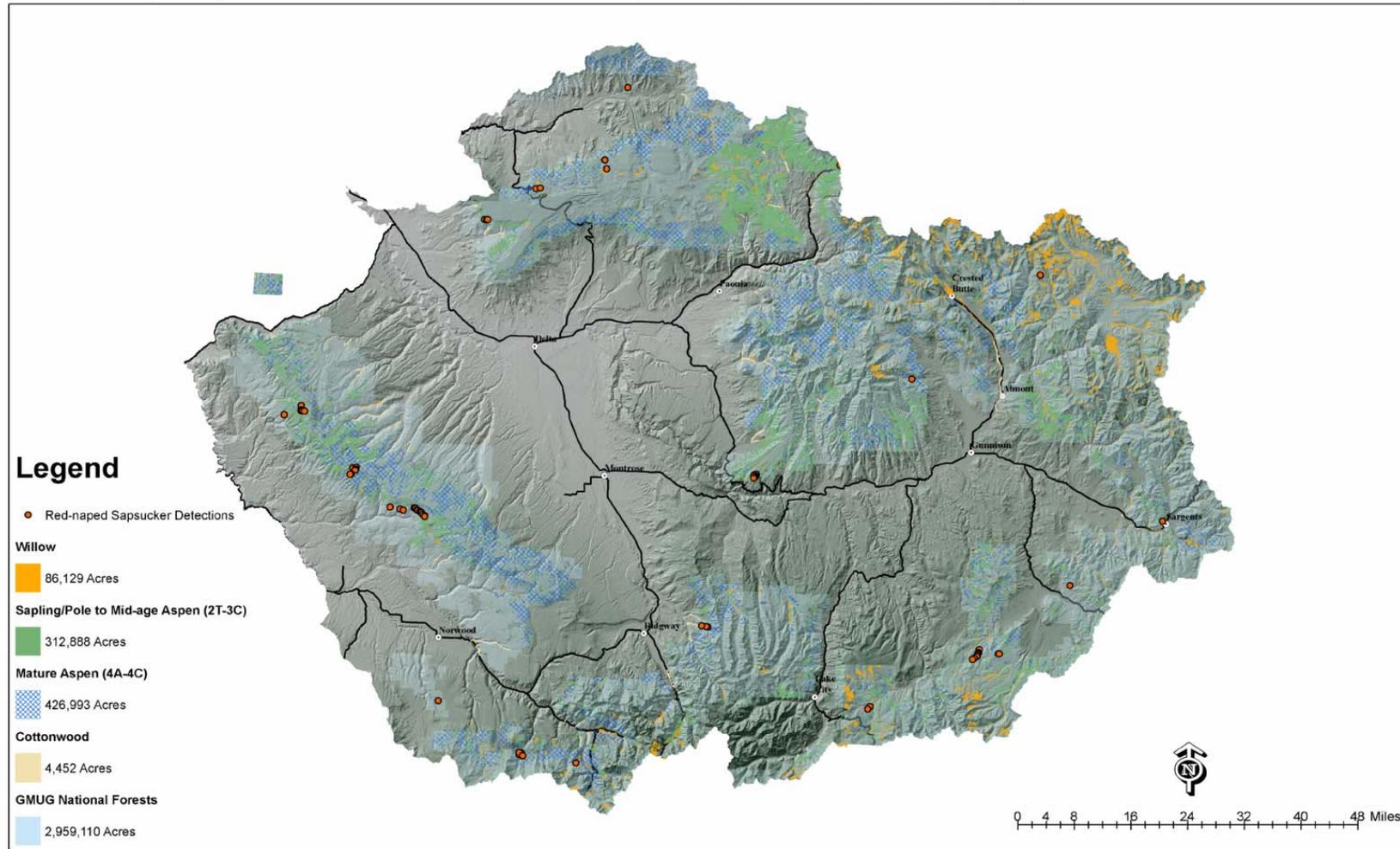
APPENDIX A

Breeding Bird Survey (BBS) Routes on the GMUG NF



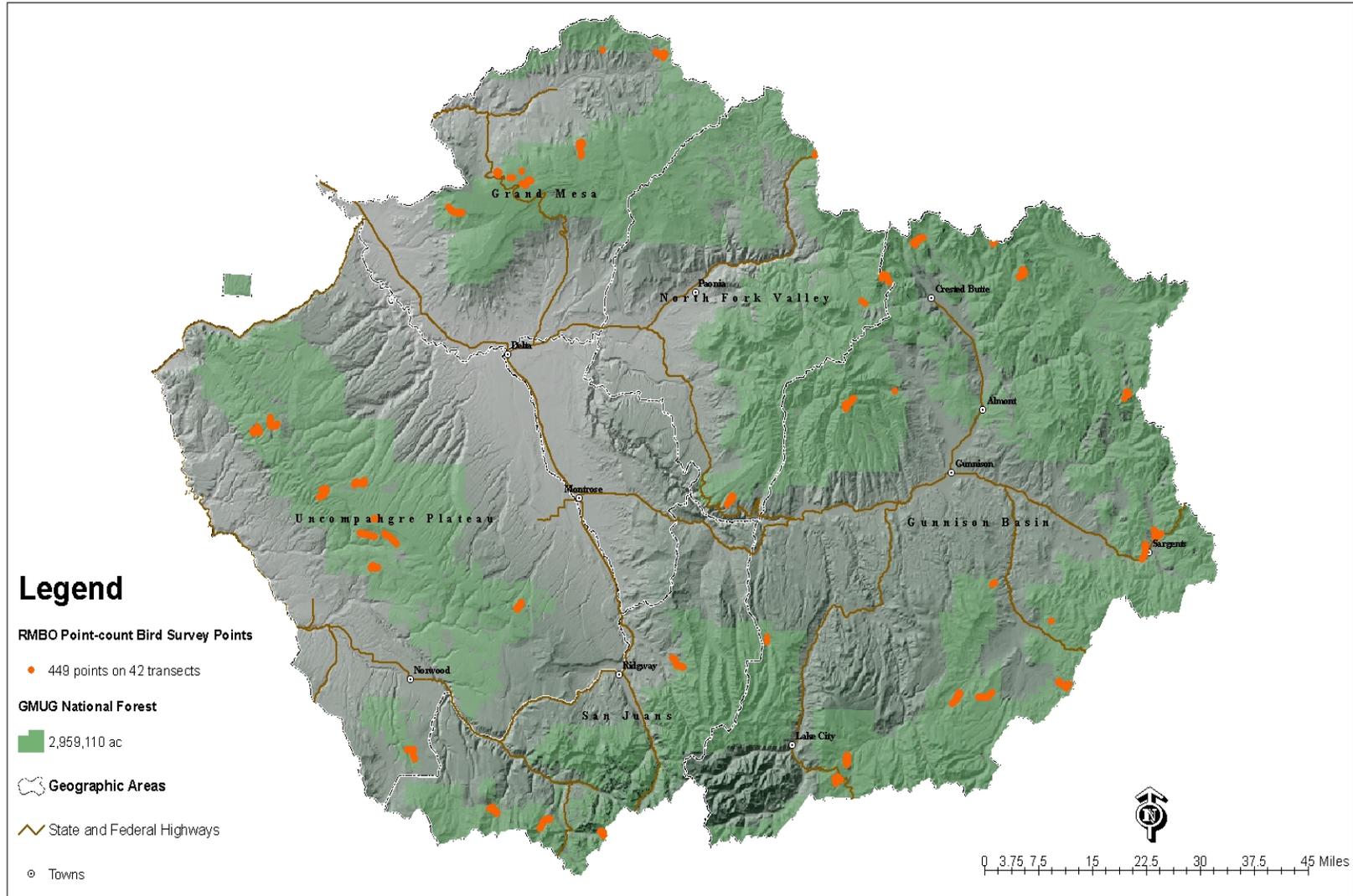
APPENDIX B

Red-naped Sapsucker Detections in Relation to Primary Habitat, Grand Mesa, Uncompahgre, and Gunnison National Forests



APPENDIX C

Rocky Mountain Bird Observatory, Monitoring Colorado's Birds Point-count Transect Locations on the GMUG NF



APPENDIX D

Landscape-level Habitat Characteristics for Red-naped Sapsucker Detections on the Forest											
Cover Type	Sample Size	Distance Range To Riparian (m)	Mean Distance To Riparian (m)	Patch Size Range (ha)	Mean Patch Size (ha)	Distance Range To Nearest Aspen Patch (m)	Mean Distance To Nearest Aspen Patch (m)	Slope % Range	Mean Slope %	Elevation Range (m)	Mean Elevation (m)
Forbland	2	49.4-107.6	78.3	3.2-6.9	4.9	8.8-50.6	29.9	13-15	14	2677-2716	2697
Grassland	15	0-235.3	96.9	3.2-112.9	41.3	8.5-2079.3	224.3	3.0-30.0	11	2468-3552	2790
Gambel Oak	11	78.9-513.6	193.2	14.6-140.8	34.4	5.5-331.3	154.8	4.0-30.0	15	2428-2784	2550
Sagebrush	1	62.5-62.5	62.5	200.3-200.3	200.3	333.8-333.8	333.8	26-26	26	2664-2664	2664
Snowberry	3	443.5-443.5	443.5	10.9-10.9	10.9	41.8-41.8	41.8	17-17	17	2777-2777	2777
Willow	2	0-3.4	1.5	9.3-15.8	12.5	5.8-151.8	78.6	5.0-6.0	5.5	2772-2999	2886
Aspen	41	33.5-731.5	251.5	1.7-169.6	33.7	0-0	0.0	8.0-34.0	17	2459-3291	2885
Ponderosa Pine	11	11.9-476.2	225.2	1.3-276.3	122.2	35.4-1365.2	385.3	3.0-12.0	8	2407-2606	2483
Blue Spruce	3	18.9-28.3	25.3	18.2-19.8	19.4	3.7-118.8	80.5	10.0-29.0	23	3023-3079	3060
Spruce-fir	5	167.9-977.5	468.2	4.0-32.8	18.6	10.4-94.2	46.9	6.0-27.0	16	2747-3285	3012
No data	92										
Summarized data	186	0-977.5	184.6	1.2-276.4	49.8	0-2079.3	137.6	3.0-34	15.25	2407-3552	2780