

**SURVEY PROTOCOL FOR THE GREAT GRAY OWL  
IN THE SIERRA NEVADA OF CALIFORNIA**

**May 2000**

**Prepared for  
USDA Forest Service  
Pacific Southwest Region  
Vallejo, California**

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## TABLE OF CONTENTS

|      |   |    |
|------|---|----|
| I.   | Introduction .....                        | 4  |
|      | A. Protocol Objectives .....              | 4  |
|      | B. Threats to the Species .....           | 4  |
|      | C. Triggers for Protocol .....            | 5  |
| II.  | Great Gray Owl Biology.....               | 5  |
|      | A. Range and Distribution.....            | 5  |
|      | B. Biology and Habitat Requirements ..... | 6  |
|      | C. Key Habitat Characteristics.....       | 9  |
| III. | Methods .....                             | 10 |
|      | A. Definitions .....                      | 10 |
|      | B. Survey Period .....                    | 14 |
|      | C. Survey Procedures .....                | 16 |
|      | D. Determining Occupancy Status .....     | 24 |
|      | E. Determining Activity Centers .....     | 25 |
|      | F. Protocol Testing and Refinement .....  | 26 |
|      | G. Field Forms .....                      | 27 |
| IV.  | Qualifications.....                       | 27 |
| V.   | Supplemental Notes .....                  | 28 |
| VI.  | References .....                          | 30 |
| VII  | Appendices .....                          | 33 |
|      | 1. Field Visit Form                       |    |
|      | 2. Nest Site Form                         |    |

# **SURVEY PROTOCOL FOR THE GREAT GRAY OWL IN THE SIERRA NEVADA OF CALIFORNIA**

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## **I. INTRODUCTION**

The following section summarizes objectives of the survey protocol for great gray owl (*Strix nebulosa*) in the Sierra Nevada of California and the management status of the species with the USDA Forest Service and the California Department of Fish and Game. It includes threats to the species and the triggers that specify when and where the survey protocol should be used.

### **A. Protocol Objectives**

The Regional Forester for the Pacific Southwest Region has listed the great gray owl (GGOW) as a Sensitive Species, which means that management of the species is subject to Forest Service policy found in FSM 2672.1. This states: "Sensitive species of native plant and animal species must receive special management emphasis to ensure their viability and to preclude trends toward endangerment that would result in the need for Federal listing."

All Sensitive Species must be evaluated when Forest Service projects are proposed to determine effects of the project and whether or not the project is likely to cause a trend toward Federal listing or loss of viability. The standards for biological evaluations are found in FSM 2672.42, including the following requirements: (1) An identification of all listed, proposed and sensitive species known or expected to be in the project area or that the project potentially affects, and (2) An identification and description of all occupied and unoccupied habitat recognized as essential for listed or proposed species recovery, or to meet Forest Service objectives for Sensitive Species.

To meet these requirements, it is often necessary to conduct field surveys for certain species for which reliable information on habitat occupancy is lacking or out of date. The primary objective of this survey protocol is to provide a standardized, consistent, and reasonably reliable method of determining presence and occupancy status of great gray owls within the Sierra Nevada of California.

### **B. Threats to the Species**

The great gray owl has been designated a Threatened Species by the State of California and a Sensitive Species by Region 5 of the Forest Service. This is based on several factors: (1) an apparent decline in occupied habitat over the last 100 years; (2) the species is dependent on dense forests with large snags and on meadows in medium to high seral condition; (3) these habitats have been reduced in many areas due to forest and range management practices. Both green tree and salvage harvest activities can eliminate potential nest trees, and grazing practices remove cover necessary for prey species and can also degrade meadow sites, lowering water tables and reducing productivity for grass-forb habitat. Prescribed burning can remove potential nest snags and downed woody material needed for small mammal habitat.

### **C. Triggers for Protocol**

Within the Sierra Nevada exclusive of the area subject to management requirements of the Pacific Northwest Forest Plan, the following areas will require surveys:

1. Where proposed ground-disturbing activities, including logging, prescribed burning, and grazing, are above the minimum elevation, The minimum elevations are 2000 feet in the northern Sierra, 2500 feet in the central Sierra and 3500 feet in the southern Sierra; and
2. Activities proposed are within mid- or late-seral forest stands that correspond to California Wildlife Habitat Relationships (Mayer and Laudenslayer 1988) size class 4 (average size of dominant and co-dominant trees 12-23 in.) or larger with canopy closure greater than 60%, or are within meadows that which total 10 acres or more and represent a potential territory for great gray owls; and
3. Activities, if in forest stands, are within 440 yards of a natural meadow or meadow-complex that totals 10 acres or more and represents a potential territory for great gray owls.
4. If great gray owls are known to reproduce repeatedly in the general area of the proposed project, items 1-3 will also pertain to regeneration cut units and burns <10 years old that have high suitability for pocket gophers and other rodents and that total more than 30 acres in one potential territory.

Criterion number 2 refers to canopy closure over 60% that may occur in small patches of ¼ acre, or even less, and not necessarily to how forest stands have been mapped and labeled for management purposes. Semi-open stands of 40-60% canopy closure often include small patches of dense trees that provide suitable nest sites. The 10-acre meadow standard of criterion 2 may include several small “stringer” meadows that total at least 10 acres, if in close proximity to each other. Refer to Supplemental Notes on page 28 for more on meadow habitat suitability.

## **II. GREAT GRAY OWL BIOLOGY**

### **A. Range and Distribution**

The great gray owl is an uncommon but widespread species inhabiting boreal forests of the Holarctic. It is a rare breeding bird in the United States south of Canada, and only isolated populations are known to occur in the lower 48 states, mainly west of the Rocky Mountains. These owls are thinly distributed through the Cascade Mountains of Washington and Oregon, with the exception of rather dense populations in the Blue Mountains of northeastern Oregon (Bull and Henjum 1990) and the mountains of Southwestern Oregon (Fetz et al. 2000). They are very rare in the Cascade/Siskiyou systems of California, with only a few historic records known from Del Norte, Humboldt, Shasta, and Siskiyou Counties. The species' presence on the Modoc Plateau of California is something of an enigma, where only a few records are known. The center of abundance in California is in the Sierra Nevada, where at least 75 percent of the records are from the greater Yosemite area (Winter 1986). Nearly all of the Sierra Nevada records are from the west slope but enough recent sightings and potential habitat are on the east slope to indicate that more could be located if surveys were conducted.

GGOWs are rarely found south of Yosemite, but recent detections exist as far south as the Sequoia National Forest (Tulare County). They are also rare in the northern Sierra, but several historic records are from the Modoc, Lassen, Plumas, Tahoe, and Eldorado National Forests (NF) and they have been seen recently on the Plumas NF and near Nevada City. The Sierran great gray owl population is the most southerly in the world and is unique in that respect.

## **B. Biology and Habitat Requirements**

### Identification

Great gray owls are the largest owls in North America in terms of body length (24-33 inches), but their average body weight is considerably less than both snowy (*Nyctea scandiaca*) and great horned owls (*Bubo virginianus*) (Synder and Wiley 1976). Their feathers are long, fluffy, and gray in general coloration with occasional brownish overtones from old worn or abraded feathers. The head is round and without ear tufts; the facial disc is gray with several dark concentric rings within which are set two small yellow eyes. The facial disk is subtended by two conspicuous white crescents and a narrow black patch beneath the bill. The underparts are diffusely streaked with gray. The tarsi and feet are densely feathered. The large size, grayish coloration, small yellow eyes, and black chin spot with lateral white crescents are diagnostic field marks. The hatching year birds look like adults by September and appear uniform gray in body, wing, and feather coloration. They retain this color pattern through their first breeding season. Adults usually have two and sometimes three generations of flight and/or tail feathers that are conspicuously faded in color from varying degrees of wear. The first-year birds retain pointed, white terminal tips on their tail feathers until about the middle of their first winter. The juveniles, just after leaving the nest, can be easily confused with great horned owls of a similar age (the two species are often found in the same habitats). Great gray owls always have *gray facial disks*, while great horned owls have brown facial disks at any age.

Spotted owls (*Strix occidentalis*) are about two-thirds the size of a GGOW, and are heavily spotted below and have dark eyes. No other species of owl in California can be confused with a great gray owl.

### Vocalizations

The primary territorial call (given mainly by males) is a low, evenly spaced series of 4-12 hoots. The whole call lasts about 6-8 seconds, with a mean interval of 33 seconds between calls. The primary call can carry a remarkable distance in spite of its softness. It can be heard in forests at a distance of over 400 yards on a clear, cool, windless night. The male call is lower in pitch than the female.

A second call (Low Double Hoot), usually heard in response to a taped call of another great gray owl, is a series of low, soft double hoots given at a rate of about 2-3 per second, usually for 15-20 seconds. This call is believed to be an aggressive response to a territorial intruder. It usually cannot be heard more than 50 yards. Both sexes give this call.

On occasion the primary calls are preceded (or given solely) by a low “who...WHOO” or “who...who...WHOO,” or “who..WHOO....who..who,” and although these calls are not often heard, they probably serve to reinforce territoriality. These variations could be confused with calls of a great horned owl, but they are much lower in pitch.

A soft “WHOOP” is often heard when a bird is startled near a nest and seems to be a kind of alarm note, most often heard from the females, but occasionally from males. The call seems associated with intersexual communication (Nero 1980).

A short, deep, two-note “bark” call is sometimes heard after the young have fledged and are begging for food. It is an alarm-warning directed toward the juveniles. The call is very reminiscent of the spotted owl, but is much lower in pitch.

During courtship and throughout the nesting cycle, the females give a distinctive begging call (the only call given exclusively by the females) that serves to reinforce the pair bond and acts as a location call that allows the male to locate his mate during courtship feeding. This call is a nasal “ee WHEET.. ee WHEET...” or “ee...EEET”, which inflects to a higher pitch at the end of the call. It can be given so loudly that it can be heard at 200 yards when a female is hungry, but most of the time it cannot be heard more than 20 yards away. If this call is heard during a follow-up survey, it is a good indication of where a nest will be located. When a male brings food to a female, either on the nest or during courtship feeding, this call will increase in loudness and frequency particularly when the male calls just before delivery of a prey item. The female often lapses into a rapid staccato chatter for several seconds after taking the prey from the male. Playing a recording of this feeding chatter is useful in prompting juvenile birds to call after they have left the nest, making it fairly easy to determine if breeding has taken place, making it a useful technique to use during a follow-up survey.

The begging call of the juveniles is a harsh, nasal “...err REEK....err REEK” that sound much like the begging calls of adult females, but higher in pitch and with a sharp up-down inflection. These calls become harsher and somewhat deeper in the fall and can be heard as late as November. They can be confused with the juvenile begging calls of great horned owls in the fall. Get visual confirmation if the only evidence of occupancy is based on a juvenile begging call.

Male GGOWs are vocally active from January through mid-May, depending upon the elevation of the breeding area. At Middle Elevation (see Elevation Zone definitions) sites, they are most vocal from February through mid-April. At Low Elevation sites, they can start calling in early January. At High Elevation sites, they arrive in late March and early April and begin calling as soon as they arrive on the breeding grounds.

In areas with only enough habitat to support a single pair of birds, male GGOWs frequently ignore taped calls, probably because of the absence of other males to stimulate territorial behavior. This fact should be kept firmly in mind during surveys. Lack of a response to a recorded call doesn’t necessarily mean that birds are not present. Meadow searches for sign provide another important means of detecting their presence.

GGOWs are not particularly vocal and many observers have never heard the species probably because the owls do most of their territorial calling after 0100 hours. A study conducted at Ackerson Meadow in the Central Sierra (Winter 1986) revealed that 56% of the unprompted calling activity was recorded between 0100-0400 hours with a pre-midnight peak of only 12% of the calling occurring at 2200 hours. However, there is no evidence of similar differences in response to played tapes. The assumption of the protocol is that GGOW will respond to tapes anytime during night hours.

## Habitat

On the lower margins of their distribution, great gray owls are found in conifer-woodland habitats consisting of ponderosa pine (*Pinus ponderosa*), incense cedar (*Calocedrus decurrens*), and black oak (*Quercus kelloggii*), sometimes near blue oak (*Q. douglasii*) or live oak (*Q. wislizenii*) woodlands. Slightly higher in the Mixed Conifer type, the dominant trees are ponderosa pine, sugar pine (*Pinus lambertiana*), white fir (*Abies concolor*), Douglas-fir (*Pseudotsuga menziesii*), incense cedar, and smaller amounts of black oak. At higher elevations Red Fir forest is preferred and consists of red fir (*Abies magnifica*), and combinations of white fir, lodgepole pine (*Pinus contorta*), Jeffrey pine (*Pinus jeffreyi*), and white pine (*Pinus monticola*). Mixed Conifer habitat in the Sierra Nevada ranges in elevation from 2000 to 6500 feet, and Red Fir forest from 6000 to 9000 feet (Munz and Keck 1959). However, most of the known great gray owl breeding activity occurs between 2500 and 8000 feet.

Virtually all GGOW records in California are of birds found in or near montane meadows. Meadows appear to be their preferred foraging habitat in California because their preferred prey inhabit grass-forb habitats, which do not grow under the dense canopies of the Sierran forests (Winter 1986). In the Blue Mountains of northeastern Oregon, the canopies are more open and park-like; grass-forb habitats commonly occur on the forest floor and are actively used by great gray owls for foraging (Bull and Henjum 1990). Such habitats rarely exist outside of meadows in the Sierra Nevada, except in stands that have been thinned. Clear-cuts and recent burns, where they exist in the Sierras, provide some structural similarity to a meadow ecosystem for a few years before the trees or brush shade out the grasses and forbs. Such sites can provide foraging for nesting GGOWs, but only on a short-term basis (Greene 1995).

Evidence in the Yosemite Region suggests that GGOWs need meadows at least 25 acres in size for persistent occupancy and reproduction (Winter 1986) but that meadows as small as 10 acres will support infrequent breeding (USDA 2000).

## Prey

All available literature indicates that GGOWs in the western United States overwhelmingly select only two prey taxa: voles (*Microtus* sp) and pocket gophers (*Thomomys* sp.) (Bull & Henjum 1990, Franklin 1988, Reid 1989, Winter 1986). Over 90% of the prey taken in the Sierras are from these two taxa, both of which are found mainly in grass/forb habitats. In the Sierra Nevada, pocket gophers are widespread but voles occur almost exclusively in meadow systems.

## Nesting

Throughout most of their Holarctic range, great gray owls prefer abandoned stick nests for nesting (Mikkola 1983). Only 17 natural nests have been found in California, and 16 of those were in large, broken-topped conifer snags or a broken-out black oak cavity (Greene 1995). Only one nest has been found on an old hawk nest. The nest trees averaged 32" in dbh on the Stanislaus NF and 45" dbh in Yosemite National Park (NP). Heights to the nest bowl averaged 32 feet and 45 feet, respectively in the two areas. The canopy cover was over 70% at all sites (Greene 1995). Large snags (> 24 inch dbh) averaged 5-6 snags/acre at nesting areas in Yosemite NP but were less common in areas on adjacent NF land (Winter 1986). Of the known GGOW pairs in California, most nested within 280 yards of a meadow, with an average distance of 166 yards (Winter 2000).



Egg laying in California begins in late March or early April at Lower Elevation sites (refer to definitions) and the nesting chronology can be as much as a month later at High Elevation sites. The onset of breeding is influenced by snow conditions on the breeding grounds. A heavy snow pack can delay the onset of breeding at High Elevation sites, and late spring rains can cause nest abandonment. The incubation period is about 30 days and they lay only 2-3 eggs/clutch, but usually only 1-2 chicks leave the nest. The fledglings leave the nest 26-28 days after hatching (Bull and Duncan 1993). The time interval between the laying of the first egg and the fledging of the last juvenile is about 2% months.

An analysis of 30 Yosemite great gray owl territories in 1988 revealed that only 13-20% of the population breeds in any given year (Winter 1999b). These data firmly underscore the need for the two-year surveys followed in this protocol because not all pairs breed every year and because fidelity to a breeding territory can be tenuous in a poor prey year.

### Migration and Dispersal

Great gray owls in the northern boreal forests typically migrate (or disperse) several hundred miles south of their breeding grounds in the fall and winter, depending upon prey availability and possibly weather (Duncan 1992, Mikkola 1983). In California, great gray owls simply move to lower elevations when snow conditions drive them out of their breeding territories. Studies in Yosemite indicate that great grays drift down to snow-free areas in the winter (Winter 2000). They winter in habitats similar to their breeding grounds while some owls remain all year on territories that are at or below snowline. Adults (particularly the females) often wander to higher or lower elevations for a few weeks after breeding. The juveniles can sometimes be found on the breeding grounds as late as November before the adults drive them out.

### **C. Key Habitat Characteristics**

Great gray owls have rather specific habitat relationships in California primarily because they are so tightly linked to meadow ecosystems for their survival and the fact that there is a general lack of grass/forb habitats in Sierra Nevada forests. The following list serves as a summary of these characteristics as they are currently understood. Other characteristics may surface in the future as more is learned about this species.

1. Mid- or late-succession conifer forests containing large, broken-top snags (> 24 in, dbh, particularly red and white firs) in the forest matrix in sufficient numbers (5-6 snags/acre) to provide nest sites. Old and decadent black oaks have been used for nesting at lower elevations.
2. Suitable nest sites located < 300 yards from montane meadows or grass-forb forage types between 2,000 and 8,000 feet in elevation.
3. Canopy closure greater than 60% in at least portions of the forest stands adjacent to meadows or other openings.
3. Meadows or openings that have sufficient herbaceous cover to support pocket gophers and microtine rodents. There should be a minimum of 5- 10 inches of residual cover at the end of the summer to maintain suitability. Meadows with standing water remaining at mid-summer are not suitable.

### III. METHODS

The objective of this protocol is to locate great gray owl (GGOW) nest sites or to determine the presence of GGOW. The GGOW has several key characteristics to consider when conducting surveys. Both males and females have a very soft hoot. They tend to respond from the immediate nest-site area but in general are much less responsive than spotted owls. They are very large owls and can be found visually at a roost site but they are much easier to see when flushed. They will hunt during daylight hours when there are nestlings or fledglings present, and then mostly in early morning and late evening hours. Daytime meadow surveillance can detect them at those times.

In the zone of mixed conifer and fir forests of the Sierra Nevada, nest sites are almost always in the top of broken-topped snags and are usually within 300 yards of a primary foraging area. Most nesting territories known in the Sierra Nevada depend on a permanent meadow or meadows that total at least 25 acres but nests have been found where as little as 10 acres of meadow is available. At lower elevations in ponderosa pine types, nests have been located in decadent oaks adjacent to meadows and oak woodlands.

With these characteristics in mind, this protocol has been designed to achieve a high likelihood of detecting owls and locating nest sites. The probability of detection has not been determined.

Read the entire methods section before initiating any phase of the survey. The protocol guidelines follow a step-by-step process. It resembles the northern spotted owl protocol but there are important differences based on great gray owl biology and habitat relationships. The protocol is designed primarily for field biologists.

Spotted owl surveys can be done concurrently with GGOW surveys because neither species is known to compete, intimidate, or prey upon the other. Avoid calling for adults in the nest area, or for fledged young, if great horned owls or goshawks are known to be nearby. See the Supplemental Notes on page 28.

#### A. Definitions

##### Activity Center

The activity center is the point or area that best describes the core area of use by territorial owls. This can be based on locations of nests, roosts, young, or adult owls. A “protected activity center” with some acreage of special management around the Activity Center is a management issue for the Forest Service or other land owner.

NOTE: An activity center and a nest territory are not necessarily the same thing. A resident single owl or a pair of owls can be the basis for an activity center. While these may be found without signs of nesting, they should be considered to indicate potential nest territories, depending on the habitat.

##### Complete Survey

The survey area has been surveyed to protocol standards, which is a minimum of six survey visits each year for two consecutive years, (or fewer visits in conjunction with the discovery of an active nest site located through use of the survey protocol). The first five visits are calling visits done during the courtship, nesting, and post-fledgling periods when it is most feasible to detect owls. A meadow search at the end of summer, if meadows are present, counts as the sixth visit. Where meadows are not present, the sixth visit will be a calling visit done before the end of the calling visit season.

### Complete Visit

A complete visit is achieved when calling from all designated stations has been done and the follow-up surveys resulting from any detections are finished. If a surveyor gets an owl response at night, then the surveyor will conduct a daytime follow-up visit, and the combination of the night outing and the follow-up visit is counted as one complete visit. If a surveyor goes out at night and does not get a response, a follow-up visit is not necessary, so the night outing alone constitutes one complete visit. Visit number six may be a daytime meadow search, and its completion is a complete visit.

If the survey area cannot be completely surveyed in one night, the remaining survey area must be surveyed in a second field outing, preferably the next night. Every effort must be made to completely survey each potential nest territory in one night to minimize double counting or missing owls. Such units would be individual meadows or close clusters of meadows separate from other meadows in the survey area. If it is discovered that the survey area is too large to be covered within 6 days, it should be divided into smaller survey areas, based on available habitat, topography, drainages, and other physical characteristics.

### Elevation Zones

Three elevation zones are used to approximate differences in great gray owl nesting chronology for the purpose of survey timing (Table 1). These zones are prescribed by three geographic regions based on latitudinal changes in forest vegetation and snow accumulation in the 400-mile long Sierra Nevada province. These regions correspond to National Forests as follows: The Northern Sierra includes the Lassen, Plumas, and Tahoe NFs, the Central Sierra includes the Eldorado and Stanislaus NFs, and the Southern Sierra includes the Sierra and Sequoia NFs. Each elevation zone has a unique survey period, as explained below under Field Season and under Field Season on page 14.

Areas on the Modoc and Inyo NFs, LTBMU, and east side areas of the Lassen, Plumas and Tahoe NFs will use survey dates for the Middle Elevation Zone (3/10 to 7/10), unless local information on nesting chronology or conditions of weather and elevation justify modifications.

Table 1. Elevation Zone Definitions:

| Elevation Zones |                     |                     |                  |
|-----------------|---------------------|---------------------|------------------|
| Region          | Low Elevation       | Middle Elevation    | High Elevation   |
| Northern Sierra | 2,000 to 3,000 feet | 3,000 to 5,000 feet | Above 5,000 feet |
| Central Sierra  | 2,500 to 4,000 feet | 4,000 to 6,000 feet | Above 6,000 feet |
| Southern Sierra | 3,500 to 5,000 feet | 5,000 to 7,000 feet | Above 7,000 feet |

### Field Forms

The field visit form is used to record survey visits and owl detections and the nest tree form is used to record information about nest sites discovered.

### Field Season

Low Elevation Zone: Visits 1-3 should be done between 2/15 and 4/20 and visits 4-5 should be done between 4/20 and 6/15, with visits timed to coincide with the nesting phases as shown under Field Season on page 14.

Middle Elevation Zone: Visits 1-3 should be done between 3/10 and 5/15 and visits 4-5 should be done between 5/15 and 7/10, with visits timed to coincide with the nesting phases as shown under Field Season on page 14.

High Elevation Zone: Visits 1-3 should be done between 4/10 and 6/10 and visits 4-5 should be done between 6/10 and 8/05, with visits timed to coincide with the nesting phases as shown under Field Season on page 14.

All Zones: Visit 6, if consisting of a meadow search, will be done between 8/01 and 10/15 for maximum possible findings. Refer to Field Season on pages 14-15.

#### Follow-up Survey

The objective of the follow-up survey is to locate GGOWs during the day by conducting an intensive search (2-4 hours) within 200 yards of the original night response location. The follow-up survey should be completed as soon as possible (weather permitting) after an owl is detected, preferably the next day. A follow-up survey is part of a complete visit. See Follow-up Survey on page 21.

#### Historic Visit

A preliminary survey visit to an activity center that has had paired owls or resident singles in past years. It does not count as a complete visit unless the methods for a complete visit are followed. See directions for Historic Visit on page 19.

#### Meadow Search

A systematic, daytime search of a meadow or grassland edge for molted feathers and pellets that may confirm GGOW presence for the year. A minimum area to search is under trees, fence posts, or other potential foraging perches at least 100 feet into the meadow and 50 feet into the forest from the meadow edge. Conditions may justify a wider search zone. Scattered trees or tree islands within meadows must be included. See Meadow Search on page 22.

#### Nest

The actual substrate upon which the eggs are laid.

#### Nest Site

The tree/snag in which a nest is located and the immediate area surrounding it.

#### Occupancy Status

Occupancy status refers to the specific numbers, sex and reproductive success of GGOWs inhabiting a site. The type of occupancy will be based on detections or evidence of GGOW sign. Refer to Determining Occupancy Status on page 24.

#### Pair

This is the occupancy status determined when a male and female close to each other (within 0.10 miles) are detected once during the daytime or twice at night during a 2-year timeframe, or if a male takes food to a female. Refer to page 24.

#### Potential Nest Territory

Based on typical examples in the Sierra, a forested area that includes montane meadows larger than 10 acres or where a number of small meadows within a one-half mile distance total at least 10 acres, and where the habitat is suitable. Potential territories that will provide the most frequently successful reproduction have at least 25 acres of meadow.

#### Presence (status unknown)

This is the occupancy status when the only detection after a complete survey are pellet or feather sign that can be identified as from GGOW. Refer to page 25.

#### Resident Single

This is the occupancy status for detection of a GGOW that is not known to be paired with a mate where at least two detections are made in a 2-year timeframe (one each year) or three detections in 1 year during the breeding season. Refer to page 24.

#### Single Owl (status unknown)

This is the occupancy status where an auditory response or visual detection of GGOW has confirmed their presence but data is insufficient to determine if a resident single or pair are occupying the site. Refer to page 25.

#### Suitable Nesting Habitat

Montane meadows, in mid- to high-ecological condition, located in mixed-conifer or red fir forest settings are the most commonly known occupied habitat. The conifer stands adjacent to the meadows should have overstories comprised of medium to large trees (CWHR size classes 4, 5 and 6) with multi-storied characteristics. These are stands characterized by trees 11-24 in. dbh in the smaller range to over 24 in. dbh at the larger range (comparable to R5 Forest Service FIA handbook tree sizes 3 and 4). Canopy cover should be greater than 60% or have inclusions that are in that class. Nest territories at lowest elevations can be found in ponderosa pine/oak forests adjacent to meadows or in blue oak/annual grass types. Refer to Mayer and Laudenslayer (1988) for CWHR tree classes.

#### Survey Area

The area within a ¼ mile (440 yds) distance outside of the perimeter of all planned ground-disturbing activities, where potentially suitable habitat occurs. If a project extends to the edge of potentially suitable meadows, the survey area is extended to ¼ mile from the far edge of the forage type. Where scattered meadows within a project area lie in a pattern and proximity that may all be within a potential territory, all area between the meadows must be included in the survey area. For very large meadows, the survey area need not extend beyond a mile along the perimeter from the project boundary.

#### Survey Timing

1. Sunset-to-sunrise for nighttime surveys, except that calling during late-nesting season calling should start 2 hours before sunset and may continue up to 2 hours after sunrise.

1. First light to sunset for daytime surveys and follow-up surveys.

#### Verified Unoccupied Habitat

A complete survey of the area has been done without detection of GGOW or GGOW sign. Refer to page 25.

#### Young

Alive or dead great gray owlets.

## B. Survey Period

The timing of calling surveys is scheduled to coincide with their nesting season and when you would likely find adults preparing to nest or tending to a nest, or recently fledged owlets. The meadow search visit is scheduled to find signs in a likely foraging area. Depending on elevation and snow depths, GGOWs will nest anytime from late March through mid- June.

### 1. Field Season

The survey protocol prescribes five complete calling visits based on four phases of the nesting cycle, with the objective to conduct at least one complete visit during each nesting phase and one late summer meadow search visit for a total of six visits.

**Visits during the courtship period are the most important to accomplish.** If, however, the area is inaccessible during this period due to snow pack or other winter effects on access, such problems must be documented and the required number of visits accomplished by conducting more visits during nesting and post-fledging periods. For each phase of the nesting period, the number of visits allowed (up to two) provides flexibility to respond to early-season access problems.

Bear in mind that nesting may be earlier in years of very dry/warm winters or later in years of very wet/cold winters, and dates of surveys may have to be adjusted accordingly. Low, middle, and high elevation zones are described under “Elevations” in the definition section. For all elevation zones, if meadows are present, a meadow search should be done between 8/01 and 10/15, which will count as visit number six. If meadows suitable for searches are not available, visits 1-4 should be done during the courtship and incubation periods, and visits 5-6 before the end of the calling period.

#### Low Elevation Zones

For low elevation zones three complete survey visits should occur between 2/15 and 4/20 and two complete survey visits should occur from 4/20 to 6/15. The early-season visits are the most important to accomplish on time, but access problems may delay them. If it is not possible to complete the early season visits, more visits may be done between 4/20 and 6/15 provided they are a minimum of 6 days apart. Field visits should be timed according to phases of the nesting period, as shown below, if possible:

|                          |                 |                                       |
|--------------------------|-----------------|---------------------------------------|
| February 15 to March 20: | Courtship       | two complete visits                   |
| March 20 to April 20:    | Incubation:     | one (up to two) complete visits       |
| April 20 to May 20:      | Brooding:       | one (up to two) complete visits       |
| May 20 to June 15:       | Post-fledgling: | one (up to two) complete visits       |
| Aug. 01 to Oct. 15:      |                 | one meadow search visit, if possible. |
|                          |                 | Visits should total six for the year. |

#### Middle Elevation Zones

For middle elevation zones: three complete survey visits should occur between 3/10 and 5/15 and two complete survey visits should occur between 5/15 and 7/10. The early-season visits are the most important to accomplish on time, but access problems may delay them. If it is not possible to complete the early season visits, more visits may be done

between 5/15 and 7/10, provided they are a minimum of 6 days apart. Field visits should be timed according to phases of the nesting period as shown below, if possible:

|                       |                |                                       |
|-----------------------|----------------|---------------------------------------|
| March 10 to April 15: | Courtship:     | two complete visits                   |
| April 15 to May 15:   | Incubation:    | one (up to two) complete visits       |
| May 15 to June 15:    | Brooding:      | one (up to two) complete visits       |
| June 15 to July 10:   | Post-fledging: | one (up to two) complete visits       |
| Aug. 01 to Oct. 15:   |                | one meadow search visit, if possible. |
|                       |                | Visits should total six for the year. |

### High Elevation Zone

For the high elevation zones three complete survey visits between 4/10 and 6/10 and two complete survey visits between 6/10 and 8/05. The early-season visits are the most important to accomplish on time, but access problems may delay them. If three visits cannot be completed prior to 6/10 at high elevations, additional visits can be made after 6/10 to count toward the required visits provided they are separated by a minimum of 6 days. Field visits should be timed according to phases of the nesting period as shown below, if possible:

|                     |                |   |
|---------------------|----------------|---|
| April 10 to May 10  | Courtship:     | two complete visits   |
| May 10 to June 10:  | Incubation:    | one (up to two) complete visit  |
| June 10 to July 10: | Brooding:      | one (up to two) complete visits   |
| July 10 to Aug. 5:  | Post-fledging: | one (up to two) complete visits   |
| Aug. 01 to Oct. 15: |                | One meadow search visit, if possible. Visits should total 6 for the year. |

NOTE: If National Forests have site-specific information indicating that different dates would better match the nesting phases, they should modify the survey dates for their area and attach the justification for their dates to the survey report.

## **2. Survey Timing**

Night Searches: Survey work should start just before dark and last until at least 1-2 a.m. as the optimal time, with the realization that safety and logistical aspects of doing work at this time need to be considered. For night searches using begging calls of the young, surveys should begin 2 hours before dark and, if being done in morning darkness, can be continued for 1-2 hours after sunrise.

Day Searches: The first several hours of daylight and the last several hours prior to sunset are the best times for day searches, depending on the specific objectives (refer to Survey Procedures), but follow-up searches should start as early in daylight as possible and continue until completed.

NOTE: Great grays will respond to calls at all hours of darkness and night searches should be timed to optimize completion of a visit for the survey area. Fledglings out of the nest will respond to begging or chatter calls at any time of the day or night.

## **C. Survey Procedure;**

### **1. Survey Plan**

A survey plan is recommended for documenting survey efforts. Such a plan should include:

- a. A brief narrative describing the survey area(s) and the appropriate timelines, based on the geographic location and elevation;
- b. A map showing boundaries of the survey area(s), GGOW habitat, delineated survey areas, survey routes, and approximate calling stations;
- c. Estimates of time, number of personnel needed, and costs to complete; and

### **2. Mapping the Habitat to Survey**

Delineate a ¼-mile (440 yd) survey boundary beyond the proposed ground disturbing activity and delineate potentially suitable habitat on a photograph, topographic map, or other suitable map. The area mapped will be the survey area. For any meadow or forage type that qualifies for survey under the Triggers for Protocol because it is within 440 yards of the project but portions of the meadow is outside the project area, the survey area will include forest stands 440 yds beyond the entire perimeter of the forage type up to a maximum limit of one mile from the project area boundary.

Forest habitat, sighting databases, and personal knowledge can be used to locate GGOW nesting, roosting, and foraging habitat, and any historical/known sites of great grays.

Survey effort should be concentrated in forest/meadow interfaces, particularly in mixed-conifer, red fir, or ponderosa pine/hardwood settings. GGOWs will nest in younger stands with residual large trees, snags, or other nesting structures. Survey any areas with stands with appropriate nest structures, especially broken-topped white fir or red fir snags, including forested islands in meadows. Great grays will also forage in open stands with adequate herbaceous vegetation for small mammals.

Use the Triggers for Protocol, historical information, and table 2 on page 16 to guide where surveys should occur. Less typical forage habitats such as cut units, burns, and pine/oak-grass woodlands should be surveyed only if great grays are known to occur and reproduce in the area and if typical meadow habitats have been surveyed first, or where the atypical habitats are near meadow types and could be used for foraging in conjunction with the meadows.

Large areas should be divided into smaller survey areas to ensure that a visit can be completed in 6 days. Consider any known owl locations, habitat, and topography in making this decision. Delineate boundaries to reduce the possibility of singles and pairs being counted more than once in the project area.



Table 2. Types of habitats used by great gray owls for nesting, roosting, and foraging in the Sierra Nevada (drawn from various sources)

| Habitat Type   | Nesting | Roosting | Foraging |
|--|---------|----------|----------|
| Mature/Old Forest with WF, RF present and 60-100% canopy closure.                | X       | X        |          |
| Mid-Seral Forest w/ fir snags or old oaks and some 60-100% multi-storied canopy. | X       | X        |          |
| Mid-seral forest with no decadence and with some 60-100% multi-storied canopy.   |         | X        |          |
| Open LP/Grass at sub-alpine elevations.  |         |          | X        |
| PP/oak /grass w/ 10-40% canopy cover, usually near meadow.                       |         |          | X        |
| Burns, clearcuts, shelter-woods with grass-forb the dominant cover habitat.      |         |          | X        |
| Meadows, mostly mesic to dry with grass/sedge cover 5-30" high in spring-summer. |         |          | X        |

### 3. Establish Calling Stations and Survey Routes

Establish calling stations and survey routes within the survey area to achieve complete coverage of great gray owl habitat. The intent is for the owls to hear the surveyor and for the surveyor to be able to hear responding owls. Assume that an owl will not be detected if more than 220 yds from a calling station. If more than one transect or route is required, establish additional routes not more than ¼ mile (440 yds) apart.

Along each transect, space fixed calling stations every 0.10 to 0.15 mile (160-240 m, or 176-264 yds) from each other. Vary distances between transects and calling stations depending on local topography and habitat. In general, the greater the variation in topography, the closer the spacing between transects and calling stations. Routes that are elevated over the area being searched, or that are in semi-open forests, may use stations farther apart.

Mark each established station on an aerial photograph and/or topographic map (the standard is 1:24,000 scale), and assign route and station numbers. An alternate method is to estimate calling stations and map them later after locating them on the ground by use of vehicle odometer or pacing during the first calling visit.

a. **Nighttime Survey Off Roads.**

Calling stations should be established around meadow edges or on easily followed trails near meadows where there is little danger to a caller equipped with only a flashlight or headlamp, as these edges provide the best routes for detecting great gray owls.

b. **Nighttime Survey Using Roads.**

Supplement meadow-edge routes with calling stations along roads as needed to obtain good coverage of the survey area, especially areas beyond 220 yards from the meadow

perimeter. Nighttime surveys in areas lacking meadows will rely more heavily on roads or various classes of trails for calling routes.

**c. Daytime Surveys.**

Routes that cannot be effectively or safely surveyed at night will be surveyed during the daytime. Fixed calling stations along trails should also be spaced no more than a straight-line distance of 0.10 mile apart. Great gray owls are reluctant to respond to calls during the day, so survey times near dawn and dusk will offer the best chances of detection. Daytime surveys should include searches for pellets, whitewash, and movements by birds along the edges of meadows or openings, as well as mobbing behavior by Steller's jays, robins, and other small birds. If an owl responds vocally and after a surveyor walks into the area, it is often helpful to soften the broadcast by lowering the volume or pointing the tape player away from the response.

**d. Considerations.**

- (1) Consider the physical characteristics of the survey area:  
Sound travels best in a straight line, but not too well around bends or over ridges.  
Establish calling stations that directly face each drainage.
- (2) Avoid establishing calling stations near loud noises, like loud creeks and well-used roads. Try to back off from frog chorus areas, if they cannot be avoided.
- (3) Whenever possible, establish stations at useful physiographic features such as prominent ridge points, saddles, and openings in the vegetation to ensure complete coverage of the survey area.

**4. Surveying**

The two survey procedures below (b. and c.) should be used to prioritize how a current survey is done. First, consider any historical or known sites to determine if parts of the project area will require only daytime visits. If historic information is not available or does not lead to current detections, conduct complete visits using stations as per the protocol. The following calls are to be used in conducting the surveys.

**a. Calls**

Four types of calls are used in this protocol based on two periods of the nesting cycle. Response to the *male territorial call* may be better early in the nesting season than after incubation, and from courtship through brooding there may be a response to the *female begging call*. After the owlets have fledged, response to a *juvenile begging call* or the *female nest chatter* may be better. Use some type of amplifying device that will broadcast the calls at least 220 yds (0.125 mi) with an accurate rendition. Use voice calling only if the surveyor can imitate it well and consistently.

**Early Nesting Season:** (until brooding period)

For early season calling, work from sunset until at least the middle of the night and allow time the next morning for any follow-up surveys that may be needed. Working longer into the night or splitting between evening and morning hours is optional, depending on the best scheduling to complete the visit.

- (1) The male GGOW territorial call is the most common vocalization. One call sequence is made up of about 5-12 low hoots. Play 5-6 sequences separated by 30-45 seconds.

- (2) Listen carefully during the call playing and for several minutes afterward.
- (3) Repeat "1" and "2" above. For walking routes, the final listening can be done while moving to the next calling station. The minimum playing and listening time is 5-6 minutes per station if walking and 6-8 minutes if driving.
- (4) Continue to the remaining stations until the visit is complete or you get a response. It is important to listen carefully for delayed responses while moving to, and while at, the next calling station.
- (5) The important aspect of early season calling is to emphasize male territorial calls. Tapes that include occasional female begging calls or which have slightly different timing intervals are acceptable.

**Late Nesting Season** (brooding and fledgling periods)

Visits during this period should start up to 2 hours before sunset and extend 2-4 hours after sunset. Morning calling may extend for up to 2 hours past dawn, but evening calling should be more productive.

- (1) Give 10 juvenile begging calls at 10-15 second intervals followed in 2 minutes by one male territorial call and one female begging call. Calls of the female chatter can also be used in combination with the begging calls.
- (2) Listen for a juvenile begging call response or a response from the male or female. Spend at least 5 minutes at walking stations and 6 minutes at driving stations.
- (3) Continue to the remaining stations until the visit is complete or you get a response.
- (4) The important aspect of late-season calling is to emphasize juvenile begging calls and female chatter with an occasional female begging call and male territorial call. Tapes that accomplish this with slightly different timing intervals or combinations than described above will be acceptable.

**b. Historic Visit Using Known Site Information.**

Some historical or known locations or nest sites may be located more efficiently by going directly to their activity center during the day than by standard survey procedures using established routes and calling stations. If it is possible to locate pairs or singles without doing station visits, time and effort may be saved. Use your knowledge of the area in deciding if this will be beneficial. This does not substitute for a complete visit unless the methods for a complete visit are followed.

- (1) Identify the activity centers of the known pairs and singles in the survey area on a map or aerial photo.
- (2) Go to the activity center during the day. Use whatever techniques are appropriate to locate a pair or resident single (calling, nest searching). GGOWs may use alternate nests up to ½ mile away but generally show high nest site fidelity. Night calling may also be used, as needed.
- (3) If the pair or single is located, record the information on the field form, and follow the procedure described under step (7) of Complete Visit on page 20 for sites where visual detection has been made.
- (4) If the historic or known pair or single owl cannot be located, record the results on the field visit form and commence with night surveys as described for standard protocol procedures, as follows.

### c. Complete Visit

These procedures are essentially the same for driving or walking, with slight differences. Walking between stations provides a better chance of hearing responses to tape playing, and can be done most efficiently with crews of two surveyors per vehicle. See (1) for differences between driving and walking techniques.

Complete the Field Visit form for all visits, whether owls were found or not. Record all detections, including other owl responses besides great grays.

- (1) (a) Driving Routes: Using the survey map for the area, begin calling from stations located 0.10 to 0.15 miles apart on pre-determined routes. Use an odometer to determine exact locations of stations. Spend 6-8 minutes at each calling station before moving on to the next. The survey visit is complete if there are no responses along the survey route, and all routes in the survey area have been covered within 6 days time.
- (b) Walking Routes: These can be on roads, trails, or cross-country, and the procedure is similar to driving. Follow cross-country routes by using compass bearings; calling stations are located by pacing. Stations should be flagged for later visits, as cross-country routes will normally be done in daytime and flagging will help relocate calling points. Walking on roads, trails, and meadow edges will usually be done at night, and pacing may be used to determine station locations, unless they have been preflagged. Spend at least 5-6 minutes at each calling station before moving on. Listen carefully for the several minutes it will take to get to the next station.
- (2) If a response to the calls is received, estimate the owl's location by getting a compass bearing and estimating the distance from the station to the response. To get a better location, use triangulation by taking compass bearings from 2-3 locations along the survey route. Make sure the compass bearings are taken as soon as possible after a response.
- (3) Record the location of the station and approximate location of the detection on the field visit form. Show the same information, as well as the compass bearing(s), on a map or aerial photo and attach this to the field visit form.
- (4) Flag the surveyor's location and start point for the follow-up. If the owl is not far, attempt to find its location immediately, especially if it is a female giving begging calls, and flag the location for daytime follow-up.
- (5) Move to the next calling station and repeat above steps. Do not skip stations.
- (6) Do a follow-up survey within 48 hours of any response, but it should be done at dawn the next day if at all possible. The night survey and any follow-up survey (daytime) required constitutes a complete visit.
- (7) Once occupancy status consisting of at least Resident Single or Pair has been confirmed (see page 24) the site is considered an activity center and remaining visits will be done in daylight using follow-up visit procedures. Calling at stations within 880 yds (½ mile) of an activity center may be dropped on subsequent visits. Where the foraging area is a single meadow under 20 acres in size, all other calling stations may be dropped for that year, as it is highly unlikely there would be more than one GGOW territory.

#### **d. Follow-up Surveys (day)**

The goals of a follow-up survey are to visually confirm or infer the presence and location of one or more great gray owls and to locate a nest tree if the detection is during the incubation/brooding period. Use the field visit form to record results. In addition, use the nest tree form to record a located nest tree.

- (1) Starting from the station where a response was heard, using compass bearings(s) as needed, begin a search by moving toward the approximate response location. Do a systematic search, looking for adult owls in the canopy and signs of nest sites:

Nests can be found by searching for:

- a. Broken-topped snags or live trees; use binoculars and look carefully for nesting female owls or body feathers attached to rims of broken-tops;
- b. Old goshawk, red-tail hawk, cooper's hawk, or squirrel nests;
- c. Whitewash and/or pellets around the base of possible nest and/or roost sites, or hunting perch trees. These signs may indicate proximity to a nest tree within 100 to 200 feet.
- d. During the nesting season, listen for the female begging call. This is a soft, two-note ascending call. The female makes it usually from the nest as she begs for the male to deliver food. She may call at any time of day or night but most often in the hours just before and after sunset. Record the locations of such calls and search for the nest using the male call.

Adult owls can be found by searching for:

- a. Large-bodied owls on limbs in the lower part of the tree canopy and often close to the bole of the tree.
- b. Movement in the canopy. GGOWs will often be flushed from a roost site by intrusion, but usually do not move far to the next roost.
- c. Whitewash and pellets on the ground below favorite roost trees.
- d. Daytime responses to taped calls, which can include the female begging call during the early courtship period.

Fledged young can be found by:

Playing the late season tape of juvenile begging calls and female chatter, if young are out of the nest, which can be anytime after the estimated fledging dates.

NOTE: GGOWs tend to fly away from intruders; search for visual clues as suggested above. Calling may help to elicit responses from great grays, but they may not respond to calls during the day. A technique that may be helpful is to play the tape softly when calling to avoid startling the owl as you walk in the direction of the night response. Remember that great grays are shy, and the surveyor may only get within 30 yards or so of an adult.

- (2) The minimum time for the initial search is 2 hours, but the search should continue until the surveyor is satisfied. If no owl is located after this effort, note the results on the field form, and the visit is complete.

- (3) If an owl is located, allow up to 2 additional hours to establish pair status. Use visual observation to help determine status. Observe and note behavior. Make note of agitated calls, continuous responses (males often look toward the nest area), movements, roosting, preening, or other behavior. This will help in analyzing the data and determining activity centers.  
NOTE: Do not call or stimulate owls any more than necessary to determine status. By stimulating owls to move around during the day, you may increase their risk of predation. Great gray chicks and fledglings are susceptible to avian and mammalian predation and calling may attract predators. Be cognizant of raptors in the area. If species such as great horned owls, goshawks or ravens are present, leave the area and try a follow-up at another time.
- (4) If the owl is located, but is observed roosting/sleeping and no other signs indicate a nest site, that follow-up visit is over. Additional visits to complete the required number would be nighttime until at least Resident Single status is achieved and the site becomes an activity center. Once it is an activity center all further visits are daytime visits (follow-up survey procedure) to search for pair status or a possible nest. Further night calling at this point could constitute needless harassment and should be avoided.
- (5) Once Resident Single or Pair status is determined, adjust the area to be surveyed for the remaining complete visits during a given survey year so you do not pick up these owls again at night. Nighttime surveys at stations beyond 880 yds (½ mi) of the found pair should continue if it appears that enough habitat is available to support more than one nest territory.

#### **e. Meadow Search Visit**

- (1) The meadow search is done after August 1 when molted flight feathers and regurgitated pellets are most likely to be present if owls have been using the meadow during the nesting season. It should be completed prior to October 15 or the fall rains, whichever comes first. Meadow searching may be incorporated as part of daytime surveys (page 18) early in the season, however, as it may detect pellets from the prior year. If confirmation of Presence based on pellet and/or feather signs is obtained in conjunction with calling visits 1-5 and no detections from calling are obtained by the end of visit 5, Presence is established and visit number six, the meadow search visits is unnecessary.
- (2) The search will extend at least 100 feet into the meadow from the forest edge and 50 feet into the forest. Interior trees and islands should be included. Two people working together can conduct the most efficient search.
- (3) Start at one point on the meadow edge and search carefully around the entire perimeter until returning to the start point. Potential perch trees that command good access to the meadow for a hunting owl should be searched more carefully for owl pellets.

NOTE: Pellets of GGOW are similar to those of great horned owl but pellets that are more than 3 cm in diameter located under trees at the edge of meadows have a very high likelihood of being from GGOW. Pellets from the prior year often stand out as the fur matrix surrounding bones will be washed and compressed so that the white bones stand out very well. Pellets from great horned owls can be similar to those of GGOW but will not be found at meadow edges in any abundance. Consult the field visit forms to see if great horned owls were detected during calling visits.

- (4) The presence of pellets that resemble those of GGOW in montane meadows is strong evidence. Flight feathers will add to the certainty. The only possible outcome from the meadow search is “presence” unless owls are located from tape playing. Fledglings will depend on adults for feeding into November and may respond to tapes of the chatter calls. With current sign of great gray owls, the late season tape should be played at locations around the meadow perimeter.
- (5) Large meadow systems may take more than one day to search. There is no time restriction on completing the meadow search except that it must all be done in one field season.

**f. Considerations for all visits**

- (1) The follow-up survey may take up to 4 hours: 2 hours searching for an owl and 2 hours trying to determine pair or nesting status. Additional time may be used, as the time constraints are minimums.
- (2) Surveyors use a great gray owl calling tape or CD, and a tape or CD player with amplification that closely reproduces the tones of the male GGOW territorial call. Surveyors must be outside their vehicle and use a calling device that can project the call so it can be heard by another observer at least 220 yds away.
- (3) Do not survey during inclement weather, such as high winds (> 10 mph), moderate to heavy rain, or high noise levels (e.g., stream noise, machinery) which would prevent one from hearing a response that would be heard under better conditions. Also, owls are not likely to respond to calls during inclement weather. Interference by frog and stream noise can be minimized by the location of the calling routes and stations.
- (4) If doing a survey using the walking method, surveyors must be cautious to avoid clothing that generates noise while moving, such as certain types of nylon. Avoid unnecessary talking with partners.
- (5) The responsiveness of owls depends on many factors, which include:
  - (a) Time of day. GGOWs are most likely to be detected at night. They will respond anytime between sunset and sunrise, and occasionally during daylight to calls played near the nest site. Generally, however, they are relatively inactive and not likely to respond during the day.
  - (b) Time of season. Male GGOWs are most responsive to the territorial call during the early season pre-incubation period, as described elsewhere.
  - (c) Temperature. Owls may be less likely to respond in hot weather.
  - (d) Individual variation. Individual owls appear to have individual “comfort” radii. Sometimes they will respond from 100 yds away, but not respond as the caller draws nearer.
  - (e) Quality of the calling device. GGOWs are very sensitive to the rendition quality of the taped call being played.
- (6) When appropriate, record similar information for other avian predators (e.g., goshawk, great horned owl) that are detected while surveying for great gray owls. DO NOT encourage response from nesting females or fledglings if other avian predators are nearby.
- (7) If field crews are camping out after work, they should camp near meadows or suspected locations, as great gray owls may call several hours after the survey calls have ceased, giving the surveyors more opportunity to get an auditory detection.
- (8) A technique that has been found useful for visual searches is to play a varmint lure tape of a squealing rabbit or small rodent to coax the adults toward the surveyor at or just before dawn. Another technique that may be useful for surveyors is to

bring along a coyote-sized dog, as great grays may react to the dog and be easier to detect.

#### **D. Determining Occupancy Status**

The confirmation of successful reproduction ends the need for any further visits, and the protocol is finished. Full determination of capability and occupancy of a site for GGOW is not reached until successful nesting is confirmed or, through 2 full years of survey, a lower level of occupancy or absence is the outcome. Data is not available at this time to determine the statistical probability of detecting GGOWs through application of this protocol. Avian biologists knowledgeable with the GGOW feel it provides a high likelihood of detection, if properly followed. If this survey protocol is conducted using less than 12 visits done over 2 years as prescribed, assumptions of non-occupancy or lack of reproduction cannot be made.

1. Reproduction Confirmed status is determined by the following:

One or more young observed or heard, either on the nest or after fledging, either alone or in the company of an adult. This includes dead owlets.

NOTE: Juvenile great horned owls, just after fledging, can be easily misidentified as great gray owls. While still in downy plumage great horned owls are very gray, but they always have brown facial disks. Great gray owls have gray facial disks at all ages.

2. Nesting Confirmed status is determined by the following:

- a. A female is seen on a nest.
- b. A male takes food to a nest site where the female cannot be seen.
- c. A male is seen hunting and repeatedly taking prey into a certain stand during the nesting period.

3. Pair status is determined by any of the following:

- a. A male and female are heard and/or observed in close proximity (within 0.10 mile) to each other on the same outing during the day.
- b. A male and female are heard and/or observed in close proximity (within 0.10 mile) to each other on two separate outings at night within a 2-year timeframe.
- c. A male takes food to a female not on a nest.

NOTE: Males are smaller than females but have a deeper voice.

4. Resident Single status is determined by:

- a. The presence or response of a single owl within the same general area on three or more visits within a single breeding season, with no visual observation or response of an owl of the opposite sex after a complete survey.
- b. The presence or response of a single owl within the same general area during the breeding season at least once a year in 2 or more years.



5. Single owl (status unknown) is determined by:

The response of a male and/or female and/or unknown sex GGOW that does not meet the pair or resident single requirements.

6. Presence (status unknown) is determined by:

The detection of pellets or feathers that can be identified as from GGOW.

7. Verified Unoccupied Habitat is determined by:

The completion of the survey protocol throughout a survey area, with no owls or owl sign detected. The lack of detections after 2 years of full protocol survey should be viewed as a high likelihood, not a certainty, that the site is unoccupied. The conclusion of unoccupied status should not be used for more than 2 years from the completion of the survey protocol unless contractual obligations are in place. Where contractual obligations are established, approved projects that have not been implemented within 5 years must be resurveyed and a new biological evaluation prepared if new information is obtained.

## **E. Determining Activity Centers**

An activity center is that part of the territory most important for nesting or, if nesting is not occurring, for roosting. The relative strength of the validity of the activity center is based on occupancy information in the following order, from strongest to weakest:

1. A nest location.
2. Location of great gray owlets.
3. Location of a pair during the nesting season.
4. A day location of an adult female.
5. A night location of an adult female.
6. A day location of an adult male.
7. A night location of an adult male.

NOTE: An activity center and a nest territory are not necessarily the same thing. A single territorial owl or a pair of owls will be the basis for an activity center. While these may be found without signs of nesting, they should be considered to indicate potential nest territories, depending on the habitat. NOTE: If fledglings are found late in the season (i.e., Sept. to Nov.) they may have moved some distance since fledging and an activity center based on this could be far from the actual nest site.

Provide a location to at least the nearest 1/16<sup>th</sup> of a section or to a UTM coordinate. Place the location on a topographic map or aerial photo, as well as in GIS, to track the location of the activity center.

## **F. Protocol Testing and Refinement**

This protocol was designed to achieve a “high likelihood” of detecting GGOWs for the purpose of preparing biological evaluations and NEPA documents, for projects being planned within the Sierra Nevada area of the Pacific Southwest Region of the Forest Service. This protocol requires five (5) calling survey visits and one (1) meadow search visit each year for 2 years, with calling stations 0.10 to 0.15 mile apart, and transects up to ¼ mile apart for the calling visit portion. Such surveying is deemed appropriate because GGOWs are somewhat nomadic, they hoot very quietly, and they are known to be shy and unresponsive to calling.

The meadow search visit was incorporated because it has been found that presence of great gray owls can be determined based on molted feathers and/or regurgitated pellets under hunting perch trees at meadow edges (Greene 1995). Flight and tail feathers should be compared to sample feathers, a guide, or referred to experienced biologists, as they can be confused with great horned owl feathers. Verification of presence is important for the implementation of management guidelines on some national forests and for the determination and full disclosure of possible effects of projects on the species.

This protocol was adapted from the survey protocol for great gray owls developed specifically for the Northwest Forest Plan by several people with expert knowledge of the species. It was tailored for the Sierra Nevada based on knowledge of great gray owls in the Yosemite region and with input from biologists experienced with great gray owls in California and the Pacific Northwest. Especially helpful were wildlife biologists in Oregon who have recent experience in surveying and detecting great gray owls.

The protocol should be reevaluated and adjusted as necessary after it has been implemented and enough information is available from the field to make improvements. This might include statistical evaluation of survey results by PSW Research Station personnel. Alternative methods of survey and detection of great gray owl that require less survey effort may be developed in the future. The Regional Forester should revise this survey protocol whenever different survey methods or alternative techniques appear to provide more reliable or more cost-effective results.

To keep track of information obtained through surveying, and to make adjustments to the protocol where necessary, the following procedure must take place. All Forest Service field units should maintain hard copies of survey plans, field and nest forms, and maps and aerial photos used during the surveys. The data should also be stored in Forest GIS computer databases to facilitate data retrieval at the Forest or Region level. Forest Service data should also be submitted to the California Department of Fish and Game Natural Diversity Database.

## **G. FIELD FORMS**

There are two forms- the field visit form and the nest site form- located in the Appendix. They are essentially identical to the forms used for great gray owl surveys in the Northwest Forest Plan area, Feedback from field units following implementation will be used to revise the forms, if needed. The definitions for the data entries are attached to the forms. Use the field visit form to document all GGOW survey results. Use the owl nest tree form to document GGOW nest trees found during the course of survey visits or through other means.

## **IV. QUALIFICATIONS**

The protocol is designed for field biologists who will be conducting great gray owl surveys on Federal land within the Sierra Nevada province of California. "Field biologist" is defined as those currently employed as professional biologists, biological technicians, or volunteers that are supervised by a professional biologist.

Professional judgment is involved in interpreting owl behavior, habitat use and surveys. The following qualifications are provided as requirements for personnel responsible for implementation of the survey protocol and the designation of GGOW activity centers.

The minimum requirements are:

- A bachelor's degree in wildlife biology or related field and/or qualifies as a GS-486-901;
- At least 2 years of field experience with surveying for spotted owls or other owl species.

It is required that personnel not meeting the minimum requirements above be supervised by someone who does meet the requirements.

Surveyors should be familiar with project layout in establishing stations and compass bearings, including triangulation. They should be able to identify by visual observation and calls all the owl species that occur in their area, as well as potential predator species such as northern goshawks, ravens, red-tailed hawks, and great horned owls. They should also be familiar with species that may sound similar to GGOW such as blue grouse, great horned owls, and band-tailed pigeons. They also must be able to locate, describe, and interpret visual signs of owl nesting, occupancy, and behavior. In addition, because great grays can be difficult to hear, a standard hearing exam is recommended for personnel surveying for the great gray owl. Anyone that has hearing falling within the normal limits should be able to hear the species.

It is assumed that most field biologists who work within the Sierra Nevada are familiar with the procedures for surveying for California spotted owls, and the calls of the various species of owls that occur within its range.' The GGOW protocol is somewhat different from that for the spotted owl, but not so much that a field biologist would not rapidly become familiar with it and be able to implement it. Biologists who are planning to train and supervise seasonal and volunteer personnel to do spotted owl surveys should train the crews in great gray surveys at the same time. Both species can be surveyed concurrently.

## V. SUPPLEMENTAL NOTES

### Meadow Search:

In 1993 and 1994, Greene (1995) used several methods of day and nighttime surveys to detect presence of GGOWs in Yosemite NP and Stanislaus NF. In 1994 the feather search method yielded positive findings in 23 of 49 meadows where it was used. The sign search (for pellets and whitewash) resulted in positive findings in 14 of 30 meadows. The afternoon watch method for daytime hunting owls was successful in 12 of 18 meadows. The night calling method yielded positive results in only 6 of 31 sites where it was used, but it was used late in the nesting season when calling is least successful. The snag search method provided verification of attempted and successful nesting in 9 of the 16 sites where it was used. All meadows surveyed either had previous records of great gray owls or appeared to be potential territories. Daytime search for owls and searches for their signs have been useful methods in Yosemite NP and are key components of the survey protocol developed for Yosemite by Maurer (1992).

### Potential nesting territory:

The size and shape of meadow forage areas probably has an effect on the territory size. On the Stanislaus NF, at three nest season home ranges where the data were available, GGOWs spent 90% of their time within 280 yds of the meadows used for hunting and those territories ranged from 450 to 1,000 acres in size (Winter 1986). In Oregon, where foraging areas were more dispersed, territories ranged from 325 to 1,625 acres and averaged 1,125 acres (Bull and Henjum 1990). Nesting GGOWs are very tolerant and allow considerable overlap of foraging areas with neighboring pairs, so that nest sites can be closer together than the nest season foraging area might otherwise indicate. Minimum distances between nests found by Bull and Henjum (1990) in NE Oregon were 464 to 497 yds (1990). At Ackerson Meadow in the Stanislaus NF the two distances between three nest areas found by Winter (1986) were 1.2 and 1.4 mi. Several times since 1986, GGOWs have used artificial nest structures at Ackerson Meadow as close as ¼ mile to each other (USDA 2000).

### Suitable foraging habitat:

The meadow component should be in middle to high ecological condition, not closely cropped by grazing animals before August, and be moist to dry in soil moisture over most of the meadow. Nest territories have been found in conjunction with atypical foraging habitats such as clearcuts, burns, and open oak woodlands, but these are considered suboptimal compared to meadow sites (Greene 1995). Oak woodland and grassland complexes are most likely to be used by great gray owls for hunting within the Low Elevation Zone, often in conjunction with a meadow or pasture.

Meadows with standing water during the nesting period are not suitable for foraging because such sites provide poor conditions for small mammals. Ratliff (1982) classified Sierra Nevada meadow sites into 14 classes. Of these, the Beaked Sedge (*Carex rostrata*), Epemeral-lake, and Few-flowered Spikerush (*Heleocharis pauciflora*) classes would be too wet to provide suitable foraging habitat. The Hillside Bog meadow class probably is of low value because the waterlogged soil conditions may limit prey numbers. The Nebraska Sedge (*Carex nebrascensis*) class may be unsuitable in the wetter conditions where it can occur, but on drier sites where it often occurs in association with tufted hairgrass (*Deschampsia caespitosa*), it would be suitable. The Short-Hair Sedge (*Carex exserta*) meadow class may be of marginal value for foraging due to very dry soils

and low vegetation height and productivity. It occurs only above 8,000 ft elevation in the alpine and subalpine zone, which is higher than almost all GGOW sightings. The other 9 meadow classes described by Ratliff (1982) can provide suitable foraging habitat for GGOW.

#### Field seasons of the Protocol:

The dates of the nesting chronology are based on actual nest site data from sites in the Stanislaus NF (USDA 2000) and Yosemite NP and from Bureau of Land Management nestsites in SW Oregon (Godwin 2000a) which are not far from the northern Sierra Nevada. At Low Elevation sites on the Stanislaus NF between 2,800 ft and 3,600 ft elevation, fledging dates are most often in late May. At Middle Elevation sites (mostly Ackerson Meadow at 4,600 feet elevation) the fledging dates are generally around June 10 to 15. At High Elevation sites Winter (1986) estimated that average fledging dates at 7,000 ft would be the early part of July. The elevations estimated to correspond to elevational zones in the Yosemite region for northern and southern areas of the Sierra Nevada were based on latitudinal differences in forest habitats and snow accumulation (Potter 2000), as well as nesting data acquired from southwestern Oregon (Godwin 2000a). Details of these estimates of nesting chronology likely will need revision as we learn more about GGOWs in the Sierra Nevada.

#### Surveys for Both Great Gray Owls and Spotted Owls:

Surveying for spotted owls could be done concurrently with great gray owl surveys because the two species are not known to act aggressively toward each other. It is recommended that one call first for great grays, then for spotted owls. The transects and calling stations could be set up to call for spotted owls at every second, third or fourth great gray owl station, depending on spacing.

## VI. REFERENCES

The following literature was cited or used in developing a survey protocol for great gray owls in the Sierra Nevada. For purposes of brevity, many of the references used to refine the survey procedures were not cited in the methods section. Wildlife biologists listed with the Forest Service and BLM in Oregon provided invaluable information about effectiveness of surveys done since 1995 using the protocol developed for the Northwest Forest Plan.

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APPENDIX 1.- GREAT GRAY OWL FIELD VISIT FORM

**Great Gray Owl Detected? Yes                      No**

| (1)<br>Forest/<br>District | (2)<br>Planning Area Name | (3)<br>Area<br>No. | (4)<br>Area<br>Type | (5)<br>% Area<br>Callable | (6)<br>Type of Visit<br>and number | (7)<br>Outing<br>Number |
|----------------------------|---------------------------|--------------------|---------------------|---------------------------|------------------------------------|-------------------------|
|                            |                           |                    |                     |                           |                                    |                         |

| (8)<br>Date:<br>month/day/year | (9)<br>Time (24 Hr) | (10)<br>Day/Night | (11)<br>Survey Time | (12)<br>Observer Name(s) |
|--------------------------------|---------------------|-------------------|---------------------|--------------------------|
|                                |                     |                   |                     |                          |

| (13)<br>Route ID | (14)<br>Method | (15)<br>Wind | (16)<br>Cloud Cover | (17)<br>Precip. | (18)<br>Per cent of<br>area called | (19)<br>Visit Complete? |
|------------------|----------------|--------------|---------------------|-----------------|------------------------------------|-------------------------|
|                  |                |              |                     |                 |                                    |                         |

| (20)<br>Species<br>Detected | (21)<br>Detection<br>Type | (22)<br>Number,<br>sex & age | (23)<br>Time | (24)<br>Location<br>Township/Range/Sec/ UTM        | (25)<br>Elev. | (26)<br>Habitat | (27)<br>Resp.<br>No. | (28)<br>Sta.<br>No. |
|-----------------------------|---------------------------|------------------------------|--------------|--|---------------|-----------------|----------------------|---------------------|
|                             |                           |                              |              | T__R__S__¼__ UTM<br>1/16__ 1/64__ N_____<br>E_____ |               |                 |                      |                     |
|                             |                           |                              |              | T__R__S__¼__ UTM<br>1/16__ 1/64__ N_____<br>E_____ |               |                 |                      |                     |
|                             |                           |                              |              | T__R__S__¼__ UTM<br>1/16__ 1/64__ N_____<br>E_____ |               |                 |                      |                     |
|                             |                           |                              |              | T__R__S__¼__ UTM<br>1/16__ 1/64__ N_____<br>E_____ |               |                 |                      |                     |

G. Comments:

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05/01/00

## DEFINITIONS FOR GREAT GRAY OWL FIELD VISIT FORM

Indicate in the upper right corner if great gray owls were detected. Fill out blocks 1-19 for each visit and blocks 20-28 for any detected owls. Attach a copy of the monitoring plan map for the survey area showing routes and calling locations. Keep all subsequent field visit forms together with the initial form and map.

### Visit Information (items 1- 19)

1. National Forest and Ranger District. Use 2 or 3-letter acronym for Forest and acronym or name of Ranger District. Use codes provided for use with spotted owl protocol survey forms.
  2. Planning Area Name. This can be based on name of planned project, name of meadow(s) or other identifier that is unique to this survey area.
  3. Area Number - The number, if any, assigned to the survey area. This block can be used to identify different survey areas if a planning area is very large and must be subdivided into sub-units for survey purposes.
  4. Area (site) type. Record one of the following number codes:
    - 6- General surveys or monitoring not related to proposed projects.
    - 9- Surveys conducted to protocol for completion of Biological Evaluations and NEPA documents related to proposed timber, fuels, range or other projects.
  5. Percent of the area that can be safely surveyed/monitored. For example, if 20% of an area where surveys are required is in cliffs or other condition that cannot be safely surveyed, then record 80%.
  6. Type of visit and number of visit -
    - HV- Historic Visit. This is a preliminary survey using historic information.
    - SV - A Survey Visit only. A Survey Visit includes:
      - Nighttime survey using roads.
      - Nighttime survey using routes off roads:
      - Daytime survey using routes off roads.
      - General survey work that does not include stations.
    - FO - A Follow-up Visit only.
    - SF - A Survey Visit and Follow-up Visit conducted in the same field outing.
    - MS- A Meadow Search conducted in daytime as visit number six.
- Record the visit number after the 2 letter visit type code. For example, the second survey visit would be "SV2".
7. Outing Number- During surveying,. it may not always be possible to conduct a complete visit in one field trip. Several "outings" may be necessary to conduct a complete visit. This variable is to be used to track the number of "outings" needed to complete a visit.
  8. Date- A six-digit entry for month, day and year. (For example, May 28, 2001 is entered as 05/28/01).



18. Percent of the Area Called- This is the percent of the area that can be called that & called. If the entire area is called then record 100%. If only 80% of the area can be called (see item 9 above) and the full 80% is covered, then record 100%. If 5 stations are not called due to proximity to a night time detection in a survey area with 20 calling stations and the other 15 are called on this outing, then record 75%. If only 25 of 50 stations can be called in one nighttime outing then record 50% (the other 50% and the Visit will be completed in another night outing).
19. Visit Complete- Record "Y" for yes and "N" for no.

Response Information

20. Species

|                        |                             |
|------------------------|-----------------------------|
| NONE- no owls detected | OTFL- flammulated owl       |
| STNE- great gray owl   | GLGN northern pygmy owl     |
| STOC- spotted owl      | AEAC- northern saw-whet owl |
| BUVI- great horned owl | OTKE- western screech owl   |
| STVA- barred owl       | ASOT- long-eared owl        |
| TYAL- barn owl         |                             |

21. Detection type. A single letter code for the type of observation made on this visit.

|                            |  |
|----------------------------|--|
| C= calling only            | N= female seen on nest                 |
| V= visual only             | Y= young observed                      |
| B= both calling and visual | S= Feathers or pellets identifiable as |
| GGOW                       |  |

22. Number of owls and Sex of Owls Responding.

|                |                      |                                 |
|----------------|----------------------|---------------------------------|
| F= female      | M= male              | PR= pair                        |
| U= unknown sex | Y= young of the year | N= nestling (young in the nest) |

Record 1 PR for two owls that meet the definition of a pair. Record 2Y for two fledglings out of the nest. Record 1U for an adult that cannot be identified as to sex, and so on. Remember that a male and a female must be detected within 0.10 miles of each other and at least twice in 1-2 years to be considered a pair.

If an owl is found dead, record number and sex as above, plus record the fact that the owl was found dead. For example, if one young owl is found dead, record 1Y-Dead. Use the comment section to record any notes about how the owl died- i.e. hit by a vehicle, great horned owl suspected, etc.

23. Time of Detection: Record the time of day the owl responded or was seen by the surveyors, using a 24 hour clock.

24. Location of Detection- Legal location and UTM coordinates of the detection.

Legal location is required. Record the Township, Range, Section, quarter section and 1/16 section if possible. A space for the 1/64 section is also provided, if that can be determined. An owl detected in the NW quarter of the SW quarter of section 10 would be recorded as S 10, SW<sup>1</sup>/<sub>4</sub>, NW <sup>1</sup>/<sub>16</sub> and the 1/64 entry would be left blank if that cannot be determined. UTM coordinates will be entered in the right-hand part of the block.

25. Elevation- Record the elevation of detection in feet.

26. Habitat of the Detection Location- (Based on California WHR wildlife habitat classes). Use codes 01 to 05 depending on the size structure of trees at the detection location.

01- Late Seral Forests: This code is used for CWHR 6, multi-layered forest stand comprised of CWHR size class 5 trees over a distinct layer of size class 4 or 3 trees with a total tree canopy > 60%. closure, or CWHR 5, single storied stands with trees greater than 24" average dbh (diameter at breast height). Late seral forests are usually typed as size class 4 using the Forest Service silvicultural typing codes.

02- Mid-Seral Forests: This code is used for CWHR 4 stands where the trees are 1 1-24" average dbh in size. These stands will usually be typed as size class 3 using the Forest Service silvicultural typing codes.

03- Early Seral Forests: This code is used for CWHR 3 stands where the trees are 6-11" average dbh in size. These stands will be typed as size class 2 using the Forest Service silvicultural typing codes.

04- Very Early Seral Forests- This code is used for CWHR 2 stands where the trees are generally under 6" average dbh in size. These stands will be typed as size class 1 or 2 using Forest Service silvicultural typing codes.

05- Unknown what type of stand the response came from.

27. Response Number- Record the number of the detection in sequence. If on the first visit you hear a great gray owl then enter the number "1". The next time you detect a great gray owl, on that visit or subsequent visits, you would enter a number 2, etc. Include in the sequence the detection of predators and other owls when appropriate. The sequence numbers should correspond with the numbers used for the detection locations on the appropriate map.

28. Station Number- This field is used for detections in combination with visits that are "Survey Visits" and coded "SV" under block number 6. It identifies the station number from which the detection was first made.

Comments: Use this section to record important information that was not described adequately in blocks 1-28. This would include behavior of detected great gray owls, details of raptors in the area, circumstances of dead great gray owls found, factors affecting the survey protocol such as noise, weather, access, etc., details of meadow search results, recommended next visit date, and so on.

APPENDIX 2 - GREAT GRAY OWL NEST FORM

1. Year \_\_\_\_\_ 2. Region \_\_\_\_\_ 3. State: \_\_\_\_\_ 4. County \_\_\_\_\_
5. National Forest \_\_\_\_\_ 6. RD \_\_\_\_\_
7. Site No. \_\_\_\_\_ 8. Site Name \_\_\_\_\_ 9. Year Originally Found \_\_\_\_\_
10. Legal: T \_\_\_\_\_ R \_\_\_\_\_ Sec \_\_\_\_\_ 1/4 \_\_\_\_\_ 1/16 \_\_\_\_\_
11. UTM Coordinates: \_\_\_\_\_
12. Health of Tree (Live= 1, Snag=2, Decadent Top= 3, Broken Top= 4) \_\_\_\_\_
13. Tree Height \_\_\_\_\_ ft. 14. Tree Species \_\_\_\_\_ 15. DBH \_\_\_\_\_ in.
16. Nest Height \_\_\_\_\_ ft 17. Elevation \_\_\_\_\_ ft.
18. Nest Type \_\_\_\_\_ (N= nest of other spp, M= mistletoe platform, C= cavity, B= broken top, A= artificial platform, AT= artificial top, O= other )
- If other, describe:  
\_\_\_\_\_
19. Aspect of nest entrance/ platform/ bole top \_\_\_\_\_
20. Habitat Type \_\_\_\_\_ (01= old growth/mature forest, 02=mid seral forest, 03= early seral forest, 04= very early seral forest sites, H= hardwood dominated forest type)
21. Distance from nest tree to the nearest opening (10 acres or greater) \_\_\_\_\_ ft
22. Tree Description:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
23. Describe how to find the nest site:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_