COORDINATING TIMBER MANAGEMENT ACTIVITIES WITH RAPTOR NESTING HABITAT REQUIREMENTS

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Abstract: Timber management activities result in significant changes to forested land in the western United States. These activities affect a number of raptors through changes in habitat composition and structure. Raptor habitats are altered by the timber management activities in four major ways: (1) mature or old-growth stands are reduced to younger successional stages, (2) stands are placed under rotation and management schemes that will prevent them from attaining stand characteristics associated with older seral stages, (3) large expanses of existing forest are broken into smaller patches comprised of various age classes, and (4) human access is allowed into areas that were previously undisturbed. Timber management activities have generally increased forest diversity by increasing the number and distribution of habitat patches and edges between patches. Increased diversity can be beneficial to populations of raptor species that have wide ecological tolerances. However, it can be detrimental to those species requiring large expanses of habitat with old-growth characteristics. A variety of methods have been used for raptor habitat management and protection in the West. Historically, most habitat preservation methods emphasized protection of only the nest sites and often ignored nest stand and foraging habitat requirements. In the late 1970s, with the publication of the *Wildlife Habitats in Managed Forests—The Blue Mountains of Oregon and Washington* and the interest in protecting raptor habitats, methods began to consider all components of nesting and foraging habitat. One promising method is to identify certain raptor species for management emphasis in forested habitats. Emphasizing raptors that have narrow, identifiable ecological tolerances can be used to coordinate timber management objectives with maintenance or enhancement of raptor habitat and populations. Emphasizing raptor species is an iterative process. Such an approach requires (1) setting measurable objectives, (2) developing management standards and prescriptions based on known habitat requirements, (3) taking inventory of quality and quantity of available habitat, (4) developing alternative treatment mixes based on goals and objectives, (5) managing habitats using standards, prescriptions and recommended treatments, (6) monitoring the results of management activities to ensure that objectives are being met, and (7) using the monitoring results to refine management prescriptions as necessary.

Of the original forested lands in the United States, 95% have been altered by human uses, including timber management. Approximately 130.3 million acres are considered commercial forest lands in the western United States (U.S. For. Serv. 1986). Of these, 66.7 million acres (50%) are administered by the Forest Service (U.S. For. Serv. 1986). Timber management activities have generally resulted in the shifting of mature or old-growth forested areas to lower successional stages, or, in some cases, permanently changing the vegetative structure to provide for tree species of higher economic values than those naturally occupying the site. Such management areas are placed into rotation cycles that maximize timber production. These rotation periods are normally much shorter than under natural conditions and result in stands that lack the biotic characteristics of older seral stage forests. Such impacts are additive. As new areas are accessed and put under management, fragmentation of remaining, naturally occurring mature stands leads to isolation of like habitats (Harris 1984).

Forest management has resulted in an increase in the number and distribution of vegetation communities, seral stages and ecotones associated with these habitats (Harris 1984). Raptor species with wide ecological tolerances such as red-tailed hawks or great horned owls usually benefit from manipulation of such habitats. However, species that have narrow ecological tolerances, particularly if depend-

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ent on older seral stages, are adversely impacted by such land management strategies. This includes species such as goshawks and spotted owls in the western United States.

Additional impacts on raptors may result from increased access into forested habitats that have been bisected by roads. Human disturbance occurs in the form of logging activity, fuelwood gathering and recreation use. Many raptor species initiate nesting activity in early spring, when roads are still impassable to vehicles. When the roads open, human access into these areas often coincides with the incubation and brood rearing periods. Such increased human activities can result in nest abandonment or lower fledgling success (Call 1978). Secondary effects of human use relate to removing fuelwood. The removal of standing snags is prohibited on Forest Service lands in California but is still allowed in other regions and on other public and private lands. Down logs, also a common source for firewood, provide habitats for a myriad of species that are a prey base for forest associated raptors. In addition, snags and down logs serve as nest sites, perches and *plucking posts* for accipiters.

Biological input into timber sales has historically been reactionary, particularly for nongame species. A reactionary approach to coordinating timber management and wildlife management objectives can cause unnecessary conflicts in allocating resources for the same geographical area. Reactionary management usually considers only the impacts of a proposed action on habitats. Habitat protection and enhancement opportunities are often forgone as a result of this approach. To ensure habitat protection or enhancement for raptors, an active approach must be taken in allocating habitats. Ideally, this allocation is initiated at a planning level and then implemented in the timber sale environmental analysis process.

This paper reviews past and present efforts for coordinating raptor nesting habitat requirements with timber management activities in the western states. It demonstrates the use of management indicator species as one viable method for protecting raptor habitats and provides an example of this process for managing goshawk nesting habitats on the Inyo National Forest in California.

PAST HABITAT PRESERVATION EFFORTS

Solutions to past wildlife/timber management concerns were largely directed at timber stands to lower successional vegetative stages and the associated ecotones. Vegetative management strategies resulted in diversification of forage and cover types for harvest species such as bobwhite quail (Stoddard 1931), ruffed grouse (Gullion 1967), deer (Longhurst et al. 1952) and elk (Black et al. 1976). However, until the publication of the *Wildlife Habitats in Managed Forests—The Blue Mountains of Oregon and Washington* (Thomas 1979) and other similar publications, little effort had been expended on total habitat requirements for nongame species including raptors. Raptorial bird species were often only considered in relation to their role as predators of selected game species or, in a few cases, when their status was already considered a concern, such as with condors and eagles (U.S. For. Serv. 1947).

Most timber management plans and early NEPA documents did not address the effects of forest management on raptors. However, by the late 1960s and early 1970s public attitudes regarding raptors were rapidly changing, and concerns regarding the effects of forest management on these species began to surface in some documents (Gittens 1966; Grewe 1966; P. Corr, unpubl. data; J. Kahl, unpubl. data; and others).

For the most part, raptor habitat protection strategies have emphasized the protection of the known or suspected nest site. Such actions were normally in response to nest site history or accidental discovery of a nest site during sale layout. Efforts to assess and manage overall territorial requirements for maintenance of wide-spread raptor populations has been lacking.

Raptors often choose nesting locations in close proximity to populations of their prey species. However, in some cases, and with some species such as peregrine falcons, ospreys and bald eagles, suitable sites may be removed from the preferred foraging area due to nest structure availability, topography, vegetation, territorial requirements or disturbance factors. Melquist (1974) found certain osprey successfully nesting several miles from the lake where they foraged. California condors traditionally nested in the Sespe Condor Sanctuary in Ventura County, California, but often foraged fifty miles away in the Tehachapi Mountains, even when carrion was available in close proximity to the nest site.

While some species and individual pairs within species may tolerate considerable disturbance near their nest sites, most raptors are intolerant of activities near the site, especially during site selection, egg laying and incubation. This condition appears to be augmented by the quality of the habitat surrounding the site, especially as it relates to availability of food resources. Ospreys on the St. Joe River in northern Idaho often nested within fifty meters of each other and were quite tolerant of high levels of motorboat traffic directly below their nest sites, whereas those on the Clearwater River were extremely territorial and intolerant of human activity. Food resources were abundant directly surrounding the nest sites at the St. Joe location while the Clearwater River had low aquatic productivity. Peregrine falcons have shown extreme tolerance of human activities

at urban nest sites on building ledges in areas where rock dove populations are high. Bald eagles will roost near areas of high human activity when food resources are abundant. In spite of the importance of prey availability to the success of nesting pairs and its relationship to raptor tolerance to disturbance, past and present practices of raptor habitat management in forested areas focus solely on the nest site and its ultimate protection.

A reference review of 86 literature citations regarding forest management and raptors, provided by the Raptor Management Information System, revealed almost all to be directed solely to nest site protection. In 1981, the State of California, in response to its Forest Practices Act, initiated nesting bird habitat protection requirements for forest management on private lands in the state. These measures are directed at known nest sites and are strictly reactive to proposed projects. Pre-project surveys are not required, thus protection is only granted to those nest sites known prior to project initiation. This is also normally the case in similar situations on National Forest lands as time and funding constraints preclude intensive pre-project surveys. Thus, unless the site is previously known or detected and reported during initial sale layout, there is little effort expended for raptor habitat protection. If sites are located during the course of the implementation of the sale, most emphasis is on protection of the active nest and its occupants. Concerns as to the future stability of the site are largely ignored once the sale is in progress. Thus, for the most part, total habitat requirements of raptorial bird species have been grossly overlooked.

Beginning in 1978 with the publication of the *Wildlife Habitats in Managed Forests — the Blue Mountains of Oregon and Washington* (Thomas 1979) and the spotted owl controversy in the Pacific States, raptor management strategies began to change. For the first time, supported by data collected in the late 1960s, territories were laid out based on the perceived total habitat needs of the species, including nest site and foraging requirements. This methodology is now being considered for other species, especially forest dwelling raptors. Guidelines are presently under development for goshawks using base data from research that is introduced into the management arena through the Wildlife Habitat Relationships programs. Such strategies attempt to provide for the total needs of the species and are adaptable to different situations as may occur throughout the species' range.

MANAGEMENT INDICATOR SPECIES

The Management Indicator Species (MIS) concept was developed on the basis of several environmental regulations. The Council on Environmental Quality provided implementation guidelines for the National Environmental Policy Act of 1969 that required that changes in wildlife habitats be addressed in terms of quality and quantity of habitats and that all species be addressed. Since it is logistically impossible to address all species individually, the National Forest Management Act of 1976 provided impetus for the selection of species that could be used to represent wildlife and fish issues. Management Indicator Species are used to: 1) establish minimum management requirements for diversity and population viability, 2) guide habitat planning and management to meet specific wildlife goals, 3) facilitate quantitative analyses of wildlife resources, 4) monitor management results, 5) identify research needs, and 6) communicate programs and plans to management, users and cooperators (CFR 219.19 and 219.26-27).

Management Indicator Species are divided into the following groups: (1) species federally listed as endangered or threatened, (2) species designated as sensitive to management activities, (3) species that are ecological indicators of specific vegetation communities and successional stages, (4) harvest species, and (5) species that are of local special interest. In California, several raptor species are considered Management Indicator Species because of viability concerns (Table 1). These species also tend to have narrow ecological requirements and thus can be effectively used to display changes in forested habitats that result from timber harvest activities.

Table 1. Raptor species in California that are used as Management Indicator Species (MIS) on forested lands administered by the U.S. Forest Service.

MIS	Category	Issue
Bald eagle	Federal-endangered State-endangered	Viability
Peregrine falcon	Federal-endangered State-endangered	Viability
Northern goshawk	Forest Service-sensitive Ecological indicator	Viability
Spotted owl	Forest Service-sensitive State-threatened	Viability Ecological indicator
Great gray owl	Forest Service-sensitive State-endangered	Viability Ecological indicator

Habitat capability or suitability models are developed for selected management indicator species. These are models that qualitatively and quantitatively define habitat parameters such as vegetation communities, seral stages, basal areas, crown closures and others that are used to identify habitats suitable for nesting and foraging components of territories.

Management Indicator Species are used to guide land-use allocation and habitat management direction for a particular geographic area. Geographical areas managed for these species are selected on the basis of existing or potential habitat suitability, compatibility with other resources, public demand, legal requirements and cooperative input (T. Darden, unpubl. data). Those species with viability concerns are the highest priority.

On U.S. Forest Service administered lands, the MIS concept is initiated at the Forest Land Management Planning level and implemented at the project level. Direction for managing MIS is defined in the forest-wide standards and guidelines and management prescriptions. Forest-wide standards and guidelines provide species management direction that is applied over an entire national forest. Management prescriptions provide direction to geographical areas and are used in addition to the forest-wide standards and guidelines to emphasize species in specific geographical areas.

At the project level, the aforementioned management direction is applied to identifiable areas such as timber compartments. This phase involves several steps: (1) determine what species will be emphasized for a specific project or geographical area, (2) determine the objectives for managing these species, (3) determine existing and potential suitable habitats within the project area, (4) develop different treatment alternatives based on the species requirements and objectives set to manage the species, (5) implement the project, and (6) monitor the results of project implementation.

MANAGING NESTING GOSHAWK HABITAT — AN EXAMPLE

The northern goshawk was selected as a Management Indicator Species on the Inyo National Forest (Fig. 1)because it is designated as a sensitive species and is considered an ecological indicator for mature and old-growth forests in the east-side Sierra Nevada. A habitat capability model for this species was developed for northeastern California (Shimimoto and Airola 1981) and modified for habitats on the Inyo National Forest (C. McCarthy, unpubl. data). This model defines goshawk nesting and foraging habitat in terms of vegetation communities and structure

Table 2. Primary and secondary habitat criteria used for delineating northern goshawk nesting habitat on the Inyo National Forest.[a]

Parameter	High quality suitable habitat	Moderate qual. suitable habitat
Nest stand:		
Vegetation communities	Red fir, lodgepole pine, Jeffrey pine, quaking aspen, and mixed conifer communities	
Seral stages[b]	WHR Type 4B	WHR Type 3B
Nest stand size	20-50 ha	12-20 ha
Stand canopy	40%+	25-40%
Stand basal area	34-57 m^2/ha	23-34 m^2/ha
Slope	0-20%	20-30%
Distance to water	< 0.4 km	0.4 - 1.7 km
Territory:		
Territory size	3,000 ha	4,665 ha
No. vegetation communities and seral stages within 1.6 km of nest	8+ vegetation assoc. and seral stages	5-7 vegetation assoc. and seral stages
Nest stands within territory	≥ 2 high quality sites	≥ 1 high or med. quality site
Dist. between nest stands	≤ 1.6 km	1.6 - 3.2 km

[a]Model was adapted for the Inyo National Forest using Shimimoto and Airola (1981).
[b]WHR 4B are stands of trees with a DBH size of at least 61 cm with a canopy cover of at least 40%. WHR 3B are stands of trees with a DBH size between 28 cm and 61 cm with canopy cover of at least 40%.

(Table 2). Using this model, suitable nesting goshawk habitat could be identified on the forest.

The draft Inyo National Forest Plan established forest-wide standards and guidelines for the management of the northern goshawk. Specific management guidelines include:

- Maintain a minimum of one goshawk territory per 50 km within suitable habitat. Distances between territories or clumps of territories will not exceed 20 km.
- Maintain at least 50 ha of suitable nesting habitat per territory.
- Give preference to active nests when delineating a population network.
- Delineate nest stands in areas that have canopy cover exceeding 40%; a water source within 0.4 km of the nest stand; are located on slopes less than 20%; and have at least five vegetation communities and three successional stages within 1.7 km of the nest stand.
- Locate nest stands in areas classified as unsuitable for commercial timber management, if these provide high quality goshawk nesting habitat.
- Exclude timber management activities within 0.4 km of occupied stands during the nesting season.
- Limit timber activities during time periods other than those activities that meet requirements stated in the habitat capability model.

A total of 44,820 km^2 on the Inyo National Forest are considered suitable for timber management purposes. Of this, 28,015 km will be intensively managed for timber

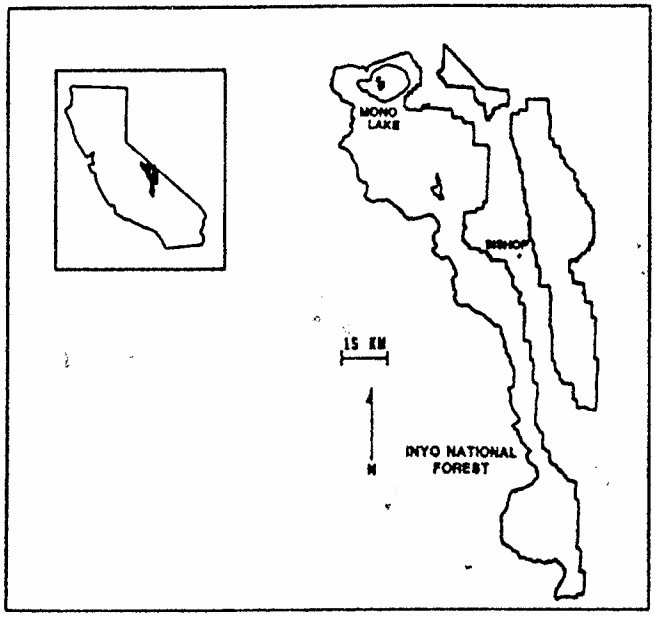

Fig. 1. Location of the Inyo National Forest.

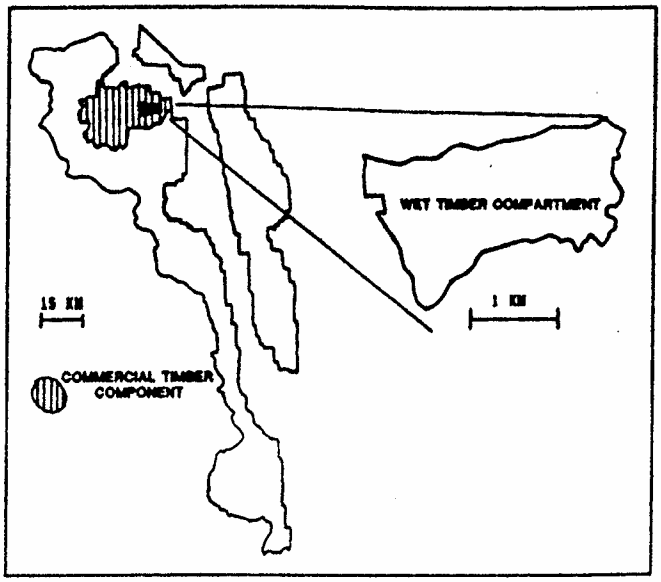

Fig. 2. Wet Timber Compartment.

(Fig. 2). Based on the habitat capability model, a total of 15 territories were prescribed within the suitable area. Nest stands will be allocated for these territories on a timber compartment basis prior to or during the environmental assessment process for timber sales. Within nest stands, goshawk nesting requirements are the primary management goal. Outside of these stands, integrity of foraging habitat will be ensured.

The most important step in emphasizing species is ensuring that the prescriptions are implemented at the ground level. An example of goshawk nest habitat allocation within timber compartments is demonstrated using Wet Timber Compartment (Fig. 2). Wet Timber Compartment (37° 50′ N, 118° 50′ W) lies 280 km south of Reno, Nevada, and 100 km north of Bishop, California, in the Glass Mountains of the Inyo National Forest and encompasses 1474 ha. Major vegetation communities include Jeffrey pine (*Pinus jeffreyi*), lodgepole pine (*Pinus contorta*), quaking aspen (*Populus tremuloides*), big sagebrush (*Artemisia tridentata vaseyana*) and mountain meadows.

The goshawk was one of several Management Indicator Species used as an emphasis species. The reasons for selecting the goshawk were threefold:

- Goshawk habitat requirements could be used as a barometer for assessing habitats of other species dependent on similar habitats.
- There was a historical goshawk nest located within the compartment and we wanted to maintain the integrity nesting habitat.
- We wanted to ensure a distribution of suitable nest stands in this and other compartments in areas

managed for timber harvest to maintain a viable population network (McCarthy and Hargis 1984).

Objectives that were set for goshawk habitat included the following:

- Ensure implementation of the forest-wide standards and guidelines.
- Identify all stands that could function as goshawk nesting habitat.
- Designate at least one and preferably two stands that would be managed as goshawk nest stands.
- Coordinate the selection of stands with timber management objectives.
- Propose habitat improvement potential for enhancing nesting and foraging habitats.

A field reconnaissance was conducted by running survey routes through different vegetation types. Data were collected on structure and composition of overstory and understory vegetation, the availability of snags and down logs, and pertinent topographical features of each vegetation community. These parameters were measured using four to six randomly placed 0.04 ha plots along each survey route. Survey routes were delineated on 7.5 minute U.S. Geological Survey orthophoto quad maps. Vegetation communities and habitat structure were used to delineate habitat units. Each unit was evaluated for capability to support one or more of the indicator species based on habitat capability models modified to reflect environmental conditions unique to the eastern Sierra Nevada.

Using the habitat capability model, 292 ha were identified as suitable goshawk nesting habitat (Fig. 3). Of this, 41 ha were considered high quality habitat, and 251 ha were considered moderate quality habitat. These stands were all located in lodgepole pine vegetation communities.

Four stands of lodgepole pine, totaling 155 ha, were selected and delineated for management as goshawk nest stands (Fig. 4) in the environmental assessment process. Two stands were selected that will function as existing habitat. An additional two stands will be managed silviculturally to function as high quality nesting habitat within the next 20 years. Aspen stands that currently function as suitable nesting habitat will also be retained. Nest stands allocated for goshawk management in this compartment could support two nesting pairs. The remainder of stands designated as existing goshawk habitat could be used to meet timber management objectives without significant degradation of goshawk nesting habitat.

Another important facet in the emphasis species concept is monitoring. Monitoring can be accomplished on two levels. The first is validating the Habitat Capability Models for specific regions. On the Inyo National Forest we are in the process of analyzing home range and habitat

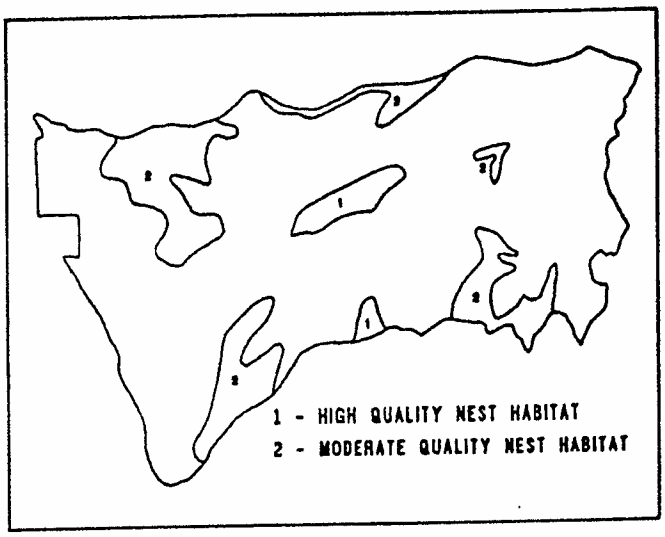

Fig. 3. Habitats identified that can currently function as goshawk nest stands in Wet Timber Compartment.

selection data to determine the accuracy of existing models. Since most species', including goshawks', habitat requirements appear to vary from one geographical region to another, this is an important step. The second is that activities implemented to protect or enhance MIS habitats need to be reviewed to ensure that the objectives are realized.

CONCLUSIONS

To date, wildlife input into timber management, particularly with nongame species, has been passive. One reason for this is the lack of funding and personnel. Typi-

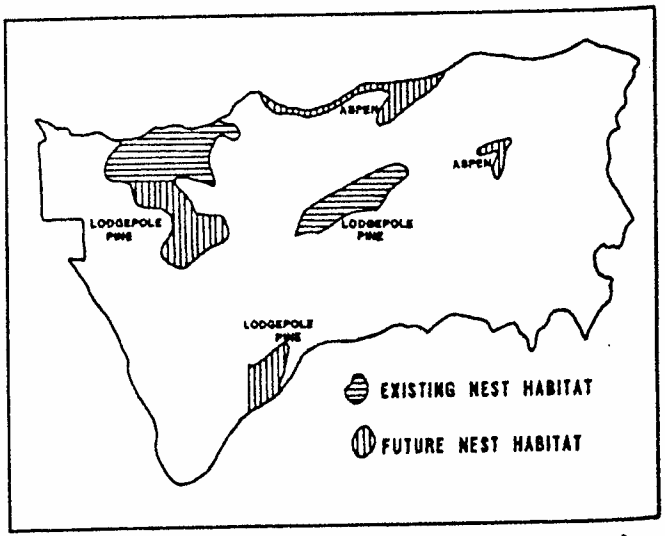

Fig. 4. Habitats that will be managed as existing and future goshawk nest stands in Wet Timber Compartment.

cally, biologists are not involved in the resource management process until an action is proposed. The agency proposing the activity has already determined what actions are desired and where these will be implemented. The biologist is put into a reaction mode and attempts to identify small areas, such as nest sites, for protection or to develop mitigation guidelines to alleviate impacts. No attempt is made for long-term habitat allocations or developing enhancement opportunities. Benefits derived from this approach are incidental. Often habitats of species are traded-off without comprehending the significance of associated impacts.

Biologists need to take an active role in determining habitat allocation and management strategies for specific species. This direction should be initiated and displayed at the planning level and applied at the ground level. An MIS approach to managing habitats is one method that can be used to ensure the viability of selected species and others dependent on similar habitats.

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