Review of the Forest Management Guidelines for Bald Eagles, Ospreys, and Great Blue Herons in Ontario

Brian Naylor, Ontario Ministry of Natural Resources, Northeast and Southern Science and Information Sections, 3301 Trout Lake Road, North Bay, ON P1A 4L7 and Bob Watt, Ontario Ministry of Natural Resource, Northeast Science and Information Section, P.O. Bag 3020, South Porcupine, ON P0N 1H0.

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Introduction

Industrial, developmental, and recreational human activities can disturb nesting birds, resulting in nest desertion, disruption of feeding patterns, and increased egg, nestling, and adult mortality (Knight and Skagen 1988, Hockin et al. 1992, Hill et al. 1997, Richardson and Miller 1997). Localized effects may be cumulative, ultimately influencing nest site selection, carry capacity, population density, and community structure (Stalmaster 1983, Hockin et al. 1992, Hill et al. 1997).

Bald eagles1 (Haliaeetus leucocephalus), ospreys (Pandion haliaetus), and great blue herons (Ardea herodias) are provincially or regionally featured species in Ontario. Their nest sites are classed as areas of concern; forest management activities are modified in the vicinity of nest sites to minimize adverse effects associated with disturbance and habitat alteration following direction provided by a set of forest management guidelines (Penak 1983, Bowman and Siderius 1984, OMNR 1987).

These guidelines were originally developed in the early to mid 1980s, at a time when populations of eagles and ospreys (and to a lesser extent herons) were recovering from declines during the 1950s to 1970s associated with environmental contaminants such as DDT. The guidelines were based on expert opinion and existing literature, but few rigorous studies documented the effects of forest management activities on these species. The guidelines remained largely untested and unrevised circa 2000, with the exception of the osprey and heron guidelines that were modified for use in the Great Lakes – St. Lawrence (GLSL) forest in the early 1990s (see Szuba and Naylor 1998).

The 1999 Forest Accord stipulated that:

MNR, the forest industry and the Partnership for Public Lands will support an expeditious independent and transparent review of the guidelines which are applied within the forest management planning process …with a goal of ensuring the guidelines fulfill their intended purpose in an effective and efficient manner

A subsequent review of Ontario’s forest management guidelines recommended that the eagle, osprey, and heron guidelines needed to be reviewed to ensure that the science, terminology, and references were up-to-date (ArborVitae et al. 2000).

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1 The golden eagle (Aquila chrysaetos) is not discussed in this review because it nests in the extreme northern portions of the province (DeSmet and James 1987), and is thus not affected by forest management activities.
In this report, we review the literature describing the effects of forest management practices and other human activities on nesting eagles, ospreys, and herons. Our primary objective was to critically evaluate the guidelines based on this literature, and where warranted, recommend changes that would ensure their effectiveness and efficiency. Our secondary objective was to recommend ways to make the guidelines easier to understand and apply, including ways to improve consistency (especially with respect to terminology) and integration with other guidelines. We anticipate these recommendations will be considered during development of the new forest management guide that integrates existing site level prescriptions (ArborVitae et al. 2000).

Terminology used loosely follows Steenhof (1987). We use the term nest to refer to a physical nesting platform and its supporting structure; nest site refers to the nest and the habitat immediately surrounding it; breeding area is an area containing one or more nests within the home range of a pair of birds. Occupied nests are those associated with a pair of birds that have presumably attempted to lay eggs and raise young (also sometimes referred to in the literature as active nests). Productivity refers to the number of young produced in an occupied nest. Successful nests are those that fledge at least one young.

Review of the Bald Eagle Guidelines

Status and Distribution of the Bald Eagle in Ontario

The bald eagle is classified as Endangered in Ontario by COSSARO (NHIC 2004) and is regulated under the provincial Endangered Species Act (RSO 1990). Because it is endangered, it is considered a provincially featured species within the context of forest management activities. The Endangered Species Act protects the habitat (includes nests) of bald eagles from willful destruction or interference (Sec 5(b)). Thus, forest management guidelines must, by legal necessity, be conservative.

In contrast to the classification by COSSARO, the bald eagle is designated as Not At Risk in all provinces and territories by COSEWIC (COSEWIC 2003). Moreover, it is considered common and not susceptible to immediate threats in Ontario by the Natural Heritage Information Centre (S-Rank of S4; NHIC 2004).

There were almost 1,400 pairs of bald eagles nesting in Ontario in 1998 (Grier et al., in prep.). The population appears to be increasing. The number of known bald eagle nests in 1998 was almost double that reported by Jones (1995) based on a survey in 1990. Moreover, counts of migrating eagles at Grimsby (Ontario) and Duluth (Minnesota) during the 1970s and 1980s suggest an annual increase in the provincial population of 14 to 19 percent (Hussell and Brown 1992).

In Ontario, nesting bald eagles are distributed from the shores of Lake Erie to the Lake-of-the-Woods and north to Hudson Bay (Bortolotti 1987). The greatest concentration of nests is in northwestern Ontario; in 1998 there were 15 occupied nests in Southern Region, 185 occupied nests in Northeast Region, and 1193 occupied nests in Northwest Region (Grier et al., in prep.).
Brief Overview of the Habitat Requirements of Bald Eagles

Eagles require large, stout-limbed, open-crowned trees to support their large bulky nests of sticks and provide perch and roost sites. In Ontario, nests are generally (75%) in living trees; white pines (74%) and trembling aspens (19%) are used predominantly (Jones 1995). Supercanopy trees are typically used because they are easily accessed. The majority of nests in the Ontario Nest Records Scheme are on wooded islands associated with large lakes or rivers (Peck and James 1983). Nests are typically located in mature or old forest with a discontinuous canopy and numerous supercanopy trees (Peterson 1986).

Eagles generally nest close to water, ideally adjacent to lakes > 10 km² in surface area (Peterson 1986). Whitfield et al. (1974) noted that 90% of eagle nests in Manitoba and Saskatchewan were within 200 m of a lake or river. Large, productive waterbodies are important because eagles are primarily fish eaters during the breeding season (Snow 1973, Peterson 1986). Productivity of the waterbody adjacent to eagle nests may determine territory size (Gerrard et al. 1983), density of nesting eagles (Dzus and Gerrard 1993), growth rate of young (Bortolotti 1989), and number of young fledged (Gende et al. 1997).

Eagles generally nest in areas with little or no human disturbance (Peterson 1986). Use of shorelines and proximity of nests to water is often related to amount of human activity along shorelines (Fraser et al. 1985, Buehler et al. 1991b, Montopoli and Anderson 1991, Bowerman et al. 1993). They apparently prefer to nest > 1 km from human dwellings (Peterson 1986), although some pairs may be tolerant of human activity (Watson et al. 1999); > 20 human dwellings or campsites per km² generally renders potential nesting habitat unsuitable (Peterson 1986).

Bald Eagle Guidelines in Ontario

The bald eagle guidelines currently used in the province were first described in the document Habitat management guidelines for Ontario’s forest nesting accipiters, buteos, and eagles (James 1984) and were based largely on recommendations by Radtke (1973), Mathisen et al. (1977), and Grier et al. (1983). The guidance provided by James (1984) was subsequently revised and expanded and described in the document Bald eagle habitat management guidelines (OMNR 1987).

The guidelines identify a number of components required for the conservation of bald eagle habitat in Ontario. At a regional scale, the guidelines recommend that disturbance be managed to ensure that large contiguous areas of potentially suitable habitat remain by setting upper limits to habitat modification, and by limiting the rate and timing of human activity.

For each individual breeding area, the guidelines recommend that breeding area management plans be developed that identify and protect 260 ha of essential habitat. Essential habitat represents the aquatic and terrestrial habitat used for feeding, nesting, and roosting. Breeding area management plans should also address factors such as prey base and other features necessary for maintaining habitat suitability. Moreover, the following guidelines are to be followed within essential habitat:

- Retain 5 to 10% of all trees > 25 cm dbh (especially white pines and trembling aspens) as future nest trees
- Retain at least 4 to 6 supercanopy trees of species favoured by eagles (e.g., white pine, trembling aspen) for every 130 ha within 400 m of a river or lake > 16 ha
• Retain at least 3 supercanopy trees (preferably dead or with dead tops) within 400 m of each nest as roost and perch sites

The guidelines also prescribe buffer zones around all nests within a breeding area as follows:

<table>
<thead>
<tr>
<th>Buffer zone</th>
<th>Width</th>
<th>Prescription</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary zone</td>
<td>0 to 100 m</td>
<td>All land use activities including forest management prohibited throughout the year. No human entry during the most and moderately critical periods (February to June).</td>
</tr>
<tr>
<td>Secondary zone</td>
<td>101 to 200 m</td>
<td>All land use activities that result in significant alterations to the landscape such as clearcutting, land clearing, and major construction prohibited throughout the year around nests used within the past 5 years. Thinning (interpreted to include selection cutting in the GLSL forest; see Szuba and Naylor 1998) is permitted outside the most critical and moderately critical periods. No human entry during the most critical period (March to May). Roads and trails should be closed during the most and moderately critical periods.</td>
</tr>
<tr>
<td>Tertiary zone</td>
<td>201 to 400 m (up to 800 m based on line-of-sight)</td>
<td>Land use activities such as clearcutting and construction prohibited around nests used within the past 5 years. Some activities permitted outside the most critical period (interpreted to include selection and shelterwood cutting in the GLSL forest; see Szuba and Naylor 1998).</td>
</tr>
</tbody>
</table>

The guidelines also recommend that fisheries management should attempt to maintain a prey base consistent with the food habits of eagles in lakes and rivers that support nesting eagles.

**Evaluation of the Guidelines**

**Comparison with bald eagle guidelines in other jurisdictions**

Ontario provides greater protection for nesting eagles than any other province in Canada (Table 1). Alberta, British Columbia, Nova Scotia, Prince Edward Island, and Saskatchewan do not have official guidelines for the protection of eagles during forest management operations (these provinces may provide protection at the discretion of the local biologist). Only Manitoba, New Brunswick, Newfoundland, and Quebec have official guidelines to protect nesting eagles. Manitoba’s guidelines recommend a 200 m buffer around occupied eagle nests. New Brunswick permits no clearcutting within 50 m of nests, no timber harvest within 200 m of occupied nests during the breeding season, and no access roads within 400 m of nests. Newfoundland’s guidelines prohibit timber harvest within 200 m of eagle nests at any time of year but permit clearcutting within 201 to 800 m outside the breeding season. Quebec’s guidelines recommend a 300 m no-cut reserve around nests and restrict timber harvest within 301 to 700 m of nests to the period outside the nesting season.

Ontario’s guidelines are based on the 3 zone protection system proposed for the northeastern US by Grier et al. (1983). Similar 3 zone systems are recommended for the protection of nesting eagles in the Chesapeake Bay area, Minnesota, New Hampshire, and Wisconsin (Table 2). However, only Minnesota extends the tertiary zone to 800 m based on line-of-sight and all jurisdictions permit some form of partial timber harvest within the secondary zone and clearcutting within the tertiary zone outside the breeding season. Other jurisdictions in the US use a 2 zone system. In the southeast, the primary buffer zone is 457 m in radius (except in Florida where it is 229 m) and the secondary buffer zone extends to 1.6 km (U.S. Fish and Wildlife Service 1987). Guidelines for Alaska and the Pacific Northwest recommend no timber...
harvest at any time of the year within the 100 m primary zone, and no timber harvest within the secondary zone (101 to 200 m but up to 800m depending on line-of-sight) during the breeding season (U.S. Fish and Wildlife Service 1981).

Regional Management

The guidelines clearly recommend some planning or assessment of habitat supply at a scale above the individual nest site. Managing the supply of potentially suitable nesting habitat across a landscape (in addition to the protection of existing nests) is important because individual breeding areas may be lost to fire, wind, or other disturbance and expanding eagle populations will require more habitat than is currently occupied. Garrett et al. (1993) suggested that regional planning was a critical component of the management of eagle habitat in the Columbia River estuary in Oregon.

This component of the guidelines has not been thoroughly implemented (Armstrong, pers. com. 2001). This is not surprising; the guidelines do not define an appropriate scale for a regional plan, nor do they provide a detailed description of what a regional management approach should include.

Recommendation E1: We support the eagle guidelines in recommending a regional (or subregional) approach to managing the supply of eagle nesting habitat. However, this approach must be more clearly defined. We suggest that a regional plan should identify all critical habitats such as known nest sites, high-use feeding areas, and nocturnal winter roosts (see below). A regional plan might also identify those areas where eagles have habituated to human disturbance, and thus, where modification of some components of the guidelines may be acceptable (see below). We further suggest a regional plan should establish regional (or subregional) habitat supply targets based on assessment of habitat suitability and current and predicted populations. For example, the regional plan should identify those lakes and large rivers (or portions of lakes and large rivers) that are required to sustain the regional eagle population. The new eagle guidelines should provide a detailed description of this regional planning process with examples.

This approach to the management of regional habitat supply will require the use of a habitat suitability model. Many habitat suitability models have been developed for bald eagles (see review in Steenhof 1988), including a mechanistic model proposed as part of the Bald eagle recovery plan for southern Ontario (Szuba 1991). Jones (1995) also developed empirical habitat suitability models for northwestern Ontario based on limnological and prey base attributes of lakes and characteristics of forest vegetation at nest sites. These models should be evaluated for use with existing databases and refined for use in northern and central Ontario.

Site-specific Management

Essential habitat

The guidelines recommend the development of site-specific management plans that encompass essential habitat and address prey base, feeding habitat, and other features necessary for maintaining habitat suitability. However, the guidelines are vague in describing what a breeding area management plan should contain. Moreover, they have rarely been developed in a forest management context (Armstrong, pers. com. 2001), although they have been used to resolve issues surrounding cottage or highway development (Armstrong, pers. com. 2001, Ranta, pers. com. 2001).
Recommendation E2: We recommend that breeding area management plans are not required within the context of forest management planning. We suggest that essential habitat can be adequately addressed through regional planning for eagle habitat (see Recommendation E1) in concert with the implementation of area of concern prescriptions (see below and Appendix I).

The guidelines require the identification of 260 ha of essential habitat within each breeding area. Essential habitat is defined to include nest sites and aquatic and terrestrial habitat used for feeding. However, how essential habitat is delineated is not well defined.

Recommendation E3: We recommend that essential habitat be more clearly defined. We suggest that essential habitat include nest sites, high-use feeding areas, and nocturnal winter roosts (see below), plus the forest adjacent to lakes and large rivers (or portions of lakes and large rivers) that have been identified within a regional plan as necessary to sustain regional eagle populations (see Recommendation E1) (in the absence of a regional plan, forest adjacent to lakes or large rivers currently supporting active eagle nests should be considered essential habitat). Within essential habitat, guidelines should be applied to maintain or create potential nest, perch, and roost trees; spatial and temporal buffer zone guidelines should be applied around known nests, high-use feeding areas, and winter nocturnal roosts (see Appendix 1).

**Disturbance buffer zones for nest trees**

An eagle home range typically contains a primary nest that is currently or has been recently occupied. In Saskatchewan, about 12% of home ranges also contained alternate nests that may have been used at some past date (Gerrard pers. comm. cited in Palmer 1988); number of nests per home range averaged 1.2 (Gerrard et al. 1983). The guidelines recommend that primary buffers be placed around all known bald eagle nests and that secondary and tertiary buffers be placed around all nests known to have been occupied within the past 5 years. Clearly, protection of primary nests is important as eagles exhibit strong nest site fidelity (Gerrard et al. 1983, Kennedy and McTaggart-Cowan 1998); individual nests have a life expectancy of about 4 to 6 years (Grier 1974, Gerrard et al. 1983, Curnutt and Robertson 1994) but may last as long as 20 to 25 years (Todd and Owen 1986). Loss of the only nest in a territory can cause eagles to defer breeding for a year (Kennedy and McTaggart-Cowan 1998). Protection of alternate nests is also important; eagles may switch nests among years as nests are lost to tree senescence and blowdown (Gerrard et al. 1983), or as a result of reproductive failure (Gende et al. 1997, Steidl et al. 1997). Eagles may even rebuild and use a nest that has been unoccupied for several decades (Todd and Owen 1986).

Recommendation E4: We agree that all nests within a breeding area should be protected. All nests known or suspected to have been used within the past 5 years should be considered active and designated as areas of concern. Nests not known or suspected to have been used within 5 years should be considered inactive. When more than one nest has been occupied within a specific area, the nests have been occupied in different years, and the nests are < 1.6 km apart (see Whitfield et al. 1974, Palmer 1988), the nests should be considered part of the same breeding area. The most recently occupied nest within a breeding area should be considered the active nest; the other previously occupied nests in the breeding area should be considered alternate nests. If the status of a nest changes between the preparation and implementation of a forest management plan (e.g., an old nest is abandoned and a new nest is built and occupied in a known breeding area), prescriptions should be modified appropriately.
The guidelines recommend that nest trees that have blown down or have otherwise been damaged so they cannot support a nest do not need to be protected by buffers. However, if a nest blows out of a tree, the nest tree should still be protected by buffers for 3 breeding seasons (if the nest is not rebuilt after 3 years, buffers can be removed).

**Recommendation E5:** Nest trees that can clearly be shown to have blown down or become otherwise unsuitable for nesting should no longer be considered areas of concern and should be removed from the NRVIS database. If a nest blows out of a tree, it should be protected for 3 breeding seasons; after 3 breeding seasons the tree should no longer be considered an area of concern unless the nest is rebuilt. If active nests have not been used for 5 or more consecutive years, they should be considered inactive.

The guidelines are designed to protect nests from human disturbance during the breeding season and to maintain habitat structure required for nesting, perching, roosting, and visual screening. Below we evaluate the guidelines based on these two objectives.

**Impacts of direct human disturbance on eagles**

Numerous descriptive and experimental studies have examined the influence of various human disturbances including those associated with pedestrians, boating, all terrain vehicles, camping, aircraft, and military activities on nesting, roosting, and hunting bald eagles (Stalmaster and Newman 1978; Knight and Knight 1984; Fraser et al. 1985; Wood et al. 1989; Buehler et al. 1991b; Grubb and King 1991; McGarigal et al. 1991; Grubb et al. 1992; Bowerman et al. 1993; Watson 1993; Steidl and Anthony 1996, 2000; Stalmaster and Kaiser 1997, 1998; Brown et al. 1999; Fletcher et al. 1999; Watson et al. 1999; Wood 1999, Grubb et al. 2002). These studies suggest that response to disturbance is highly variable and depends on numerous factors including:

**Timing of disturbance** Sensitivity to disturbance varies through the nesting cycle (Steidl and Anthony 2000) with most loss of productivity associated with nest failure during incubation (Grier 1974, Anthony et al. 1994, Steidl et al. 1997, Elliott et al. 1998). The current guidelines recognize this and restrict activities within the tertiary zone from March 15 to May 31 and within the secondary zone from February 15 to June 30. These timing restrictions provide protection from disturbance during courtship, nest building, egg laying, and incubation, and the first month of chick development. However, they do not provide any protection from disturbance during the later stages of chick development, or during the post-fledging period when chicks show high fidelity to their natal nest (Wood et al. 1998).

James (1991) suggests that eagles return to breeding territories in Ontario by early March and nests may contain eggs from early April to end of June. Fledging generally takes 10 to 12 weeks (Snow 1973) and the post-fledging period typically lasts 6 to 10 weeks (Wood et al. 1998).

**Recommendation E6:** We support the current guidelines in restricting potentially disturbing events within the vicinity of occupied eagle nests during the critical breeding period. However, we recommend that the critical breeding period combine the most, moderately, and low critical periods currently described in the guidelines. This single window encompasses activities associated with courtship, nest building, egg laying, incubation, and fledging and is more consistent with the approach used in the osprey and heron guidelines. Thus, the critical breeding period should be defined as February 15 to August 31 for Northwest and Northeast Regions and February 1 to August 15 for Southern Region. However, local knowledge of breeding phenology should be used to adjust the dates to ensure key breeding activities are
protected. This window does not encompass the post-fledging period when chicks show high fidelity to a nest site. Wood (1998) suggested a buffer of about 200 m during this period. Thus, the buffer system suggested below (Recommendation E13) should likely be sufficient to protect post-fledging activities.

Type of disturbance Pedestrians elicit the greatest response from nesting eagles, followed by boats, motorized vehicles, short-duration noises, and aircraft (Grubb and King 1991, Grubb et al. 1992). The current guidelines address potential disturbance from both mechanized logging equipment and human entry.

Recommendation E7: The guidelines should clearly state that human entry includes all pedestrian-related forest management activities including preharvest inspections, road location, boundary marking, tree marking, and tree planting.

Distance to disturbance The current guidelines explicitly prohibit clearcutting during the breeding season within up to 800 m based on line-of-sight. However, it is unclear how close other mechanized forest management activities are permitted during the breeding season. Response of eagles to disturbance is typically inversely related to the distance to the source of disturbance (Grubb and King 1991, McGarigal et al. 1991, Steidl and Anthony 1996). However, there is little information on the effects of forestry operations during the breeding season on eagle performance. Therres et al. (1993) described 3 case studies where clearcutting during the breeding season appeared to cause eagles to abandon nest sites along Chesapeake Bay. Cutting occurred from 91 to 366 m from nests; the authors felt that no clearcutting should be permitted within 400 m of a nest during the breeding season.

Other studies provide indirect evidence about the likely impacts of mechanized forest management activities on nesting eagles. For example, in Arizona, Grubb and King (1991) suggested that noise associated with vehicles (ATVs, cars, trucks) had a 75% chance of eliciting a response (agitation or flight) from nesting eagles when within 445 m regardless of duration or visibility. Vehicular activity > 445 m had a 80% chance of eliciting a response if duration was > 6.5 minutes and the vehicle was visible (only 36% chance if vehicle was not visible). In Michigan, Grubb et al. (1992) suggested that noise associated with vehicles that were > 750 m from nests regardless of duration or visibility had only a 17% chance of eliciting a response from nesting eagles. These results suggest that operation of mechanized forestry equipment within 400 m of a nest has a high probability of disturbing nesting eagles while that operating > 800 m from a nest appears to provide little disruption. Furthermore, mechanized operations 400 to 800 m from nests have a high probability of disturbing nesting eagles if visible, but only a moderate probability if not visible.

Recommendation E8: We recommend that no mechanized forest management activities be permitted within 400 m of occupied nests during the critical breeding period. Some restrictions on mechanized operations within 401 to 800 m of nests may also be warranted. In Southern Region, where eagles are extremely rare, we recommend no mechanized operations within 400 to 800 m of nests during the critical breeding period; in the Northwest and Northeast Regions, where eagles are less rare, mechanized operations may be conducted within 401 to 800 m of occupied nests during the critical breeding period if the machinery is not directly visible from the nest. Visibility should be assessed by an on-site visit or some type of viewshed analysis (e.g., Camp et al. 1997).

The current guidelines explicitly prohibit pedestrian activity within 200 m of occupied nests. This may be an adequate buffer zone for feeding eagles that typically flush at distances of 150 to 250
m when disturbed by recreational activities (Stalmaster and Newman 1978, Knight and Knight 1984, Steidl and Anthony 1996, Stalmaster and Kaiser 1998). However, nesting eagles appear to be more sensitive to disturbance. For example, Grubb and King (1991) and Grubb et al. (1992) suggested that pedestrian activity within 185 m, within 275 m, within 543 m, and beyond 543 m of a nest had a 100%, 86%, 60%, and 28% chance, respectively, of eliciting a response from nesting eagles. Moreover, when approached by pedestrians, nesting eagles flushed at an average distance of 476 m in Minnesota (Fraser et al. 1985). Thus, the existing guidelines may not adequately protect nesting eagles from all pedestrian activities.

Recommendation E9: We recommend that no pedestrian-related forest management activities be permitted within 200 m of occupied nests during the critical breeding period. We further recommend that no pedestrian-related activities involving large numbers of people and likely to be accompanied by significant noise (e.g., tree planting) be permitted within 400 m of occupied nests during the critical breeding period unless the activity is not visible from the nest and is accompanied by mitigative monitoring (see Appendix 2).

Duration of disturbance Eagles generally react more frequently to disturbances that are of long duration (Grubb and King 1991, Grubb et al. 1992). For example, Grubb and King (1991) suggested that vehicular traffic noise that was > 445 m from a nest and lasted < 6.5 minutes had only a 12% chance of disturbing nesting eagles (compared to a 36 to 80% chance for similar disturbances that lasted > 6.5 minutes). Thus, some short duration activities occurring during the critical breeding period, such as hauling, likely have limited impact on eagles.

Existing amount of disturbance Eagles are more likely to react to disturbance when the general background noise level is low (Steidl and Anthony 2000). Moreover, some eagles may habituate to repeated non-threatening disturbance (Wood 1999, Watson et al. 1999, Steidl and Anthony 2000, Becker 2002, Grubb et al. 2002).

Recommendation E10: We recommend that some flexibility be permitted in application of the guidelines around nests that are in relatively disturbed landscapes and for which nesting eagles appear to have habituated to disturbance. For example, hauling might be permitted within 200 m of an occupied nest during the breeding season if 1) it takes place on an existing road that is well-traveled, 2) the eagles have a history of using the area despite the existing level of disturbance or the road predates the establishment of the nest, and 3) hauling will not dramatically alter the level of disturbance. Similarly, planting might be permitted within 400 m of a nest during the breeding season if 1) the eagles are normally subject to a high level of human disturbance during this time period (e.g., high recreational activity), 2) they appear to have habituated to this level of disturbance, and 3) planting will not dramatically alter the overall level of disturbance.

Impacts of roads on eagles

The current guidelines implicitly prohibit hauling within 200 m of occupied nests, at least during the most and moderately critical periods. They do not mention road use in the tertiary zone, only suggesting that some activities may be permitted outside the most critical period.

The documented effects of roads on nesting eagles are equivocal. Most studies fail to reveal any clear impact of the density, proximity, or level of use of roads on productivity (Mathisen 1968, McEwan and Hirth 1979, Andrew and Mosher 1982, Wood et al. 1989, Parson 1994, Anthony 2001), with the notable exception of Anthony and Isaacs (1989). They found that productivity of eagle nests in Oregon was negatively correlated with proximity of main logging
roads. However, their study is far from clear as productivity was positively affected by the proximity of paved roads.

In contrast there is considerable evidence that the location of eagle nests may be influenced by roads. For example, Andrew and Mosher (1982) found that eagle nests were significantly further from paved roads (but not unpaved roads) than expected by chance in Maryland. Anthony and Isaacs (1989) observed that new nests were built significantly further from logging roads, paved roads, and unpaved roads than were old unused nests in Oregon. Livingston et al. (1990) noted that density of roads had a negative effect on the location of eagle nests in coastal (but not inland) habitats in Maine. Parson (1994) found that density of both paved and unpaved roads tended to be lower within than beyond 140 m of eagle nests in Washington. Jones (1995) noted that lakes with eagle nests in northwestern Ontario were significantly further from roads than were lakes without nests.

Unfortunately, none of these studies provide a clear indication of how close roads can be built to eagle nests. However, Andrew and Mosher (1982) noted a mean distance of 892 m and 508 m from nests to paved and unpaved roads, respectively. Moreover, Wood et al. (1989) reported a mean distance of 705 m between nests and roads (all classes pooled) in Florida.

**Recommendation E11:** Given the potential impact of roads on the location and reuse of eagle nests, we recommend that, whenever possible, no new roads be constructed within 400 m of active eagle nests (no new roads within 200 m of alternate nests or 100 m of inactive nests). We also recommend that no hauling occur within 200 m of occupied nests during the critical breeding period (with exceptions noted above). When operational roads must be constructed within 400 m of nests, temporary roads and/or water crossings should be used whenever possible to limit future access and disturbance.

**Impacts of habitat modification on eagles**

The existing guidelines do not permit any cutting within 100 m and any clearcutting within 400 m of nests (up to 800 m based on line-of-sight).


Only one study in Ontario has attempted to describe the effects of habitat modifications associated with forest management practices on nesting eagles and evaluate the effectiveness of the guidelines. Jones (1995) compared productivity at occupied eagle nests in northwestern Ontario that were surrounded by either uncut forest, forest cut following the guidelines (OMNR 1987), or forest cut without application of the guidelines. Sites cut with the guidelines were slightly more productive (1.8 young/nest) than sites cut without the guidelines (1.3 young/nest), but undisturbed sites had the lowest productivity (0.9 young/nest). Overall, none of the treatments differed significantly, likely because of the small sample size (total of 29 nests, only 4 nests in areas cut with the guidelines).

Results of studies of the effects of forest management activities on nesting eagles in other jurisdictions are reviewed below. Studies that did not quantify the type, proximity, or amount of timber harvest, or simply pooled timber harvest and other land clearing activities generally failed
to detect an effect of harvesting on the occupancy or productivity of eagle nests (e.g., Mathisen 1968, McEwan and Hirth 1979, Anderson 1985, Parson 1994, Anthony 2001).

In contrast, studies that quantified the amount or proximity of clearcut harvesting have generally revealed significant effects. For example, Corr (1974) suggested that clearcuts within 200 m of nests had a negative effect on breeding eagles in southeast Alaska. Anthony and Isaacs (1989) found that nest site occupancy and productivity were negatively related to proximity to clearcuts (age not described) in Oregon. They recommended no clearcuts within 400 m at any time of year. Livingston et al. (1990) compared characteristics of habitat within 500 m of nest sites and randomly chosen potential sites in Maine. On inland lakes, sites with nests had a significantly lower area of clearcuts and seed tree cuts (< 20 years old) than sites without nests.

The most rigorous study of the effects of clearcutting on eagles was conducted in southeast Alaska by Gende et al. (1998). They studied 300 eagle nests and found that the proximity of clearcuts (< 20 years old) affected the location of occupied nests, but did not appear to affect productivity. Clearcuts within 100 m had the greatest impact, but effects were detectable up to 300 m away from nests. They recommended a minimum buffer of 300 m.

Results of these studies suggest that clearcutting may affect the distribution, occupancy, or productivity of eagle nests, with effects occurring when clearcuts are as far as 400 m from nests. These results and the recommendations of the authors generally support the current guidelines. However, there is little evidence that clearcutting beyond 400 m (even if visible) has any impact on nesting eagles.

**Recommendation E12: We recommend that no clearcutting be permitted within 400 m of active nests at any time of year.**

Unfortunately, few studies have evaluated the effects of partial cutting on eagles. Anderson (1985) reported on the use of 31 breeding areas in Oregon and Washington. He found no significant difference in the percent of nests that were occupied for sites that had (47% occupied) or had not (54% occupied) experienced some form of ‘selective’ timber harvest within 1 km of nests. However, in 2 of 4 case studies presented, selective timber harvest close to nests appeared to have caused eagles to abandon breeding areas or relocate nests to adjacent uncut habitat. In Oregon, Anthony and Isaacs (1989) found that the occupancy and productivity of eagle nests were unrelated to the proximity of ‘partial’ cuts.

Characteristics of stands used by eagles for nesting suggest they generally prefer mature, open forest with a discontinuous canopy (Snow 1973, Gerrard et al. 1975, Peterson 1986), likely because these large birds are unable to maneuver through closed canopies (Andrew and Mosher 1982). For example, Lehman (1980) suggested that ideal nesting habitat in ponderosa pine forests in California had 20 dominant, large-limbed, open-crowned trees/ha and canopy closure < 20%. Andrew and Mosher (1982) found that nests were in open mature forest that had lower canopy closure (61%) than random sites (84%) in Maryland. Hodges et al. (1984) found eagles nesting frequently in second growth forest if it had some ‘old growth’ trees present in British Columbia. Anthony and Isaacs (1989) suggested that structurally diverse, uneven-aged forest with a canopy closure ranging from 30 to 55% was ideal nesting habitat for eagles in Oregon. Jones (1995) found that nest sites and random sites did not differ in total basal area or canopy closure in northwestern Ontario, but nest sites did have significantly more potential perch trees/ha (dominant/codominant trees with good flight access).
Since ideal nesting habitat appears to have moderate levels of canopy closure (30-60%), some partial cutting may be beneficial within 400 m of nests. Partial cuts may also release trees that will become future supercanopy nest, perch, and roost sites (Burke 1983, Anderson 1985, Cline 1990). Selection cuts and shelterwood regeneration and first removal cuts may retain an adequate number of large trees (for nest, perch, and roost sites) and sufficient canopy closure. However, shelterwood final removal cuts likely create unsuitable nesting habitat because they leave little canopy closure.

Although partial cuts may have limited impact on eagle nesting habitat, some uncut buffer is likely required around nests to protect nests from damage during harvest operations. Moreover, uncut buffers will ensure the retention of dead trees that are potential perch sites close to eagle nests (most large dead trees are felled within partial cuts to comply with the Occupational Health and Safety Act (RSO 1990)). Uncut buffers will also help protect post-fledging habitat (sensu Wood et al. 1998).

Recommendation E13: We recommend that no cutting take place within 200 m of active or alternate nests (no cutting within 100 m of inactive nests) at any time of year and that selection cuts, shelterwood preparatory, regeneration, or first removal cuts, and other partial harvests that retain a relatively uniform minimum residual canopy closure of 30% comprised of dominant and codominant trees be permitted within 201 to 400 m of active nests (conducted outside the critical breeding season if the nest is occupied).

Retention of potential nest, perch, and roost trees

Within essential habitat, the guidelines require the retention of at least 3 supercanopy trees within 400 m of nests (1 per 16.8 ha) and at least 4 to 6 supercanopy trees per 130 ha (1 per 21.7 to 1 per 32.5 ha) within 400 m of lakes > 16 ha in area. Within essential habitat, the guidelines also recommend the retention of 5-10% of white pines and poplars > 25 cm as future nest trees.

The supply of potential nest, perch, and roost trees appears to be an important attribute of eagle nesting habitat. Livingston et al. (1990) found that density of supercanopy trees was a significant predictor of the location of eagle nests in Maine. Jones (1995) found that the density of potential perch trees was the primary difference between sites used and not used by nesting eagles in northwestern Ontario. Chandler et al. (1995) noted that use of shorelines by perching eagles was influenced by the density of suitable perch trees in Maryland.

Eagles typically nest in living supercanopy trees; white pines and red pines account for 74% of nests in Ontario (Jones 1995) and 80% in Minnesota (Mathisen 1983). Little is known of the characteristics of trees used for perching and roosting in Ontario. Elsewhere, a variety of species is used but pines are the most frequently used trees in both Michigan (Bowerman et al. 1993) and North Carolina (Chester et al. 1990). Trees used for perching and roosting are usually living (but 25% were dead in Maryland), open-crowned, dominant or codominant trees with diameters and heights greater than the surrounding stand, and are frequently in patches of older forest with an irregular canopy (Chester et al. 1990, Bowerman et al. 1993, Chandler et al. 1995, DellaSala et al. 1998, Thompson and McGarigal 2002).

Recommendation E14: We agree that potential nest, perch, and roost trees should be retained in essential habitat. Trees to be retained should be a mixture of supercanopy trees and dominant and codominant trees capable of becoming future supercanopy trees. Living trees should generally be favoured over dead trees, especially where dead trees may pose a potential
risk to worker safety. *Trees retained should be species most valuable to eagles (white and red pines preferred; otherwise poplars, white spruce, or jack pine) and should be windfirm.*

Lehman (1980) suggested that ideal nesting habitat had at least 20 dominant, large-limbed trees/ha in California. Jones (1995) noted an average of 36 potential perch trees/ha around eagle nests in northwestern Ontario. Chandler et al. (1995) observed that shoreline along Chesapeake Bay that received use by perching eagles had an average of 24 suitable perch trees/ha. These studies suggest that about 20 to 40 potential nest, perch, and roost trees should ideally be retained per ha in essential habitat.

Selection cuts and shelterwood regeneration and first removal cuts routinely maintain > 40 dominant or codominant trees/ha (OMNR 1998a,b). Even in final removal cuts, current tree marking guidelines require the retention of at least 10 dominant or codominant long-lived veteran trees/ha, 8 large mast trees/ha, 6 large cavity trees/ha (often poplars), and at least 1 supercanopy tree per 4 ha (OMNR 2004). Thus, current practices in selection and shelterwood harvests exceed the existing eagle guidelines and likely maintain sufficient potential nest, perch, and roost trees based on Lehman (1980), Jones (1995), and Chandler et al. (1995).

In clearcuts, the *Forest Management Guide for Natural Disturbance Pattern Emulation* (OMNR 2001) requires the retention of 25 trees/ha. These guidelines might meet the needs of eagles if retention favours trees that are suitable as potential nest, perch, or roost sites, especially considering that additional potential nest, perch, and roost trees will be maintained in riparian buffers that range from 30 to 90 m in width (OMNR 1988a) and in insular and peninsular residual patches (OMNR 2001).

**Recommendation E15:** The current guidelines likely underestimate the number of potential nest, perch, and roost trees needed in essential habitat. However, selection and shelterwood harvests should generally leave sufficient trees. When clearcutting in essential habitat, we recommend that tree retention favours supercanopy trees (at least 1 per 4 ha as per Naylor (1998a,b)), large living poplar cavity trees (at least 6/ha), and healthy living dominant or codominant veteran trees of species that are long-lived, windfirm, and valuable to eagles (especially white and red pines) (at least 10/ha as per the veteran tree guidelines prescribed in the OMNR (2004)). Supercanopy and veteran trees in riparian buffers and insular and peninsular residual patches contribute to meeting habitat objectives in essential habitat.

Some nests may be over 1.5 km from water (Jones 1995) and nests may average > 500 m from water in some localities (e.g., McEwan and Hirth 1979, Andrew and Mosher 1982). However, Whitfield et al. (1974) noted that 90% of eagle nests in Manitoba and Saskatchewan were within 200 m of a lake or river and eagle nests averaged 60 m from water in Minnesota (Mathisen 1983) and 65 m from water in northwestern Ontario (Jones 1995).

Moreover, perch and roost sites are generally close to water (Garret et al. 1993). In North Carolina, trees used for perching and roosting averaged 7 and 24 m, respectively, from the forest edge adjacent to water (Chester et al. 1990). In Maryland, > 90% of observations of radio-tagged eagles were within 100 m of water (Buehler et al. 1991b, 1992a) and trees used for perching averaged 46 m from water (Chandler et al. 1995) while those used for roosting during the nesting season averaged 190 m from water (Buehler et al. 1991a). In Michigan, perch trees averaged 132 m from water (Bowerman et al. 1993).
Recommendation E16: We recommend that potential nest, perch, and roost trees should be retained within 200 m of lakes and large rivers (or portions of lakes and large rivers) identified as necessary to sustain regional eagle populations (see Recommendation E1).

**Special management guidelines**

**High-use feeding areas**

Gende et al. (1997) and Steidl et al. (1997) suggested that prey availability prior to or during incubation was a key factor responsible for variability in productivity of eagles in Alaska. Gerrard et al. (1975) suggested that nesting success of eagles in Manitoba and Saskatchewan was related to the proximity of nests to spawning streams that were accessible in April. In Yellowstone National Park, Swenson et al. (1986) believed that a reliable food supply early in the nesting season (mid April) was the most important factor influencing nest site selection. Nests were generally within 5 km of open water associated with major lake inlets or outlets and provided eagles with access to waterfowl and fish. In early summer (May – June), eagles may gather at streams being used by spawning suckers, pike, and walleye (Gerrard and Bortolotti 1988, Harmata et al. 1999). Thus, areas of open water in early spring and spawning areas throughout spring and early summer that receive high use should be considered essential habitats. Numerous authors have recommended from 100 to 800 m buffers around high-use feeding areas (Stalmaster and Newman 1978, Knight and Knight 1984, McGarigal et al. 1991, Stalmaster and Kaiser 1998).

Recommendation E17: We recommend that known high-use spring and early summer feeding areas be identified as critical habitats and treated as areas of concern. Appropriate guidelines for perch and roost trees should be applied within 200 m of the water body (see above). Moreover, forest management operations should be prohibited within 400 m during periods of high use.

Many of Ontario’s eagles migrate south during winter, but some stay through the winter, often living around open water in association with large rivers and hydro dams.

Recommendation E18: When traditional high-use winter feeding areas are identified, we recommend that the guidelines described for high-use spring and early summer feeding areas be applied.

**Nocturnal winter roosts**

During winter, eagles may make traditional use of nocturnal roosting habitats that may reduce energy costs (Stalmaster and Gessaman 1984, Keister et al. 1985, Buehler et al. 1991c). Winter roosts are generally characterized by stands of old large diameter trees with high crown accessibility (Keister and Anthony 1983; Keister et al. 1987; Chester et al. 1990; Buehler et al. 1991a, 1992b; Stohlgren 1993; Stohlgren and Farmer 1994; DellaSala et al. 1998). Some timber harvest may be permitted in these areas but DellaSalla et al. (1998) recommended leaving all trees > 35 cm dbh in roosts in Oregon (their roosts averaged > 50 large trees/ha). In North Carolina, Chester et al. (1990) recommended retaining 25 to 100 large diameter (> 40 cm dbh) trees/ha in winter roosts. Winter roosts in northern California had a basal area of at least 18 m²/ha and 19 to 35 large diameter (> 50 cm dbh) trees/ha (Stohlgren and Farmer 1994). Human disturbance at roosts sites should be minimized; Grier et al. (1983) and Lanier and Foss (1989) recommended no human activities within 400 m and 500 m of nocturnal winter roosts, respectively.
Recommendation E19: We recommend that known traditional winter roost sites (sites used annually by 5 or more eagles for at least 2 weeks each year; sensu Grier et al. 1983) be identified as critical habitats and considered areas of concern. Selection, shelterwood preparatory or regeneration cuts, or other partial harvests may be conducted outside the period of use but should maintain at least 50 large diameter (40+ cm dbh) trees/ha. We further recommend no forest management activities within 400 m of a roost site during the period it is occupied.

Figure 1 and Appendix 1 summarize recommended guidelines for the protection of eagle nests.

**Review of the Osprey Guidelines**

**Status and Distribution of the Osprey in Ontario**

The osprey is not classified as a species at risk by COSSARO (NHIC 2004) or COSEWIC (COSEWIC 2003). Moreover, it is considered to be common and not susceptible to immediate threats in Ontario by the Natural Heritage Information Centre (S-Rank of S4; NHIC 2004). However, because of historic population declines related to DDT and its perceived sensitivity to disturbance, the osprey is classified as a regionally featured species in Ontario within the context of forest management activities. Moreover, nests and eggs of the osprey are protected from destruction or possession by the *Fish and Wildlife Conservation Act* (RSO 1997; Sec 7(1)).

In 2001, the MNR NRVIS database contained records for over 1500 osprey nests in the province (present status of all nests not known). Osprey populations are apparently stable or increasing across most of the species’ range in Canada (Kirk and Hyslop 1998). Counts of migrating ospreys at Grimsby (Ontario) and Duluth (Minnesota) during the 1970s and 1980s suggest an annual increase in the provincial population of 5 to 7 percent (Hussell and Brown 1992).

Ospreys breed across Ontario, from the shores of Lake Erie to the Lake-of-the-Woods and north to the Hudson Bay coast (Weir 1987). Ospreys are most abundant in the boreal and GLSL forest regions, south to the edge of the Canadian Shield (Weir 1987). Abundance appears to be highest in Northeast Region (634 nests in NRVIS); Northwest (446 nests) and Southern (433 nests) Regions have similar numbers of known osprey nests.

**Brief Overview of the Habitat Requirements of Ospreys**

In Ontario, ospreys typically build their large bulky nests of sticks in dead trees, living trees with dead tops, utility poles or towers, or on man-made structures (Peck and James 1983). Nest sites appear to have two important characteristics; they represent a stable platform and they must provide an unobstructed view (Vana-Miller 1987). Nests are generally found in marshes, swamps, flooded areas, bogs, along the shores of lakes and rivers, and on islands (Peck and James 1983). Although they will nest in very open habitats and may not require forest cover (Schroeder 1972), they appear to need suitable perches in the vicinity of nests (Vana-Miller 1987). Moreover, overly exposed nests may be more susceptible to both blowdown and predation (Saurola 1997).
Ospreys usually nest close to or over water (Peck and James 1983), but nests may be > 3 km from water (D’Eon and Watt 1994). Ospreys are strongly associated with water because they feed almost exclusively on fish (Zarn 1974, Vana-Miller 1987). Food availability does not apparently influence clutch size (Poole 1983, Eriksson 1986) but may affect chick survival and thus productivity (Poole 1982, Kushlan and Bass 1983, McLean and Byrd 1991, Chubbs and Trimper 1998, Lohmus 2001). Ospreys are extremely adaptable, hunting along large rivers (Bider and Bird 1983), lakes (Steeger et al. 1992), reservoirs (Swenson 1981a), estuaries (Hughes 1983), and ocean coastlines (Greene et al. 1983). Suitability of waterbodies used for feeding may be influenced by proximity to nests, fish productivity, and factors affecting hunting success such as transparency and the presence of structures that obscure the surface of the littoral zone (Vana-Miller 1987, Usgaard and Higgins 1995, Lohmus 2001).

Habitat suitability is also influenced by the proximity, amount, timing, and nature of human activities (Vana-Miller 1987). However, effects of human disturbance appear to be strongly related to degree of habituation (D’Eon and Watt 1994).

**Osprey Guidelines in Ontario**

The osprey guidelines currently used in the boreal portion of the province are described in the document *Management guidelines and recommendations for osprey in Ontario* (Penak 1983) and were based largely on recommendations from Jackman and Scott (1975), Grier (1976), Mansell et al. (1976), McKeating (1977), Gray (1978), Coleman (1981), and Evans (1982).

The guidelines require that buffer zones be established around each osprey nest where there is “evidence of fresh nesting material, white-wash, feathers, eggs, young, [or] incubating or brooding adults” (i.e., occupied nests). Two buffer zones are prescribed around nests as follows:

<table>
<thead>
<tr>
<th>Buffer zone</th>
<th>Width</th>
<th>Prescription</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute zone</td>
<td>0 to 200 m</td>
<td>All development and forest management activities prohibited throughout the year. No human entry except for activities associated with research or nest site maintenance.</td>
</tr>
<tr>
<td>Heavy development zone</td>
<td>201 to 800 m</td>
<td>High disturbance activities such as road construction, timber harvest, and site preparation prohibited at all times of year. Selective timber harvest, tree planting, and habitat management permitted outside the breeding season (April 15 to Sept. 1). In selective harvests, a minimum of 5 snags and 5 clumps of 6 to 10 tall trees must be maintained. No timber harvest within 70 m of waterbodies.</td>
</tr>
</tbody>
</table>

The guidelines also provide recommendations for nest site improvement and preservation, monitoring of productivity, documentation of nests, and public awareness.

The osprey guidelines currently used in the GSSL forest are described in *Forest raptors and their nests in central Ontario* (Szuba and Naylor 1998) and were based largely on recommendations by Naylor (1994). Two buffer zones are prescribed around all nests that have been occupied within the past 5 years as follows:
<table>
<thead>
<tr>
<th>Buffer zone</th>
<th>Width</th>
<th>Prescription</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reserve</td>
<td>0 to 150 m</td>
<td>No timber harvest permitted at any time of year.</td>
</tr>
<tr>
<td>Modified management area</td>
<td>151 to 300 m</td>
<td>No timber harvest permitted during the breeding season (March 1 to July 31). Selection and shelterwood harvest permitted outside the breeding season. Retain at least 3 supercanopy trees to provide nest, roost, and perch sites.</td>
</tr>
</tbody>
</table>

The GLSL guidelines also require the retention of at least 1 supercanopy tree per 650 m of shoreline around lakes occupied by breeding ospreys. Nests not used within the past 5 years are protected by a 50 m reserve.

**Evaluation of the Guidelines**

**Comparison with osprey guidelines in other jurisdictions**

Ontario currently provides greater protection for nesting ospreys than any other province in Canada (Table 3). Alberta, British Columbia, Nova Scotia, Prince Edward Island, Quebec, and Saskatchewan do not have official guidelines for the protection of nesting ospreys during forest management operations (these provinces may provide protection at the discretion of local biologists). Only Manitoba, New Brunswick, and Newfoundland have official guidelines to protect nesting ospreys. Manitoba’s guidelines recommend a 200 m buffer around occupied osprey nests. New Brunswick permits no clearcutting within 15 m of osprey nests and no timber harvest within 100 m of occupied nests during the breeding season. Newfoundland’s guidelines prohibit timber harvest within 200 m of osprey nests at any time of year but permit clearcutting within 201 to 800 m outside the breeding season.

We could find few forest management guidelines for ospreys in jurisdictions within the United States (Table 4). Ontario’s guidelines are more restrictive than those recommended by Minnesota or New Hampshire.

**Site-specific management**

**Disturbance buffer zones for nest trees**

Penak (1983: 9) recommends the establishment of buffer zones around nests with that are occupied. Szuba and Naylor (1998) suggest buffers for both active (nests known to have been used within the past 5 years) and inactive nests. Protection of individual nests is important. Ospreys show strong nest site fidelity (Poole 1981, Postupalsky 1989); individual nest sites may be used 6 to 10 years (Todd and Owen 1986). Moreover, the availability of suitable nest sites may limit population density (Poole 1989a, Witt 1990, Ewins 1997). Protection of alternate nests is also important; since ospreys show a strong preference for dead trees, it is not unusual to lose > 10% of nests each year to blowdown (Poole 1989b). If alternate nests are not available, construction of new nests delays nesting and may result in reduced clutch size, brood size, and number of young fledged (Steeger and Ydenberg 1993).

*Recommendation O1: We support the protection of all known osprey nests. Nests known or suspected to have been used within the past 5 years should be considered active and designated as areas of concern. Nests not known or suspected to have been used within 5 years should be considered inactive. When more than one nest has been occupied within a specific area, the nests have been occupied in different years, and the nests are < 1.6 km apart*
(see Vana-Miller 1987, Palmer 1988), the nests should be considered part of the same breeding area. The most recently occupied nest within a breeding area should be considered the active nest; the other nests in the breeding area should be considered alternate nests. If the status of a nest changes between the preparation and implementation of a forest management plan (e.g., an old nest is abandoned and a new nest is built and occupied in a known breeding area), prescriptions should be modified appropriately.

The existing guidelines do not specify how to treat nests or nest trees that blow down or active nests that become continuously unoccupied. Given little direction in the literature on these topics, we suggest the guidance for eagles be adopted.

Recommendation O2: Nest trees that can clearly be shown to have blown down or become otherwise unsuitable for nesting should no longer be considered areas of concern and should be removed from the NRVIS database. If a nest blows out of a tree, it should be protected for 3 breeding seasons; after 3 breeding seasons the tree should no longer be considered an area of concern unless the nest is rebuilt. If active nests have not been used for 5 or more consecutive years, they should be considered inactive.

Ospreys frequently nest on man-made structures such as utility towers and poles (Peck and James 1983). In some parts of the province (e.g., Georgian Bay) nests on artificial platforms may outnumber those in living or dead trees (Ewins et al. 1995). Moreover, productivity from nests on artificial platforms may exceed that from nests in trees (Seymour and Bancroft 1983, Westall 1983, Poole 1989a). The current guidelines provide no direction for management around artificial nests. In many cases, artificial platforms may be used in heavily developed or treeless areas and thus may not be affected by forest management activities.

Recommendation O3: We recommend that, when located within areas subject to forest management activities, osprey nests on artificial platforms should be protected by the same buffers used for nests built in living or dead trees.

The guidelines were designed to protect nests from human disturbance during the nesting period and to maintain habitat structure required for nesting, roosting, and visual screening. Below we evaluate the guidelines based on these objectives.

Impacts of direct human disturbance on ospreys

Numerous studies have shown that human disturbance can cause nest site abandonment or reproductive failure (Dunstan 1968, Lind 1976, Reese 1977, Swenson 1979, Poole 1981, Levenson and Koplin 1984, Vana-Miller 1987, Ewins 1997, Saurola 1997, Thomas and Bird 1998). Response to disturbance is quite variable and appears to be related to a number of factors including the following:

Timing of disturbance  Ospreys are most sensitive to disturbance during incubation and the first 3 to 4 weeks after hatching when prolonged absence of adults from nests may cause mortality of embryos or small nestlings resulting from exposure to heat, cold, or predation (Poole 1981, Van Daele and Van Daele 1982, Hagan 1986). Disturbance near the end of the nestling period may also force incompetent fliers to leave nests prematurely, reducing survivorship (Poole 1981).

James (1991) suggests ospreys typically return to their breeding range in Ontario by late April and nests may contain eggs from early May to late June. Fledging occurs by late July to early
August (Ewins et al. 1995) but fledged young often return to the nest to feed or rest for some weeks after fledging (Poole 1989a).

**Recommendation O4:** We support the April 15 to August 31 seasonal timing restriction around *occupied* nests for most areas in Northwest and Northeast Regions. We suggest that the critical breeding season for Southern Region might be changed to April 1 to August 15. However, local knowledge of breeding phenology should be used to adjust the dates to ensure key breeding activities are protected.

**Type of disturbance** Timber harvest is widely regarded as an important disturbance factor (Ewins 1997, Saurola 1997). Occupied human dwellings and human activities, including camping, shoreline fishing, boating, research, illegal harvest and aircraft have also been shown to have some effect on breeding or hunting ospreys or habitat suitability (Dunstan 1968, Zarn 1974, Reese 1977, Prevost et al. 1978, Swenson 1979, Poole 1981, Van Daele and Van Daele 1982, Vana-Miller 1987, Usgaard and Higgins 1995, Saurola 1997, Trimper et al. 1998, Rodgers and Schwikert 2002).

**Recommendation O5:** We recommend that the guidelines recognize disturbances associated with both mechanized (i.e., harvesting, skidding, site-preparation, tending, hauling) and pedestrian-related forest management activities (i.e., preharvest inspections, road location, boundary marking, tree marking, tree planting).

**Distance to disturbance** Two anecdotal studies (each involving only one nest) suggest that timber harvest within 100 m of osprey nests during the breeding season did not affect reproductive output (Melo 1975, Adams and Scott 1979). In contrast, Saurola (1997) suggests that road construction, timber harvest, and planting near ospreys nests during the nesting season has caused lost productivity in Finland. Moreover, in California, 15 nests subject to intense human activity (described as “generally logging”) during the breeding season produced about one-third as many chicks as 33 nests with minimal human disturbance (Levenson and Koplin 1984). Unfortunately, Saurola (1997) presents no data and Levenson and Koplin (1984) did not quantify the type, proximity, or amount of harvesting conducted around nests. Regardless, these sources do suggest that forest management activities conducted during the breeding season may have immediate effects on productivity.

Even so, short term effects of disturbance during the breeding season may be transitory; Naylor et al. (2003) found no relationship between the proximity or amount of timber harvest (or other silvicultural activities) conducted during the breeding season and long term occupancy or productivity of 150 osprey nests in Ontario.

Guidelines developed in North American and Europe recommend seasonal restrictions on forest management activities ranging from 100 to 800 m around occupied osprey nests (see Tables 3 and 4 and reviews in Ewins (1997) and Saurola (1997)). However, Ewins (1997) suggests most recommendations were based on ‘advice’ given at a time when ospreys were threatened over many parts of their range and need to be reviewed in light of the dramatic population recovery since the mid 1970s.

Bald eagles appear to be sensitive to mechanized disturbances within 400 m of nests (see discussion above). However, ospreys are generally considered to be less sensitive than eagles to disturbance (Ewins 1997). Thus, the 300 m temporal buffer used during the past decade in the GLSL forest (Szuba and Naylor 1998) appears to be more reasonable than the 800 m buffer recommended by Penak (1983).
Recommendation O6: We recommend that mechanized forest management activities should not be permitted within 300 m of occupied nests during the critical breeding period.

Pedestrian activities produced flushing responses from ospreys at a distance of 50 to 150 m (Mullen 1985, Cuthbert and Rothstein 1988). Numerous sources (cited in Cline 1990, Vana-Miller 1987, D’Eon and Watt 1994) suggest that human activity should be prohibited within 200 to 400 m of nests during the breeding season.

Recommendation O7: We recommend that no pedestrian-related forest management activities be permitted within 150 m of occupied nests during the critical breeding period. We further recommend that no pedestrian-related activities involving large numbers of people and likely to be accompanied by significant noise (e.g., tree planting) be permitted within 300 m of occupied nests during the critical breeding period unless the activity is not visible from the nest and is accompanied by mitigative monitoring (see Appendix 2).

Existing amount of disturbance Reaction of ospreys to disturbance is clearly related to degree of habituation (D’Eon and Watt 1994). In many areas, ospreys successfully nest in close proximity to houses, cottages, marinas, roads, railways and areas of high recreational activity (MacCarter and MacCarter 1979, Poole 1981, Van Dalee and Van Dalee 1982, Ewins et al. 1995, Ewins 1997). In contrast, lower amounts of disturbance can disrupt breeding activity at remote nests (Van Dalee and Van Dalee 1982, Poole 1989a, Ewins 1997). It appears that ospreys that initiate nesting activities near sources of human disturbance will tolerate more disturbance during the nesting season (Swenson 1979, Poole 1981, Vana-Miller 1987, Ewins 1997).

Recommendation O8: We recommend that some flexibility be permitted in application of the guidelines around nests that are in relatively disturbed landscapes and for which nesting ospreys appear to have habituated to disturbance. For example, hauling might be permitted within 150 m of an occupied nest during the breeding season if 1) it takes place on an existing road that is well-traveled, 2) the ospreys have a history of using the area despite the existing level of disturbance or the road predates the establishment of the nest, and 3) hauling will not dramatically alter the level of disturbance. Similarly, planting might be permitted within 300 m of a nest during the breeding season if 1) the ospreys are normally subject to a high level of human disturbance during this time period (e.g., high recreational activity), 2) they appear to have habituated to this level of disturbance, and 3) planting will not dramatically alter the overall level of disturbance.

Impacts of roads on ospreys

The guidelines (Penak 1983) suggest that no new roads be constructed within 800 m of occupied nests but provide no direction around hauling on existing roads. Unfortunately, there is little definitive information on the effect of roads on ospreys. Melo (1975) and Adams and Scott (1979) reported successful fledging at individual nests that were approximately 30 m from active logging roads. In contrast, Lanier and Foss (1989) described a nest that was 250 m from a moderately used unpaved road that produced young only once in 8 years.

In highly developed landscapes, proximity of roads and associated human disturbance may affect productivity at osprey nests. For example, Levenson and Koplin (1984) noted lower (but not statistically significant) productivity at 34 osprey nests in Californian that were subject to disturbance associated with county and state highway traffic (and related human activities)
compared to 33 remote nests. In a study of 110 nests in Idaho, Van Daele and Van Daele (1982) found that osprey nests > 1.5 km from well-traveled roads had higher productivity than those within 1.5 km of roads. In contrast, Naylor et al. (2003) found no relationship between proximity of logging roads and occupancy or productivity of osprey nests. The latter study was conducted in continuously forested landscapes where roads were associated with forestry operations but with relatively few other human development pressures.

**Recommendation O9:** Given the uncertain but potential impact of roads on ospreys, we recommend that, whenever possible, no new roads be constructed within 300 m of active osprey nests (no new roads within 50 m of inactive nests). We also recommend that no hauling occur within 150 m of occupied nests during the critical breeding period (with exceptions noted above). When operational roads must be constructed within 300 m of nests, temporary roads and/or water crossings should be used whenever possible to limit future access and disturbance.

**Impacts of habitat modification on ospreys**

Significant habitat modification associated with major land use changes can alter the abundance or distribution of nesting ospreys (Ewins et al. 1995). However, as long as nest structures are available (natural or man-made), ospreys appear to be able to adapt to a high degree of habitat modification, frequently nesting in or near houses, cottages, marinas, highway medians, runways, and even parking lots (Zarn 1974, MacCarter and MacCarter 1979, Poole 1981, Vann-Miller 1987, Ewins 1997).

Timber harvest is often considered to have a negative effect on ospreys because it may remove existing or potential nest sites (Saurola 1997). However, few studies have quantified the effects of habitat modification caused by timber harvest on nesting ospreys. One nest observed by Melo (1975) was reused 2 seasons after partial cutting occurred 30 m from the nest (cited in Scott and Adams 1979). Scott and Adams (1979) reported that ospreys occupied one nest for 7 consecutive years after partial timber harvest (30% of BA removed) was conducted to within 60 m of the nest.

Levenson and Koplin (1984) described the effects of timber harvest during the nesting season on productivity in the year of disturbance (see above). Unfortunately, they did not quantify the effect of habitat modification on nest site occupancy or productivity in subsequent years.

In the only comprehensive study to date, Naylor et al. (2003) studied the effects of forest management activities on 150 osprey nests in central and northeastern Ontario. They found no significant difference in occupancy or productivity among nest sites that had experienced cutting that followed Ontario’s guidelines, had been cut in a way that was not consistent with the guidelines, or had not experienced any cutting. Moreover, they found no relationship between occupancy or productivity and the proximity or amount of timber harvest or other silvicultural activities (site preparation, planting, tending) that had occurred within 10 years.

Minimal impact of forest management activities that alter habitat surrounding nests is not surprising given the nature of habitat typically selected by nesting ospreys (D’Eon and Watt 1994). Ospreys routinely nest in exposed situations with little surrounding forest cover such as beaver-controlled wetlands and recent burns (Swenson 1981b, Peck and James 1983).
Thus, there appears to be little justification for the restriction on clearcutting within 800 m of osprey nests as recommended by Penak (1983). Moreover, even the guidelines proposed by Szuba and Naylor (1998) may be overly restrictive (Naylor et al. 2003).

However, in their reviews of the effects of forestry practices on ospreys in North America and Europe, Ewins (1997) and Saurola (1997) suggested that timber harvest may have a negative effect on breeding ospreys if it removes existing or alternate nest trees or the protective screen of trees surrounding a nest. The latter may be important because a buffer of uncut forest protects nest trees from windthrow and visually screens nests from predators such as the eagle owl (Bubo bubo) in Europe (in North America, the great-horned owl (Bubo virginianus) is both a predator (Steidl et al. 1991) and nest competitor (Wetmore and Gillespie 1976) of ospreys). Saurola (1997) recommends as little as 50 m of uncut forest around nests. Ewins (1997) notes that various sources recommend from 40 to 200 m uncut buffers around nests.

Thus, while the current guidelines may be overly restrictive, it appears that a reasonable buffer should be left around occupied nests to protect the existing nest, potential nests, and roost and perch trees from windthrow and to screen ospreys from predators. The guidelines currently used in the GLSL forest appear to be a reasonable compromise.

Recommendation O10: We recommend no cutting within 150 m and no clearcutting within 300 m of active osprey nests (inactive and alternate nests should receive 50 m and 150 m uncut buffers, respectively). We further suggest that selection cuts, shelterwood preparatory, regeneration, or first removal cuts, and other partial harvests that retain a relatively uniform minimum residual canopy closure of 30% comprised of dominant and codominant trees be permitted within 151 to 300 m of active nests (conducted outside the critical breeding season if the nest is occupied).

Riparian management

Within 800 m of occupied nests, Penak (1983) recommended no timber harvest within 70 m of waterbodies. Szuba and Naylor (1998) further recommended the retention of at least one supercanopy tree per 650 m of shoreline around lakes occupied by breeding ospreys. Other authors also recommend riparian buffers ranging from 70 m to 3.5 km, within which timber harvest should be prohibited or at least modified to retain potential nest, perch, and roost sites (Ewins 1997).

Riparian buffers 30 to 90 m in width are routinely left around waterbodies (OMNR 1988a). Guidelines for clearcuts (OMNR 2001) and partial cuts (OMNR 2004) promote the retention of at least 25 residual trees/ha. Since ospreys are not as demanding in their nest site requirements as are eagles, we believe current guidelines should provide a sufficient number of potential nest, perch, and roost sites within the riparian forest adjacent to lakes occupied by nesting ospreys.

Recommendation O10: We recommend that current riparian buffers (OMNR 1988a) and guidelines for residual tree retention in clearcuts (OMNR 2001) and partial cuts (OMNR 2004) should maintain a sufficient number of potential nest, perch, and roost sites within the riparian forest adjacent to lakes occupied by nesting ospreys.

Figure 2 and Appendix 1 summarize recommended guidelines for the protection of osprey nests.
Review of the Great Blue Heron Guidelines

Status and Distribution of the Great Blue Heron in Ontario

The great blue heron is not classified as a species at risk by COSSARO (NHIC 2004) or COSEWIC (COSEWIC 2003). Moreover, it is considered to be common to abundant in Ontario by the Natural Heritage Information Centre (S-Rank of S5; NHIC 2004). However, because of the perceived sensitivity of colonial-nesting birds to disturbance, the great blue heron is classified as a regionally featured species in Ontario within the context of forest management activities. Moreover, the Migratory Birds Regulations (CRC c.1035) protect the nests and eggs of herons from disturbance, destruction, or possession (Sec 6(a,b)).

In the early 1980s, Dunn et al. (1985) estimated a provincial population of at least 13,000 breeding pairs of great blue herons. The population is apparently increasing; by the early 1990s, there were over 17,000 breeding pairs (Collier et al. 1992).

Great blue herons breed across Ontario, from the shores of Lake Erie to the Lake-of-the-Woods and north to the tree line (Dunn 1987). Density of colonies appears to be greatest in the more southern and eastern portions of the province; NRVIS data from 2001 contains records of 818 colonies in Southern Region, 609 colonies in Northeast Region, and 176 colonies in Northwest Region.

Brief Overview of the Habitat Requirements of Great Blue Herons

In Ontario, herons typically build their large bulky nests of sticks in living or dead trees over or close to water (Peck and James 1983). Herons may nest singly, but > 99% of 12,211 nests in the Ontario Nest Records Scheme were in colonies (Peck and James 1983). Colony size averages about 35 nests, with some colonies (in southern Ontario) exceeding 150 nests (Dunn et al. 1985). Colonies are found in wet or dry forest, sparsely treed islands, beaver ponds, and marshes (Peck and James 1983).

Colony size has been correlated with the supply of suitable feeding habitat (Gibbs 1991, Butler 1997, Gibbs and Kinkel 1997). Small fish (< 25 cm in length) comprise the majority of the diet of herons, but they also consume amphibians, rodents, aquatic insects, crayfish, snails, and carrion (Short and Cooper 1985, Butler 1992). Feeding is generally conducted in the shallow water (< 50 cm deep) of marshes, ponds, lake and river shorelines, and forested wetlands (Short and Cooper 1985, Gibbs 1991). Feeding areas are typically within 4 to 5 kms of colonies, but herons may fly up 25 km to feed (Short and Cooper 1985).

Dispersion of colonies across the landscape appears to be related to two main factors. Colonies tend to be located in areas with a low level of human disturbance (Gibbs et al. 1987, Gibbs and Kinkel 1997). Colonies also tend to be located centrally with respect to feeding areas, likely as a strategy to minimize travel costs associated with feeding (Gibbs 1991, Gibbs and Kinkel 1997).

Great Blue Heron Guidelines in Ontario

The heron guidelines currently used in the boreal portion of the province are described in the document Management guidelines for the protection of heronries in Ontario (Bowman and Siderius 1984) and were based largely on recommendations from Buckley and Buckley (1978)
and the expert opinion of Vermeer (pers. com. in Bowman and Siderius 1984), and McVaugh (pers. com. in Bowman and Siderius 1984).

The guidelines require that buffer zones be established around the perimeter of each ‘active heronry that is vulnerable to human disturbances during the sensitive breeding season’ (April 1 to August 15 in northern Ontario and March 15 to August 1 in southern Ontario). Three buffer zones are prescribed around colonies as follows:

<table>
<thead>
<tr>
<th>Buffer zone</th>
<th>Width</th>
<th>Prescription</th>
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| Minimum zone            | 0 to 300 m | All development and forest management activities prohibited throughout the year.  
                      |         | No human entry during the breeding season except for research activities.    
                      |         | No trails within this zone.                                                  
                      |         | No vehicular traffic during the breeding season.                            |
| Heavy development zone  | 301 to 1000 m | High disturbance activities such as road construction, timber harvest, and site preparation prohibited during the breeding season. |
| Aquatic zone            | 0 to 300 m | Water-based activities such as boating should be restricted. As a minimum, landing on shore near a colony should be prohibited. |

The guidelines also provide recommendations for the management of habitat within colonies, the management of feeding areas, and for research within colonies.

The great blue heron guidelines currently used in the GLSL forest of central Ontario are described in *Forest raptors and their nests in central Ontario* (Szuba and Naylor 1998) and were based on recommendations in Agro and Naylor (1994). Two buffer zones are prescribed around colonies as follows:

<table>
<thead>
<tr>
<th>Buffer zone</th>
<th>Width</th>
<th>Prescription</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reserve</td>
<td>0 to 150 m</td>
<td>No timber harvest permitted at any time of year.</td>
</tr>
</tbody>
</table>
| Modified management area | 151 to 300 m | No timber harvest permitted during the breeding season (April 1 to August 15).  
                      |          | Selection and shelterwood harvest permitted outside the breeding season. 
                      |          | A minimum 30 m uncut reserve required in this zone when a colony is > 150 m from a treed edge. |

**Evaluation of the Guidelines**

**Comparison with heron guidelines in other jurisdictions**

Ontario currently provides greater protection for heronries than any other province in Canada (Table 5). Alberta, British Columbia, Newfoundland (herons are not endemic), Nova Scotia, Prince Edward Island, and Saskatchewan do not have official guidelines for the protection of heronries during forest management operations (these provinces may provide protection at the discretion of local biologists). Only Manitoba, New Brunswick, and Quebec have official guidelines to protect heron colonies. Manitoba’s guidelines recommend a 200 m buffer around occupied heronries. New Brunswick permits no clearcutting within 50 m of heronries, no timber harvest within 200 m of occupied colonies during the breeding season, and no access roads within 400 m of colonies. Quebec’s guidelines prohibit timber harvest within 200 m of heronries at any time of year but permit clearcutting within 201 to 500 m outside the breeding season.
We could find few forest management guidelines for herons in jurisdictions within the United States (Table 6). Ontario’s guidelines are more restrictive than those recommended by Minnesota or New Hampshire. Washington adopted similar guidelines to those proposed by Bowman and Siderius (1984). However, Washington’s guidelines also require retention of alternate nesting stands within the vicinity of colonies and the establishment of buffers around important feeding areas.

**Site-specific Management**

*Disturbance Buffer Zones for Nest Trees*

Bowman and Siderius (1984) suggest that their guidelines should be strictly applied to active “colonies that contribute significantly to regional populations” and that large colonies are more valuable than small colonies. Individual large colonies represent a greater proportion of the regional breeding population than do small colonies and may produce disproportionately more young (Forbes et al. 1985, Vennesland 2000). Moreover, large colonies may be more stable (Bjorklund 1975, Werschkul et al. 1976, Parker 1980, Butler 1997) and may be indicative of a large supply of feeding habitat (Gibbs et al. 1987, Gibbs and Kinkel 1997).

However, small heronries may represent newly formed colonies (Custer et al. 1980) or splinters from larger colonies that have experienced some type of disturbance (Parker 1980, Kelly et al. 1993). Moreover, small colonies may provide alternate breeding sites for young or inexperienced birds (Brown et al. 1990).

Szuba and Naylor (1998) suggest their guidelines be applied to active colonies but do not define how many nests are required to define a colony.

How many nests constitute a colony? There is no general agreement in the literature. Different sources have defined colonies as containing from ≥ 1 nest (e.g., Parker 1980, Forbes et al. 1985, Vennesland 2000) to ≥ 4 nests (e.g., Custer et al. 1980, Gibbs et al. 1987, Butler 1991b).

How large must colonies be before they are considered to contribute significantly to regional populations? We could find no direction in the literature. To answer this question we looked at data collected during the Ontario Heronry Inventory (Dunn et al. 1985, Collier et al. 1992). Colony size (number of occupied nests) was described for 799 colonies found within the area of the undertaking (AOU). Mean colony size was similar among heronries in Northeast Region (15.4 nests/colony, N = 242 colonies), Northwest Region (15.7 nests/colony, N = 153 colonies) and that part of Southern Region within the AOU (14.2 nests/colony, N = 404 colonies) so we pooled data from across the AOU. Colonies with < 4 nests contained < 5% of all occupied nests but represented almost 25% of all colonies; those with 25 or more nests accounted for about 50% of all occupied nests but only about 15% of all colonies (Figure 3). Moreover, colonies with at least 4 nests had twice (30.0 vs 14.7%) the likelihood of remaining occupied from circa 1980 to 1990 as those with < 4 nests. Thus, we suggest that colonies with fewer than 4 nests have relatively low significance to regional populations. In contrast, colonies with 25 or more nests are especially significant.

**Recommendation H1:** We support the protection of all known heronries. Heronries known or suspected to have been used within the past 5 years should be considered active and designated as areas of concern (but see Recommendation H2). We suggest that colonies with ≥ 4 occupied nests should be considered regionally significant; those with ≥ 25 occupied nests should be considered especially significant. These thresholds may be modified based on local
knowledge. Heronries with no known or suspected use within 5 years should be considered inactive.

Heron colonies may be very stable and can exist for 20 to 50 years (Moseley 1936, Bjorklund 1975, Sullivan and Payne 1988), but the average lifespan of heronries in Ontario is only about 9 years (Collier et al. 1992). Colonies may be temporarily unoccupied for a year and then subsequently reoccupied; colonies unoccupied for 2 or more consecutive years are generally considered to be abandoned (Dunn et al. 1985, Collier et al. 1992).

**Recommendation H2:** We recommend that colonies that have been documented as unoccupied for 2 or more consecutive years or have been rendered unsuitable (e.g., all existing and potential nest trees destroyed by blowdown) can be considered inactive (abandoned).

The guidelines are designed to protect nests from human disturbance during the breeding season and to maintain habitat structure required for nesting, perching, roosting, and visual screening. Below we evaluate the guidelines based on these two objectives.

**Impacts of direct human disturbance on herons**

Human activity may disturb nesting herons, potentially resulting in reduced productivity or site abandonment (Bjorklund 1975, Mark 1976, Werschkul et al. 1976, Markham and Brechtel 1978, Kelsall and Simpson 1980, Quinnery 1983, Drapeau et al. 1984, Forbes et al. 1985, Koonz and Rakowski 1985, Simpson et al. 1987, Parnell et al. 1988, Carlson and McLean 1996, Carney and Sydeman 1999, Vennesland 2000, Skagen et al. 2001; but see Nisbet 2000). Reduced productivity may result from increased predation on eggs or young, mortality of chicks due to exposure or falling from nests, or interruption of feeding activities (Bowman and Siderius 1984, Rodgers and Smith 1995). The sensitivity of heronries to human disturbance appears to be related to numerous factors including:

**Timing of disturbance** Herons are most sensitive to disturbance (i.e., adults are most likely to flush from and temporarily abandon nests) prior to egg laying and are least sensitive when the nest is occupied by older chicks (Vos et al. 1985, Parnell et al. 1988, Butler 1991a, Rogers and Smith 1995). Butler (1991a) noted that pedestrians caused adult herons to flush from nests at an average distance of 200 m prior to laying, 100 m during incubation, 25 m when chicks were young, and 10 m when chicks were older. However, disturbance late in the breeding season, when chicks are 17 to 42 days old, may alarm pre-fledging chicks and cause them to fall from nests (see references in Bowman and Siderius 1984).

James (1991) suggests herons typically return to their breeding range in Ontario by early April and nests may contain eggs from late April to late June. Fledging occurs when young are 7 to 8 weeks old (Butler 1992) but young may return to the colony to be fed for 2 to 3 months (Bowman and Siderius 1984). Thus, the current timing restriction protects colonies from initiation of nesting to fledging, but not during the post-fledging period. However, reserves (see below) which do not permit any forest management activities at any time of year provide some buffer from disturbance during this latter period.

**Recommendation H3:** We support the current guidelines in restricting potentially disturbing events within the vicinity of occupied heronries from April 1 to August 15 in northern Ontario (Northeast and Northwest Regions) from March 15 to August 1 in southern Ontario (Southern Region). However, local knowledge of breeding phenology should be used to adjust the dates to ensure key breeding activities are protected.
Type of disturbance  Herons appear to be more sensitive to land-based disturbances than water-based disturbances (Short and Cooper 1985, Vos et al. 1985, Rodgers and Smith 1995). Motorized vehicles and farm machinery were most likely to elicit temporary colony-wide abandonment of nests in heronries in Colorado (Vos et al. 1985) but pedestrian activities had the greatest impact at colonies in Ohio (Carlson and McLean 1996). We are unaware of any studies that have specifically examined the effect of mechanized forestry operations on herons during the breeding season but assume the effects would be at least similar to motorized vehicles and farm machinery.

Recommendation H4: Seasonal timing restrictions should be applied to all aspects of forest management activities including harvest, skidding, site preparation, tending, tree marking, boundary marking, road location, preharvest inspections, and tree planting.


Only two studies have looked at the influence of forest management activities during the breeding season on occupancy or productivity of heronries. Agro and Naylor (1994) found no significant relationship between proximity of timber harvest during the breeding season and longevity of 98 colonies in Ontario. However, all summer cuts in their study were > 300 m from colonies. In a more recent study of 150 colonies in Ontario that included cutting close to nests, Naylor et al. (2003) similarly found no relationship between the proximity of timber harvest (or other silvicultural activities) conducted during the breeding season and long term occupancy or productivity.

Thus, disturbance associated with forest management activities conducted during the breeding season appears to have little effect on the long term use or productivity of colonies. However, heavy equipment operating close to colonies during the breeding season may have an immediate effect on reproductive performance. For example, land-clearing equipment operating within 50 m of one colony in British Columbia during the breeding season did cause herons to abandon their nesting attempt (Vennesland 2000). In contrast, Taylor et al. (1982) reported that farm machinery routinely operated within 85 m of a colony in Indiana with no apparent effect.

Consequently, there is little evidence to suggest that the 1km wide seasonal timing restriction on heavy development recommended by Bowman and Siderius (1984) is required. Vennesland (2000) suggested a seasonal buffer greater than 165 m for high intensity disturbances such as logging. Short and Cooper (1985) recommended that no timber harvest should be conducted within 250 m of colonies during the breeding season. Agro and Naylor (1994) recommended a 300 m seasonal timing restriction on timber harvest around colonies (500 m for colonies with > 50 nests).

Recommendation H5: We recommend that no mechanized forest management activities occur within 150 m of small or 300 m of significant occupied heronries during the breeding season. However, given the uncertainty of the immediate effects of mechanized operations on productivity during the year of disturbance, we recommend no mechanized activities occur within 500 m of especially significant occupied heronries during the breeding season.

Distance to pedestrian activity has been shown to influence response to disturbance. Pedestrian activity 100 to 200 m from heronries caused herons to flush from nests during the most sensitive
periods of the breeding season in British Columbia (Butler 1991a). In Colorado, Skagen et al. (2001) noted that pedestrian activity within 200 m of a colony caused a reduction in nest occupancy; activity within 100 m resulted in reduced nest success. Recommended buffers for pedestrian activity during the nesting season range from 100 to 300 m (Parker 1980, Vos et al. 1985, Butler 1991a, Rodgers and Smith 1995, Vennesland 2000).

**Recommendation H6:** We recommend that no pedestrian-related forest management activities be permitted within 150 m of occupied heronries during the critical breeding period. We further recommend that no pedestrian-related activities involving large numbers of people and likely to be accompanied by significant noise (e.g., tree planting) be permitted within 300 m of regionally significant occupied heronries during the critical breeding period unless the activity is not visible from the nest and is accompanied by mitigative monitoring (see Appendix 2).

**Existing amount of disturbance** There is considerable evidence that some herons may habituate to repeated, non-threatening activities (Parker 1980, Webb and Forbes 1982, Vos et al. 1985, Carlson and McLean 1996, Vennesland 2000). Thus, some flexibility in the application of the guidelines should be permitted when appropriate.

**Recommendation H7:** We recommend that some flexibility be permitted in application of the guidelines around heronries that are in relatively disturbed landscapes and for which nesting herons appear to have habituated to disturbance. For example, hauling might be permitted within 150 m of an occupied colony during the breeding season if 1) it takes place on an existing road that is well-traveled, 2) the herons have a history of using the area despite the existing level of disturbance or the road predates the establishment of the colony, and 3) hauling will not dramatically alter the level of disturbance. Similarly, planting might be permitted within 300 m of a colony during the breeding season if 1) the herons are normally subject to a high level of human disturbance during this time period (e.g., high recreational activity), 2) they appear to have habituated to this level of disturbance, and 3) planting will not dramatically alter the overall level of disturbance.

**Impacts of roads on herons**

Bowman and Siderius (1984) prohibit the construction of trails (and presumably roads) within 300 m of heronries. Proximity of roads has been linked to the location (Watts and Bradshaw 1994, Gibbs and Kinkel 1997), size (Parker 1980), and occupancy of heronries (Naylor et al. 2003). Corely et al. (1997) suggested that optimal nesting habitat was > 150 m from unimproved dirt roads in Oklahoma. Short and Cooper (1985) recommended that suitable nesting habitat had no roads (type not specified) within 250 m. Naylor et al. (2003) found no effect of tertiary roads on herons in Ontario. However, they did find that primary and secondary roads within 200 to 300 m of colonies affected occupancy. In Virginia, Watts and Bradshaw (1994) found a lower density of unimproved roads within 400 m of colonies and a lower density of secondary roads within 800 m of colonies compared to unused sites. Parker (1980) suggested that ideal nesting habitat in Montana was > 750 m from roads (type not specified). Some of the variability in the reported effects of roads on herons likely reflects study-specific context. For example, Parker (1980) and Watts and Bradshaw (1994) studied herons in highly developed landscapes where roads were associated with a variety of sources of human disturbance (e.g., permanent homes). In contrast, Naylor et al. (2003) studied herons in continuously forested landscapes, disturbed by timber harvest but with relatively little other human development.

**Recommendation H8:** We recommend that, whenever possible, no new roads be constructed within 150 m of small heronries or 300 m of regionally significant heronries. We further
recommend no hauling within 150 m during the nesting season except on existing roads where
herons show clear evidence that they have habituated to this type of disturbance (see above).
When operational roads must be constructed within 150 m of small colonies or 300 m of
regionally significant colonies, temporary roads and/or water crossings should be used
whenever possible to limit future access and disturbance.

Impacts of habitat modification on herons

Numerous studies have shown that the location or size of heronries may be positively
influenced by the supply of suitable nesting or feeding habitat and negatively affected by human
activities such as residential or agricultural development or water empoundment (Henny and

Information on the effects of timber harvest on heronries is more limited. Much of what is
suspected about the impact of timber harvest is based on anecdotal evidence and a small
number of correlative studies.

For example, clearcutting along the edge of a large mixed species heronry in Illinois conducted
during 4 successive winters apparently lead to a reduction in colony size from 820 nests to 332
nests (Bjorklund 1975). In Montana, Parker (1980) cites an example of unrestricted cutting that
appeared to have caused a heronry to relocate.

In a study of 12 heronries in Oregon, clearcutting within 500 m of colonies apparently caused a
decrease in occupancy rate of nests compared to undisturbed colonies (67 versus 93% of nests
occupied) (Werschkul et al. 1976). In one colony affected by cutting, occupied and unoccupied
nests averaged 220 m and 150 m, respectively, from the nearest clearcut, suggesting that
herons shifted their distribution within the colony in response to cutting.

In a study of 98 heronries in Ontario, Agro and Naylor (1994) found no apparent effect of
clearcutting or partial cutting (selection and shelterwood pooled) at any distance (up to 2 km) on
the longevity of colonies over a 10 year period. However, few colonies had experienced partial
cutting within 150 m or clearcutting within 300 m.

In the most comprehensive study to date, Naylor et al. (2003) studied the effects of forest
management activities on 150 heronries in central and northeastern Ontario. They found no
significant difference in colony size, occupancy, or productivity among colonies that had
experienced cutting that followed Ontario’s guidelines, had been cut in a way that was not
consistent with the guidelines, or had not experienced any cutting (although colonies cut without
the guidelines tended to have a lower rate of occupancy and chick production). However, Naylor
et al. (2003) did find that colony size, occupancy, and productivity were all influenced by the
amount of timber harvest within 250 to 500 m of colonies. Clearcutting appeared to have a
greater impact than selection or shelterwood cutting. Cutting appeared to have little effect when
beyond 100 to 200 m of colonies.

The limited data appears to support the guidelines in prohibiting clearcutting within 300 m of
heronries at any time of year. Some selection or shelterwood cutting is likely acceptable within
300 m as permitted by Szuba and Naylor (1998). However, herons appear to require sufficient
suitable habitat to permit movement of colonies as nest trees are killed by defecation and
eventually fall (see Custer et al. 1980, Parker 1980). Moreover, dense tree cover surrounding
colonies is important to minimize impact of severe wind events on heronries (see Taylor et al.
1982, Burkholder and Smith 1991). Thus, a significant amount of uncut forest should likely remain around heronries. Parker (1980) suggested that ideal patches of nesting habitat should be at least 4 ha in size. Thus, the 150 m uncut buffer (7 ha) recommended by Szuba and Naylor (1998) appears reasonable.

Recommendation H9: We recommend that no clearcutting be permitted within 150 m of small active heronries or 300 m of regionally significant active heronries at any time of year. We further recommend that selection cuts, shelterwood preparatory, regeneration, or first removal cuts, and other partial harvests that retain a relatively uniform minimum residual canopy closure of 30% comprised of dominant and codominant trees be permitted within 150 m of small active colonies or 151 to 300 m of regionally significant active colonies (conducted outside the critical breeding season if the colony is occupied). No timber harvest should be permitted within 150 m of regionally significant heronries at any time of year. Within the area of concern, a minimum 30 m uncut buffer should screen all active colonies from harvested areas.

Protection of important feeding habitat

Food supply may influence reproductive success (Pratt and Winkler 1985, Sullivan 1988, McNeil et al. 1993) and the size or location of heron colonies (Gray et al. 1980, Butler 1991b, Gibbs 1991, Gibbs et al. 1987, Gibbs and Kinkel 1997). Bowman and Siderius (1984) suggest that feeding sites that are known to be important should be protected. However, they provide no specific guidance.

Herons feed in the littoral zone of lakes and rivers but also use wetlands > 4 ha in size (Short and Cooper 1985, Gibbs 1991). Marshes and wet meadows appear to be preferred to bogs and treed or thicket swamps (Gibbs 1991). Most feeding occurs within 4 kms of colonies (Mathisen and Richards 1978, Dowd and Flake 1985, Short and Cooper 1985).

Application of guidelines for the protection of riparian habitat (OMNR 1988a, 1991) should protect the integrity of lakeshores and wetlands used as heron feeding habitat. While some human related activities can disturb feeding herons (e.g., Rodgers and Schikert 2002) and may ultimately result in changes in habitat use (e.g., Popotnik and Giuliano 2000), there is no evidence to suggest that forest management activities may limit the ability of herons to successfully procure food, and thus necessitate use of temporal buffers around feeding habitat.

Recommendation H10: Application of the guidelines for the protection of riparian habitat (OMNR 1988a, 1991) should protect the integrity of lakeshores and wetlands used by herons as feeding habitat.

Figure 4 and Appendix 1 summarize recommended guidelines for the protection of heronries.

Integration of the Eagle, Osprey, and Heron Guidelines with Other Forest Management Guidelines

In the review of MNR's forest management guidelines, ArborVitae et al. (2000) noted that some guidelines provided contradictory direction. Moreover, better integration of the many guidelines and resource manuals was recommended. Below we briefly discuss potential overlap and opportunities for integration between eagle, osprey, and heron guidelines and those for other values.
Because eagles, ospreys, and herons appear to vary in their habitat requirements, sensitivity to disturbance, and population status (and thus level of acceptable risk), it has not been possible to develop 1 set of prescriptions that can apply to all 3 species. However, we have tried to reduce some of the confusion inherent in the current guidelines by standardizing the naming and list of activities permissible within each buffer zone comprising the area of concern (see Appendix 1 for recommended buffer zone guidelines).

There is likely to be little overlap among areas of concern for eagles and ospreys or eagles and herons. However, ospreys may occasionally nest in occupied heronries (Peck and James 1983). In these uncommon cases, application of the proposed heron guidelines should provide adequate protection for both species.

Because of the association of eagles, ospreys, and herons with lakes, rivers, and wetlands, there is potential for overlap between guidelines for these species and the Timber management guidelines for the protection of fish habitat (OMNR 1988a). However, we do not see any contradictions among these guidelines. If anything, the two sets of guidelines are complementary. Application of eagle, osprey, or heron guidelines will provide enhanced protection for riparian habitats and water quality. Application of the fish habitat guidelines will maintain water quality and fish stocks that are the main prey of eagles and ospreys and will maintain mature riparian forest that contributes to the future supply of nest, perch, and roost sites.

Nests of eagles, ospreys, or herons may be situated in wetlands or along lakeshores adjacent to sites that provide aquatic feeding habitat for moose. None of the guidance suggested in this report contradicts that prescribed for moose aquatic feeding areas (OMNR 1988b). As with fish habitat, application of the recommended eagle, osprey, or heron guidelines will likely provide enhanced protection for aquatic feeding areas.

The Forest Management Guidelines for Natural Disturbance Pattern Emulation (OMNR 2001) require the retention of insular and peninsular patches and scattered residual trees within timber harvest cutblocks. Areas of concern associated with eagle, osprey, and heron nest sites may contribute to targets for insular or peninsular residual retention. Moreover, slight modifications of the guidance for retention of individual trees in riparian areas will benefit eagles (see Recommendation E15).

Where might the guidance in this document contradict that prescribed by other guidelines or resource manuals? Heronries (and to a lesser extent osprey nests) are often associated with beaver-controlled ponds or wetlands. This document recommends an uncut buffer ranging from 30 to 300 m around heronries. However, Guidelines for providing furbearer habitat in timber management (OMNR 1986), A silvicultural guide for the GLSL conifer forest in Ontario (Naylor 1998a), and A silvicultural guide for the tolerant hardwood forest in Ontario (Naylor 1998b) all suggest that some disturbance in riparian areas is desirable and necessary to ensure the persistence of beavers. Application of guidelines for herons likely affects a small proportion of beaver-controlled waterbodies. Moreover, our recommendations may partially accommodate the requirements of beavers since they permit timber harvest in the riparian zone adjacent to heronries that are abandoned. However, the potential impact of buffers around heronries on beaver persistence across the landscape likely needs to be considered.

The eagle, osprey, and heron guidelines all permit some timber harvest within modified management areas (MMAs) outside the breeding season. However, timing restrictions may prohibit subsequent site preparation, tree planting, or tending activities within MMAs. This
potentially creates a conflict between guidelines for these species and the *Silvicultural guide to managing for black spruce, jack pine, and aspen on boreal forest ecosites in Ontario* (OMNR 1997) and *A silvicultural guide for the GLSL conifer forest in Ontario* (OMNR 1998a). To avoid conflict, we recommend that timber harvest should only be conducted within MMAs if required site preparation, tree planting, or tending activities can be conducted outside the breeding season. Moreover, while partial cutting is permitted within MMAs for all 3 species, residual canopy closure must be at least 30%. Thus, final removal cuts are not permitted within MMAs and these guidelines may conflict with direction in *A silvicultural guide for the GLSL conifer forest in Ontario* (OMNR 1998a) and *A silvicultural guide for the tolerant hardwood forest in Ontario* (OMNR 1998b). Where feasible, final removal cuts may be deferred until the nest or colony is no longer occupied. When not feasible, activities required to ensure successful regeneration of the site may occur but would be considered exceptions.

Effective and efficient application of these guidelines and integration with other guidelines is enhanced when nest sites are known well in advance of operations. Thus, it is important that local Ministry of Natural Resources and forest industry staff make every effort to cooperate in the maintenance of an accurate and up-to-date inventory of nest sites. Local Ministry of Natural Resources staff should ensure that proposed allocations are flown in advance of operations following the standardized protocol outlined in Ranta (1998) and promptly entered into NRVIS. Aerial surveys should be conducted during summer when activity status of nests can be confirmed. Existing nest locations within NRVIS need to be periodically verified; about one-third of a sample of 300 osprey and heron nests from NRVIS checked by one of us were no longer extant (Naylor unpubl. data).

**Acknowledgements**

It is a great pleasure to thank the following individuals for their assistance during the preparation of this report.

Sheila Madahbee (MNR Forest Policy) and Elizabeth Gustafsson (MNR library) were of invaluable help in assembling literature on eagles, ospreys, and herons. Lil Anderson (OMNR Kenora), Ted Armstrong (OMNR Thunder Bay), Dan Beaudette (DNR, New Brunswick), Rick Bonar (Weldwood, Alberta), Gary Bortolotti (Univ. Saskatchewan), Earl Bourlon (SERM, Saskatchewan), Irene Bowman (MNR, Peterborough), Joe Brazil (FWFRA, Newfoundland), Anthony Duke (DNR, Nova Scotia), Don Gelinas (Alberta Environment), Jim Grier (Univ. North Dakota), Michel Lepage (Soc. de la Faune et Parcs du Quebec), Greg Lucking (OMNR Timmins), Wade McKinnon (FWFAE, Prince Edward Island), Ross Vennesland (Simon Fraser Univ.), and Bruce Ranta (OMNR Kenora) provided information on guidelines used in other jurisdictions, access to critical literature or information, or shared with us their thoughts on managing habitat for these species. Denis Lepage from Bird Studies Canada kindly provided the data from the Ontario Heronry Inventory that we used to identify regionally significant colony sizes.

Special thanks go to Gillian Holloway (SSI North Bay) and Michael Patrikeev (NESI Timmins) for invaluable assistance with searching and acquiring literature, contacting provincial experts, and numerous other duties as assigned.
Literature Cited


Coleman, K. 1981. Osprey nesting study, Lindsay District, 1981. Unpubl. Rpt., OMNR, Lindsay, ON.


OMNR. 1988a. Timber management guidelines for the protection of fish habitat. Queen’s Printer for Ontario, Toronto, ON.

OMNR. 1988b. Timber management guidelines for the provision of moose habitat. Queen’s Printer for Ontario, Toronto, ON.


OMNR. 1997. Silvicultural guide to managing for black spruce, jack pine, and aspen on boreal forest ecosites in Ontario. Queen’s Printer for Ontario, Toronto, ON.

OMNR. 1998a. A silvicultural guide for the Great Lakes-St. Lawrence conifer forest in Ontario. Queen’s Printer for Ontario, Toronto, ON.

OMNR. 1998b. A silvicultural guide for the tolerant hardwood forest in Ontario. Queen’s Printer for Ontario, Toronto, ON.

OMNR. 2001. Forest management guide for natural disturbance pattern emulation. Queen’s Printer for Ontario, Toronto, ON.


U.S. Fish & Wildlife Service 1987. Habitat management guidelines for the bald eagle in the southeast region. US Fish & Wildl. Serv., Atlanta, GA.


Figure 1. Area of concern prescription recommended for bald eagle nests.
Figure 2. Area of concern prescription recommended for osprey nests.
Figure 3. Percent of colonies and nests by colony size in the area of the undertaking in Ontario (data from the Ontario Heronry Inventory, Bird Studies Canada, unpublished data).
Figure 4. Area of concern prescription recommended for great blue heron colonies.
Table 1. Guidelines used by other Canadian provinces for the protection of nesting bald eagles during forest management operations (2001).

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Prescription</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberta</td>
<td>No official eagle guidelines. Protection may be provided on a site-by-site basis</td>
<td>Don Gelinas, pers. com., Forestry Enforcement Officer, Alberta Environment</td>
</tr>
<tr>
<td>Manitoba</td>
<td>Nests protected by a 200 m buffer zone, April 1 to July 31. Protect nest tree. Provide a visual buffer between nest and worksite.</td>
<td>MNR 1996</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>Maintain nest trees. No clearcutting within 50 m of nests (although selective harvest treatments may be approved). No timber harvest within 200 m of occupied nests during the breeding season (mid April-mid August). No logging roads within 400 m of nests.</td>
<td>Dan Beaudette, pers. com., Forest Habitat Biologist, New Brunswick Dept. Natural Resources</td>
</tr>
<tr>
<td>Newfoundland</td>
<td>Primary buffer zone (0 to 200 m) - no disturbance at any time of year. Secondary buffer zone (201 to 800 m) - no disturbance during the critical breeding period (beginning of courtship until young are 1 month old). Clearcutting permitted outside the breeding season. Additional site-specific management of individual nests may be prescribed if warranted.</td>
<td>Joe Brazil, pers. com., Raptor Biologist, Inland Fish and Wildlife, Forest Resources and Agrifoods, Newfoundland</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>No official guidelines for eagles. Buffer zones assigned around nests at the discretion of local biologists. General guidelines are 1) avoid disturbing nests during the breeding season (mid March-mid July), 2) leave a clump of trees large enough to conceal the nest and provide perch sites, and 3) retain large snags along shorelines as possible nests or perches</td>
<td>Anthony Duke, pers. com., Manager Wildlife Research, Nova Scotia Dept. Natural Resources</td>
</tr>
<tr>
<td>Prince Edward Island</td>
<td>No official guidelines for eagles. Eagle nests are considered “essential habitats”. The location of most nests is known and management is considered on a site-specific basis.</td>
<td>Wade MacKinnon, pers. com., Natural Resources Tech., Fish and Wildlife, Fisheries, Agriculture and Environment, PEI</td>
</tr>
<tr>
<td>Quebec</td>
<td>Primary buffer zone (0 to 300 m) – no forest management activities at any time of year Secondary buffer zone (301 to 700 m) – no forest management activities from March 15 to September 1</td>
<td>Michel Lepage, pers. com., Coordinateur aux especes menacees, Soc. de la Faune et Parcs du Quebec</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>No official guidelines for eagles. Buffers may be assigned around nests at the discretion of local biologists. Any special management is identified in local operating plans.</td>
<td>Earl Bourlon, pers. com., Forest Policy Analyst, Saskatchewan Environment and Resource Management</td>
</tr>
</tbody>
</table>
Table 2. Guidelines recommended by selected jurisdictions in the United States for the protection of nesting bald eagles during forest management operations (2001).

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Prescription</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northeastern US</td>
<td>Primary buffer zone (0 to 100 m) – no land use activities. No human entry during the most and moderately critical periods. Secondary buffer zone (101 to 200 m) – no clearcutting, land clearing, or major construction activities. Thinning permitted outside the most and moderately critical periods. No human entry during the most critical period. Roads and trails closed during the most and moderately critical periods. Tertiary buffer zone (201 to 400 m, up to 800 m depending on line-of-sight) – some activities permitted outside the most critical period. Develop breeding area management plan to identify specific hazards that require additional constraints.</td>
<td>Grier et al. 1983</td>
</tr>
<tr>
<td>Chesapeake Bay</td>
<td>Primary buffer zone (0 to 100 m) – no timber harvest, land clearing, or construction at any time of year. Secondary buffer zone (101 to 200 m) - no clearcutting, land clearing, or construction – selective timber harvest and maintenance of existing buildings and roads permitted outside the breeding season (Dec 15 to June 15). Tertiary buffer zone (201 to 400 m) – timber harvest, land clearing, and construction permitted outside the breeding season.</td>
<td>Cline 1985</td>
</tr>
<tr>
<td>Minnesota</td>
<td>Primary buffer zone (0 to 100 m) – no disturbance of any kind allowed. Secondary buffer zone (101 to 200 m) - land use activities which result in significant changes in the landscape such as clearcutting, land clearing, or major construction prohibited at all times of year. Actions such as pruning and thinning permitted during the non-breeding period (June 16-Jan 31). Roads or trails should be destroyed in this zone or at least closed during the breeding period. Tertiary buffer zone (201 to 400 up to 800 m depending on line-of-sight) – clearcutting, land clearing, and construction permitted from Oct. 1 to Feb. 15. Breeding area management plans developed that identify specific hazards that require additional constraints</td>
<td>MDNR 1985</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>Primary buffer zone (0 to 100 m) – no human disturbance at any time of year. Secondary buffer zone (101 to 200 m) – selection cuts and small patch cuts permitted outside the breeding season (Feb. to Aug.). Tertiary buffer zone (201 to 400 m) – timber harvesting permitted outside the breeding season – maintain all potential nest and roost trees.</td>
<td>&quot;Rare wildlife of New Hampshire: Bald Eagle&quot; at <a href="http://www.wildlife.state.nh.us/Eagle%20facts.htm">www.wildlife.state.nh.us/Eagle%20facts.htm</a></td>
</tr>
<tr>
<td>Wisconsin</td>
<td>Primary buffer zone (0 to 100 m) - no timber cutting, land clearing, or construction of buildings, roads or trails. Secondary buffer zone (101 to 200 m) – timber stand management and maintenance of existing roads and buildings permitted outside the breeding season (Aug. 16 – Feb. 15). Tertiary buffer zone (201-400 m) – activities within sight of eagles must be conducted outside the breeding season.</td>
<td>Eckstein 1990</td>
</tr>
</tbody>
</table>
Table 3. Guidelines used by other Canadian provinces for the protection of nesting ospreys during forest management operations (2001).

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Prescription</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberta</td>
<td>No official osprey guidelines. Protection may be provided on a site-by-site basis.</td>
<td>Don Gelinas, pers. com., Forestry Enforcement Officer, Alberta Environment</td>
</tr>
<tr>
<td>Manitoba</td>
<td>Nests protected by a 200 m buffer zone, April 1 to July 31. Protect nest tree. Provide a visual buffer between nest and worksite.</td>
<td>MNR 1996</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>Maintain nest trees. No clearcutting within 15 m of nest trees (although selective timber harvest may be approved within 15 m of nest trees). No timber harvest within 100 m of nest trees during the breeding season (March-mid August).</td>
<td>Dan Beaudette, pers. com., Forest Habitat Biologist, New Brunswick Dept. Natural Resources</td>
</tr>
<tr>
<td>Newfoundland</td>
<td>Primary buffer zone (0 to 200 m) - no disturbance at any time of year. Secondary buffer zone (201 to 800 m) - no disturbance during the critical breeding period (beginning of courtship until young are 1 month old). Clearcutting permitted outside the breeding season. Additional site-specific management of individual nests may be prescribed if warranted.</td>
<td>Joe Brazil, pers. com., Raptor Biologist, Forest Resources and Agrifoods, Newfoundland</td>
</tr>
<tr>
<td>Prince Edward Island</td>
<td>No official guidelines for ospreys. Osprey nests are considered &quot;essential habitats&quot;. The location of most osprey nests is known and management is considered on a site-specific basis.</td>
<td>Wade MacKinnon, pers. com., Natural Resources Tech., Fish and Wildlife, Fisheries, Agriculture and Environment, PEI</td>
</tr>
<tr>
<td>Quebec</td>
<td>No official guidelines for ospreys. Occupied nests cannot be harvested during the breeding season.</td>
<td>Michel Lepage, pers. com., Coordinateur aux especes menacees, Soc. de la Faune et Parcs du Quebec</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>No official guidelines for ospreys. Buffers may be assigned around nests at the discretion of the local biologist. Any special management is identified in local operating plans.</td>
<td>Earl Bourlon, pers. com., Forest Policy Analyst, Saskatchewan Environment and Resource Management</td>
</tr>
</tbody>
</table>
Table 4. Guidelines recommended by selected jurisdictions in the United States for the protection of nesting ospreys during forest management operations (2001).

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Prescription</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minnesota</td>
<td>Primary buffer zone (0 to 100 m) - no habitat alterations permitted at any time. Secondary buffer zone (101 to 200 m) - no activities which alter habitat significantly allowed at any time (includes clearcutting, land clearing, and construction activity). Activities such as thinning and pruning allowed during non-breeding season (Oct. 1 - March 14th). Roads and trails that facilitate access to nest or increase vulnerability are not allowed.</td>
<td>MDNR 1985</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Steve Merchant, pers. com., Forest Wildlife Coordinator, Minnesota DNR</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>Maintain existing nest trees and potential replacements. Avoid human activity within 200 m of occupied nests from April 1 to August 30.</td>
<td>NHDFL 1997</td>
</tr>
</tbody>
</table>
Table 5. Guidelines used by other Canadian provinces for the protection of heronries during forest management operations (2001).

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Prescription</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberta</td>
<td>No official heron guidelines. Protection may be provided on a site-by-site basis</td>
<td>Don Gelinas, pers. com., Forestry Enforcement Officer, Alberta Environment</td>
</tr>
<tr>
<td>Manitoba</td>
<td>Heronries protected by a 200 m buffer, April 1 to July 31. Provide visual barrier. Protect from disturbance.</td>
<td>MNR 1996</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>Maintain nest trees. No clearcutting within 50 m of heronries at any time (although selective harvest treatments may be approved outside the breeding season). No timber harvest within 200 m of occupied heronries during the breeding season (mid April-mid August). No logging roads within 400 m of heronries.</td>
<td>Dan Beaudette, pers. com., Forest Habitat Biologist, New Brunswick Dept. Natural Resources</td>
</tr>
<tr>
<td>Newfoundland</td>
<td>Not endemic to the province.</td>
<td>Anthony Duke, pers. com., Manager Wildlife Research, Nova Scotia Dept. Natural Resources</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>No official guidelines for herons.</td>
<td>Wade MacKinnon, pers. com., Natural Resources Tech., Fish and Wildlife Fisheries, Agriculture and Environment, PEI</td>
</tr>
<tr>
<td>Prince Edward Island</td>
<td>No official guidelines for herons. Heronries are considered &quot;essential habitats&quot;. The location of most heronries is known and management is considered on a site-specific basis.</td>
<td>Gouv. Quebec 1990</td>
</tr>
<tr>
<td>Quebec</td>
<td>No timber harvest within 200 m of heronries at any time. No timber harvest within 201 to 500 m of heronries during the breeding season (April 1-July 31).</td>
<td>Earl Bourlon, pers. com., Forest Policy Analyst, Sask. Environment and Resource Management</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>No official guidelines for heronries. Buffers may be assigned around heronries at the discretion of local biologists. Any special management is identified in local operating plans.</td>
<td>Don Gelinas, pers. com., Forestry Enforcement Officer, Alberta Environment</td>
</tr>
</tbody>
</table>
Table 6. Guidelines recommended by selected jurisdictions in the United States for the protection of heronries during forest management operations (2001).

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Prescription</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minnesota</td>
<td>Primary buffer zone (0 to 100 m) - no habitat alterations permitted at any time of year. Secondary buffer zone (101 to 200 m) – no activities which alter habitat significantly allowed at any time (includes clearcutting, land clearing, and construction activity). Activities such as thinning and pruning allowed outside the breeding season (Oct. 1-Mar. 14th). Roads and trails that facilitate access to colonies or increase vulnerability are not permitted.</td>
<td>MDNR 1985 Steve Merchant, pers. com., Forest Wildlife Coordinator, Minnesota DNR</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>Primary buffer zone (0 to 100 m) - no timber harvesting or road construction allowed at any time. No recreational activities during the breeding season (April-August). Secondary buffer zone (101 to 200 m) – single tree or group selection harvest permitted outside the breeding season. Tertiary buffer zone (201 to 400 m) – no high disturbance activities such as road construction or site preparation during the breeding season. No timber harvesting which substantially increases wind exposure of trees.</td>
<td>NHDFL 1997</td>
</tr>
<tr>
<td>Washington</td>
<td>Primary buffer zone (0 to 300 m) – no human activities that might cause abandonment at any time of year. No activities that might disturb nesting birds between Feb. 15 and July 31. Secondary buffer zone (301 to 1000 m) – no clearcutting or construction during the breeding season. Maintain several forested stands at least 4 ha in size with trees at least 17 m tall within the vicinity of heronries to provide alternate colony sites. Establish 100 m buffers around important foraging areas within 4 km of heronries.</td>
<td>Management recommendations for Washington’s priority species: great blue heron <a href="http://www.wa.gov/wdfw/hab/phs/vol4/gbheron.htm">http://www.wa.gov/wdfw/hab/phs/vol4/gbheron.htm</a></td>
</tr>
</tbody>
</table>
Appendix 1. Proposed operational prescriptions for areas of concern.
### AOC Identifier:
**EAGLE**

### Description of Value(s):**
Bald eagle nests

### Prescription

#### AOC Description
All nests known or suspected to have been used within the past 5 years are considered active. When more than one active nest occurs in a cluster (group of nests < 1.6 km apart), the most recently occupied nest should be considered the active nest (other nests are considered alternate nests). All active nests are protected by: (1) a 200 m radius reserve, and (2) an additional 200 m radius MMA (MMA1). Occupied nests are protected by an additional MMA (MMA2) that extends a further 400 m (SR) or up to 400 m based on line-of-sight (NER & NWR).

Alternate and inactive (not used within 5 years) nests receive a 200 m and 100 m reserve, respectively.

#### Harvest, Renewal and/or Tending Operations
No harvest, renewal, or tending is permitted in the reserve. No harvest, mechanized renewal, or tending is permitted in MMA1 or MMA2 from Feb. 15 to Aug. 31 (Feb. 1 to Aug. 15 for Southern Region) for occupied nests. Planting is permitted in MMA2, and in MMA1 if not visible from the occupied nest and accompanied by mitigative monitoring. The timing restriction may be removed if the nest becomes unoccupied.

Clearcutting is not permitted in MMA1. Selection cuts, shelterwood preparatory, regeneration, or first removal cuts, and other partial harvests that retain a relatively uniform minimum residual canopy closure of 30% comprised of dominant and codominant trees are permitted in MMA1 (but must be conducted outside the nesting season if nest is occupied). Any harvest is permitted within MMA2 if conducted outside the nesting season (Southern Region) or not visible from the occupied nest (Northeast and Northwest Regions).

Within MMA1, retain at least 1 supercanopy tree/4 ha, 6 large living cavity trees/ha (preferably poplars), and 10 healthy living dominant or codominant veteran trees/ha of species that are long-lived and valuable to eagles. Supercanopy and veteran trees in riparian buffers and insular and peninsular residual patches contribute to meeting habitat objectives.

#### Operational Road Conditions
Avoid locating new roads or landings within 400 m of active nests. If there is no alternative, new roads or landings may be permitted subject to MNR approval in the AWS. The cleared right-of-way to be as narrow as possible. Temporary roads and/or water crossings should be used whenever possible. Construction of new roads or landings is not permitted during the timing restriction if the nest is occupied.

Hauling and routine road maintenance is permitted on existing roads in the AOC during the timing restriction if conducted > 200 m from the occupied nest unless otherwise approved by MNR.

### Exception

### Objection

### Monitoring Program

None required because the prescription is consistent with the approved guidelines.

### Primary/Secondary Road


### FMP-17 OPERATIONAL PRESCRIPTIONS FOR AREAS OF CONCERN

<table>
<thead>
<tr>
<th>AOC Identifier:</th>
<th>Description of Value(s):</th>
<th>Prescription</th>
<th>Exception</th>
<th>AOC Description</th>
<th>Harvest, Renewal and/or Tending Operations</th>
<th>Operational Road Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>HUFA</td>
<td>Bald eagle high-use feeding areas</td>
<td></td>
<td></td>
<td>Known high-use spring, early summer, and winter feeding areas are protected by: (1) a 200 m radius MMA (MMA1), and (2) an additional 200 m radius MMA (MMA2).</td>
<td>No harvest, mechanized renewal, or tending is permitted in MMA1 or MMA2 during periods of high use. Planting may be permitted in the MMA2 during periods of high use only if not visible from the feeding area and accompanied by mitigative monitoring. Within MMA1, retain at least 1 supercanopy tree per 4 ha, 6 large living cavity trees/ha (preferably poplars), and 10 healthy living dominant or codominant veteran trees/ha of species that are long-lived and valuable to eagles. Supercanopy and veteran trees in riparian buffers and insular and peninsular residual patches contribute to meeting habitat objectives.</td>
<td>Avoid locating new roads or landings within 200 m of high-use feeding areas. If there is no alternative, new roads or landings may be permitted subject to MNR approval in the AWS. The cleared right-of-way will be as narrow as possible. Temporary roads and/or water crossings should be used whenever possible. Construction of new roads or landings is not permitted during the periods of high use. Hauling and routine road maintenance is permitted on existing roads in the AOC during the timing restriction if conducted &gt; 200 m from the waterbody unless otherwise approved by MNR.</td>
</tr>
</tbody>
</table>

| Objection | None required because the prescription is consistent with the approved guidelines. |

<table>
<thead>
<tr>
<th>Monitoring Program</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary/Secondary Road</td>
<td></td>
</tr>
</tbody>
</table>

MANAGEMENT UNIT NAME
### ROOSTS

**AOC Identifier:**

- **ROOSTS**

**Description of Value(s):**

- Bald eagle winter nocturnal roosts

**Prescription**

- Exception

<table>
<thead>
<tr>
<th>AOC Description</th>
<th>Harvest, Renewal and/or Tending Operations</th>
<th>Operational Road Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest stand, or portion of stand, containing a known traditional nocturnal roost site (sites used annually by 5 or more eagles for at least 2 weeks each year) is identified as an MMA (MMA1). The roost site is protected by a 400 m radius MMA (MMA2).</td>
<td>No harvest, renewal, or tending is permitted in MMA1 or MMA2 during the period the roost is occupied. Clearcutting is not permitted in MMA1 at any time of year. Selection, shelterwood preparatory or regeneration cuts, or other partial harvests that retain at least 50 large diameter (40+ cm dbh) trees/ha are permitted in MMA1 outside the period the roost is occupied. Normal harvest, renewal, and tending are permitted in MMA2 outside the period the roost is occupied.</td>
<td>Avoid locating new roads or landings within MMA1. If there is no alternative, new roads or landings may be permitted subject to MNR approval in the AWS. The cleared right-of-way will be as narrow as possible. Temporary roads and/or water crossings should be used whenever possible. Construction of new roads or landings is not permitted during the period the roost is occupied. Hauling and routine road maintenance is permitted on existing roads in MMA2 during the period the roost is occupied if conducted &gt; 200 m from MMA1 unless otherwise approved by MNR.</td>
</tr>
</tbody>
</table>

**Objection**

- 

**Monitoring Program**

- None required because the prescription is consistent with the approved guidelines.

**Primary/Secondary Road**

- 

**MANAGEMENT UNIT NAME**
## FMP-17 OPERATIONAL PRESCRIPTIONS FOR AREAS OF CONCERN

<table>
<thead>
<tr>
<th>AOC Identifier:</th>
<th>Description of Value(s):</th>
</tr>
</thead>
<tbody>
<tr>
<td>EFH</td>
<td>Bald eagle essential feeding habitat</td>
</tr>
</tbody>
</table>

### Prescription

<table>
<thead>
<tr>
<th>AOC Description</th>
<th>Harvest, Renewal and/or Tending Operations</th>
<th>Operational Road Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area within 200 m of lakes or large rivers identified in regional (or sub-regional) plans as essential habitat is considered a MMA.</td>
<td>Within the MMA, retain at least 1 supercanopy tree per 4 ha, 6 large living cavity trees/ha (preferably poplars), and 10 healthy living dominant or codominant veteran trees/ha of species that are long-lived and valuable to eagles. Supercanopy and veteran trees in riparian buffers and insular and peninsular residual patches contribute to meeting habitat objectives in essential feeding habitat.</td>
<td>Construction of new roads and landings is permitted within the MMA. Hauling and routine road maintenance is permitted on existing roads in the MMA.</td>
</tr>
</tbody>
</table>

### Objection

<table>
<thead>
<tr>
<th>Monitoring Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>None required because the prescription is consistent with the approved guidelines.</td>
</tr>
</tbody>
</table>

### Primary/Secondary Road
### FMP-17 OPERATIONAL PRESCRIPTIONS FOR AREAS OF CONCERN

<table>
<thead>
<tr>
<th>AOC Identifier:</th>
<th>Description of Value(s):</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSPREY</td>
<td>Osprey nests</td>
</tr>
</tbody>
</table>

**Prescription**

**AOC Description**

All nests known or suspected to have been used within 5 years should be considered active. When more than one active nest occurs in a cluster (group of nests < 1.6 km apart), the most recently occupied nest should be considered the active nest (other nests are considered alternate nests). Active nests are protected by: (1) a 150 m radius reserve and, (2) a 150 m radius MMA.

Alternate and inactive (not used within 5 years) nests are protected by a 150 m and 50 m radius reserve, respectively.

**Harvest, Renewal and/or Tending Operations**

No harvest, renewal, or tending is permitted in the reserve. No harvest, mechanized renewal, or tending is permitted in MMA from April 15 to Aug. 31 (April 1 to Aug. 15 for Southern Region) for occupied nests. Planting is permitted in the MMA if not visible from the occupied nest and accompanied by mitigative monitoring. The timing restriction may be removed if the nest becomes unoccupied.

Clearcutting is not permitted in the MMA. Selection cuts, shelterwood preparatory, regeneration, or first removal cuts, and other partial harvests that retain a relatively uniform minimum canopy closure of 30% comprised of dominant and codominant trees are permitted within the MMA (but must be conducted outside the nesting season if nest is occupied).

**Tertiary Road Conditions**

Avoid locating new roads or landings within 300 m of active nests. If there is no alternative, new roads or landings may be permitted subject to MNR approval in the AWS. The cleared right-of-way must be as narrow as possible. Temporary roads and/or water crossings should be used whenever possible. Construction of new roads or landings is not permitted during the nesting season if the nest is occupied.

Hauling and routine road maintenance is permitted on existing roads in the AOC during the nesting season if conducted > 150 m from the occupied nest unless otherwise approved by MNR.

**Objection**

None required because the prescription is consistent with the approved guidelines.

**Monitoring Program**

None required because the prescription is consistent with the approved guidelines.

**Primary/Secondary Road**

None required because the prescription is consistent with the approved guidelines.
### AOC Identifier: HERON1
**Description of Value(s):**
Small heron colonies (< 4 occupied nests)

<table>
<thead>
<tr>
<th>Prescription</th>
<th>Exception</th>
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</table>

<table>
<thead>
<tr>
<th>AOC Description</th>
<th>Harvest, Renewal and/or Tending Operations</th>
<th>Operational Road Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colonies known or suspected to have been used within 5 years are considered active. Active colonies are protected by a 150 m radius MMA. In inactive colonies (not used within 5 years or unused for 2 consecutive years), individual nest trees should be protected by a T/L reserve.</td>
<td>No harvest, renewal, or tending is permitted within the MMA from April 1 to August 15 (March 15 to August 1 in Southern Region). Clearcutting is not permitted in the MMA. Selection cuts, shelterwood preparatory, regeneration, or first removal cuts, and other partial harvests that retain a relatively uniform minimum residual canopy closure of 30% comprised of dominant and codominant trees are permitted within the MMA (but must be conducted outside the nesting season if colony is occupied). Within the MMA, a minimum 30 m buffer of uncut trees must be maintained adjacent to the colony or along visible shoreline.</td>
<td>Avoid locating new roads or landings within the MMA. If there is no alternative, new roads or landings may be permitted subject to MNR approval in the AWS. The cleared right-of-way must be as narrow as possible. Temporary roads and/or water crossings should be used whenever possible. Construction of new roads or landings is not permitted during the nesting season if the colony is occupied. Hauling and routine road maintenance is not permitted within the MMA during the nesting season unless otherwise approved by MNR.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objection</th>
<th>Monitoring Program</th>
<th>Primary/Secondary Road</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>None required because the prescription is consistent with the approved guidelines.</td>
<td></td>
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</tbody>
</table>
### FMP-17 OPERATIONAL PRESCRIPTIONS FOR AREAS OF CONCERN

<table>
<thead>
<tr>
<th>AOC Identifier</th>
<th>Description of Value(s):</th>
</tr>
</thead>
<tbody>
<tr>
<td>HERON2</td>
<td>Regionally significant heron colonies (≥ 4 occupied nests)</td>
</tr>
</tbody>
</table>

#### Prescription

<table>
<thead>
<tr>
<th>AOC Description&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colonies known or suspected to have been used within 5 years are considered active. Active colonies are protected by a 150 m radius reserve and an additional 150 m radius MMA (MMA1). Especially significant colonies (≥ 25 occupied nests) receive an additional 200 m radius MMA (MMA2). In inactive colonies (not used within 5 years or unused for 2 consecutive years), individual nest trees should be protected by a T/L reserve.</td>
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</table>

<table>
<thead>
<tr>
<th>Harvest, Renewal and/or Tending Operations&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>No harvest, renewal, or tending is permitted in the reserve. No harvest, mechanized renewal, or tending is permitted in MMA1 (or MMA2) from April 1 to August 15 (March 15 to August 1 in Southern Region) for occupied colonies. Planting is permitted in MMA1 (or MMA2) if not visible from the occupied nests and accompanied by mitigative monitoring. The timing restriction may be removed if the colony becomes unoccupied. Clearcutting is not permitted in MMA1. Selection cuts, shelterwood preparatory, regeneration, or first removal cuts, and other partial harvests that retain a relatively uniform minimum residual canopy closure of 30% comprised of dominant and codominant trees are permitted within MMA1 (but must be conducted outside the nesting season if colony is occupied). There are no restrictions on harvest within MMA2 if conducted outside the nesting season when colony is occupied. Within the AOC, a minimum 30 m buffer of uncut trees must be maintained along visible shoreline.</td>
</tr>
</tbody>
</table>

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<th>Operational Road Conditions</th>
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<tr>
<td>Avoid locating new roads or landings within 300 m of active colonies. If there is no alternative, new roads or landings may be permitted subject to MNR approval in the AWS. The cleared right-of-way must be as narrow as possible. Temporary roads and/or water crossings should be used whenever possible. Construction of new roads or landings is not permitted during the nesting season if the colony is occupied. Hauling and routine road maintenance is permitted on existing roads in the AOC during the nesting season if conducted &gt; 150 m from the occupied colony unless otherwise approved by MNR.</td>
</tr>
</tbody>
</table>

### Monitoring Program

None required because the prescription is consistent with the approved guidelines.

### Primary/Secondary Road


In some cases, occupied nests may be found after some harvesting has been conducted within the AOC surrounding the nest. Whenever possible, subsequent activities such as removal of felled wood, site preparation, planting, or tending should not be conducted within the AOC during the timing restriction. Exceptions or deviations may be considered based on compelling socio-economic or silvicultural rationale.

Exceptions will require the development of an exception monitoring protocol in consultation with OMNR. We recommend a mitigative monitoring approach. This type of approach involves monitoring the response of birds to a specific activity. The activity is permitted to continue as long as the birds do not exhibit a negative response. The activity is suspended at the first sign of a negative response. The protocol should be designed to ensure that disturbance of nesting birds is minimized (by the observers as well as the activity to be monitored!). Box 1 provides points to consider when designing and implementing a mitigative monitoring protocol. All exceptions require approval by OMNR prior to implementation.

**Box 1. Considerations in designing and implementing a mitigative monitoring protocol.**

- High disturbance activities (e.g., prescribed burns, aerial spraying) should not be permitted
- Avoid any activities when very young chicks are likely to be in the nest
- Avoid any activities within 50 m of active nests
- Schedule activities during the warmest part of the day when operating between February 1 to May 15
- Begin work as far from the occupied nest as possible to provide birds a chance to habituate to the activity
- Do not work in a straight line toward the nest
- Minimize noise to the extent possible
- Minimize duration of activity to the extent possible
- Conduct activities only during daylight hours
- Have a designated person monitor the nest from a concealed location (ideally > 150 m from nest) with binoculars – use a vehicle as a ‘blind’ if possible
- Monitor the nest continuously for the first hour following the start of operations each day or a change in the nature of operations, and once per hour thereafter
- Detailed records should describe the nature and proximity of activity and the corresponding response by birds and should be submitted to OMNR
- Operations should cease immediately if a negative response is observed, such as a) an incubating bird leaves the nest and is absent for more than 5 minutes or b) chicks exhibit agitated behaviour, adults exhibit prolonged aggressive behaviour or predators (e.g., ravens) are attracted to the nest