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Summary No.52

Morice & Lakes Innovative Forest Practices Agreement

PROJECT SUMMARY

Ecosystem Management

Forest Productivity

Public Involvement

Adaptive Management

The ecosystem management component of the Morice & Lakes IFPA has embarked on several projects that assess biodiversity, ecological attibutes, and fish and wildlife habitat. These projects provide important ecological data used in learning scenario development for the IFPA.

Effects of forest development near nest sites on the reproductive success of Northern Goshawks: an adaptive management approach.[1]

Introduction

The northern goshawk (Accipiter gentilis, hereafter goshawk) is widely recognized as a species sensitive to forest development (Squires and Reynolds 1997) and several studies have documented impacts to individual breeding pairs (Crocker-Bedford 1990) and populations (Widen 1997) resulting from forest harvesting. Forest development activities that affect the nest area represent one of the most direct potential impacts to goshawks because: 1) of the critical importance of the nest area for reproduction of the species, 2) the relatively small size of the nest area (~24 ha) makes it susceptible to being completely removed by a cutblock, 3) goshawks exhibit very strong site fidelity to nest areas, often using them for periods of years or decades (and it is unknown how successfully they can establish a new nest area once an original one becomes unsuitable), and 4) there is high overlap with suitable nest area habitat and the Timber Harvesting Land Base.

Despite the obvious importance of nest areas, and the focus of management guidelines on that territory component (e.g. Reynolds et al. 1992, BC Ministry of Forests and BC Ministry of Environment 1999), few studies have monitored the response of goshawks to timber harvest near occupied nest areas. This project directly assesses the response of northern goshawks to timber harvest within, or adjacent to known goshawk nest areas, using an adaptive management framework. The goal of this adaptive management strategy is to provide forestry planners and regulatory agencies with local empirical data to confidently design and approve stand-level forestry development plans that will maintain use of goshawk nest areas while minimizing impacts to timber development. This is the most comprehensive experimental nest area study to date.

This project is an extension of a broader goshawk inventory and research study previously conducted within the Nadina Forest District that examined nesting habitat selection, post-fledging area use, prey, and population status. For results of that work refer to Mahon and Doyle (2003).

Objectives

The primary objective of the this project was to compare re-occupancy and breeding success of goshawks between treatment and control nest areas at 49 known nest areas within the Nadina Forest Districts and 39 nest areas in the Kispiox Timber Supply Area. In addition to nest monitoring we also investigated reports of possible goshawk sightings by forestry workers and the public, documented breeding chronology, and collected pellets and prey remains at active nests for future diet analysis.

[1] *Interim results of this study to 2002 have been published in the Journal of Raptor Research (Mahon and Doyle 2005).*

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Study Area and Methods

This study is replicated in two biogeoclimatic zones within the Northern Interior Forest Region in west-central British Columbia—pine dominated Sub-Boreal Spruce (SBS) in the Lakes and Morice TSAs of the Nadina Forest District and hemlock dominated Interior-Cedar-Hemlock (ICH) in the Kispiox and Cranberry TSAs of the Skeena-Stikine Forest District (Banner et al. 1993). Both areas have similar goshawk densities of approximately 4 pairs per 100km2 (Doyle and Mahon 2000, Mahon and Doyle 2003), with 49 known nest areas in the SBS and 39 in the ICH.

We employed an adaptive management framework in this study to integrate our research into operational timber harvesting and to maximize the utility of research outcomes to forest managers. This approach involved four key steps: (1) defining an area of scientific uncertainty; (2) developing and implementing management trials as real world experiments to test that uncertainty; (3) evaluating the outcomes of the trials; and (4) adjusting management guidelines on the basis of the knowledge gained (Morrison et al. 1998). The key uncertainty we investigated is how much goshawk nest area habitat can be removed via clearcutting before nest area reoccupation and productivity are impacted.

We estimated the mean nest area size to be 24 ha, based on the average number and spacing of nests within nest areas. Forest harvesting trials have been conducted at 35 of the 88 known nest areas. Treatment and control nest areas have been monitored annually since 1996 to assess rates of nest area re-occupancy and nest productivity. We tested for overall differences in reoccupation rates between treatments and controls using a chi-square analysis and pooled data from study areas and years. To assess the effect of treatment level (amount of nest area harvested) we also summarized the reoccupation rates separately for treatments areas that had >50% of the nest area stand removed, and which we had monitored for at least two years post-treatment.

Results

Of the 88 nest areas located in the two study areas, harvesting trials have been implemented at 35 (20 in the SBS and 15 in the ICH). Harvesting has been proposed at another 25 nest areas. The level of treatment ranges from marginal influence along one edge of a nest area to harvesting of the entire nest area including all known nests. Oblique aerial photos of four of the treatment nest areas are provided in Appendix 1.

To date, there is no difference in re-occupancy rates of nest areas between treatment and control areas (X^2=0.02, p=0.99, Figure 1). Since 1997, when multiple post-treatment nest areas became available, the total re-occupancy rates have been 47% at treatment areas (n=161 potential breeding attempts) and 48% (n=270) at controls. This pattern of no statistical difference between treatments and controls is consistent when the study areas are tested separately over all years and for each year individually (all P values > 0.10). The pattern of little difference between treatment and controls is consistent across years with greater variation among years than between treatments and controls (Figure 1).

There are eight nest areas where timber development has removed at least 50% of the nest area habitat, and which we have been able to monitor for at least three years post-treatment. At all eight of these nest areas goshawks have returned and successfully bred in at least one year since harvesting was conducted.

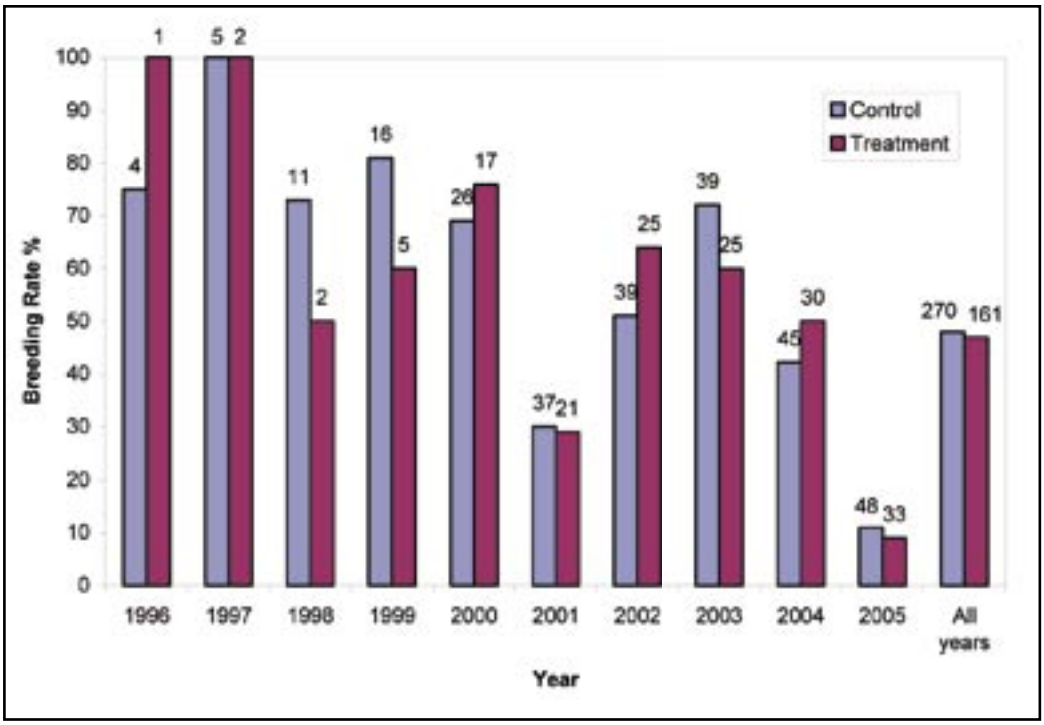

Figure 1. Reoccupation rates at goshawk nest areas for treatment and control areas by year (values above the bars = no. nest areas available for reoccupation).

Further, the total reoccupation rate for these nest areas was higher than for controls when compared annually or for the entire time period (2000-2005 treatments >50% removal = 57%, controls = 50%). It is worth noting, however, that at two of these areas birds have not been detected for the last three years. Also, three additional pairs have established new nest sites in more contiguous forest stands 300-1200m from the original nest area centres.

Similar to reoccupation rates, the average number of chicks fledged over all years did not differ between treatments (1.58 ± 0.91 (SD) (n=76)) and controls (1.42 ± 0.94 (SD) (n=161)) (T=0.69, p=0.51).

Discussion and Management

The results of these trials to date indicate that goshawks can tolerate some level of forest development within their nest area without decreased reproductive success. However, due to high annual variation and a potential lag effect exhibited by the goshawks, these preliminary results must be interpreted with caution. A minimum of five years post-treatment monitoring is required to confidently determine the ultimate response of these trials. As of 2005, most of the treatment nest areas have been monitored for 4 breeding seasons post-treatment. Unfortunately the low overall breeding rates in 2005 resulted in low samples sizes that did not contribute much additional information about the responses of goshawks to the trials. At least one additional year of monitoring with normal breeding rates is key to quantifying the response of the goshawks to the trials.

Two previous studies have examined the response of goshawks to timber harvest near occupied nest areas within an experimental framework and reported decreased nest productivity but were limited by their study design or scale of analysis. Crocker-Bedford (1990) measured the effects of timber harvest on goshawk reproduction by examining the success of 16--200 ha reserves in maintaining goshawk occupation in nest areas surrounded by large partial-cut units (1000--5000 ha). He found that only 25% of 12 treatment territories were reoccupied at least once over a three year period, compared to 79% of 19 control areas that were reoccupied (Crocker-Bedford 1990). A limitation of this study was that the harvest units were so large that they also affected foraging suitability at the territory scale, confounding interpretation.

Patla (1997) found that occupancy was higher at nest areas prior to timber harvesting (79%) than after (47%), and that post-harvest areas with >50% occupancy had higher percent mature forest cover than nest areas with <50% occupancy. A major limitation of Patla's (1997) study, however, was that it lacked comparison to control areas. Pre- and post-treatment comparisons in the absence of controls depend on the assumption that other factors affecting reproductive success are similar over the entire monitoring period, or at least have a minor affect relative to the treatment effect being studied. However, the reproductive success of goshawks is known to vary considerably from year to year depending on prey abundances (Doyle and Smith 1994) and weather (Younk and Bechard 1994)

A more recent study in Europe (Penteriani and Faivre (2001) reported similar results to our study – that goshawks can tolerate some modification to nest area stands without decreased reproductive output. Penteriani and Faivre (2001) found that breeding frequency and the number of young produced per breeding pair did not differ between partially logged and unlogged stands. They also reported that where timber harvesting exceeded 30% of the nest stand, goshawks often relocated to neighbouring mature stands, but that overall reproductive success was not affected.

Several independent studies in Fennoscandia have shown that goshawk populations declined by 50-60% from the 1950-80s (Widen 1997). Widen (1997) examined several factors most often associated with declining raptor populations including pesticides, persecution, prey populations, and nesting and foraging habitat loss associated with forest development. Of these factors, only decreases in the amount and patch size of mature forest at the foraging habitat scale showed a clear correlation with the decline in goshawk populations.

Assuming the lack of response we have currently observed holds over a longer period, it supports the idea that goshawk reproductive success may be more dependent on habitat condition at a larger territory scale (Widen 1997), than impacts to nest area habitat. Examining this issue is the focus of a new component of the Nadina project. Specifically we are examining how quantity and quality of habitat, at multiple territory scales, relates to long-term reproductive success of goshawks. We have secured funding for a portion of this work through the national Sustainable Forest Management Network and Todd Mahon is conducting this research as part of a PhD program at the University of Alberta.

Detailed management guidelines, that fully incorporate the results of these adaptive management trials, will be provided upon completion of this project. Interim management guidelines were developed during the initial five-year component of the project and are available in The Northern Goshawk in the Lakes and Morice Forest Districts – 5-year project summary (Mahon and Doyle 2003), which is available on the IFPA website.

Harvesting Trial Photographs

Examples of harvesting trials implemented near active goshawk nest areas. Nest sites are indicated by the red dots on the photos.

Figure 1. Tea Lake, SBFEP A37692. Breeding 3 of 4 years pre-harvest, 3 of 6 years post-harvest.

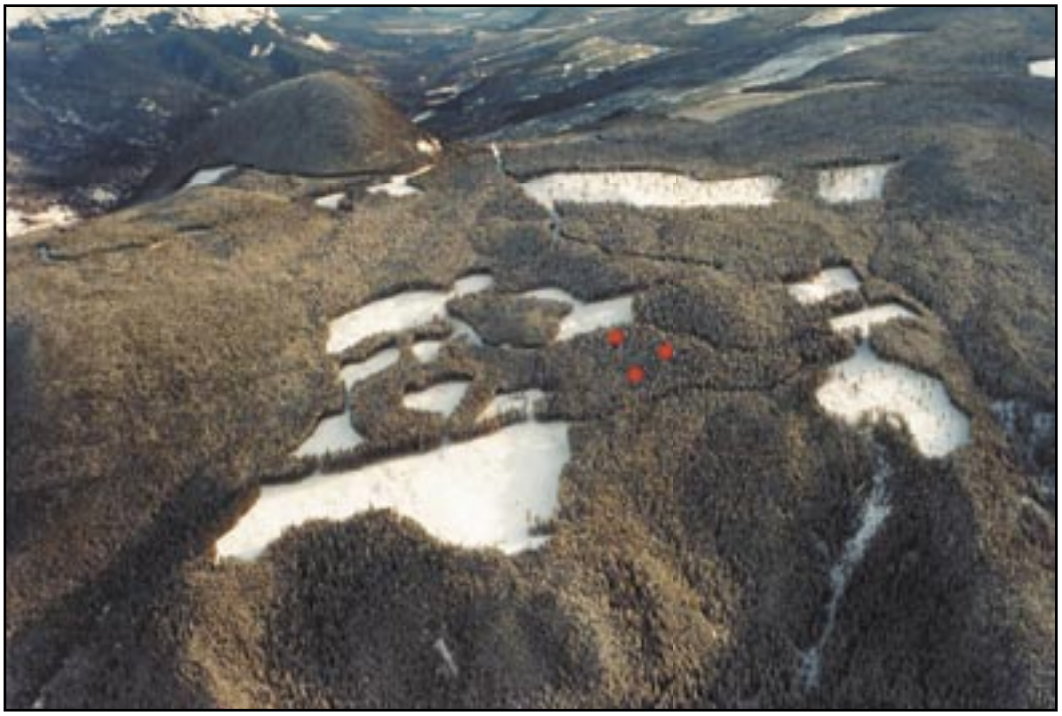

Figure 2. Kitsuns, Kitwanga Lumber 229-1. Breeding 4 of 5 years pre-harvest, 4 of 5 years post-harvest.

Figure3. Skeena-Carrigan SCI 704-83. Breeding 2 of 3 years pre-harvest, 2 of 3 years post-harvest.

Figure 4. Ten Link, Kitwanga Lumber 222-1. Breeding unknown pre-harvest (although 2 nests are older than 2 recent cutblocks), breeding 2 years immediately post-harvest but not in subsequent 7 years.

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