# Breeding Success of the goshawk (A. g. laingi) on Haida Gwaii/Queen Charlotte Islands 2008



(Goshawk Nest: Lignite Watershed: F. Doyle 2008)

### **Prepared For:**

### **Gwaii Forest**

**Society** Haida Gwaii British Columbia V0T 1S0 Western Forest

Products Inc. Campbell River British Columbia V9W 8C9

Prepared By: Frank Doyle

#### Wildlife Dynamics Consulting

P.O. Box 129 Telkwa, B.C. V0J 2X0

March 2009

### **Executive Summary**

This was thirteenth year of goshawk inventory and research, and the ninth year of systematic goshawk nest monitoring on Haida Gwaii. Nest monitoring included several visits to each known nest area. If no birds were initially located, goshawk playback surveys were conducted throughout the nest area, and in adjacent areas of suitable habitat (within  $\sim \leq 2$ km of the known nest area), to establish if the birds were present and possibly using an alternate nest.

In addition, systematic goshawk breeding surveys were also conducted in 21 separate landscapes, which were selected for surveys based on previous goshawk sightings, predicted spacing of territories, and the presence of active harvesting within areas of suitable nesting habitat.

All 13 of the previously known nest areas were monitored. In early spring, during a time when courtship and nest-building is initiated, birds were present in 25% of the nest areas. However, no goshawks bred successfully in any of the monitored nest areas. Birds were detected in 3 (23%) of 13 nest areas during the breeding season, but there was no evidence of chicks in any nests. Independent of this monitoring, and outside of the focal survey areas this summer, a new territory was located by forestry crews working in the Lignite Watershed, near Naden Harbour; and at least 1 chick successfully fledged. This new territory fits with the previously observed spacing pattern, and was located just a kilometer away from a previously designated goshawk management nest area, which was identified by Husby Forest Products Ltd., based on the habitat suitability, and the observed spacing pattern of nest areas Haida Gwaii.

The continuing pattern of low nest area reoccupation, low numbers of birds detected on new surveys, and the low number of young fledging per breeding attempt have previously been linked to the impacts of introduced deer and past extensive clearcut harvest practices. In addition to these impacts the evidence now also suggests that goshawks are potentially being negatively impacted by a changing climate. On Haida Gwaii there is an observed trend towards wetter spring weather which, in other areas, is associated with lower nest area reoccupation, and low breeding success. Under these circumstances the potential for the long-term persistence of a sustainable goshawk population across the islands remains in doubt.

To ensure the forest stewardship goals for goshawks continue to be met in the context of a changing climate, it is recommended that the long-term monitoring of goshawk nest areas continues. No other forest dependent species on Haida Gwaii has been so closely monitored throughout this period of change, and continued monitoring therefore provides a unique opportunity to determine if this focal species is being impacted by a changing climate.

In addition, this monitoring should continue to be linked by adaptive management feedback loop to all forest stewardship managers, and to the goshawk Recovery Team, such that we can continue to identify, and manage for nesting and foraging conditions that support goshawks.

### Table of Contents

Executive Summary
Acknowledgements
Introduction
Project Rationale
Objectives
Methodology
Results
Goshawk Nest Monitoring
New Nests Located
Breeding Status
Goshawk Breeding Surveys7
Discussion
Climate Change and its Impact on Goshawk Management 11
Distribution of the Report to the LUP and Goshawk Recovery Team 12
Literature Cited
Appendix 1 15
Project Summary

## Acknowledgements

This project is indebted to the hard work of the dedicated goshawk survey team;, Gerry Morigeau, Jason Shafto, Jacques Morin, Kiku Dhanwant and Nick Reynolds. In addition, the reports of goshawk sightings and logistical support from the BC Government (MoE, and at MoFR), Haida Forest Guardians, Parks Canada, and Western Forest Products Inc was essential. Critically, the work conducted this year was only made possible due to the financial and logistical support of both Gwaii Forest Society and Western Forest Products Inc. This support continues to provide the opportunity for the long-term maintenance of a healthy and viable goshawk population on Haida Gwaii.

Finally, I would like to give a special thank you to Dave Trim of Western Forest Products Inc. His open and professional approach to balancing forest stewardship responsibilities within the framework of the goals of a working forest, in a landscape with numerous harvesting and focal species management challenges, has contributed greatly to our understanding of how these divergent goals can be met.

### Introduction

Goshawks (*Accipiter gentilis laingi*) on coastal British Columbia, including Haida Gwaii/Queen Charlotte Islands, are a provincially Red-listed species and are designated threatened by COSEWIC. Since 1995 when work on goshawks was first initiated, it has become apparent that this bird is at very low densities on Haida Gwaii. In addition, its rate of breeding is very low when compared to other goshawk populations. In 2004, a Northern Goshawk Recovery Team was formed in the acknowledgement of the need for a management plan to ensure the long-term maintenance of a healthy and viable goshawk population throughout its range including Haida Gwaii.

### **Project Rationale**

On Haida Gwaii the Northern Goshawk *laingi* sub-species (*Accipiter gentilis laingi*) has been shown to be only found in areas of mature and old-growth forest. Through the impact of past large scale clearcut harvesting and introduced species, the population in the last 50 years is estimated to have declined by 63-67%, to possibly less than twenty viable territories (Doyle 2005). Without a management strategy the number of viable territories will continue to decline (Doyle 2004a), and potentially this species could be lost from the islands by 2040 (LUP presentation Sept. 2004, Doyle 2003).

At the present time, Western Forest Products Inc, the Northern Goshawk Recovery Team and the Islands LUP Table, are all developing plans to try and ensure the long-term sustainability of the goshawk population, a population which we now know is genetically distinct from *laingi* goshawks found elsewhere (DNA report: Talbot et al., 2005). Information from monitoring the success of the known nest areas and any new nests that are found will be combined with other work to assist in the development of robust long-term management plans for this threatened species. Other projects include the Forest Investment Account (FIA) funded work on the habitat requirements of a focal prey species, the Blue Grouse, and a project to identify when second growth forest becomes suitable goshawk nesting habitat,

## **Objectives**

This project will monitor known and predicted goshawk nest areas to determine if territories contain breeding pairs, and the success of those pairs (number of young fledged per pair).

In addition, goshawk breeding surveys will take place both in areas where suitable habitat and/or previous goshawk sightings have been made, particularly in those areas where harvesting is currently taking place.

This information will then be used by Western Forest Products Inc, the Goshawk Recovery Team and the Islands LUP Table to help develop plans which will ensure the maintenance of a sustainable goshawk population across Haida Gwaii.

### Methodology

For all known nests, suspected nests (sites with multiple goshawk sightings and/or nest defence behaviour), and predicted nest areas (based on observed habitat selection and location of known nest areas) we conducted intensive ground searches in suitable nesting habitat within a radius of approximately 2 km using systematic call playback surveys (Kennedy and Stahlecker 1993, RISC 1997) to elicit responses from the goshawks in the vicinity, to ascertain the occupancy of each area.

For all known nest sites, nests were inspected for recent signs of nest building. If none of the known nests within each nest area showed sign of activity, we then systematically searched for new nests and other signs of use, such as presence of goshawks, whitewash, and plucking perches. If no sign was found we then conducted systematic call playback surveys (Kennedy and Stahlecker 1993, RISC 1997) to elicit responses from the goshawks in the vicinity. In addition to the within-stand searches, we also conducted stand watch surveys in locations that allowed a good view of the search area in order to observe courtship activity above the canopy (RISC 1997).

Monitoring of known nest areas took place both early in the season prior to egg laying, and then any active nests were monitored at strategic periods throughout the breeding season (incubation, nestling and fledgling stage). Pellets and prey remains were collected during these visits and if possible the young were counted using a spotting scope or binoculars. Successful breeding was defined as the successful fledging of the young from the nest. The fledged young were not intensively monitored, so it is possible that some young died post fledging, before they became independent of the adults.

Goshawk breeding surveys also took place in areas of suitable nesting habitat using the predicted spacing of goshawk nests on Haida Gwaii (Doyle 2005), and in areas with previous goshawk sightings. Systematic call playback surveys (Kennedy and Stahlecker 1993, RISC 1997) were conducted within these areas.

We adhered to Resource Inventory Committee Standards (RIC) for surveying for goshawks (see below). All work was conducted by experienced personnel under strict supervision of a goshawk biologist, and surveys covered the covered the known area between alternate nests (800m radius ) as identified for *laingi* populations on Vancouver Island (McClaren 2003).

#### Forms

- Animal Observation Form-Raptor Encounter Transects
- Wildlife Inventory Survey Description Form- Raptor
- Animal Observation Form-Raptor Call Playback (Ecosystem Field Forms excluded at playback stations)
- Nest site visit cards

### Results

#### **Goshawk Nest Monitoring**

All 14 of the previously known goshawk nest areas were monitored throughout the key breeding stages from February to July of 2008. In the spring, stand watches were performed to attempt to detect birds during courtship activities at two of the known nest areas as well as three other areas with high value goshawk habitat.

#### **New Nests Located**

Independent of any goshawk surveys, a new goshawk nest area was detected in the Lignite Watershed near Naden Harbour by employees of Tecfor Resources Ltd.

#### **Breeding Status**

In the spring of 2008 during the nest building/courtship stage, territorial birds (near the nest and or responding to playback) were seen at 25% (3 of 12) of nests sites (Black Bear, Datlaman, and Survey) visited (Table 1).

Of the 13 nest areas visited during the incubation, nestling and fledgling stages (May through July), goshawks were detected in 3 nest areas (23%) (Blackbear, Datlaman, Three Mile). Of the previously known nests, no active nests (eggs or young) were found and none successfully fledged young.

In late summer a goshawk nest was detected in the Lignite Watershed near Naden Harbour and one fledged young was seen.

#### **Breeding Success: All Years**

Goshawk annual breeding success (number of nests fledging young) has now been closely monitored since 2000 (Table 2) and on average the success rate per previously known nest areas (including 2008) is 20% (N = 13 years).

The average number of young fledged per successful breeding attempt (when the number of young are known) is 1.57 (SD = 0.51, N = 23).

Overall, 2008 is the second year since intensive monitoring began in which none of the previously known nests fledged young. In addition in March, <50% of nest areas were occupied by adult birds, which is the lowest seen in the previous 4 years of early season monitoring.

Nest Area	Response to call playback	Goshawks seen near Nests (<200m)	Goshawk seen above the forest Canopy	Probable Goshawk Sighting/ Call
Ain				
Black Bear	Y	Y		
Bonanaza				
Crease				
Datlaman	Y			
Demon				
Upper Hancock				
Ian NE				
Ian SW	Not Surveyed			
Lyell Is.	Not Surveyed			
Skowkona				
Survey	Y	Y		
Three Mile				
Yakoun Lake				

Table 1	. Spring	2008:	Goshawk	territorial	activity	surveys	at known	Nest Sites.
---------	----------	-------	---------	-------------	----------	---------	----------	-------------

Y = Yes, Blank = No Response/Observation.

Nest Site	Number of young fledged per Nest													
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Bonanza	2	2	1	0	0	2	1	0	0	0	0	1	2	0
Datlamen		1	0	0	0	0	0	0	0	0	0	2	0	0
Ain				?	0	N/S	0	0	0	0	0	0	0	N/S
Survey					<u>&gt;</u> 1	0	0	0	0	0	0	2	0	0
lan SW							1	0	0	0	0	0	0	0
Demon								1	1	2	2	0	0	0
lan NE									2	0	0	0	2	0
Lyell Is.									<u>&gt;</u> 2	2	<u>&gt;</u> 1	0	0	0
Black Bear										0	0	0	2	0
Yakoun Lake										<u>&gt;</u> 2	0	2	0	0
Skowkona											0	0	0	0
Upper														
Hancock*											1	0	0	0
Three Mile											<u>&gt;</u> 1	1	0	0
Crease												1	0	0
Lignite														<u>&gt;</u> 1
Total number of Young Fledged	2	3	1	?	<u>≥</u> 1	2	2	1	<u>≥</u> 5	<u>≥</u> 6	<u>≥</u> 5	<u>≥</u> 9	6	≥1
% of previously known nests fledging young		100	50	0	0	33	25	0	17	25	20	38	21	0
% of previously known nests Defended prior to breeding (laying)											56	58	80	25

 Table 2. Goshawk Breeding Success on Haida Gwaii.

N/S = Not Surveyed, \* = Possible alternate for Ain.

#### **Goshawk Breeding Surveys Summer 2008**

Twenty three goshawk breeding surveys also took place in 21 locations (2 areas were repeated) that were selected based on the observed spacing pattern of nest areas and/or on the presence of suitable nesting habitat in areas which are presently focal areas of harvest (including older second growth stands), and/or on past observations of goshawks. Surveys took place over 214 playbacks stations, and only 1 bird (Mosquito/Nina) possibly responded to playback although there is no indication the bird was breeding.

Location	Dbase Code	Survey Date	Call Type Used	Number of Survey Stations	Goshawk "possibly" Responded to Playback	Goshawk seen but No Response to Playback
Ain 21	CP08B_AINL02	6/30/2009	Alarm	7		
Ain Lake South	CP08B_AINL02	7/18/2009	Begging	9		
Awun/McLinton	CP08B_AWUN01	7/1/2009	Alarm	14		
Begbie Peninsula	CP08B_BEG01	7/11/2009	Begging	11		
Deena/Nina	CP08B_DEEN01	7/7/2009	Begging	14		
Deuce Lake	CP08B_DL01.	6/19/2009	Alarm	6		Y
Furguson main	CP08B_FER01	7/3/2009	Begging	9		
Geike Creek	CP08B_GEI01	6/17/2009	Alarm	13		
Gold Creek	CP08B_GOL01	6/24/2009	Alarm	3		
Honna River	CP08B_HONR01	7/16/2009	Begging	9		
lan/Tara	CP08B_TARA01	7/2/2009	Begging	7		
King Creek	CP08B_KC01	6/24/2009	Alarm	8		
Lawn Hill	CP08B_LAW02	7/4/2009	Begging	11		
Mayer Lake	CP08B_ML01	6/27/2009	Alarm	10		
Mayer Lake	CP08B_ML02	7/8/2009	Begging	12		
Mosquito Lake North	CP08B_MOSL01	7/3/2009	Begging	9		
Mosquito Lake	CP08B_MOSL02	7/15/2009	Begging	12		
Mosquito Lake	CP08B_MOSL03	8/1/2009	Begging	4		
Mosquito/Nina	CP08B_MOSL02	7/4/2009	Begging	14	Y	
North Nadu	CP08B_NAD01	7/17/2009	Begging	2		
Skidegate Lake	CP08B_SKL01	7/14/2009	Begging	10		
Tara Creek	CP08B_TARA02	7/2/2009	Begging	7		
Tlell River	CP08B_TR01	6/24/2009	Alarm	8		

**Table 3.** Location of Goshawk Breeding Surveys.

#### **Goshawk Breeding Surveys Summer 2008**

In the spring 2009, birds were only detected at 2 of 8 nest areas surveyed (Table 4) with 2 or more surveys conducted per nest area. However, conditions were poor this year with exceptionally cold – snowy weather throughout the survey month.

<b>Table 4.</b> Spring 2009 Goshawk territorial	activity surveys at known Nest Sites.
---	---------------------------------------

Nest Area	Response to call playback	Goshawks seen near Nests (<200m)	Goshawk seen above the forest Canopy	Probable Goshawk Sighting/ Call
Ain	Not Surveyed			
Black Bear				
Bonanaza	Not Surveyed			
Crease	Not Surveyed			
Datlaman				
Demon				
Upper Hancock				
Ian NE				
Ian SW	Not Surveyed			
Lyell Is.	Not Surveyed			
Skowkona	Not Surveyed			
Survey	Y	Y		
Three Mile				
Yakoun Lake		Y		

### Discussion

The highlight this past summer came courtesy of an observant forest survey crew working in the Lignite Watershed who located a recently fledged goshawk. A later follow up survey resulted in the location of a goshawk nest.

It appeared to be an extremely poor year for goshawk productivity with no signs of breeding birds both prior to egg laying and during the later breeding surveys over the 13 known nest sites surveyed. Only one other time since 2000 have no breeding birds been detected (2002), and this was at a time when less than half the number of nest areas were being monitored. Poor breeding years are not unknown in monitored goshawk populations (Squires and Reynolds 1997, Flatten et al. 2001, Finn et al. 2002, McClaren 2003,), but when combined with the low number of pairs breeding annually over the past 14 years of nest monitoring, and with the failure to locate any new nest areas in the 21 new areas surveyed this year, causes concern for the long-term viability of a goshawk population on Haida Gwaii. The presence of goshawks in 80% of nest areas in 2007, suggests that birds are still present across the islands, however in most cases only single birds were seen, and in the end only 21% of the nest areas had successfully fledged young.

As discussed in the past (Doyle 2005, Doyle 2007), both the spacing of the known nest areas and the low reproductive success suggests a landscape that is of low suitability

for goshawks. However, the pattern of occupancy and breeding success of the individual territories continues to show no strong linkage to the area of suitable foraging habitat, at any scale, surrounding the known nests (above the identified landscape territory scale 40-60% threshold of mature-old growth, Doyle 2005). This therefore raises the possibility that occupancy and breeding success are being impacted by larger island wide influences. If this indeed the case, then other factors such as the introduced deer (Doyle 2004), and increased precipitation that has been observed over the last 60 years (Mantua et al. 1997, Mote 2003, Woods et al. 2005, Environment Canada 2008), may be impacting the ability of the island to continue to support goshawks.

The introduced deer indirectly impacts the abundance of grouse in all habitat types (Doyle 2004), with the deer heavily browsing the shrubs and herbs on which the grouse is dependent in spring and summer. The deer are spread throughout the islands and could be impacting all territories equally, thereby reducing the ability of any territory, independent of its habitat composition, to support breeding birds.

High precipitation negatively impacts goshawks, as it results in a decrease in nest area occupancy (Manning et al. 2004), an increase in nestling mortality through hypothermia (Kostrzewa and Kostrzewa 1990), and an overall reduction in raptor hunting success (Olsen and Olsen 1989). In addition, increased rainfall is linked to a lower prey abundance of many of the main goshawk prey found on the islands (squirrels, thrushes, woodpeckers, jays and grouse) (Bloxton 2002).

If we look at the trends in rainfall on Haida Gwaii over the last 60 years, we see that in spring, at a time when the goshawks are breeding, that we have a continuing trend towards wetter months (Figure 1 & 2). There has been an increase in the amount of precipitation and an increase in the number of consecutive days with rain (Woods et al 2005).



**Figure 1.** Total March Precipitation at Sandspit Airport, Haida Gwaii 1949-2006. <u>http://www.climate.weatheroffice.ec.gc.ca/climateData/monthlydata\_e.html November</u> 2008.



**Figure 2.** Annual trends (Regression line) in monthly Spring precipitation at Sandspit Airport, Haida Gwaii 1949-2006.

http://www.climate.weatheroffice.ec.gc.ca/climateData/monthlydata\_e.html November 2008.

In goshawks, high rainfall in March and April resulted in a reduction in the number of laying birds in Europe (Kostrzewa and Kostrzewa 1990), and in Nevada a one centimeter increase in May and June rainfall resulted in an 8.7% decline in the number of territories occupied at that time (Fairhurst and Bechard 2005). In southwestern Washington with coastal rainforest similar to Haida Gwaii, Bloxton (2002) also reported a significant decline in nest area occupancy in years with high rainfall.

On Haida Gwaii over the past 29 years, May and June precipitation (115.50mm, SD 38.08, Years 1977-2006), is on average 10 cm higher than recorded in the previous 29 years (106.75mm, SD 37.70, Years 1949-1976; Environment Canada, Sandspit Airport, Haida Gwaii) and we did see a decline in nest area reoccupancy rates with high rainfall in June (Figure 3).



Figure 3. Total number of territories fledging young.

Unfortunately the increase in rainfall has occurred primarily since the 1980's and we do not have data on the annual goshawk breeding rates prior to 1995. It's also worth noting that the monthly average rainfall is some 10 times higher on Haida Gwaii than in the other areas where goshawk occupancy and reproduction have been monitored, and therefore we cannot be sure if the birds here will respond to the increase in rainfall is the same way.

However, if we compare the number of territories successfully fledging young on the island, with those of an interior population on the adjacent mainland (Skeena-Stikine Forest Districts) where a changing climate is potentially impacting breeding success (Doyle 2008), then the trend in recent years (>2002 - 2008) are similar in both areas, with 17.3% (SD 13.6%) fledging young on Haida Gwaii, and 25.6% (SD 17.7%) fledging young in the Kispiox.

However, over the longer term (>1995) the density of territories, and number of pairs successfully fledging young, are well below the trend seen in other monitored populations (33% fledging young in the Kispiox, 19% fledging young on Haida Gwaii), and potentially too low to sustain the population in the long-term (Doyle 2003). This seems to be unlikely to have been always the case, as we also know that the Haida Gwaii goshawk population is genetically distinct (Talbot et al. 2005), suggesting that the past conditions supported a healthy goshawk population.

Goshawks on Haida Gwaii are possibly being negatively impacted by several factors (changing climate, introduced species and historic large scale clearcut harvesting) which at the present time may limit the potential for the island to continue to sustain a viable goshawk population.

#### Climate Change and its Impact on Goshawk Management

If the changing climate has the potential to change or is changing the environment in which the goshawks live, then one way in which we can try to mitigate this impact is to ensure that continued monitoring of known territories is linked in adaptive management feedback framework. Through this mechanism we can identify and subsequently manage for conditions (landscape harvest pattern, seral stage and composition) that provide for successful breeding in goshawks. Hand in hand with this adaptive management approach, we also need to ensure that we are not just working towards a minimum habitat threshold, but develop forest stewardship practices that provide for a range of conditions, at a scale appropriate for goshawk territorial requirements. This approach will ensure that we continue to have the opportunity to adapt to the species habitat requirements, identified by an adaptive management feedback mechanism.

#### Distribution of the Report to the LUP and Goshawk Recovery Team

The results of this monitoring work supported by WFP Inc, MoE and Parks Canada, has been circulated to the Council of Haida Nations, the LUP Table, the Goshawk Recovery Team and to the Licensees. Of particular value to these working groups is the knowledge that goshawks are still present in many territories, even though annual breeding success is relatively low. This information provides for the possibility that if suitable conditions for nesting and foraging can be provided then it may be possible to ensure that the islands support a healthy goshawks population.

# Literature Cited

- Bloxton, T. D. 2002. Prey abundance, space use, demography and foraging habitat of Northern Goshawks in western Washington. MSc Thesis. University of Washington.
- Doyle, F. I. 2003. Biological Review and Recommended Interim Strategy Direction for Northern Goshawks on Haida Gwaii/Queen Charlotte Islands. MWALP. Smithers.
- Doyle, F. I. 2004a. Breeding Success of the goshawk (A. g. laingi) on Haida Gwaii/Queen Charlotte Islands 2004: Is the population continuing to decline? SMFRA, Weyerhaeuser Ltd.
- Doyle, F. I. 2004b. Blue Grouse habitat on Haida Gwaii/Queen Charlotte Islands. HCTF.
- Doyle, F. I. 2005. Breeding Success of the goshawk (*A. g. laingi*) on Haida Gwaii/Queen Charlotte Islands: Is the population continuing to decline? Goshawk productivity and habitat requirements 2004-2005. SMFRA, Weyerhaeuser Ltd.
- Doyle, F. I. 2006a. Breeding Success of the goshawk (A. g. laingi) on Haida Gwaii/Queen Charlotte Islands 2005: Is the population continuing to decline? BC Ministry of the Environment, British Columbia Timber Sales, Cascadia FP Ltd,

Gwaii Haanas National Park Reserve and Haida Heritage Site, South Moresby Forest Replacement Account.

- Doyle, F. I. 2006b. Blue Grouse Breeding Habitat on Haida Gwaii. Cascadia F.P. Ltd.
- Doyle, F. I. 2008. Goshawk Nest Monitoring in the Cranberry and Kispiox Watersheds 2008. Cranberry/Kispiox FIA Steering Committee. Pp 1-19.
- Doyle, F. I. and J. N. M. Smith 2001. Raptors and Scavengers. Chapter 16 In: Ecosystem Dynamics of the Boreal Forest: The Kluane Project. Eds Krebs, C. J. S. Boutin and R. Boonstra. Oxford University Press. 2001:1-511.
- Environment Canada 2008. Sandspit. Haida Gwaii. November 2008. http://www.climate.weatheroffice.ec.gc.ca/climateData/monthlydata\_e.html
- Fairhurst, D. G., and M. J. Bechard. 2005. Relationship between winter and spring weather and Northern Goshawk (*Accipiter gentilis*) reproduction in Northern Nevada. Journal of Raptor Research 39 (3):229-236.
- Finn, S. P., J. M. Marzluff and D. E. Varland. 2002. Effects of landscape and local habitat attributes on Northern Goshawk site occupancy in Western Washington. Forest Science 48 (2). 427-436.
- Flatten, C., K. Titus and S. Lewis. 2002. Technical assistance, analysis, and dissemination of results from an interagency northern goshawk study on the Tongass National Forest. Alaska Dept. Fish and Game.
- Kennedy, P. L. and D. W. Stahlecker, 1993. Responsiveness of nesting northern goshawks to taped broadcasts of 3 conspecific calls. J. Wildlife Management 57 (2):249-257.
- Kostrzewa, A. and R. Kostrzewa. 1990. The relationship of spring and summer weather with density and breeding performance of the buzzard Buteo buteo, goshawk Accipiter gentilis and kestrel *Falco tinnunculus*. Ibis. 132:550-559.
- Manning, E.T., J.M. Cooper, and J.A. Deal. 2004. Queen Charlotte Goshawk adaptive management strategy TFL 37. Canadian Forest Products Ltd. Woss, BC. January 2004. 27 pp
- Mantua, J. N., S. R. Hare, Y. Zhang, J. M. Wallace, and R. C. Francis 1997. A Pacific Interdecadal Climate Oscillation with Impacts on Salmon Production Bulletin of the American Meteorological Society Volume 78 (6): 1069–1079.
- Mahon, T., F. I. Doyle and M. Nelligan. 2002. Inventory of the Northern Goshawk in the Lakes and Morice Forest Districts. 2001/2002 Annual Report. Babine and Houston Forest Products Ltd.

- McClaren, E. L. 2003. Northern goshawk (*Accipiter gentilis laingi*) population inventory summary for Vancouver Island, British Columbia (1994-2002). Ministry of Environment, Lands and Parks, Nanaimo, B.C.
- Mote. P. W. 2003. Trends in Temperature and Precipitation in the Pacific Northwest. During the Twentieth Century. Northwest Science. Vol.77. No 1: 271-282.
- Olsen, P. D. and J. Olsen. 1989. Breeding of the peregrine falcon *Falco peregrinus*: I. Weather, nest spacing and territory occupancy. Emu. 88(4):195-201.
- RISC, 1997. Resource Inventory Standards Committee. Standard methodologies for the inventory of biodiversity in British Columbia: Raptors. Min. Water Land and Air Protect. Victoria. B.C.
- Squires, J.R. and R.T. Reynolds. 1997. Northern Goshawk. *In*: A. Poole and F. Gill (Eds.). The birds of North America. No 298. Academy of Natural Sciences and The American Ornithologists Union, Washington, DC
- Talbot, S. L. Gust, J. R. Sage, G. K., and S. A. Sonsthagen. 2005. Preliminary investigations of genetic relationships among goshawks of Alaska and British Columbia. Unpublished Report. U. S. Geological Survey, Anchorage, AK.
- Woods, A., K. D. Coates, and A. Hamann. 2005. Is an unprecedented Dothistroma Needle Blight Epidemic related to Climate Change? BioScience 55 (9):761-769.



#### GFS PROJECT SUMMARY

### Project Name: <u>Goshawk Population Status on Haida Gwaii</u> File # : <u>SFM2-2008</u>

#### **EMPLOYMENT:**

Name	Local ( $$ )	Off-Island ( $$ )	# Hours per day	# Days	Total Hrs
Nick Reynolds	$\checkmark$		10	22.5	225
Gerry Morigeau			10	18	180
Kiku Dhanwant	$\checkmark$		10	21	210
Jacques Morin			10	22	220
Jason Shafto			10	5	50
Frank Doyle			10	10	110

#### TRAINING:

Name	Area of Training	Total Hours
Kyle Hall July Skyler Boulton-Brown Tow Stocker Simon Lemaire Sarah Dutheil Tristan Cober Raven Engle	<ul> <li>describe typical goshawk habitat</li> <li>analyze and describe the effect that <i>clear-cut</i> <i>logging</i> has had on goshawk habitat</li> <li>analyze and describe the effectiveness of <i>wildlife patches</i> in <i>clear- cuts</i> with regard to goshawk conservation</li> <li>describe the feeding and breeding habits of goshawks</li> <li>demonstrate awareness of the importance of raptors in ecosystem health</li> <li>Plant Identification</li> </ul>	63 hours (7 people x 9 hours)
Jonathan Dunsmore	As above	10
Laurence Greenhough	As above	20