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SPOTTED OWL MANAGEMENT PLAN

Strategic Component

November 1997

Prepared by:

Spotted Owl Management Inter-agency Team

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No project like this comes to completion without exacting a toll on the participants' personal support group of families and friends. We appreciate the indulgence of those closest to us, who have put up with our frequent physical and mental absences during the preparation of this report.

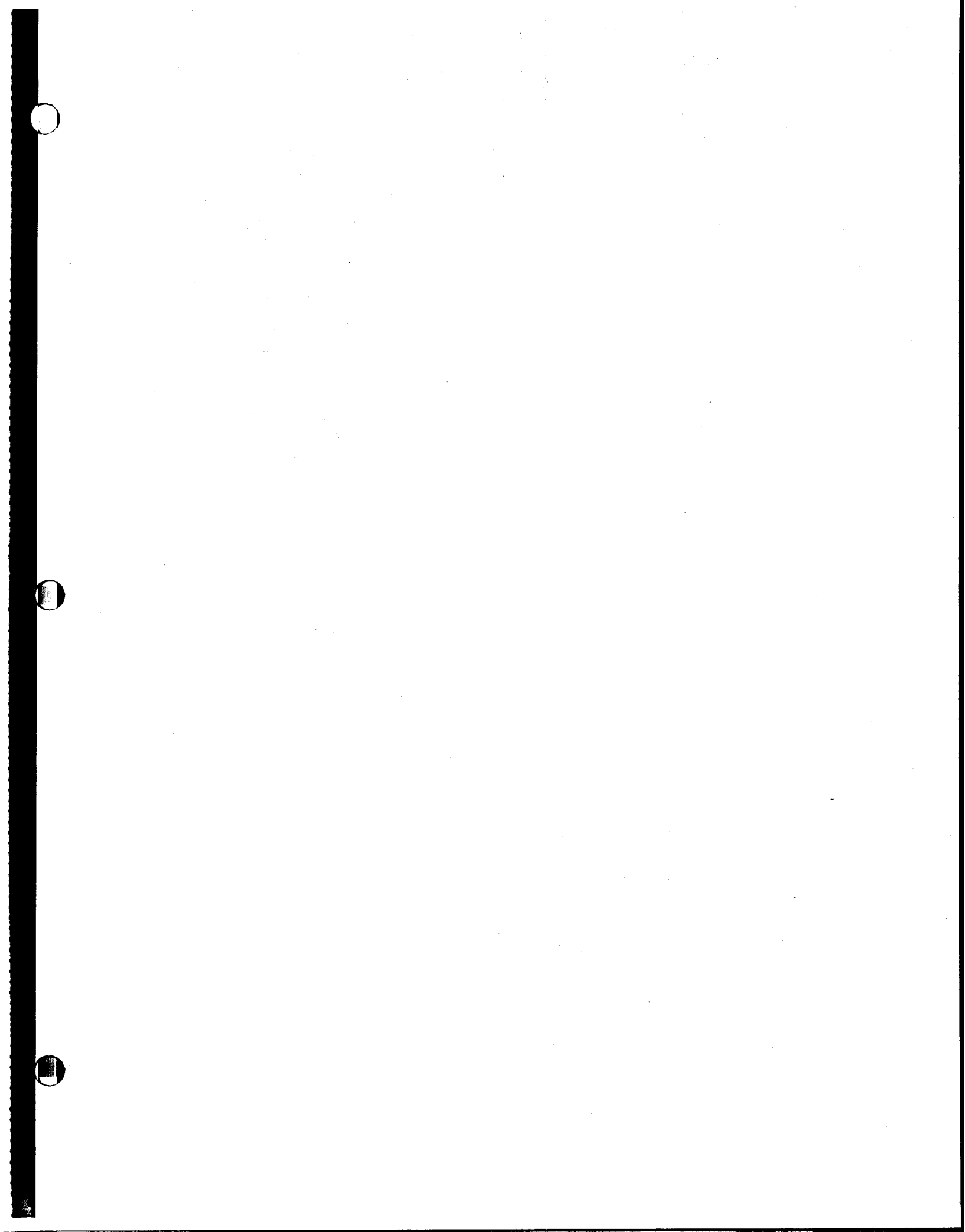
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INTRODUCTION

The northern spotted owl (*Strix occidentalis caurina*) is found exclusively within the temperate coniferous forests of western North America. The range of the bird occurs from British Columbia south to California. The entire Canadian distribution of the owls occurs within the southwest mainland of British Columbia where it is considered a rare, but local resident species (Campbell *et al.* 1990). Although the present range approximates the limits of its historic range in North America, the species' distribution and abundance have changed greatly (USDI 1992).

Based on a status report by Campbell and Campbell (1984), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated the spotted owl as Endangered in Canada in 1986. This means the spotted owl is "threatened with imminent extirpation throughout all or a significant portion of its Canadian range." This designation was based on the small number (n=28) of historic spotted owl records in southwestern British Columbia; the owl's close association with late successional and old growth forests for foraging, roosting and nesting; and on the large reduction of these forests caused by agricultural development, urban development and timber harvesting (Campbell and Campbell 1984). Besides its national designation as Endangered, the spotted owl is on the Provincial Wildlife Branch Red List as a species being considered for legal designation as Endangered under the *British Columbia Wildlife Act*. In 1990, the northern spotted owl was listed as Threatened under the U.S. *Endangered Species Act* throughout all of its range in the United States.

The national Committee for Recovery of Nationally Endangered Wildlife (RENEW) is responsible for overseeing and co-ordinating recovery efforts for nationally endangered and threatened species. At the request of RENEW, the B.C. Director of Wildlife established the Canadian Spotted Owl Recovery Team (SORT) to develop a recovery plan for the spotted owl in Canada. SORT is an eight-member technical committee consisting of professional biologists and foresters. The mandate of SORT was to examine the current status of spotted owls in Canada and to develop a national recovery plan for the species.

Since a recovery plan would involve some level of protection for forests capable of maintaining a viable spotted owl population, concerns were raised regarding the potential economic and social impacts to local communities and the forest industry. Therefore, the B.C. Director of Wildlife directed SORT to provide a report that outlined an array of management options, with their associated risks to the owl, that could be used to address the potential economic impacts associated with owl conservation. In December 1994, six options were proposed in *Management Options for the Northern Spotted Owl in British Columbia*

(Dunbar and Blackburn 1994) that span the scale from maximum to minimum protection for the owl, and consequently, span the scale of maximum to minimum economic and social impact to local communities and forest industry.

In June 1995, the B.C. government announced a broad strategy to develop a management plan for spotted owls in the province utilizing the Protected Areas Strategy, Forest Practices Code and other land use and resource management initiatives. In arriving at this decision, Cabinet considered the many management options provided in reports by the Spotted Owl Recovery Team, community leaders, industry and environmental organizations. The goal of the strategy was to achieve "a reasonable level of probability that owl populations will stabilize, and possibly improve, over the long term without significant short-term impacts on timber supply and forestry employment." The strategy was developed in hopes of bringing stability and long-term viability to the spotted owl population and also to remove much of the uncertainty facing industry over the future of forestry within the range of the owl.

A joint Ministry of Forests and Ministry of Environment, Lands and Parks Spotted Owl Management Inter-agency Team (SOMIT) was established to develop a Spotted Owl Management Plan that addressed the Terms of Reference provided by Cabinet (Appendix A). Guiding principles in the terms of reference provided to SOMIT included:

- Any spotted owl habitat areas that are to be proposed for permanent protection will be resolved through the Protected Areas Strategy process.
- Spotted Owl Conservation Areas may be proposed as Special Resource Management Zones under the Forest Practices Code.
- The long-term intention of SRMZs, which are identified as essential to spotted owl conservation, will be to return to or achieve approximately 67% in suitable spotted owl habitat conditions. This shall not be interpreted without consideration of social and economic concerns.
- Forest harvesting and road construction will occur in all SRMZs outside protected areas subject to the Forest Practices Code. Specific prescriptions will be proposed within SRMZs to encourage return to suitable habitat conditions and to maintain owl populations, as long as their impact has no more than approximately 10% reduction in long-term timber supply over and above the levels set in the current Timber Supply Review.
- Plan objectives and guidelines for application in SRMZs will define new and creative opportunities for industrial use and will encourage creative and flexible application of rules—as long as they achieve the basic objectives.

- Wherever possible and practical, the plan should maximize opportunities to use landscape level planning concepts to integrate owl management and conservation with other measures such as protection of visual quality, critical deer winter range, and community watersheds.

The Spotted Owl Management Plan will guide all spotted owl management in the Chilliwack and Squamish forest districts. The Spotted Owl Management Plan is comprised of a summary report, a strategic plan component and an operational guidelines component. The strategic plan component describes the strategic objectives and policies for spotted owl management in spotted owl areas. The operational guidelines component provides resource managers with further guidance for developing long-term operational plans within spotted owl areas, and for forest practices that will create or retain forest attributes critical for spotted owls.

SPECIAL RESOURCE MANAGEMENT ZONES

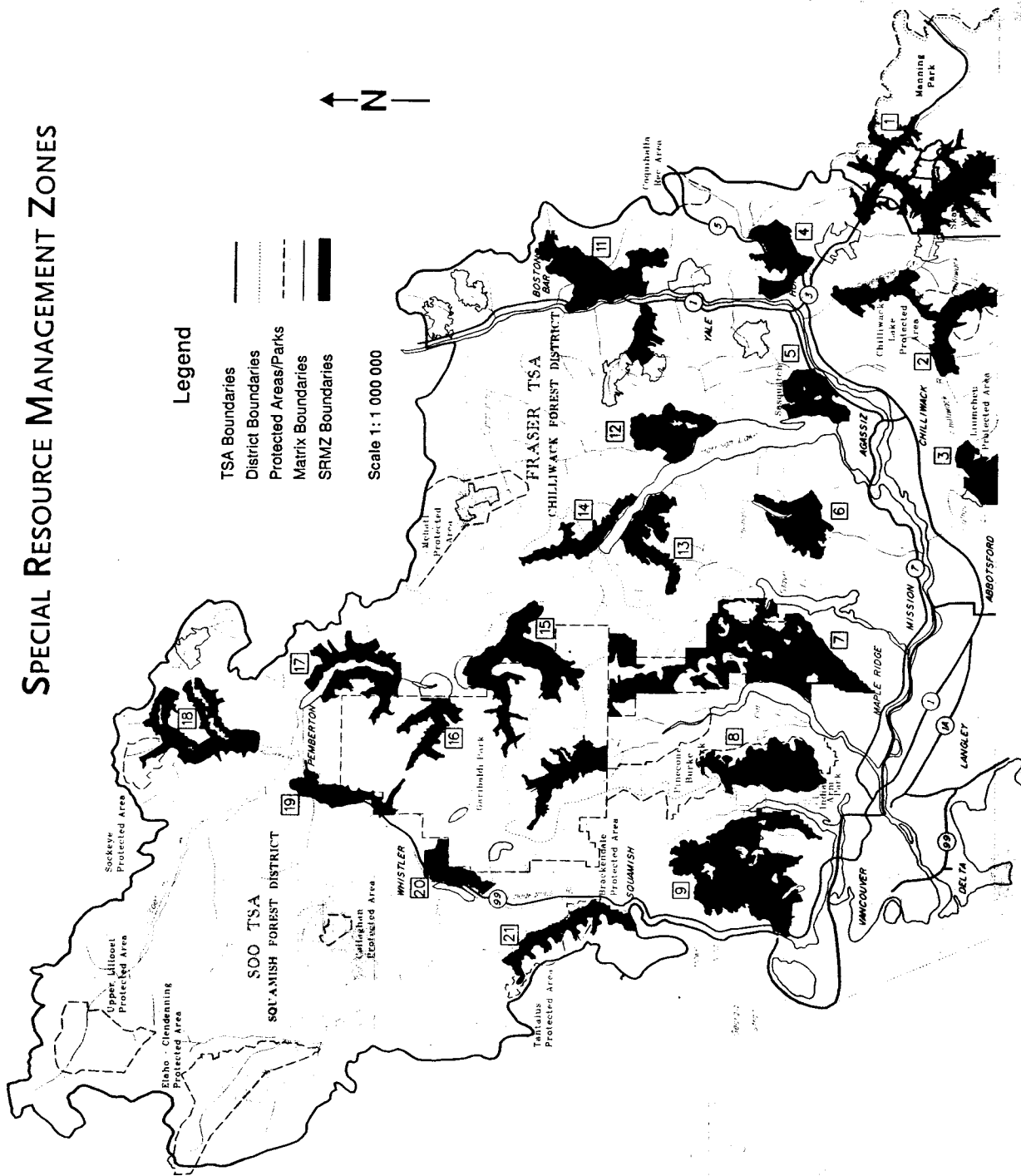


Figure 1. Map of SRMZs in the Chilliwack and Squamish forest districts.

Suitable Owl Habitat Definition (also see Appendix B)

Spotted owls require habitat with specific forest stand attributes to provide for foraging, roosting, dispersal and nesting. The quality of habitats used by the owl is variable and can be graded from superior to poor, and likely varies from ecosystem to ecosystem, and site to site. In general, superior habitats are found in old-growth forests, but occasionally occur in younger forests that exhibit old-growth forest like conditions that were created from earlier disturbances which left behind large trees, snags and downed logs (e.g. fire, wind, selective logging). In British Columbia, spotted owls have not been detected using forests younger than 120 years.

A goal of the Spotted Owl Management Plan is to achieve suitable owl habitat at an earlier age than through natural succession (i.e., 120 years). This will require both intensive silviculture and partial harvesting of young and mature forests, as well as the structural retention of forest attributes at the time of final harvest. It is expected that intensively managed forests will, on average, attain suitable owl habitat conditions at 100 years of age (likely range, 80 to 120 years).

Protected Areas

Protected areas play an integral part of the plan as they permanently protect spotted owl habitat. Of the approximate 363 000 hectares of forested habitat identified for the long-term management of spotted owls, approximately 159 000 hectares (44%) of forests capable of providing suitable owl habitat exists within protected areas (Table 1). This includes the recently announced protected areas at Pinecone Lake/Burke Mountain, Indian Arm, Chilliwack Lake, Liumchen Creek, Sockeye Creek, Mehatl Creek and Tantalus Range.

Some of these protected areas currently do not provide suitable habitats for spotted owl use as they are comprised of young, non-suitable habitats created by earlier disturbances. Natural conversion of these forests to suitable owl conditions may take up to 120 years to create foraging habitat and 200 years to create nesting habitat. The management of these forests falls under the jurisdiction of BC Parks. BC Parks Management Plans will set the objectives for spotted owl management within protected areas. SOMIT recommends that future BC Parks Management Plans consider the enhancement of these non-suitable forests to accelerate the development of owl habitat characteristics suitable for owl use and increase the probability of owl population stabilization and recovery in the province.

Special Resource Management Zones (SRMZs)

Approximately 204 000 hectares of provincial Crown forest (including GVWD watersheds) identified in the Chilliwack and Squamish forest districts will be designated as Special Resource Management Zones (SRMZs) under the higher level plan. This will provide the legal authority under which the management objectives for the Spotted Owl Management Plan are implemented. Eighteen SRMZs have been delineated throughout the range of the owl (Table 2).

Table 1. *Estimated potential amount of forest capable of providing suitable owl habitat over the long term within existing protected areas*

Protected area	Estimated owl habitat (ha)
Skagit, Manning and Cascade	37 273
International Ridge and Cultus Lake	2 241
Sasquatch	1 000
Golden Ears	37 350
Lynn Valley and Cypress	8 900
Garibaldi, Nairn Falls	32 740
Birkenhead and Sockeye Creek	2 546
Tantalus and Lake Lovely Water	4 125
Pinecone and Burke Mountain	10 900
Indian Arm and Mt. Seymour	7 049
Chilliwack Lake	3 171
Liumchen Creek	1 640
Mehatl Creek	6 593
Nahatlatch River	1 693
Sumas Mountain	1 700
Total	158 921

The primary goal within SRMZs is to integrate spotted owl management and forest management objectives. To achieve this goal, sufficient levels of suitable owl habitat will be maintained over the long term within SRMZs to stabilize the owl population while providing opportunities for silviculture and harvesting systems to create, enhance and maintain suitable owl habitat. As a result, this will provide for long-term forestry employment and timber supply.

Resource management plans

A resource management plan (RMP) for each SRMZ is required to demonstrate how the objectives of the Spotted Owl Management Plan will be achieved within each SRMZ over a long-term planning horizon of one or more forest rotations. Each RMP will identify landscape and stand level management strategies to protect suitable owl habitat and to provide forestry, economic and employment opportunities. Additional guidance on the development and requirements of the RMP is provided in *Management of Spotted Owl Habitat—Operational Guidelines Component*.

Table 2. *Summary of special resource management zones^a*

Special resource management zones	Estimated gross forested area
Chilliwack Forest District	
1. Manning and Skagit	2 125
2. Chilliwack and Silverhope	10 839
3. Liumchen	5 373
4. Sowaqua	9 401
5. Sasquatch	8 575
6. Chehalis	11 542
7. Golden Ears Provincial Park	Golden Ears Provincial Park
8. Coquitlam (GVWD watershed)	16 088
9. Capilano & Seymour (GVWD watershed)	33 671
10. Upper Pitt River	Garibaldi Provincial Park
11. Anderson River	17 489
12. Hornet and Clear	11 979
13. Tretheway	9 355
14. Douglas (includes Squamish District portion)	8 442
Chilliwack total	144 879
Squamish Forest District	
15. Glacier and Tuwasus	12 276
16. Billygoat	Garibaldi Provincial Park
17. Lillooet	14 137
18. Birkenhead	14 273
19. Wedge and Green	7 187
20. Cheakamus	5 764
21. Squamish	5 384
Squamish total	59 021
Total	203 900

^a Protected areas do not fall under the definition of special resource management zones and, therefore, the forested area within the protected areas are not included in the SRMZ total. However, the forested areas within these protected areas contribute to the overall management plan.

The development of RMPs for each SRMZ will involve government and stakeholders, and may require up to two years to complete. During this period, a transition strategy that follows the intent of the Spotted Owl Management Plan will be in effect that will direct all forest developments in SRMZs (see "Implementation Strategy").

Spotted Owl Management in the Squamish and Whistler Corridor

SRMZs within the Squamish and Whistler corridor are proposed for long-term management to provide an opportunity to restore the owl population in this area and provide one of two important north-south linkages to help stabilize spotted owls in the Pemberton area. Although historic records (as recent as 1979) indicate that spotted owls occur in the Squamish and Whistler area, inventories to date have been unsuccessful at locating owl presence in this area (see Appendix B). As a result of this information, and to reduce short-term timber supply impacts in the Squamish Forest District, the Squamish, Cheakamus and Wedge/Green SRMZs will not be managed to meet the 67% suitable habitat target over the short term. Management will adhere to Forest Practices Code requirements and some application of the operational guidelines component to retain key stand elements (i.e., large snags, green tree retention). Before substantial harvesting occurs within the second-growth stands (within 20 years), the value of these SRMZs as potential future owl habitat will be reassessed and a decision made at that time whether or not to implement long-term management for spotted owls. A resource management plan will not be required for these SRMZs.

Each resource management plan *must*:

- consider and incorporate, where appropriate, other higher level plans.
- demonstrate how the objectives for spotted owl management and forest management will be achieved in each spotted owl activity centre within SRMZs over one or more forest rotations.
- receive joint sign-off by the Ministry of Forests district manager and a designated Ministry of Environment, Lands and Parks official prior to approval of long-term forestry operations within SRMZs.
- be adaptive and make changes as needed in response to new information, natural disturbances and other unforeseen factors that may influence the success or failure of the plan. Any significant changes to the RMP requires joint sign-off by the Ministry of Forests district manager and a designated Ministry of Environment, Lands and Parks official.

The following summarizes the key spotted owl management and forest management objectives that are to be considered in the development of the resource management plan. Further clarification of these objectives is provided in Appendix C.

Spotted owl management objectives

The primary spotted owl management objective is to provide a reasonable probability that the spotted owl population will stabilize, and possibly improve its status, over the long term in the Chilliwack and Squamish forest districts. This will be achieved by:

- maintaining a minimum 67% of the gross forested land as suitable owl habitat in each spotted owl activity centre within SRMZs.

To reduce the effects of forest fragmentation, the distribution of suitable owl habitat within each spotted owl activity centre:

- should be maintained in large patches greater than 500 hectares.
- should be maintained in corridors greater than 1 km wide between these large patches.

The quality of suitable owl habitat within each spotted owl activity centre:

- should be maintained with a minimum target of 50% of the gross forested land as superior suitable owl habitat.

To ensure that adequate protection is given to known spotted owl nest sites and critical roost sites:

- a minimum 80-hectare reserve zone (about a 500 m radius) of suitable habitat should be maintained around known nest sites and critical roost sites.

Forest management objectives

The primary forest management objective within SRMZs is to optimize the removal of timber resources without jeopardizing the long-term survival of the spotted owl. This will be achieved by:

- allowing up to 33% of the gross forested land as suitable owl habitat within activity centres in a SRMZ to be clearcut harvested.
- encouraging innovative alternate silviculture and harvesting systems in activity centres to create, enhance and maintain suitable owl habitat.

To minimize forest fragmentation and maintain large patches of suitable owl habitat, the management plan will:

- relax the 40-hectare cutblock requirement of the Operational Planning Regulation part 3.2.
- relax the green-up requirements of adjacent blocks of the Operational Planning Regulation part 3.23.

To provide suitable habitat:

- forest development should prioritize younger, less suitable owl habitats for harvesting.

To maintain forest health:

- salvage of catastrophic damage should occur where removal of the damaged forest would reduce the risk of further damage to the remaining stand and maintain or improve the habitat suitability for owls.

To reduce overall timber supply impacts:

- the 67% owl habitat area should overlap, as much as possible, heavily constrained features of the land base.
- apply innovative alternate silvicultural and harvest systems to create suitable owl habitat earlier than through natural succession.

To reduce overall employment impacts:

- utilize Forest Renewal BC to renew the forest economy and offset potential employment impacts due to the management plan.

Spotted Owls Located Outside SRMZs and Protected Areas

Spotted owls located outside SRMZs and protected areas (matrix activity centres) play a critical role in the current population structure by contributing to its overall connectivity, productivity, genetic diversity and viability. Therefore, the longer matrix activity centres are maintained to allow SRMZs to be fully functional, the greater the probability that the population will stabilize, and possibly improve.

Each matrix activity centre is currently managed to maintain 67% suitable owl habitat within an approximately 3200-hectare spotted owl activity centre. Consistent with the Terms of Reference for the Spotted Owl Management Plan, the number of matrix activity centres was capped at the level set on June 1, 1995. No new matrix activity centres will be established in the Chilliwack and Squamish forest districts.

Spotted owls found before June 1, 1995

As part of the Lower Mainland Protected Areas Strategy in the Chilliwack Forest District, six matrix activity centres will gradually be phased out over the next 50 years to offset the timber supply and forestry employment impacts associated with the protection of the Mehatl Creek (see Appendix D). As part of the Spotted Owl Management Plan, the remaining two matrix activity centres in the Squamish Forest District will also follow a 50-year phase-out strategy. At the end of this 50-year phase-out period, no matrix activity centres will exist.

The phase-out of these matrix activity centres is based on the assumption that as the amount of suitable owl habitat and the number of spotted owls increase in SRMZs and protected areas, the level of habitat protection for owls outside of these areas can decrease. The strategy for phasing out matrix activity centres considered several factors that include: reproductive status; amount of suitable owl habitat within the spotted owl activity centre; its location in relation to SRMZs, protected areas and other owl activity centres; and the timber supply requirements of licensees involved in the Mehatl offset. Those matrix activity centres that were deemed critical to the short- and long-term management of

spotted owls were given the greatest level of protection during this period. Conversely, matrix activity centres that have been assessed to contain non-reproductive owl pairs and minimal amounts of suitable habitat were identified for phase-out first, as the habitat within these activity centres may act as possible "sinks" that attract owls, but do not provide sufficient amounts of nesting habitat for spotted owls to reproduce.

Although no special forest practices will be required within these matrix activity centres, they will be harvested in a manner that attempts to maintain spotted owls for as long as possible. This will include prioritizing forests located in the outer periphery of the activity centre before harvesting closer to the nest site, and minimizing forest fragmentation.

The overall impact on the spotted owl population should be minimal since the rate at which matrix activity centres phase out closely resembles the rate at which suitable habitat will be restored within the SRMZ. As well, some of these spotted owls are expected to receive some long-term protection through the application of biodiversity requirements, the level of forest constraints (i.e., inoperable forest, deer winter range) that occur within the spotted owl activity centre, and through their close, or overlapping proximity to protected areas and SRMZs (Table 3).

Table 3. *Matrix spotted owl activity centre phase-out*

Owls before June 1, 1995	Status of spotted owl activity centre
<i>Chilliwack Forest District</i>	
1. 12 Mile Creek	Phased out within 5 years
2. Upper Spuzzum Creek	Phased out within 10 years
3. Klesilkwa Creek	Phased out within 10 years
4. Urquhart Creek	Partially maintained within SRMZ 11
5. Siwash Creek	Partially maintained by forest constraints (inoperable forest)
6. Stulkawhits Creek	Partially maintained by forest constraints (inoperable forest)
<i>Squamish Forest District</i>	
7. Billygoat Creek	Partially maintained by forest constraints and protected area
8. Tuwasus Creek	Partially maintained within SRMZ 15

Spotted owls found after June 1, 1995

Spotted owls found after June 1, 1995 may receive some habitat protection through the landscape unit planning process under the *Forest Practices Code of British Columbia Act*. For example, landscape unit planning may integrate spotted owl management to provide some long-term protection to spotted owl habitat by overlapping it with the biodiversity requirements for old forests (see Appendix C). However, unlike matrix activity centres, no additional timber supply impact, over and above Forest Practices Code impacts, will be incurred as a result of integrating spotted owl management with landscape unit planning.

Under the Terms of Reference for the Spotted Owl Management Plan, the total area of SRMZs was capped. Although this provides adequate long-term management of habitat for spotted owls within the range of SRMZs, it does not provide any habitat protection for spotted owls that are found outside of this range in the Chilliwack and Squamish forest districts. Changes to the existing SRMZs to accommodate these spotted owls found outside of the current SRMZ range would reduce the effectiveness of the SRMZs (i.e., make SRMZs smaller and further apart), and would reduce the probability of stabilizing the spotted owl population.

To provide adequate protection for spotted owls that are found outside of the range of SRMZs in the Chilliwack and Squamish forest districts, the Spotted Owl Management Plan recommends that an intermediate or high biodiversity emphasis option be applied to the Ainslie and Gates landscape units in the Chilliwack and Squamish forest districts, respectively. Although this may not protect all known spotted owls locations within the landscape unit, some spotted owls should be maintained. Spotted owls found in other landscape units will be subject to the Landscape Unit Planning Strategy and biodiversity emphasis option designation criteria (Table 4).

Table 4. *Spotted owls subject to landscape unit planning*

Owls after June 1, 1995	Recommendation
Chilliwack Forest District	
1. North Ainslie Creek*	Intermediate/High landscape unit biodiversity designation
2. Mowhawkum Creek*	Intermediate/High landscape unit biodiversity designation
3. South Ainslie Creek*	Intermediate/High landscape unit biodiversity designation
4. Kookipi Creek	Subject to Landscape Unit Planning Strategy
5. Tincup Creek	Subject to Landscape Unit Planning Strategy
Squamish Forest District	
6. Halymore Creek**	Intermediate/High landscape unit biodiversity designation

* North Ainslie Creek, Mowhawkum Creek and South Ainslie Creek are within the Ainslie Landscape Unit.

** Halymore Creek is within the Gates Landscape Unit.

Dispersal Habitat

Suitable dispersal habitat is required outside of SRMZs to allow owls to move from one SRMZ to another. These habitats provide conditions for dispersing individuals to capture prey in an environment that is relatively safe from predators, and provides temporary refugia until individuals have located and established their owl territories. The landscape configuration patterns, minimum habitat patch size and stand characteristics are poorly defined. For the most part it is believed that spotted owls do not require superior owl habitat to successfully disperse. However, superior habitat will provide a higher number of prey and greater protection, and will likely improve chances of successful owl dispersal.

Under the Spotted Owl Management Plan, dispersal habitat will largely be provided by the biodiversity requirements under the *Forest Practices Code of British Columbia Act* (see Appendix F). The *Biodiversity Guidebook* provides guidance to forest managers for a number of attributes including old-growth forest retention, ecosystem representation, seral stage distribution and wildlife tree retention. A major component of the biodiversity guidelines is the delineation of a forest ecosystem network (FEN) intended to capture much of the old-growth and ecosystem representation requirements into a logical framework that minimizes fragmentation. The application of the guidebook should provide for variable habitat patch sizes and distribution and considerable old forest retention suitable for owl dispersal.

Adaptive Management

The Spotted Owl Management Plan is dynamic, and will change in response to new information. Adaptive management is a process that can improve management practices incrementally by implementing plans in ways that maximize opportunities to learn from experience. Adaptive management can provide a reliable means for assessing the management plan, providing better ecological knowledge, and developing appropriate modifications to improve forest management. The primary challenge for using an adaptive management approach is to demonstrate simply and clearly why a change in management would benefit owls (Thomas *et al.* 1990).

Many objectives within this management plan are based on available spotted owl ecology or are based on best professional judgement. Over time, it is anticipated that modifications to the management plan will be required as new information becomes available. The goal of this adaptive process is to improve the protection of spotted owls while improving the methods and efficiencies of forest management within spotted owl areas. To achieve this, requires close monitoring and research of spotted owls and forest practices at the landscape and stand level to determine effective and efficient management practices.

As part of this plan, a Spotted Owl Research and Inventory Advisory Committee (see "Implementation Strategy") was formed to provide direction for research and inventory. The committee will review the objectives presented in the management plan and will recommend changes to the Spotted Owl Management Inter-agency Team.

IMPLEMENTATION STRATEGY

The implementation of the Spotted Owl Management Plan will result in impacts to the forest industry and forest workers. The purpose of the Implementation Strategy is to identify the important components to minimize these impacts and successfully implement the management plan. These key components include: establishment of resource management plans for each SRMZ, a transition period, Spotted Owl Management Plan workshops, an employment mitigation strategy, and the Spotted Owl Research and Inventory Advisory Committee.

Development of Resource Management Plans

For each SRMZ (excluding the Cheakamus and Wedge/Green SRMZs), RMPs will be developed by government and stakeholders with the primary goal is to integrate long-term forestry and spotted owl management objectives. The purpose of a RMP is to incorporate spotted owl management objectives with landscape- and stand-level strategies to provide enhancement and protection of owl habitat, and economic and employment opportunities within SRMZs. The RMP will describe the goals and objectives for owl habitat management and timber harvesting in each SRMZ over a long-term planning horizon of one or more forest rotations. Each resource management plan must consider and incorporate other higher level strategic plans and demonstrate how the objectives for owl habitat management and timber harvesting will be achieved and maintained within SRMZs. Once complete, the RMP will require approval by both the district manager and designated environment official prior to implementation. A phase-in period of two years will be given for licensees and agencies to develop RMPs for the SRMZs.

Transition Period

The transition period is the time between the approval of the Spotted Owl Management Plan and the completion of the resource management plans for each SRMZ. It must be recognized that, in the development of the SRMZs, there have been a number of changes to the existing SRMZ boundaries. Forest licensees have made every effort possible to avoid harvesting in SRMZs and have modified development plans or cutblock boundaries to accommodate spotted owl habitat objectives. During the transition period, agencies and licensees will have to work together closely for the approval of stand-level prescriptions.

Spotted Owl Management Workshops

Training will be provided to all licensees, MoF and MELP staff that are responsible for the development and approval of resource management plans. Training will be provided through a series of workshops. Workshops will be provided to other organizations if there is interest.

Employment Mitigation Strategy

The primary social and economic objective of the Spotted Owl Management Plan was to provide "a reasonable level of probability that owl populations will stabilize and possibly improve, over the long term without significant short-term impacts on timber supply and forestry employment." It is estimated that the implementation of the Spotted Owl Management Plan, without any attempts to offset the impacts from the reductions that will occur, could result in the loss of 70 person years (PY) of direct forestry employment. However, opportunities to maintain or perhaps increase direct employment from the implementation of the management plan and the application of the Operational Guidelines Component do exist.

The employment mitigation strategy will ensure that mitigating direct job loss is the focus of any initiatives, thereby minimizing indirect or induced job loss. Funding sources, such as Forest Renewal BC, will play a fundamental role in the development of mitigation measures and in the application of innovative ideas to offset job losses in the forest sector. To meet the objectives of creating or enhancing spotted owl habitat, there will be a need to create new jobs and/or increase the amount of activities that are presently occurring in the forest. Many of the jobs will require re-training of forest workers. Government, industry and labor will play major roles in providing the opportunities and skills required by those employees affected by reductions in harvest levels.

The following sections discuss the mitigation measures that can be used to ensure that employment levels remain the same or increase over time.

Increase of alternative silvicultural system and innovative harvesting methods

Although the landbase has been reduced for conventional silvicultural systems (i.e., clearcut), there is an opportunity and necessity to apply alternative silvicultural systems (i.e., selection) to create, enhance or maintain suitable owl habitat in the 67% area. It is estimated that the use of these alternative silvicultural systems may increase the direct forest jobs for each 1000 cubic metres harvested by 50%.

For example, the current AAC for the Soo and Fraser TSAs is approximately 2 million cubic metres and provides about 2000 direct forest jobs (1 person year/1000 m³). If 10% of this AAC (200 000 m³) was specifically harvested utilizing alternative silvicultural systems

(estimated to require 1.5 person/years per 1000 m³) to meet the spotted owl habitat requirements; 1800 direct forest jobs would be maintained for conventional systems and 300 direct forest jobs would be created from alternate systems. As a result, this would create a total of 2100 direct forest jobs, which is an increase of 100 direct forest jobs.

Review of the current appraisal system

The Ministry of Forests will review the current appraisal system to provide an updated commercial thinning additive. The intent of the review is to accurately estimate the cost of commercial thinning and thus reduce the costs to licensees for commercially thinning stands. This could offset the costs associated with implementing the Spotted Owl Management Plan.

Increase employment opportunities

To meet some of the objectives of spotted owl habitat creation or enhancement there will be a need to create new jobs or increase the activities that are presently occurring in the forests. These include:

- Commercial thinning
- Incremental silviculture
- Stand conversion (i.e., deciduous to coniferous)
- Early harvest
- Opportunity wood
- Increase value-added opportunities
- Creating or improving owl habitat in provincial parks and forests
- Through the Forest Renewal BC initiative, increase funding for watershed restoration and enhanced silviculture projects
- Increase research and inventory projects for both wildlife and forests needs
- Provide incentives for increasing botanical forest products management
- Increase recreational activities that are compatible with resource management
- Increased effort will be required for the implementation of the Forest Practices Code.

Forest worker training

Many of the jobs being created to meet the objectives of the Spotted Owl Management Plan require re-training of forest workers. Several programs are in place to retrain displaced forest workers. Forest Renewal BC has several priorities within its mandate that are compatible with achieving the objectives of the Spotted Owl Management Plan and which will help ensure the short- and long-term stability of affected workers and communities. These include:

- Identifying training needs associated with improved harvesting practices required under the Forest Practices Code.
- Developing new silviculture programs such as improved thinning, spacing and pruning.
- Continuing work to research logging practices that maintain both biodiversity and jobs.
- Supporting rehabilitation of watersheds, eroded logging roads and other sites.
- Assessing proposals for value-added joint ventures.
- Improving timber growth and yield information.
- Assisting communities facing serious economic problems to plan for their economic development through diversification strategies.
- Increasing incentives for forest companies to finance their own research and development.
- Supporting inventories to locate and monitor all spotted owl nest sites or areas of high owl activity, and to collect qualitative and quantitative wildlife habitat information for RMP planning.
- Supporting research to assess the habitat requirements of spotted owls and study the effects of various silviculture and harvesting techniques used to create or maintain suitable owl habitat.

Spotted Owl Research and Advisory Committee

The province has established a Spotted Owl Research and Inventory Advisory Committee. The advisory committee will identify projects to assist the Ministry of Forests and the Ministry of Environment, Lands and Parks in enhancing the adaptive nature of the Spotted Owl Management Plan.

More specifically, the committee will:

1. Develop a spotted owl management research and inventory strategy for southwestern British Columbia that:
 - defines research priorities for spotted owl management (e.g., spotted owl monitoring and inventory, habitat inventory); and
 - recommends the most appropriate research approaches (i.e., adaptive management versus traditional research approaches).
2. Communicate research and inventory priorities to funding agencies.
3. Communicate research findings to the province's Spotted Owl Management Inter-agency Team.
4. Periodically review and revise the research strategy and priorities.

The advisory committee will be co-chaired by the Ministry of Environment, Lands and Parks and the Ministry of Forests. Other members will include representatives from the following:

- environmental groups,
- community/local government,
- forest companies, Canadian Wildlife Service,
- Forest Renewal BC, IWA Canada,
- academic wildlife researchers, and
- First Nations.

The committee will report through the co-chairs to the Regional Director of the Ministry of Environment, Lands and Parks and the Regional Manager of the Ministry of Forests for a five-year term, beginning this summer.

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APPENDIX A: TERMS OF REFERENCE

Terms of Reference
For
Preparation of a Joint Plan
To Manage Forest Harvesting
in Spotted Owl Habitat

BACKGROUND

British Columbia has a number of closely linked initiatives under way to improve forest resource stewardship, ensure long term community viability and economic stability and ensure protection of the Province's most important natural and cultural values.

Development of a plan which will ensure the long term recovery and survival of Spotted Owl populations requires close coordination with all these initiatives since:

- At the present time the Spotted Owl is on the endangered species list and faces extinction throughout its range in Canada - the southwest mainland of BC, principally the Chilliwack and Squamish Forest Districts, which is the most northerly extension of the range in North America.
- The forests in the So0 and Fraser TSAs and TFLs have been heavily committed and any reduction in accessible timber directly impacts employment in communities such as Hope, Squamish, Pemberton and New Westminster.
- A number of initiatives - including the Protected Areas Strategy, landscape level constraints for visual quality, deer winter range and other environmental considerations, have already reduced the amount of land available for forest harvesting.

In 1994 a Spotted Owl Recovery Team (SORT) produced a Management Options Report which employed the same principles for Spotted Owl Recovery as those used in the United States. In releasing the report to the public in December 1994, the Ministers of Environment, Lands and Parks and of Forests confirmed that a spotted owl management and recovery strategy would be determined in relation to the PAS, the Forest Practices Code and other land use and resource management initiatives.

Cabinet has now directed that a plan shall be developed based on the following terms of reference. In arriving at that decision, Cabinet considered both the SORT report, the recommendations contained in the "Mayors Report" - a report developed by communities directly impacted by the recovery plan, and the many other observations and petitions made over the past year.

Cabinet has directed that a plan shall be developed immediately by local staff from both Ministries. It has as its goal the achievement of a reasonable long term potential for recovery of owl populations without causing undue and unacceptable economic hardship. In particular, the plan must be coordinated with and utilize all available existing programs such as PAS, Forest Practices Code, etc., to ensure that they incorporate Spotted Owl initiatives and optimize the opportunities to achieve multiple objectives from any one action or initiative.

GOALS FOR SPOTTED OWL MANAGEMENT

The Ministry of Environment, Lands and Parks and the Ministry of Forests will jointly prepare a management plan for the Squamish and Chilliwack Forest Districts which has the goal of achieving a reasonable level of probability that owl populations will stabilize, and possibly improve, over the long term without significant short-term impacts on timber supply and forestry employment.

The plan will be presented to the Deputy Ministers by September 30, 1995.

GUIDING PRINCIPLES FOR THE MANAGEMENT PLAN

- Any Spotted Owl habitat areas which are to be proposed for permanent protection of Spotted Owl habitat will be resolved as part of the Protected Areas Strategy and should be dealt with early in that process.
- Spotted Owl Conservation Areas may be proposed as Special Resource Management Zones under the Forest Practices Code.
- Forest harvesting and road construction will occur in all resource management zones outside protected areas subject to the Forest Practices Code. Specific prescriptions will be proposed.
- The long term intention for those Special Resource Management Zones which are identified as essential to Spotted Owl conservation, will be to return to or achieve approximately 67% in suitable Spotted Owl habitat conditions. This shall not be interpreted without consideration of social and economic concerns.
- Plan objectives and guidelines for application in all Resource Management Zones will define new and creative opportunities for industrial use and will encourage creative and flexible application of rules - so long as they achieve the basic objectives.
- Wherever possible and practical, the plan should maximize opportunities to use landscape level planning concepts to integrate owl management and conservation with other measures such as protection of visual quality, critical deer winter range, community watersheds, etc.

PLAN COMPONENTS

The plan will include the following:

Protected Areas and Study Areas

- About 1% of the region with high Spotted Owl Conservation values and protected areas values will immediately be designated as Protected Area Strategy Study Areas.
- Areas to be permanently protected will only be designated through the Protected Area Strategy planning process.
- As a result, more than 45% of all previously identified Spotted Owl Conservation Areas will be within Protected Areas and Study Areas, at least until the PAS process is completed.
- Future protected area management planning for designated protected areas with Spotted Owl habitat will be developed to encourage habitat recovery.

If, at the completion of the planning process for Protected Areas Strategy, those lands are not recommended for long term formal protection, they will be added to and will increase the absolute size of the Special Resource Management Zone.

Special Resource Management Zone

- The remaining SOCA lands, equaling a maximum of approximately 175,000 hectares (which include GVWD lands), may be identified as Special Resource Management Zones for Spotted Owls. These zones may be based on the previously identified Spotted Owl Conservation Areas but may also be amended to optimize owl recovery opportunities and to mitigate short-term timber supply problems so long as critical owl habitat is not lost.
- Habitat conservation and forest harvesting guidelines will be proposed to encourage return to suitable habitat conditions and to maintain owl populations, so long as their impact is no more than approximately 10% reduction in long-term timber supply over and above the levels set in the current Timber Supply Review.
- Within the zone and under the Forest Practices Code a full range of forest harvesting practices will be considered, proposed and approved for implementation.
- If activity centres inside this zone already have 67% suitable habitat condition, every effort should be made to retain suitable habitat conditions which support that situation, but not without consideration of social and economic costs.
- Protected Areas Study Areas which do not become designated Protected Areas after December 31, 1995, will be considered for addition to this zone.

Other Resource Management Zones

- Spotted Owl "activity centres" identified outside the Special Resource Management Zone will be part of a General Resource Management Zone and subject to application of the Forest Practices Code for that zone.
- As of June 1 the number of activity centres will be capped at current levels, existing centres will be recognized and amendments allowed if other sites with greater value are discovered over the course of the plan or after plan completion.
- These Activity Centres will be managed with the long term intent to achieve 67% suitable habitat conditions where economically possible.
- Activity centres could be added to the Special Resource Management Zone over the duration of the plan provided that the total for that zone does not increase, i.e., there is an equivalent withdrawal of forested land.
- The team may identify areas with potential for future designation as Enhanced Resource Management Zones, under the Forest Practices Code, through further sub-regional planning as advice only, to those future processes.

Other

- The plan will propose experimental harvesting and silvicultural programs to test and demonstrate effective low impact methods to harvest in areas of known and high potential existing Spotted Owl habitat areas and to improve poor habitat while creating jobs.
- A research and inventory program to monitor plan effectiveness will be proposed.
- A consolidated plan and budget package will be prepared for presentation, following plan approval, to request assistance from Forest Renewal BC. The focus on the plan will be on supporting experimental programs to encourage innovative silvicultural and harvesting techniques and to protect employment.
- The current Interim Conservation Strategy will be followed until this new management plan is in place except that the provisions described above for "Activity Centres" will be applied immediately.

RESPONSIBILITY

The Regional Manager, Ministry of Forests, and the Regional Director, Ministry of Environment, Lands and Parks, are responsible to the Deputy Ministers for preparation of the plan.

The Chair of the IAMC will be responsible to coordinate this work with the PAS process. A small team of technical staff will be assigned to prepare the plan. The team will prepare a work plan and make regular reports to the two Deputy Ministers.

Ministry of Forests:

Gene MacInnes - Chilliwack
Oliver Thomae - Squamish
Myles Mana - Vancouver

Ministry of Environment, Lands & Parks:

Ian Blackburn - Surrey

In the event that the two ministries are unable to achieve an agreement on the plan, the Deputy Ministers will meet with the Deputy Minister of Environmental Assessment and LUCO, to resolve the differences.

CONSULTATION

The team should seek comment on its proposals from key stakeholders, and in particular the Ministers' Community Advisory Group, municipalities and local government, in the course of their work.

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APPENDIX B: GENERAL SPOTTED OWL BIOLOGY

The following provides a summary from *Management Options for the Northern Spotted Owl in British Columbia* (Dunbar and Blackburn 1994) describing the general biology and threats facing the owl in the province. Where possible, the summary was updated with new information.

Introduction

The northern spotted owl is a chocolate brown, medium-sized owl with round to elliptical white spots on the body feathers, white horizontal bars on the chest and tail, and dark eyes surrounded by tawny facial disks. Males and females are not easily distinguishable by plumage characteristics, however, the sex of the owls can be recognised readily by voice and size (Forsman *et al.* 1984). Spotted owls, and most owls in general, exhibit reversed sexual dimorphism with females larger than males (Blakesley *et al.* 1990).

Research on spotted owls in British Columbia is limited. Most studies in the province have involved inventories to determine the range, distribution and abundance of spotted owls. The majority of research conducted on the species to date has been concentrated in the United States. In the preparation of this document, pertinent information from the United States was largely extrapolated and applied to the owl population in this province. In general, individuals that are widely separated across the species' range may exhibit different behaviours and characteristics than individuals located closer to one another. For example, spotted owls in British Columbia will exhibit more similar habitat requirements with owls in the United States located closest to the International Border than with those found further south. To minimize these possible differences, most information applied to spotted owls in the province was extrapolated from Washington State data.

Currently Known Range and Distribution

Since 1985, owl surveys have been conducted to determine the current range, distribution and status of the owl in British Columbia (Forsman and Dunbar 1985; Forsman and Booth 1986; Booth 1987; Hetherington *et al.* 1987; Banci 1989; Blackburn 1990, 1991; Blackburn *et al.* in prep.). Over the years, these surveys have been limited in geographic coverage, in timing and in intensity. These factors have made delineating the range and distribution of the spotted owl difficult. Furthermore, the total area surveyed does not include all potential owl habitats available in the province, but represents a sample of habitat types, quality and quantity.

Therefore, any inferences regarding the “true” abundance, range and distribution of spotted owls in British Columbia should be viewed cautiously.

Between 1985 and 1996, a minimum of 60 active spotted owl sites have been detected in the province. An active spotted owl site refers to an area where there has been a recent (within 5 years) detection of a single owl or pair of spotted owls. From these data, the currently known range¹ of the spotted owl in the province extends west to Capilano River, north to Anderson lake, east to Mowhawkum Creek and south to the International Border (Figure B1). However, the full extent of the range of the species in the province still remains to be determined.

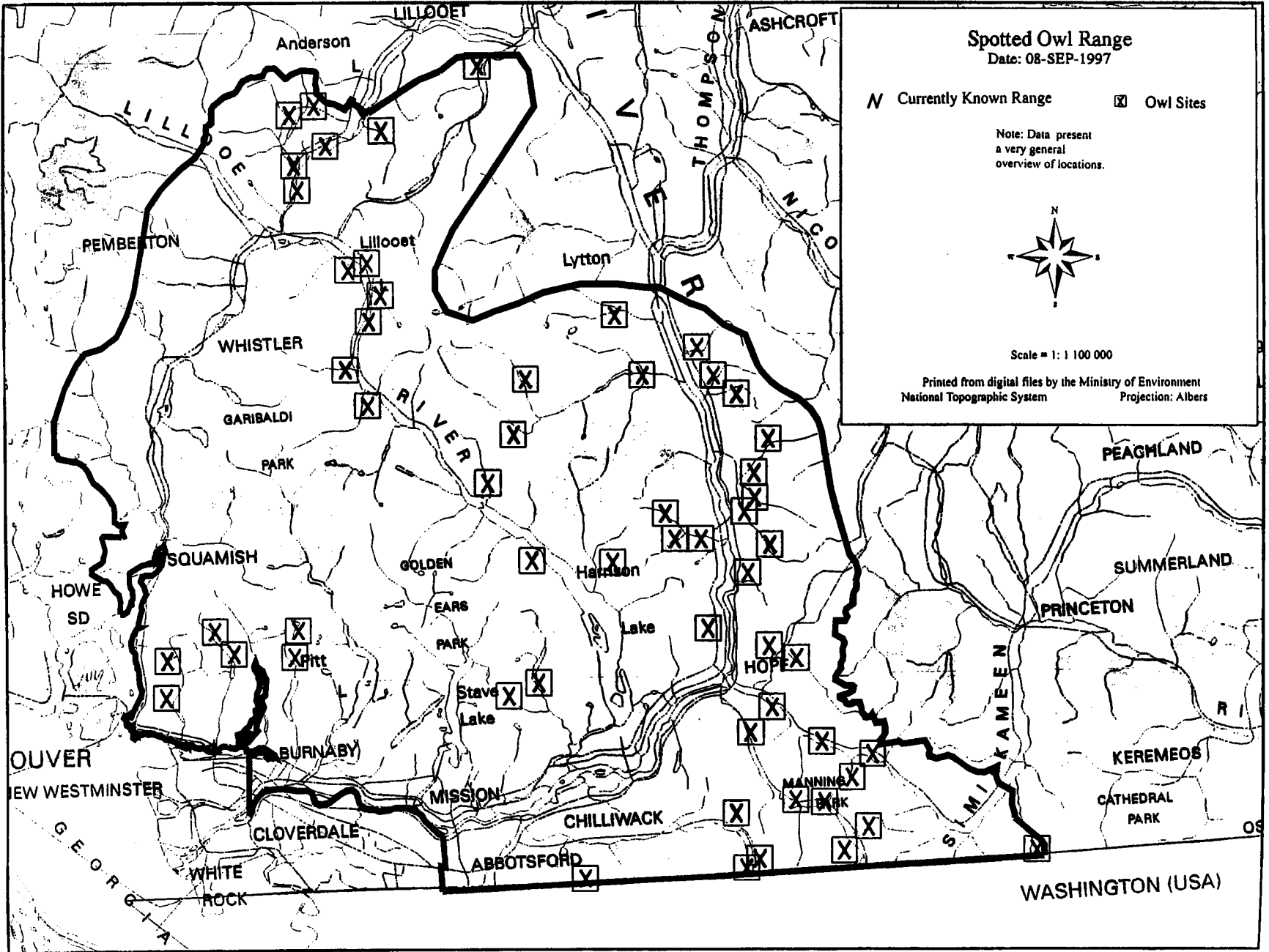
Although the range of the owl probably has not been severely altered from historic times, the owl's distribution within its range probably has undergone significant changes. For example, much of the lower Fraser River Valley, once occupied by spotted owls, has been converted to urban and agricultural uses. Spotted owls are generally found from sea level to approximately 1370 metres in elevation and occur within the Coastal Western Hemlock (CWH), Mountain Hemlock (MH), Interior Douglas-fir (IDF) and Engelmann Spruce-Subalpine Fir (ESSF) biogeoclimatic zones.

Abundance

Given the extensive network of old-growth forest throughout southwestern British Columbia prior to the 1900s, it is assumed that historic populations were much greater than present. Recent inventory surveys (post-1985) conducted in the southwestern mainland of British Columbia suggest that spotted owls are rare in the remaining habitats (Dunbar *et al.* 1991; Lenihan, pers. comm., Ministry of Environment, Lands and Parks). A minimum of 98 adult owls has been recorded at 60 different sites. Of these, 38 have been identified as resident owl pairs. This number only provides an index of the owl's relative abundance as it does not include juveniles, undetected resident owls and floater populations. An accurate number of spotted owls occurring in the province is unknown. Surveys on the periphery of the currently known range are ongoing and are expected to increase the number of known active owl sites. Based on the availability of suitable owl habitat within the currently known range of spotted owls in the province, there are probably less than 100 resident pairs occurring in Canada.

¹ Currently known range is defined as the area encompassing known active spotted owl sites.

Figure B1. Current range and distribution of spotted owls in British Columbia.



Habitat Requirements

Studies to determine the habitat requirements of spotted owls in British Columbia are limited (Dunbar and Blackburn 1994). Conversely, numerous studies have been conducted on the habitat requirements of spotted owls in Washington State (summarized in Hanson *et al.* 1993), and may provide insight into the habitat requirements of spotted owls in British Columbia. For this reason, the Inter-agency Team extrapolated pertinent information regarding the habitat requirements of spotted owls in Washington State and applied it to the owl population in British Columbia. The Inter-agency Team recognizes that the description of suitable owl habitat in Washington may differ slightly from habitats in British Columbia, and strongly recommends that habitat studies be conducted in the province to better represent the habitat needs of the owl.

Spotted owls use a wide variety of habitat types and forest stand conditions throughout its range in North America (USDI 1992). The quality of habitats used by the owl is variable and can be graded from superior to poor (Thomas *et al.* 1990). For example, habitats considered superior support higher densities of owls and prey than habitats that represent lesser quality. In general, superior suitable habitats associated with spotted owls exhibit an uneven-aged, multi-layered, multi-species canopy that contains numerous large trees with broken tops, deformed limbs and large cavities; numerous large snags; large accumulations of logs and downed woody debris; and canopies that are open enough to allow owls to fly within and beneath it (summarized in Thomas *et al.* 1990, USDI 1992). With the exception of some habitat types used in southern Oregon and California and in some dryer ecosystems on the eastern slopes of the Cascade Mountain and Coast Mountain ranges, these habitat characteristics are predominately found naturally within old-growth forests (summarized in Thomas *et al.* 1990, USDI 1992, Hanson *et al.* 1993).

Although selection for old-growth forests by spotted owls is relatively consistent throughout its range, owls have been observed using younger forests in various regions. In general, these younger forests exhibit old-growth forest like structural characteristics that were created from earlier disturbances (e.g., fire, wind, selective logging) which left behind large trees, snags and downed logs. In British Columbia, this habitat type occurs within some owl sites located in the Interior Douglas-fir (IDF) and dryer, subarctic Coastal Western Hemlock (CWH) biogeoclimatic zones. Although the level of owl use of these younger forests is uncertain, it is believed that they may be used for foraging. Within the wetter maritime CWH biogeoclimatic zone, no spotted owls have been detected using forests dominated with trees less than 120 years old (Blackburn 1991). Similar results have been observed in northern Washington State in the western Cascade physiographic province (D. Hays, pers. comm., Washington State Fish and Wildlife).

These results do not necessarily suggest that spotted owls avoid young forests, but the numbers and densities of owls using these habitat types are very low. Conversely, the observations of owls using some young forests suggests that the maintenance and creation of structural characteristics typical of old-growth forests in these young forests may lead to greater use by spotted owls.

Suitable owl habitat is defined as habitat essential to meet the life requisites of the owl (e.g., nesting, roosting, foraging and dispersal). Comparison of suitable owl habitat from the western Washington Cascades and eastern Washington Cascade physiographic provinces demonstrated that spotted owls have slightly different habitat requirements in these two regions. These two physiographic provinces are correlated with habitats in British Columbia in the wetter maritime and dryer sub-maritime ecosystems, respectively (Figure B2). Caution should be used when reviewing the line between wetter maritime and dryer sub-maritime ecosystems as habitat studies have not been conducted to accurately define this line, and, it is highly possible that a "transitional" ecosystem that possesses characteristics of both ecosystems may exist between the two areas. Wetter maritime ecosystems generally are composed of maritime CWH and windward Mountain Hemlock (MH) biogeoclimatic zones. Dryer sub-maritime ecosystems generally include IDF, sub-maritime CWH biogeoclimatic zones, and leeward MH. These forests are distinguished by more frequent, larger fire events and greater incidences of pest damage from spruce budworm, bark beetle and root rot.

Hanson *et al.* (1993) classified suitable owl habitat as Types A, B and C for the western and eastern Cascade physiographic provinces. These definitions will be applied as an interim classification until local studies have assessed British Columbia habitat suitability (Table B1).

Home Range Size

Home range refers to the area in which the activities of an animal are confined during a defined period of time (Thomas *et al.* 1990). Radio-telemetry is the only current method that reasonably estimates the size of spotted owl home ranges. At present, no radio-telemetry studies have been conducted in British Columbia. However, it seems reasonable to expect that spotted owls in British Columbia will exhibit home ranges comparable in size to their Washington counterparts in similar ecosystems. In British Columbia, activity centres are delineations of areas used by owls based on estimates of home range size and habitat requirements.

Hanson *et al.* (1993) summarized the existing home range data for spotted owls in the Western Washington and eastern Washington Cascade physiographic provinces (Table B2). To account for the

SPECIAL RESOURCE MANAGEMENT ZONES

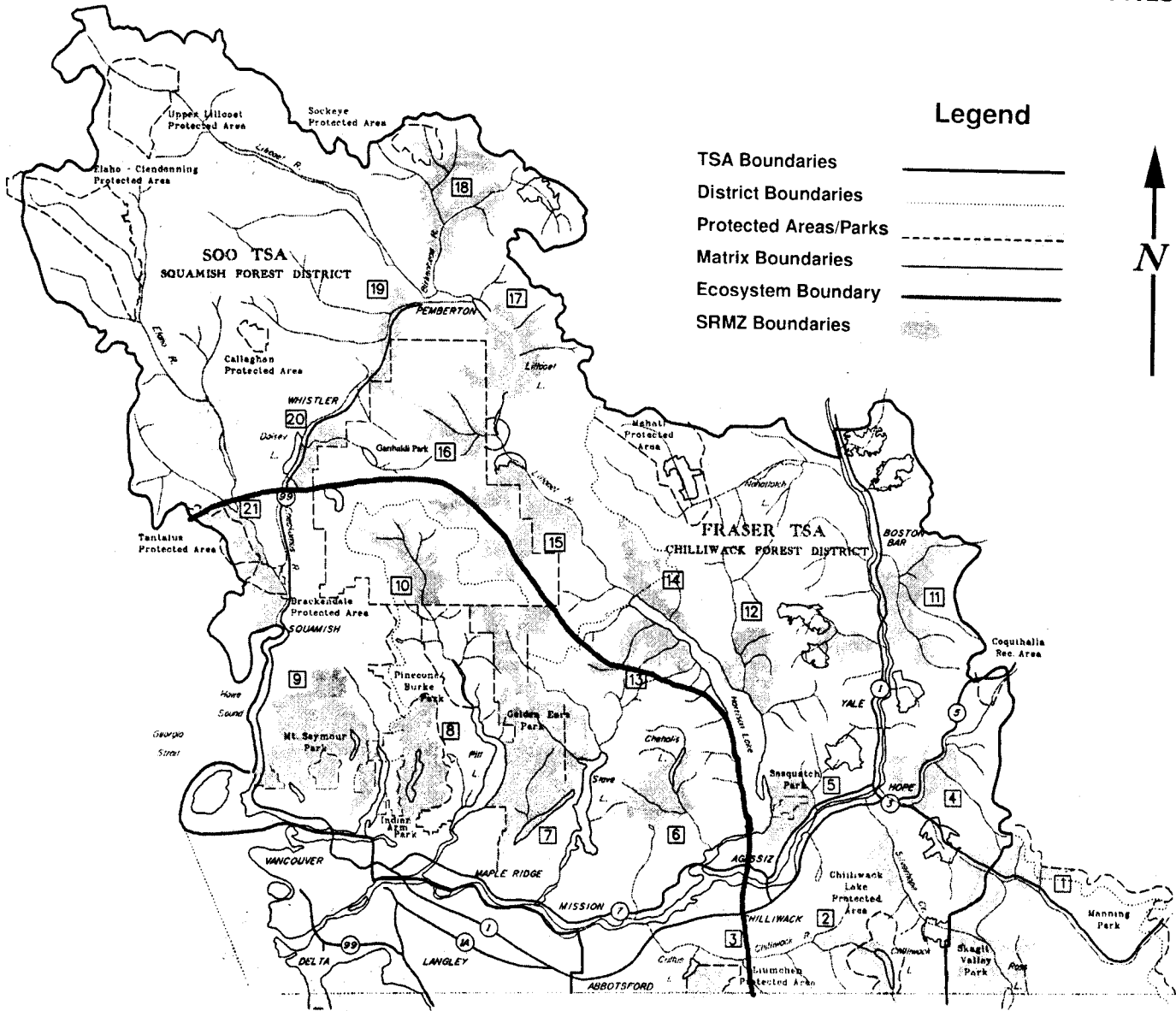


Figure B2. Approximate boundary between the coastal and interior ecosystem types.

variability in sizes, the median annual home range was used for each physiographic province to reduce the effects of atypically large or small values. Within each annual home range, the median amount of suitable habitat also was used since this total may be a good indicator of the amount of habitat needed to sustain a pair of owls (Thomas *et al.* 1990).

Table B1. *Suitable spotted owl habitat classifications*

The following suitable owl habitat definitions for the wetter and dryer ecosystems in British Columbia are based on Hanson *et al.* (1993) definitions for the western and eastern Cascade physiographic provinces in Washington State and have been applied to represent wetter maritime and dryer sub-maritime ecosystems. In considering these descriptions, caution should be used as descriptions of suitable habitat may change as data in British Columbia are gathered.

Wetter Maritime Ecosystems:
(Approximates wetter maritime coastal western hemlock and windward mountain hemlock biogeoclimatic zones)

Type A Suitable Habitat:

Superior, old-growth forest habitat that has the following characteristics:

- Multi-layered, multi-species canopy dominated by large (>76 cm dbh) overstorey trees (typically 37 to 185 stems/ha);
- Moderate to high (60–80%) canopy closure;
- High incidence of large trees with various deformities (e.g., large cavities, broken tops, dwarf mistletoe infections);
- Numerous large (>76 cm dbh) snags (typically >5 stems/ha); and
- Large accumulations of fallen trees and other woody debris on the ground.

Type B Suitable Habitat:

Mature forest habitat that has the following characteristics:

- Few canopy layers, multi-species canopy dominated by large (>51 cm dbh) overstorey trees (typically 247–457 stems/ha, although densities as low as 86 stems/ha are possible where large diameter trees are present);
- Moderate to high (60–80%) canopy closure;
- Some large trees with various deformities (e.g., large cavities, broken tops, dwarf mistletoe infections);
- Large (>51 cm dbh) snags present; and
- Accumulations of fallen trees and other woody debris on the ground.

Type C Suitable Habitat:

Marginal habitat quality, usually younger stands with some old-growth/mature components and/or structural characteristics. Type C suitable habitat is defined on the basis of use by spotted owls.

- Type C suitable habitat includes "atypical" habitat documented to be used by spotted owls. Generally, such habitat results from fire or windthrow. Fire and windthrow often result in patchy habitat, with remnants of old-growth/mature forest interspersed among younger stands and/or old-growth/mature structural components are retained.
- Type C suitable habitat may also include partially harvested stands that have had less than 40% volume removed and still contain the structural components important to spotted owl (multi-layered canopies; multi-species composition; moderate to high canopy closure; some large trees; snags; down woody debris; large trees with cavities, broken tops, dwarf mistletoe infections, and other evidence of decadence).

Dryer Submaritime Ecosystems:
(Approximates the interior Douglas-fir and dryer maritime coastal western hemlock biogeoclimatic zones)

Type A Suitable Habitat:

Generally, these stands consist of amabilis fir, grand fir, Douglas-fir, and ponderosa pine forests that have not been logged. Stands are typically old-growth and mature forest habitat that has the following characteristics:

- Multi-layered, multi-species canopy dominated by large (>51 cm dbh) overstorey trees (typically 173–247 stems/ha, although tree densities as low as 86 stems/ha are possible where large diameter trees are present)
- Moderate to high (60–85%) canopy closure;
- Some large trees with various deformities (e.g., large cavities, broken tops, dwarf mistletoe infections);
- Large (>51 cm dbh) snags present (typically >7 stems/ha); and
- Accumulations of large (>51 cm dbh) fallen trees and other woody debris on the ground.

Type B Suitable Habitat:

Generally these stands consist of amabilis fir, Douglas-fir and ponderosa pine forest stands that are typically mature forest habitat that has naturally regenerated following fire or windthrow and has the following characteristics:

- Multi-layered, multi-species canopy dominated by overstorey trees approximately >30 dbh. Stands must contain >20% fir (Douglas-fir, grand fir) and/or hemlock in the overstorey to be considered Type B suitable habitat;
- Approximately >50% canopy closure;
- Dominant live trees with various deformities (e.g., large cavities, broken tops, dwarf mistletoe infections); and
- Snags and down logs, at least some of which are of similar dbh to dominant live trees.

Type C Suitable Habitat:

Type C suitable habitat is defined on the basis of use by spotted owls. These are usually younger stands occurring at low- to mid-elevation where some old-growth/mature components and/or structural characteristics are present. This habitat often appears as a mosaic of relatively small, older stands scattered among and within younger stands. Type C habitat also includes areas of historic high-grade logging and partial entry. Type C suitable habitat may include:

- Historic selectively harvested stands that have had less than 40% volume removed and still contain the structural components important to spotted owls (multi-layered canopies, multi-species composition, moderate to high canopy closure [>40%], some large trees, snags, down woody debris, and evidence of decadence and/or deformities).
 - Stands that have most of the characteristics of Type A or B habitat, but grow on rocky or poor soils resulting in highly variable canopy closure. This habitat appears as clumps or pockets of stands with high canopy closure in a patchwork distribution.
 - Multi-layered stands that have most of the characteristics of Type A and B habitat, but are dominated by ponderosa pine, with as little as 10% of the overstorey comprised of Douglas-fir.
-

Table B2. *Median annual home range sizes and median levels of suitable owl habitat found from radio-telemetry studies from Washington State*

Physiographic range	Median annual home range size (ha) ^a	Median superior suitable owl habitat	Total suitable owl habitat
Western Cascade	3321	1451 ha (44%)	2739 ha (82%)
Eastern Cascade	2675	1315 ha (49%)	1908 ha (71%)

^a Minimum convex polygon home range estimates for pairs that were judged to have sufficient year-round location data.

The size of an owl's home range probably is dependent on many factors (e.g., food availability, interspecific competition, amount and arrangement of suitable owl habitat in the landscape) (USDI 1992). For example, home range size increased when the amount and quality of suitable habitat within the home range decreased (Carey 1985, Forsman *et al.* 1984, Thraillkill and Meslow 1990). Conversely, pairs with the smallest annual home ranges were generally found in areas where the remaining suitable owl habitats were contiguous.

Several considerations should be applied when interpreting the median annual home range estimates. First, the small sample size and associated large variability suggest that the precision and accuracy of the results may be biased and should be viewed cautiously. Second, these figures were made from a spotted owl population that is declining, not a stable owl population. The primary reason that spotted owls are in decline is loss of suitable habitat. Therefore, a stable, non-declining spotted owl population may require more suitable habitat than is currently available. Third, telemetry studies in the United States have shown an increasing trend in annual home range size as one moves northward (Thomas *et al.* 1990). If this trend extends into British Columbia, the annual spotted owl home range in the province may be larger than those found in Washington.

It is uncertain how much habitat loss and fragmentation within the landscape can be tolerated by spotted owls, or whether this tolerance varies with location, quality of habitat and length of time since harvesting. Several studies have attempted to determine the amount of suitable owl habitat required to maintain a pair of spotted owls. Bart and Forsman (1990) observed that levels of suitable owl habitat below 40% within the landscape resulted in the elimination of spotted owls. Conversely, the researchers reported that increasing the amount of suitable owl habitat within the landscape increases the number of owls per square mile, pairs of owls per square mile, young per square mile and young per pair. Ripple *et al.* (1991) observed an average of 65% suitable owl habitat within the landscape (3500 ha) around owl nest sites in Oregon. Given the uncertainty of the long-term viability of these owl

sites, Ripple *et al.* (1991) suggested a conservative management plan that provides a minimum 74% suitable owl habitat within the landscape around nest sites (3.4 km radius). In Washington State, Hanson *et al.* (1993) reported medians of 82% and 71% suitable owl habitat within median home ranges of spotted owls located in the western Cascade and eastern Cascade physiographic provinces, respectively.

Food Habits

Although spotted owls prey on a variety of species (e.g., mammals, birds and insects), small mammals predominate their diet, particularly those which are nocturnal and arboreal or semi-arboreal (Thomas *et al.* 1990, USDI 1991, Carey 1992). In general, spotted owls prey largely upon flying squirrels from British Columbia to central Oregon (Thomas *et al.* 1990). In southwestern Oregon and northwestern California, there is an increasing shift towards woodrats and voles, particularly the red tree vole (*Arborimus longicaudus*) (Thomas *et al.* 1990). This trend towards woodrats may also occur in British Columbia where owls tend to occupy dryer subarctic ecosystems.

The availability of prey is an important factor in understanding the habitat requirements of the spotted owl. In Washington, flying squirrels reach their highest densities in old-growth forests; they are more than twice as abundant than other forest types (Carey 1992). A density estimate of 0.21 ± 0.09 individuals/hectare was observed by Carey (1992) in the northern Washington Cascades. Furthermore, Carey *et al.* (1992) reported that spotted owls may depress flying squirrel numbers by up to 50% within a given area. Clearly, in order to find enough to eat and avoid eliminating flying squirrels from the forest, spotted owls must use large areas to forage.

Population Trend

Limited life history information exists for spotted owls in British Columbia. In recent years, spotted owl pairs were recorded at 25 of 39 active sites, and breeding was confirmed nine times. Persistence of owls at known locations indicates that spotted owls are a regular resident species in British Columbia. No information is available for British Columbia concerning other aspects of demography, including juvenile and adult survivorship, nesting-attempt and nesting-success rates, dispersal rates, or site-colonization rates.

From studies in the United States, spotted owls are considered monogamous and are capable of reproducing annually but there is considerable year-to-year, geographic region-to-region and pair-to-pair variation. Forsman *et al.* (1984) determined that an average of 62% of pairs attempt to breed in any given year (range of 16–89%). Nesting success within a population is also highly variable (range of 0 to 100%) (USDI 1992).

Spotted owls die from a variety of causes including predation by other animals, accidents and starvation (USDI 1992). Adult spotted owls' annual survival rates are very high with an 81 to 96% chance of living from one year to the next (Barrowclough and Coats 1985, Lande 1985, Franklin *et al.* 1990, Thomas *et al.* 1990). Subadult owls have lower survival rates with a 71 to 92% chance of living to their next year (Noon and Biles 1990, Thomas *et al.* 1990). Compared to adult owls, juvenile survival rates are relatively low with a 15 to 29% chance of surviving their first year (Thomas *et al.* 1990). The dangers of dispersal and the consequences of inexperience (e.g., poor hunting skills, lack of familiarity with a territory) likely leads to higher juvenile mortality rates.

Juvenile spotted owls undergo dispersal behaviour from their natal areas in the fall. Studies in the United States have shown that the direction of dispersal is random and the distances travelled during their first year ranged between 14 and 48 km (Gutiérrez *et al.* 1985, Miller 1989). Estimated dispersal distances from banded birds that established territories averaged about 6.5 km for juvenile males and 19 km for juvenile females (Gutiérrez *et al.* in prep).

The status of the spotted owl population is difficult to estimate given the longevity of adult owls, and because many adult and subadult birds are probably non-territorial and difficult to tally. These floaters may wait for several years for a territory to become available before they pair and reproduce. If a population is declining, the number of territorial birds is likely to remain nearly constant as long as floaters remain because territorial birds that die are replaced rapidly from the pool of floaters. Since territorial birds are the only portion of the population that can be effectively monitored, trends of this portion of the population may not necessarily provide an accurate estimate of trend of the overall population (USDI 1992).

Mathematical models have been used to project population trends using estimates of the vital survivorship rates described earlier (Marcot and Holthausen 1987, USDA 1988, Doak 1989, Lande 1988, Noon and Biles 1990, Thomas *et al.* 1990, Lutz 1992, Lamberson *et al.* in press, Lahaye *et al.* in press). Calculations of finite population growth rate (λ) from data collected between 1985 to 1991 indicated that all five separate populations studied declined by an average of 10%. Although some biases exist in these projections, these estimates supported the widely held belief that populations of spotted owls were declining throughout all or most of their range in North America (Thomas *et al.* 1990, USDI 1992).

No demographic studies or population trends have been conducted in British Columbia to determine population trends. Given the comparatively smaller and more widely distributed population and the current rate of habitat alteration in the province, it appears likely that similar population trends exist in British Columbia.

Threats to the Northern Spotted Owl

Habitat availability

Loss of suitable owl habitat is believed to be the single greatest threat to the spotted owl population in North America (Barrows 1981, Gutierrez 1985, Forsman *et al.* 1987, US Fish Wildl. Serv. 1989). Throughout much of the range of the spotted owl, suitable owl habitat is highly fragmented resulting in decreased owl productivity, decreased dispersal success, and increased mortality (USDI 1992). Approximately 3000 ha of suitable habitat is harvested each year within the range of the owl in British Columbia. As a result, individual pairs are becoming more isolated with the continued loss of suitable habitats. This will likely accelerate population declines, reduce management options, or may cause the extirpation of the bird from regions of its current range.

The land area within the range of the owl is divided into parks, private lands and provincial Crown forests. At present, the range of the spotted owl does not overlap with the Canadian National Parks system. The current provincial and regional parks system provides, or eventually will provide, 156 717 hectares of potential suitable owl habitat conditions that are protected from future timber extractions. Most of this habitat occurs in two geographic areas with 71% occurring within Golden Ears, Garibaldi and Mount Judge Howay parks, and 24% occurring within Manning, Skagit and Cascade parks. Unfortunately, these protected areas are poorly linked with a linear distance of approximately 85 km between them. Successful dispersal between these two areas is probably unlikely. The addition of protected areas through the Protected Areas Strategy process has reduced this distance, and provides a better connection between these two areas.

Random environmental events

It is generally accepted that small populations are vulnerable to extinction through random environmental or demographic events (Gilpin and Soulé 1986). Consecutive years of poor reproduction or high adult mortality, as well as catastrophic events such as wildfires, storms and other natural events, can result in quick extirpations of small populations. Because wildlife managers cannot control these events, the only recourse is to provide for populations large enough to withstand these effects, and close enough together to facilitate recolonization if and when extirpations occur (Soulé 1987). Theoretical studies support the generalization that small, fragmented populations are at a greater risk than large, continuous populations (Noon and Biles 1990, Doak 1989). Existing data are inadequate to state with any certainty how many spotted owls are "enough" to overcome the risk of extinction through random demographic or environmental events.

Island effects on isolated sub-populations

Northern spotted owls are increasingly concentrated within islands of suitable habitat surrounded by a sea of human-modified landscapes. Dispersal is a key ingredient for continued viability of these sub-populations because animals dispersing between them may buttress existing sub-populations, provide a rescue effect for sub-populations that are declining, or provide seed for recolonization. Various factors including required dispersal distances between sub-populations, the total quantity of suitable habitat within the dispersal range, and the proportion of habitat likely to be searched by a dispersing owl before either establishing a territory or dying, may exert a radical influence on survivorship of these isolated sub-populations.

Genetic variability

Genetic conservation is an integral part of endangered species management (Hoffman and Parsons 1991). Insularization effects of isolated populations increase with increased habitat fragmentation (Wilcove *et al.* 1986), resulting in localized reduced genetic variance (Grumbine 1992). Theory suggests this reduced variability can be a consequence of founder effects, increased incidence of inbreeding and/or genetic drift. Isolated populations may have a greater incidence of deleterious recessive characteristics, reduced adaptability to environmental change, and/or higher susceptibility to disease. Ralls *et al.* (1986) argue that inbreeding is largely theoretical and undocumented; they suggest that if an individual's mating opportunity is only with a close relative, they will either disperse or not mate at all. Regardless of the theory employed, the effective overall reproductive population size is reduced.

Relative to the distribution of the species, the entire British Columbia spotted owl population could be considered a peripheral population. Peripheral populations are thought to play a crucial role in the long-term survival and evolution of a species. Peripheral populations have a high adaptive significance to the species as a whole, and maintaining the spotted owl on the edge of its range is one of the best ways to conserve the genetic diversity of a species. Southern counterparts of the spotted owl population may be closely adapted to their habitats and lack the ability to adapt to a rapidly changing environment. Inhabiting a climatically harsher and less predictable environment, the genetic make-up of the British Columbia population may be better suited for adaptation. For these reasons, the northern range of the spotted owl may play a critical role in the future survival of the species in North America.

Competition with barred owls

The conservation of spotted owls may be complicated by the recent expansion of northern barred owls into the Pacific Northwest (Campbell *et al.* 1990, Taylor and Forsman 1976, Grant 1966). First recorded

within British Columbia in 1943 (Munro and Cowan 1947), the species now overlaps the range of spotted owls in most portions of the Pacific Northwest (Hamer *et al.* 1989), and is at least four times greater in abundance within the range of spotted owls in British Columbia.

Hamer *et al.* (1989) were successful in documenting divergent life-history characteristics of barred and spotted owls in the Mount Baker region in Washington. Their analysis indicated that barred owls are more flexible in choice of prey, exhibit much smaller annual home range sizes (barred owl HR = 205–1356 hectares; spotted owl HR = 988–7261 hectares), forage less often in older forests, and may utilize a greater range of nest cavity sizes.

Spotted owls and barred owls appear to be somewhat spatially segregated. Although both species have been observed at various elevations, barred owls tend to occupy low elevational habitats that contain young forests with some riparian and hardwood components (Hamer *et al.* 1989, Dunbar *et al.* 1991, Blackburn *et al.* in prep.). Spotted owls tend to occupy mid to high elevations where contiguous, old-growth conifer forests still remain. In general, these lower elevational areas have been harvested within the last 100 years and currently may provide only marginal habitats for spotted owls. As the young forests become more suitable for spotted owls, it is uncertain whether spotted owls will re-occupy these low elevation habitats and displace barred owls.

The barred owl's preference for younger forests is not entirely clear. Hamer *et al.* (1989) suggest that young forests provide higher abundances and/or diversity of prey items, and ideal foraging habitat for barred owls. They observed that prey selection appears to be partially segregated between the two species, with barred owls largely consuming terrestrial prey items and spotted owls largely consuming arboreal and semi-arboreal prey items. Young forests selected by barred owls exhibit a moderate to high density of trees, high canopy closure, and few shrubs or forbs in the understory (Hamer *et al.* 1989). The lack of brush make it easy for barred owls to observe, fly and attack terrestrial prey. Furthermore, the shorter canopy height of young forests enables barred owls to perch closer to the ground and provides a better advantage while hunting terrestrial prey (Hamer *et al.* 1989). Conversely, spotted owls specialize in flying squirrels, an arboreal species that is at least twice as abundant in old-growth forests than in other types of forests (Carey 1992). Old-growth forests provide perching structures at various heights within the canopy that may provide advantages when hunting arboreal and semi-arboreal prey.

Blackburn (1991) speculated that as old-growth forests become increasingly fragmented and/or smaller in area, the habitat remains suitable for barred owls but becomes less suitable for spotted owls. Given the spotted owl's considerably larger home range size and habitat requirement, the gradual loss of habitat should affect spotted owls before

it affects barred owls. As spotted owls are displaced, habitat would become available for colonization by additional barred owls. In British Columbia, no known spotted owl has been displaced from an area where no timber harvesting has occurred. Furthermore, clearcuts and edges caused by fragmentation may provide high abundances and diversity of terrestrial prey items used by barred owls.

The competitive exclusion principle suggests that the barred owl may drive the spotted owls towards extinction. If this is true, the spotted owl population should show signs of the barred owl effect. However, spotted owls still occupy most large stands of old-growth forests. The continued persistence of spotted owls in British Columbia, despite 30 to 40 years of barred owl occupancy, suggests that spotted owl may be able to persist for long periods of time despite relatively high densities of barred owls (E. Forsman, pers. comm.). Furthermore, it is suspected that as young forests begin to develop old-growth forest characteristics, the habitat will become less acceptable to barred owl, and more acceptable to spotted owls (D. Johnson, pers. comm.; D. Hays, pers. comm.). Or alternatively, British Columbia spotted owls have been in contact with barred owls longer than those in the United States and may have adapted to coexist. If so, this could also increase the importance of British Columbia spotted owls to the long-term survival of the species.

Predation

Key avian predators on the spotted owl include the great horned owl (*Bubo virginianus*), goshawk (*Accipiter gentilis*), and red-tailed hawks (*Buteo jamaicensis*). The common raven (*Corvus corax*) also is considered a predator, more likely preying on juveniles than adult spotted owls.

The great horned owl is the most commonly documented predator of the spotted owl (Miller 1989). Great horned owls are abundant through much of the range of the spotted owl in North America, however, the severity of this threat is difficult to measure. Relative densities of the two species in undisturbed landscapes are unknown, but ratios of great horned owl density to spotted owl density are known to be highest in more fragmented portions of the owl's range. Johnson (1993) found that great horned owls occupied areas that contained significantly less mature/old-growth forest and interior habitat; had greater edge to area ratios; had more shrub/forb, sapling, and shelterwood stands; and were more fragmented than those occupied by spotted owls.

APPENDIX C: DESCRIPTION OF SPOTTED OWL MANAGEMENT AND FOREST MANAGEMENT OBJECTIVES

Spotted Owl Management Objectives

The primary spotted owl management objective is to provide a reasonable probability that the spotted owl population will stabilize, and possibly improve its status, over the long term in the Chilliwack and Squamish forest districts. This will be achieved largely by maintaining a minimum 67% of the gross forested land as suitable owl habitat in each spotted owl activity centre within SRMZs. However, the quality and distribution of this suitable owl habitat within each spotted owl activity centre will influence the probability that the spotted owl population will stabilize.

Distribution of suitable owl habitat

Increasing forest fragmentation or reducing habitat connectivity is associated with lower owl productivity, lower juvenile dispersal success, increasing competition with other species, increasing predation by predators, and may result in an increasing susceptibility of the forest stand to natural disturbance (i.e., blowdown). Therefore, to increase the likelihood of owl survival and productivity, the distribution of suitable owl habitat within each spotted owl activity centre:

- should maintain large patches greater than 500 hectares of suitable owl habitat.

During the breeding season, spotted owls generally forage within a minimum 500 hectares of suitable owl habitat found adjacent to the nest. The more fragmented the forests are adjacent to the nest, the greater the distance the adults must travel to find sufficient numbers of prey and the greater the risk of predation. Although nest selection by spotted owls is random, maintaining several large patches greater than 500 hectares in each spotted owl activity centre should provide areas ideal for nesting. As a result, this may increase the productivity of nesting owls, and increase the probability of stabilizing the owl population.

- should maintain corridors of suitable owl habitat greater than 1 km wide between these large patches.

Spotted owls may be considered interior forest species and generally avoid traveling through large open areas to access suitable habitats. Instead, owls generally fly around these open areas within and underneath a forest canopy. It is believed that spotted owls avoid these open areas to reduce the risk of predation by great-horned owls

and other predators that use these forest edge habitats. Although spotted owls will travel through corridors of suitable habitat that are less than 1 km wide, the use of these areas for travel or foraging may increase the risk of predation. Therefore, maintaining corridors greater than 1 km wide should minimize the risk of predation, and provide interior forest conditions that are safe for traveling and foraging by the owl.

Quality of suitable owl habitat

The quality of suitable owl habitat ranges from superior to poor, with superior habitats providing for all of the needs of the owl and poor habitats generally only providing for dispersal. Superior owl habitats are strongly selected for by spotted owls in greater proportion than their availability in the landscape, and support higher densities of prey, nests and roost structures than lesser quality habitats. Low levels of superior suitable habitats may reduce adult survival and productivity. Therefore, to increase the likelihood of owl survival and productivity, the quality of suitable owl habitat within each spotted owl activity centre:

- should maintain a minimum target of 50% of the gross forested land as superior suitable owl habitat.

Studies in Washington State have indicated that about 50% of the forested area within activity centres are comprised of superior suitable habitat. For the most part, the superior suitable habitat target in British Columbia will be achieved through existing protected areas and other heavily constrained forests such as inoperable forests, riparian management areas, biodiversity requirements, environmentally sensitive areas and other forests managed over long rotations. In addition, a key component of this management plan is to accelerate the development of superior suitable habitats through intensive silviculture and harvesting techniques.

Protection of spotted owl nests

Spotted owls do not create their nests, but rely on pre-formed structures such as cavities, platforms or other raptor nests. Nest tree selection is random and may change from year to year, and owl to owl. In general, spotted owls use the same nest for the duration of their life. In non-reproductive years, spotted owls may still use the nesting area as a roosting area. The loss of the nesting area may reduce the productivity of the resident owls as other possibly less protected nest sites (i.e., from climate, predators) may be used. Therefore, to ensure that adequate protection is given to known spotted owl nest sites and critical roost sites:

- a minimum 500-m radius reserve zone should be maintained around known nest sites and critical roost sites.

The reserve zone should reduce the amount of exposed forest edge and forest fragmentation. As a result, this should reduce the risk of predation on juvenile owls and the susceptibility of the nest tree falling down due to strong winds. The reserve zone may be removed provided that a minimum two-year monitoring of the zone indicates the area is no longer used for nesting.

Forest Management Objectives

The primary forest management objective within SRMZs is to optimize the removal of timber resources without jeopardizing the long-term survival of the spotted owl. This will be achieved by maintaining a minimum 67% of the gross forested land as suitable owl habitat in each spotted owl activity centre within SRMZs while providing opportunities for silvicultural and harvesting systems to create, enhance and maintain owl habitat. However, several requirements under the *Forest Practices Code of British Columbia Act* hinder the spotted owl management objectives and, if implemented within SRMZs, will reduce the probability of stabilizing the owl population.

Minimize forest fragmentation

Under the *Forest Practices Code of British Columbia Act*, the maximum cut block size (40 hectares) and green-up adjacency rules may result in a landscape that is fragmented and less suitable for spotted owls. This may reduce the probability of stabilizing the spotted owl population.

Therefore, to minimize forest fragmentation and maintain large patches of suitable owl habitat, the management plan will:

- relax the 40-hectare cutblock requirement (Operational Planning Regulation part 3.21).
- relax the green-up requirements of adjacent blocks (Operational Planning Regulation part 3.23).

Relaxing these landscape-level requirements will allow for the creation of large cut blocks and the maintenance of large patches of suitable owl habitat greater than 500 hectares and corridors of suitable owl habitat greater than 1 km wide. Achieving these spotted owl management objectives should increase the probability of stabilizing the owl population.

Silvicultural and harvesting systems to create, enhance and maintain suitable owl habitat

Spotted owls require specific forest stand attributes to provide suitable habitats for foraging, roosting, nesting and movement. These attributes have been found primarily in old-growth forests, but occasionally occur in younger forests that exhibit old-growth forest like conditions that were created from earlier disturbances (e.g., fire, wind, selective logging)

that left behind large trees, snags and downed logs. The maintenance and creation of these structural attributes, typical of old-growth forests, in younger forests may lead to greater use by spotted owls.

A goal of the Spotted Owl Management Plan is to achieve suitable owl habitat at an earlier age than through natural succession (i.e., 120 years). This will require both intensive silviculture and partial harvesting of young and mature forests, as well as the structural retention of forest attributes at the time of final harvest. However, conventional silvicultural and harvesting systems that optimize tree volume growth produce forest structures that are generally uniform with limited complexity. These habitats generally are not used by spotted owls. Therefore, to ensure that habitats are suitable for owls:

- innovative alternate silvicultural and harvesting systems will be encouraged to create, enhance and maintain suitable owl habitat.

Innovative alternate systems will be required to create the desirable stand attributes. For example, commercial thinning to create spotted owl habitat generally will remove greater volumes and leave behind greater structural diversity (e.g., deformed trees, snags, deciduous trees) than conventional thinning systems. The greater volume removal is required to provide sufficient amounts of light to the forest floor to stimulate vegetative growth. To maintain sufficient levels of light reaching the forest floor, several commercial thinning operations within the same forest stand may be required. As a result, the structural complexity required by the spotted owl should be created.

Create quality suitable owl habitat

Superior owl habitats are strongly selected for by spotted owls in greater proportion than their availability in the landscape, and support higher densities of prey, nests and roost structures than lesser quality habitats. Lesser quality suitable habitat is not selected for by the owl, but may be used to supplement the habitat requirements of the owl when limited amounts of superior habitat exists in the landscape. In general, superior habitat is associated with older forests that have naturally developed the structural complexity required by the owl.

Most superior suitable habitat will be obtained through existing protected areas and other heavily constrained forests such as inoperable forests, riparian management areas, biodiversity requirements, environmentally sensitive areas and other forests managed over long rotations. In addition, non-constrained forests will be managed to accelerate the development of suitable habitats through intensive silviculture and harvesting techniques. It is expected that intensively managed forests will, on average, attain suitable owl habitat conditions at 100 years of age (likely range between 80 and 120 years). However, superior suitable habitat will likely not be achieved for many years thereafter.

Unfortunately, the techniques to create suitable habitat are still experimental and may require many years of monitoring to determine its effectiveness and suitability. During this experimental period, it is important to ensure that the quality of suitable owl habitat is maintained. This can be achieved by:

- ranking forest developments in younger, less suitable owl habitats.

Within SRMZs, younger less suitable habitats should be ranked for forest developments where greater than 67% suitable habitat exists within activity centres. This will reduce pressures on harvesting superior owl habitat and will help maintain the 50% superior habitat target. As silviculture and harvest techniques demonstrate their effectiveness at creating superior habitat conditions, this recommendation may be eliminated.

Where less than 67% suitable habitat exists within an spotted owl activity centre, younger less suitable owl habitat should also be ranked for forest developments to create suitable owl habitat. This should accelerate the development of suitable habitat and reduce the time delay in achieving the 67% habitat requirement and allow for final harvest of mature stands within activity centres sooner.

- ranking the salvage of catastrophic damage.

Salvage of catastrophic damage in stands should occur, where removal of the damaged forest would reduce the risk of further damage to the remaining stand and maintain or improve the habitat suitability for owls. Salvage may benefit both the owl and the health of the forests by promoting the restoration of suitable owl habitat and by preventing further potential disturbance to the forests (i.e., spread of pests).

Minimize timber supply impacts

By maintaining 67% suitable owl habitat within each spotted owl activity centre, the management plan allows for up to 33% of activity centres to be clearcut harvested following the Operational Guidelines. Silviculture techniques, commercial thinning, and partial harvests that create, enhance or maintain suitable owl habitat will be allowed within the 67% suitable owl area and 33% non-suitable area. This will provide for long-term forestry employment and timber supply.

To reduce overall timber supply impacts the management plan recommends overlapping spotted owl habitat requirements with other heavily constrained features of the landbase including: inoperable forests, visual quality objectives, low productive sites, environmentally sensitive areas, Forest Practice Code requirements, other Red-/blue-listed species habitat requirements, and other regionally important wildlife habitat requirements (e.g., deer winter range).

APPENDIX D: BIOLOGICAL ANALYSIS

The Spotted Owl Management Plan was developed with a goal of providing the species with a reasonable probability that the population would stabilize, and possibly improve, over the long term. Population stability is not simply achieved by maintaining current levels of habitat or population size, but involves many factors that include: survival, productivity and mortality rates; habitat availability and suitability; and interactions among other individuals within the population. The only effective method to determine population stability requires long-term monitoring of the species throughout its range.

This biological analysis attempts to estimate the probability of stabilizing, and possibly improving, the owl population under the Spotted Owl Management Plan. This will be achieved, in part, by comparing the management plan to Management Option H proposed by the Spotted Owl Recovery Team in *Management Options for the Northern Spotted Owl in British Columbia*. The management plan and Option H are similar in that they both maintain a minimum 67% suitable owl habitat within large areas capable of supporting multiple breeding pairs of spotted owls. An independent Biological Analysis Team assessed Option H as providing a 61% chance of improving the status of the owl in the province over the next 100 years. Since an independent biological assessment was not performed for the management plan, the following provides a comparison of the management plan with Option H.

The Spotted Owl Recovery Team's report identified three independent biological parameters that, when combined, formulated an option to manage the spotted owl. This included: managed range of the spotted owl, configuration of managed owl areas, and forest management within owl areas. Within these parameters falls six principles of population conservation biology that are essential for achieving the long-term stabilization of the spotted owl population. The following assessment of the management plan considers these three parameters and the five principles of population conservation ecology.

Managed Range of the Spotted Owl

Principle: Spotted owls that are well distributed across their range are less prone to extinction than if spotted owls were confined to smaller portions of their range.

Maintaining the owl across the overall range of environments occupied by the species results in a population that is less vulnerable to random environmental events. For example, habitats at different elevations, in different forest types, and in different parts of the owl's geographic range

may act as refugia for the species in the face of adverse weather conditions, rapid environmental change, natural disturbances (e.g., forest diseases, insect infestation, forest fire), or other unforeseen changes that may eliminate owl occurrence from a specific geographic or ecological area. A population well distributed across the geographic and ecological conditions throughout its range provides a high likelihood that the species will survive such catastrophic events, and reduces the risk that the species becomes extinct.

The Spotted Owl Recovery Team identified the documented range of the species to include all confirmed historic and current (pre-1995) records of the species. Within the Chilliwack and Squamish forest districts, both Option H and the management plan maintain the spotted owl throughout the documented range. However, the management plan delays the decision on the long-term management of spotted owls in the historic portion (Squamish and Whistler corridor) of its range. Although spotted owl occurrence in this area is currently unknown, long-term management in this areas is designed to provide an opportunity to restore the owl population and to provide for one of two important north-south corridors to facilitate owl movement between populations near Pemberton and the north shore mountains. Therefore, in comparison to Option H, the elimination of owl management in the historic portion of its range would reduce the probability of population stabilization.

Recent inventories (post 1994) have detected spotted owls further north of this documented range. To accommodate this new information, the management plan provides additional long-term protection for some spotted owl habitat found outside the documented range within the Chilliwack and Squamish forest districts. As a result, this increases the representation of interior Douglas-fir ecosystem, and allows for better population connectivity with spotted owls found further north of the Chilliwack and Squamish forest districts. Although Option H also allows for the managed range to increase in response to new inventory information, the independent biological analysis team likely did not consider this in their assessment of the option as the information was unavailable. Therefore, in comparison to the assessment of Option H, the larger managed range in the management plan will increase the probability of population stabilization in the province.

Configuration of Managed Owl Areas

Principle: Large blocks of habitat containing multiple breeding pairs of spotted owls are superior to small habitat blocks containing only one breeding pair.

Spotted owl populations located in large habitat blocks have much higher persistence rates, or better chances of sustaining themselves for many generations, than smaller isolated groups of breeding owl pairs. Large habitat blocks also provide available habitat for maintaining juveniles and non-territorial owls, which in turn, will help maintain the breeding population by reducing the lag time for the replacement of vacant owl territories. Large habitat blocks also are less susceptible to complete elimination from natural and human disturbances than smaller blocks, and the high perimeter-to-area ratio associated with smaller habitat blocks may increase competition and predation by other species. Increasing the size and reducing the amount of forest edge around the habitat block improves the likelihood of stabilizing the owl population.

Principle: Blocks of habitat that are located close together are better than blocks located far apart.

Dispersal of spotted owls between habitat blocks is essential to support existing sub-populations,² rescue sub-populations that are declining in numbers, or re-establish vacant habitat blocks. As well, dispersal maintains genetic variability within a population, which improves the resistance to disease, adaptability to environmental changes, and suppression of deleterious genetic traits. Reducing the distance a spotted owl has to move between one habitat block to another block improves the likelihood of successful dispersal, and the stabilization of the owl population.

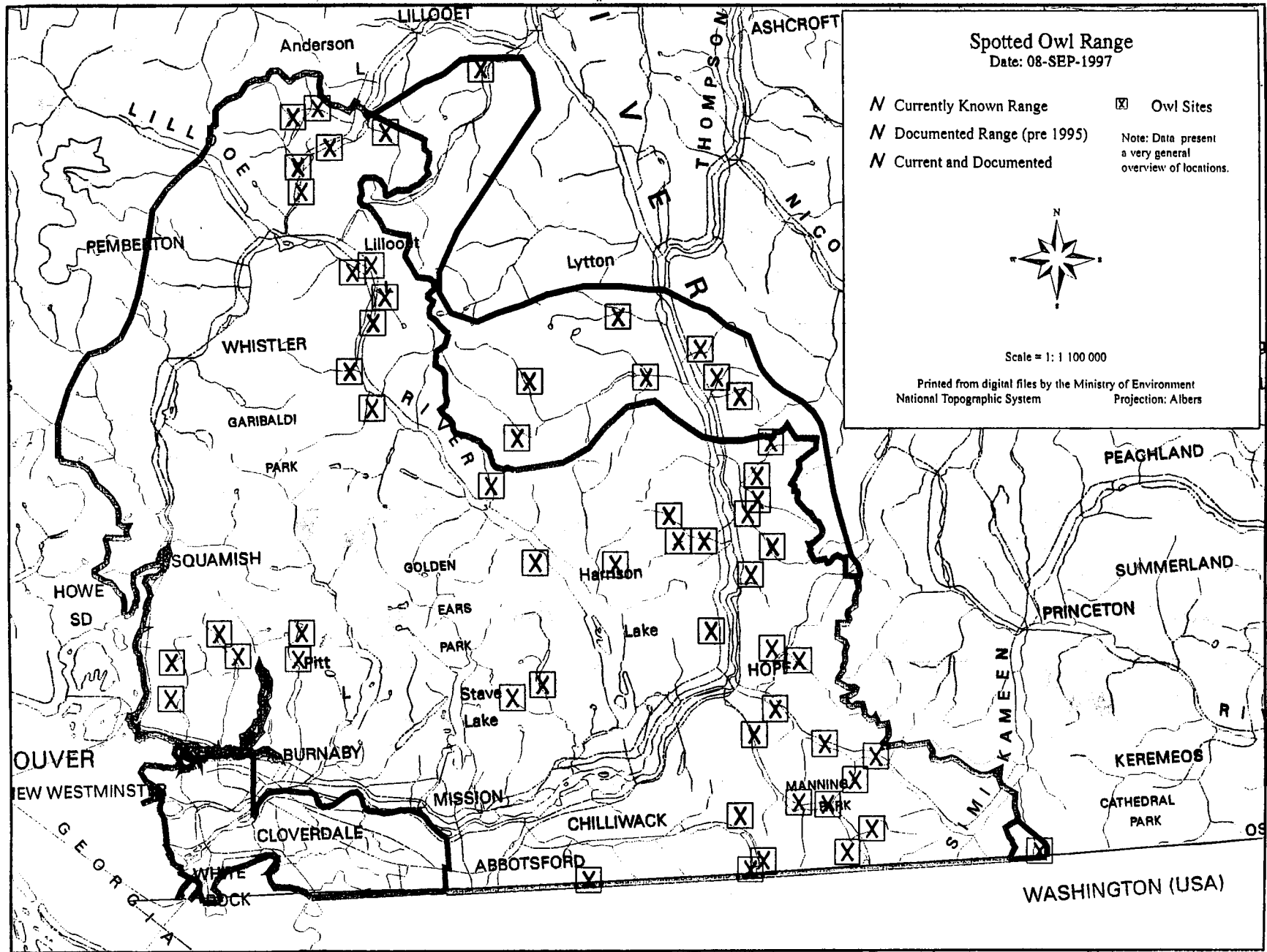
Special resource management zones and protected areas within the documented range

Both the management plan and Option H use a system of large blocks of forested habitat (SRMZs and Spotted Owl Conservation Areas [SOCAs] and protected areas) capable of supporting, or eventually supporting, multiple breeding pairs of spotted owls. These blocks are distributed across the documented range (pre-1995) to provide opportunities for successful owl dispersal from one block to another.

Under the terms of reference, SOCAs proposed in Option H were revised to SRMZs to improve the recovery potential of the population while reducing the overall impact on timber supply. Although the total

² Sub-populations refer to the local population of spotted owls that would occupy a SRMZ.

Figure D1. Spotted owl documented range and current known range.



gross area did not increase, the resulting SRMZs overlapped a greater number of known spotted owl activity centres, increased the percentage of gross forested area within the boundaries, increased the percentage of existing suitable owl habitat, and reduced the average dispersal distance between adjacent SRMZs. In addition, about 9500 hectares of suitable habitat within SRMZs became protected under the regional Protected Areas Strategy, and another 19 600 hectares of potential habitat became protected within the range of SRMZs. Although the Protected Areas Strategy was made known to the independent biological analysis team, the amount and distribution of new protected areas was not available for their assessment. Therefore, the independent biological analysis team did not consider the benefits of new protected area in their assessment of the Option H.

Although the new protected areas increase the likelihood of maintaining spotted owls, the distribution of protected areas still remains largely isolated and provides low probabilities that owls will successfully move from one protected area to another. As a result, this still places a large dependence of the SRMZ system to provide the population structure and connectivity between these protected areas.

In comparison to the assessment of Option H, the management plan, with its combination of SRMZs and protected areas, will improve the probability of stabilizing the spotted owl population within the range of SRMZs.

Spotted owl management outside the documented range

Outside the documented range in the Chilliwack and Squamish forest districts, spotted owls will not be managed over the long term within SRMZs, but by either protected areas and/or landscape unit biodiversity requirements under the *Forest Practices Code of British Columbia Act*. Under Option H, the management of spotted owls outside the documented range was not considered by the independent biological analysis team.

The recent protection of the Mehatl Creek in the northern periphery of the Chilliwack Forest District provides about 6600 hectares of suitable owl habitat capable of supporting between two to three breeding pairs of spotted owls (equivalent to a small SRMZ). Although this habitat is currently occupied by spotted owls, the long-term stability of the owl in the area is at risk due to the large dispersal distance along the Nahatlatch River to the nearest SRMZ (Anderson SRMZ) and due to the planned forest developments in this drainage that will reduce the amount and connectivity of dispersal habitat. This risk could be reduced with the application of intermediate or high biodiversity emphasis requirements to the Ainslie Landscape Unit located east of Mehatl Creek. However, it is uncertain whether the biodiversity requirements will be sufficient to

stabilize owl populations located within this landscape unit as it will likely result in maintaining single breeding owl pairs. Despite the possible stabilization of the owl population within the Ainslie Landscape Unit, the dispersal distance to and from the Mehatl Creek would still be large and may not result in the stabilization of owl populations in the Mehatl Creek. This risk could be further reduced with the application of intermediate or high biodiversity emphasis to the Nahatlatch Landscape Unit.

In the northern periphery of the Squamish Forest District, the Gates Landscape Unit may also receive an intermediate or high biodiversity emphasis to manage for spotted owls. Its close proximity to the Birkenhead SRMZ will improve the probability of stabilization of spotted owl population in this area.

Under the management plan, the resulting population structure in the Chilliwack and Squamish forest districts will resemble a large core area of SRMZs and protected areas, surrounded on the northern periphery by protected area (Mehatl Creek) and single activity centres managed under the biodiversity requirements of the Forest Practices Code. Although these single activity centres outside the range of SRMZs will be at a greater risk of extirpation, in comparison to the assessment of Option H, the management plan improves the probability of stabilization of the owl population in the northern portion of the owl's range in the Chilliwack and Squamish forest districts.

Forest Management within Owl Areas

Principle: Within these blocks, greater amounts of habitat that are less fragmented are better than lower amounts of habitat that are more fragmented.

Reducing the amount and connectivity of the forest (forest fragmentation) is associated with lower spotted owl densities and decreased productivity of the owl population. This may decrease juvenile dispersal success, increase competition with other species, increase predation by predators, and may result in an increased susceptibility of the forest stand to natural disturbance (i.e., blowdown).

Principle: Within these blocks, maintaining superior quality habitat is better than maintaining lesser quality habitats.

The quality of suitable owl habitat ranges from superior to poor, with superior habitats providing for all of the needs of the owl and poor habitats generally only providing for dispersal. Superior owl habitats are strongly selected for by spotted owls in greater proportion than their availability in the landscape, and support higher densities of prey, nests

and roost structures than lesser quality habitats. Although the quality of a stand is determined by its structural characteristics, the age of the stand may provide an index on when these characteristic may be established. Under natural conditions, it may take up to 120 years to develop foraging habitat and up to 200 years to create nesting (superior) habitat from a clearcut stand.

For the most part, the availability of superior owl habitat over the long term will be limited to existing protected areas and other heavily constrained forests such as inoperable forests, riparian management areas, biodiversity requirements and environmentally sensitive areas. The limited opportunity to manipulate the spatial patterns of these constrained forests could limit the availability of superior habitats within some activity centres in SRMZs. This could have a direct affect on population productivity and abundance. Two key contributors of potential superior habitat are protected areas and inoperable forests.

Protected areas

Protected areas play an integral role in spotted owl management by providing long-term protection of large contiguous forests capable of supporting spotted owls. If undisturbed by natural or human causes, these forests should achieve and/or be maintained as superior habitat. This will provide for higher densities of spotted owls and greater productivity of the owl population. Unfortunately, due to their protected status, the creation or enhancement of suitable owl habitat in protected areas after a disturbance will be largely dependent on natural regeneration. As a result, the associated time delay in the development of suitable owl habitat may hinder the management and stabilization of the owl population.

Of the 363 000 hectares of forested habitat identified in the Spotted Owl Management Plan, approximately 159 000 hectares (44%) of forest capable of providing suitable owl habitat exists within protected areas. In comparison to Option H, the management plan provides a 44% increase, due to new protected areas, in the amount of potential suitable owl habitat found within protected areas.

Special resource management zones

Both the management plan and Option H are similar in the management approach of owl areas. Both maintain a minimum of 67% suitable owl habitat over the long term, and distribute this habitat to reduce the effects of forest fragmentation. Forest management also is oriented towards the creation, enhancement and maintenance of suitable owl habitat. However, to reduce overall timber supply impacts, the management plan differs from Option H by increasing the use of heavily constrained forests and increasing the dependence of habitat enhancements to create owl habitat.

Heavily constrained forests

Inoperable forests will provide temporary, or permanent, protection of forests capable of supporting spotted owls. Similar to protected areas, these forests may achieve and be maintained as superior habitat if undisturbed by natural or human causes. These forests are defined as unavailable for harvest for terrain-related or economic reasons, areas with high recreational values, non-productive forests and areas that are environmentally sensitive. In general, the majority of inoperable forests are found at higher elevations and may be less productive in species abundance and diversity. In addition, habitats at the upper elevational range used by owls are subject to greater snow depths and persistence, and have been documented to be used significantly less for nesting sites. In addition to these potentially lesser qualities, the inoperability boundary is flexible and may change due to new harvest techniques and/or increased demand for timber.

The development of suitable owl habitat in inoperable forests will be largely dependent on natural regeneration due to its inaccessibility, terrain and sensitivity to environmental disturbances. Some habitat enhancement may be possible, but will be costly. From a management perspective, the spatial pattern and patch sizes of inoperable forests in the landscape can not be manipulated to meet all the needs for spotted owls, and the level of superior habitat will vary from spotted owl activity centre to spotted owl activity centre.

The management plan places a higher dependence on heavily constrained forests to meet the needs of the spotted owl. As a result, the management plan, in comparison to the assessment of Option H, reduces the probability of stabilization of the owl population.

Enhancement of suitable owl habitat

The management plan differs from Option H by reducing the minimum forest age considered as suitable owl habitat from 120 years down to 100 years. Spotted owls require habitat with specific forest stand attributes to provide for foraging, roosting, dispersal and nesting. In British Columbia, spotted owls have not been detected using forests younger than 120 years. A goal of the Spotted Owl Management Plan is to achieve suitable owl habitat at an earlier age than through natural succession (i.e., 120 years). This will require both intensive silviculture and partial harvesting of young and mature forests, as well as the structural retention of forest attributes at the time of final harvest. It is expected that intensively managed forests will, on average, attain suitable owl habitat conditions at 100 years of age (likely range between 80 and 120 years). This assumption is based on existing examples in the United States where younger forests used by spotted owls exhibited old-growth forest like conditions that were created from earlier disturbances (e.g., fire, wind, selective logging), which left behind large trees, snags and downed logs.

However, whether young forests can be enhanced to provide adequate foraging, roosting and possibly nesting habitat at 100 years old has not been proven scientifically. Therefore, how habitats will be modified over the short term will play a critical factor in achieving population stability. Spotted owl population trend is directly related to the level and quality of suitable owl habitat available. If, through monitoring of the owl population, these enhancement techniques are determined unsuccessful or the level of suitable owl habitat continues to decline (i.e., replacement of suitable habitat with 100-year-old non-suitable habitat), this will reduce the total amount of suitable habitat within SRMZs available to spotted owls and will reduce the probability of stabilizing the owl population. To reduce this risk, the management plan provides direction to maintain a target of 50% superior owl habitat within each spotted owl activity centre, and direction to prioritize clearcut harvest in young mature forest where greater than 67% suitable habitat exists. This should ensure that a sufficient amount of high quality habitat is maintained over the short term until techniques to enhance owl habitat are confirmed.

In comparison to the assessment of Option H, the management plan's dependence of creating suitable owl habitat earlier than through natural succession reduces the probability of stabilizing the spotted owl population. However, if these enhancement techniques are successful, the probability of owl stabilization would be comparable to the current assessment of Option H.

Spotted owl located outside SRMZs and protected areas

Spotted owl located outside SRMZs and protected areas (matrix activity centres) play a critical role in the current population structure by contributing to its overall connectivity, productivity, genetic diversity and viability. Despite all efforts to stabilize and improve habitat conditions in SRMZs over the long term, the loss of all matrix activity centres over the short term could accelerate population isolation, decline and risk of extirpation of the population from all or a significant part of its range.

The management plan and Option H both propose a phase-out of matrix activity centres. Option H proposes that matrix activity centres may phase out as suitable owl habitat and owl populations are restored in SRMZs. An assumption of the independent biological assessment team was that spotted owl habitats found inside and outside SRMZs would not be further degraded, and that the protection of spotted owls was the single least step to maintain opportunities to recover the species.

The management plan differs in that the number of matrix activity centres is capped at the levels identified in June 1995, the phase-out of these matrix activity centres must occur within a 50-year period, and in relation to the Mehatl Off-set Agreement, specific activity centres were identified for phase-out to meet licensee needs. Spotted owls found outside SRMZs after June 1995 may receive some protection through the biodiversity requirements under the *Forest Practice Code of*

British Columbia Act. Although the rate of phase-out closely resembles the rate of restoring suitable owl habitat in SRMZs, the management plan does not consider the restoration of owl populations in SRMZs. As well, there is uncertainty that new spotted owls found after June 1995 will be adequately maintained under the *Biodiversity Guidebook*. As a result, the owl population will decline over the short term and some genetic diversity may be lost. The loss of genetic diversity could hinder the species' resilience to disease and its adaptability to its environment. There is also a risk that the population may decline to levels significant enough to prevent the recovery of the species without human intervention. In comparison the assessment of Option H, the management plan reduces the probability of stabilization of the owl population.

Conclusion

The Spotted Owl Management Plan follows key principles of conservation ecology that are considered essential for the stabilization of the owl population. These include a system of large conservation areas (protected areas and SRMZs) distributed throughout the range of the spotted owl in the Chilliwack and Squamish forest districts that support, or eventually support as habitats are restored, multiple breeding pairs of spotted owls, and are distributed to provide opportunities for successful owl movement from one area to another. Forest practices within SRMZs are oriented towards creating, enhancing and maintaining 67% suitable habitat. In addition, the provisions of Forest Practice Code (Biodiversity, Riparian, Managing Identified Wildlife guidebooks) will help in managing additional spotted owl sites outside of protected areas and SRMZs, and will improve the habitat connectivity between conservation areas for owl movement.

In comparison to Option H, the management plan improves the configuration of managed owl areas within the documented range to benefit spotted owls (Table D1). However, the management plan attempts to balance spotted owl requirements with social and economic concerns, and therefore, there are some risks to the spotted owl population in the forest management practices within SRMZs and the management of spotted owls found outside SRMZs.

Despite the stabilization of habitat within these conservation areas, the spotted owl population is predicted to decline over the short term (20 to 30 years) as suitable habitats outside of these areas are harvested. Over the long term, the population is predicted to stabilize and eventually improve. The probability of owl population stabilization, and possible improvement, under this management plan is comparable to Option H at about 60%. It is important to recognize that the recovery team would only support a management plan that provided greater than a 70% chance the population would stabilize.

Table D1. Summary of biological analysis

Plan components	Spotted Owl Management Plan	SORT management Option H	Relative risk of Spotted Owl Management Plan on spotted owl population
<i>Managed range</i>	Documented (Pre-1995)	Documented (Pre-1995)	Same (No Change)
Squamish/Whistler Area	Defer management	Manage for spotted owls	Increase risk to population
Outside Documented Range in Chilliwack and Squamish FD	Manage for spotted owls	Not considered by BAT	Decrease risk to population
<i>Configuration of managed owl areas in the documented range</i>	SRMZ (Modified SOCA)	SOCAs	Decrease risk to population
<i>Configuration of managed owl areas outside the documented range</i>	Protected areas and biodiversity management	Not considered by BAT	Decrease risk to population
<i>Forest management within SRMZs</i>	67% suitable owl habitat	67% suitable owl habitat	Same (No change in distribution and forest management approach)
Distribution of superior owl habitat within SRMZs or SOCAs	Mostly constrained areas	As required for spotted owl activity centre	Increase risk to population
Creation of suitable owl habitat	Dependence of enhancements	Natural succession	Increase risk to population
<i>Matrix activity centres</i>	Capped at 8, phase out over 50 years	Maintain as required	Increase risk to population
<i>Likelihood of stabilizing population</i>	Comparable to Option H – 60% chance	BAT assessed 61% chance of improvement	

APPENDIX E: TIMBER SUPPLY AND EMPLOYMENT IMPACTS

The Spotted Owl Management Plan was developed to “provide a reasonable level of probability that owl populations would stabilize, and possibly improve, over the long term without significant short-term impacts on timber supply and forestry employment.” Under the Terms of Reference, the Spotted Owl Management Plan was not to exceed more than “an approximate 10% reduction in long-term timber supply over and above the levels set in the current Timber Supply Review.” The following describes the analytical process and the predicted timber supply and employment impacts associated with the Spotted Owl Management Plan.

Accounting for Timber Supply Impacts Due to Other Initiatives

Analyses were carried out for both the Soo and Fraser timber supply areas (TSAs) to assess the impact that the Spotted Owl Management Plan will have on the short- and long-term timber supply in these areas. In both analyses, the estimated timber supply impact of spotted owl management was measured against a “base case” that accounts for major forest management changes that have occurred since the last timber supply review completed for each of the two TSAs. These changes include new practices required by the Forest Practices Code and recent land use decisions (e.g., creation of the Pinecone Lake/Burke Mountain and Indian Arm provincial parks, riparian management zones, biodiversity requirements). By using this updated base case the timber supply analysis accounted for the many complementary overlaps between other forest management initiatives and spotted owl management (e.g., amount of owl habitat provided by the Forest Practices Code biodiversity guidelines).

Short- and Long-term Timber Supply Impacts

The short-term timber supply impacts associated with the Spotted Owl Management Plan are estimated at 3.5 to 4% for the Fraser TSA, 4.5 to 5% for the Soo TSA. Over the long term, as the second-growth forest ages and begins to provide suitable owl habitat, timber supply impacts are expected to be reduced to less than 3% in both TSAs. These timber supply impact estimates are based on the assumption that a minimum of one-third of the stands that are being maintained as suitable owl habitat would be available for partial harvesting that removes about one-third of the timber volume in the stand. Under the Operational Guidelines Component, partial harvesting will be used to create, enhance or

maintain suitable owl habitat. As a result, the timber volume removed from partial harvesting should not adversely affect the quality of the spotted owl habitat.

Timber Supply Impacts at the SRMZ level

A guiding principle for the Spotted Owl Management Plan was to limit the timber supply impact on the rate of harvest within SRMZs to no more than 10%. However, this goal could not be reconciled within the short term, but will meet the long-term requirements as stated in the terms of reference.

Due to past harvesting and natural disturbances, few SRMZs have more than 67% suitable habitat remaining. However, the preparation of draft resource management plans for some SRMZs that currently contain less than 67% suitable owl habitat actually possess individual activity centres within the SRMZs with greater than 67% suitable habitat. In this situation, opportunities for clearcut harvesting may still exist even though the SRMZs may have been below the 67% threshold. However, in general, opportunities for timber harvesting are reduced until areas of younger forests mature.

The reduction in the rate of harvest from the SRMZs, when assessing the impacts on timber supply and forestry employment, should be viewed with caution. The short-term rate of harvest at the timber supply area level is not necessarily dependent upon harvesting as much as possible from the SRMZs in the short term. Reduced opportunities for harvesting within SRMZs in the short term can be partially offset by harvesting in alternative areas outside of SRMZs. As forests in the SRMZs mature, owl habitat and some timber harvesting opportunities will be realized.

Timber Supply Impacts on Employment

Employment estimates were based on review of licensee employee information from Crane Management Consultants Ltd. report entitled *Social-economic Assessment of Northern Spotted Owl Management Options for B.C.* All information is expressed as a coefficient, person years (PY) per 1000 m³ of harvested wood, and reflect estimate of forest sector employment based on timber harvest level changes.

It is estimated that the implementation of Spotted Owl Management Plan, without any attempts to offset the impacts from the reductions that will occur, would result in the loss of 70 person years (PY) of direct forestry employment. However, opportunities exist to maintain or perhaps increase direct employment from the implementation of the management plan and the application of the Operational Guidelines Component.

The indirect/induced employment is defined as those spin-off and employment effects that result when the workers in the direct and indirect businesses spend their earnings on other goods and services.

The estimated regional employment multiplier for the forest sector is estimated at 2.2. This implies that with the total employment multiplier of 2.2 for the forest industry, there are 1.2 indirect/induced jobs attributable to 1 forest industry job.

Indirect/induced employment will only be affected if jobs are lost by the people in the direct employment areas such as harvesting or silviculture. It is the intention of the Employment Mitigation Strategy (see "Implementation Strategy") to focus on mitigation measures to ensure that the direct job loss potential is the focus of any initiatives. Indirect or induced jobs would therefore be minimized.

APPENDIX F: RELATIONSHIP TO OTHER INITIATIVES

Forest Practices Code

The conservation of biological diversity is a goal of the *Forest Practices Code of British Columbia Act*. Three documents are key to accomplishing this: *Biodiversity Guidebook*, *Riparian Management Areas Guidebook*, and *Managing Identified Wildlife Strategy*. These forest management requirements and guidelines will help protect some mature and old-growth forest inside and outside of SRMZs that will be suitable for spotted owl use. The following provides a brief overview of the overlapping benefits of the Forest Practice Code with the Spotted Owl Management Plan.

Biodiversity Guidebook

The *Biodiversity Guidebook* describes a methodology for planning for biodiversity at both the landscape and stand level. This is done by setting objectives for a number of attributes including old-growth retention; ecosystem representation; seral stage distribution and wildlife tree retention. A major component of the *Biodiversity Guidebook* is the delineation of a forest ecosystem network (FEN) intended to capture much of the old-growth and ecosystem representation requirements into a logical framework that minimizes fragmentation. The guidebook recommends that a district be subdivided into landscape units, each of which would be an assessment unit for the biodiversity objectives.

Old-growth forest

The biodiversity guidelines specify that a minimum of 13 to 19% of the forest should be maintained in stands that are older than 250 years. The owl SRMZs will contribute significantly to providing older age classes within a landscape unit, however, the management target age for suitable owl habitat is stands of only 100 years of age. It is likely that some proportion of stands on inoperable sites within an SRMZ will be greater than 100 years but generally, in coastal biogeoclimatic subzones, the SRMZs will not meet the target proportion of 240+ stands recommended in the *Biodiversity Guidebook* for some subzones.

Seral stage distributions

Seral stage distributions should be evaluated by landscape unit, to determine how close each one is to the recommended ratios in the *Biodiversity Guidebook* and what role the owl areas may play in achieving those ratios, when a landscape unit plan is being developed.

Connectivity

The degree to which the SRMZs contribute to the connectivity objectives for a landscape unit will vary by unit depending on the configuration of both. In many cases it will be fairly large, particularly within the mid elevation subzones. Some connectivity will be achieved in the lower elevations through more linear zones such as resource management zones. Much of the connectivity outside of the SRMZs can be achieved through careful planning of the spatial and temporal distribution of cutblocks without increasing the impacts on the timber supply. In this latter case, however, the full amount of connectivity desired may not be achieved in the short term.

Stand-level biodiversity

Stand level biodiversity guidelines, such as the retention of large snags and coarse woody debris, also benefit spotted owl management by improving future habitat conditions for prey species that support spotted owl populations, and reducing the time required for a stand to exhibit owl habitat characteristics after final harvest.

Forest ecosystem networks

Forest ecosystem networks (FENs) are a planning tool to assist in meeting the above-mentioned objectives, they are not an objective in their own right. In many of the landscape units, the SRMZs for the owl should be considered as the main part of a FEN design and thereby become part of the biodiversity plan for the unit. Whether further requirements are needed to address biodiversity should be determined during the resource management plan development.

Riparian Management Area Guidebook

Riparian areas occur next to bodies of water such as streams, lakes and wetlands. These areas frequently contain the highest number and diversity of species compared to upland areas and serve as natural linkages. This guidebook provides recommendations for planning and conducting operations within these sensitive areas. Waterbodies are classified according to size and fish presence and management areas of various widths are applied. Depending on the classification, different degrees of harvest are allowed. Where harvest is restricted, these riparian areas can add to the overall complexity of habitat in an area and may provide habitat for spotted owls, and many other species, while moving from one area to another.

Managing Identified Wildlife Strategy

The *Managing Identified Wildlife Strategy* acts as a fine filter by addressing habitat requirements of wildlife that require additional management attention above the Biodiversity and Riparian

Management Area guidebooks. The majority of these species are Red- or Blue-listed species, but a few are species that are considered regionally important. The Managing Identified Wildlife Strategy will establish wildlife habitat areas (WHAs) around habitat features critical to a specific species. Within these WHAs, general wildlife measures will direct all resource developments.

The management of habitat within SRMZs will benefit not only the spotted owl, but many other species of plants and animals. This benefit is particularly relevant for species that are closely associated with late-successional and old-growth coniferous forests, and is particularly important for those species that are currently considered at risk.

There are approximately 71 species of vertebrates that are closely associated with late-successional and old-growth forests within the range of the northern spotted owl in Canada (4 amphibians, 34 birds, 17 mammals, and 16 fish). Of these, 13 are considered to be at risk, either nationally or provincially. Within the range of the northern spotted owl in Canada, there are approximately 67 species of vascular plants that are closely associated with late-successional and old-growth forests. Of these, 7 are considered to be at risk provincially (Table F1).

Land and Resource Management Plans

The land and resource management planning (LRMP) is the sub-regional integrated resource planning process for British Columbia. LRMPs consider all resource values and resource management decisions and require public participation and interagency co-ordination. LRMPs will be initiated for both the So0 and Fraser TSAs in the near future. The LRMP will be important to spotted owl management because the management objectives set in the LRMP will guide the biodiversity emphasis that is applied in each area of the TSA. The more overlap that is achieved between Forest Practices Code biodiversity requirements and spotted owl habitat requirements, the lower the combined timber supply impacts of both initiatives will be.

When the LRMP begins in the So0 and Fraser TSAs, management guidelines in any existing higher level plan will be treated as primary resource management requirements in the LRMP. The Spotted Owl Management Plan will be designated as a higher level plan. As a result, any resource management decisions reached in LRMP that affect forest management within the spotted owl SRMZs will have to be consistent with the Spotted Owl Management Plan.

Table F1. *Vertebrates and vascular plants at risk that are associated with late-successional and old-growth forests within the range of the spotted owl in British Columbia*

Species ^a	Status ^b	Managing identified wildlife status
Amphibians		
Pacific giant salamander	Red-listed (nationally Vulnerable)	In prep.
Tailed frog	Blue-listed	Volume 1
Reptiles		
Rubber boa	Blue-listed	Volume 1
Birds		
Northern goshawk – <i>atricapillus</i> subspecies	Blue-listed	Volume 1
Marbled murrelet	Red-listed (nationally Threatened)	Volume 1
Turkey vulture	Blue-listed	Volume 1
Great grey owl	nationally Vulnerable	
Mammals		
Keen's long-eared myotis	Red-listed (nationally Vulnerable)	Volume 1
Pacific water shrew	Red-listed (nationally Threatened)	Volume 1
Mountain beaver – <i>rufa</i> subspecies	Red-listed	
Townsend's big-eared bat	Blue-listed	In prep.
Grizzly bear	Blue-listed	Volume 1
Fish		
Bull trout	Blue-listed	Volume 1
Vascular Plants		
Ground cone (<i>Boschniakia</i> (<i>strobilacea</i>) <i>hookeri</i>)	Blue-listed	
Mountain lady's slipper (<i>Cypripedium montanum</i>)	Blue-listed	
Redwood sorrel (<i>Oxalis oregana</i>)	Red-listed	
Narrow-leafed sword-fern (<i>Polystichum imbricans</i>)	Blue-listed ^c	
Toothleaf pyrola (<i>Pyrola dentata</i>)	Red-listed	
Dwarf bramble (<i>Rubus lasiococcus</i>)	Red-listed	
Snow bramble (<i>Rubus nivalis</i>)	Red-listed	

^a Report of 1996 Red and Blue List (Wildlife Branch 1993), Canadian Species at Risk (COSEWIC 1993), B.C. Conservation Data Centre Tracking Lists (Douglas 1994) and Rare Freshwater Fish of British Columbia (Cannings 1993).

^b Red-listed species are candidates for designation as either endangered or threatened. Blue-listed species are considered vulnerable or sensitive. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) determine national designations.

^c Vascular plants Red-listed by the Conservation Data Centre are candidates for designation as either Endangered or Threatened, or are rare species known from fewer than 21 sites. Blue-listed vascular plants are those that may become vulnerable in the future if factors affecting their status are not reversed.

New Timber Supply Review

At least once every five years, the chief forester is legally required to review the timber supply and determine an AAC for each timber supply area (TSA) and tree farm license (TFL) in the province. New timber supply reviews have recently begun for the Soo and Fraser TSAs, but are still at the early stages (data collection and preparation stage). The Spotted Owl Management Plan will be included in the new TSR and accounted for in the chief forester's AAC determination for each TSA. Other forest management issues that have arisen since the last TSR and will be considered in the new TSR for the Soo and Fraser TSAs are: Forest Practices Code requirements, the Lower Mainland Protected Areas Strategy, revised visual quality objectives in the Fraser TSA, and the results of a recent timber audit that indicated an overestimate in the forest inventory in the Fraser TSA.

APPENDIX G: MEHATL CREEK PROTECTED AREAS MITIGATION STRATEGY



RECEIVED

Date: December 11, 1996

To: Bob Brash, District Manager, Chilliwack Forest District
Jim McCracken, Regional Director, Lower Mainland Region, MELP

Re: Mitigation Strategy for the Mehatl River Protected Area

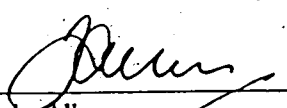
Please find attached the Mitigation Strategy for the designation of the Mehatl River as a protected area. As you know, these documents represent the various agreements reached with respect to locating offset timber volumes to replace those in the Mehatl River drainage. These agreements were reached between the Ministry of Forests, the Ministry of Environment, Lands and Parks and the affected licencees.

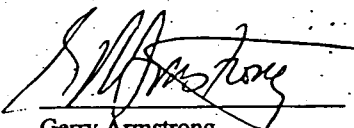
The mitigation measures cover the following licencees:

- Forest Licence A19203 - International Forest Products Limited
- Forest Licence A19202 - Cattermole Timber Co. Ltd.
- Forest Licence A47273 - Joint Licence, Nlaka'pamux Nation Tribal Council and J.S. Jones Timber Ltd.
- Small Business Forest Enterprise Program

As per the recommendation made by the RPAC, please consider this Strategy as your direction to proceed with implementation.

Thank you for your cooperation in reaching this agreement.


John Allan
Deputy Minister
Ministry of Environment, Lands
and Parks


Gerry Armstrong
Deputy Minister
Ministry of Forests

cc: Yvette Wells, Land Use Coordination Office

SUMMARY OF MITIGATION MEASURES SHOULD
THE MEHATL DRAINAGE BECOME PROTECTED

- The 4 licensees requiring 'offset' areas are:
 - FL A19203 - International Forest Products
 - SBFEP
 - FL A19202 - Cattermole Timber
 - FL A47273 - joint licence with 3 bands and JS Jones Timber
- Both Interfor SBFEP and MOELP have an agreement in principle on harvest schedules within various owl activity centres outside of SRMZ's (matrix birds) and within SRMZ's.
- Cattermole Timber agrees in principle that their portion of the Mehatl could be offset by areas identified in the Sivash drainage.
- The MOF has an obligation to find suitable areas to meet the 100000 m3 over the 10 year term requirement of FL A47273. Discussions are ongoing with the 3 bands and JS Jones whether 2 identified offset areas are suitable.
- If the proposed protected area boundary incorporates a licensee's chart area then additional replacement areas would be required or the boundary should be revised to reflect the Mehatl drainage.

D. Singer, Area 4 Manager
May 30 1996

Table G1. Summary of offset (in hectares) to find timber from administratively withdrawn areas to replace timber lost to the protection of Mehatl Creek

	1997– 2001	2002– 2006	2007– 2011	2012– 2016	2017– 2021	2022– 2026	2027– 2031	2032– 2036	2037– 2041	2042– 2046
Small Business Forest Enterprise Program										
Urquhart M.A.C. ^a					38	37	31	21		
Upper Spuzzum M.A.C.	64	98	53	15	55	54	55			
Lower Spuzzum SRMZ ^b					20				32	54
Sowaqua/Karen SRMZ	37		37	92	21	7	17	44	72	
Anderson/Hell's Gate SRMZ				40				40		40
International Forest Products										
Klesilkwa M.A.C.	25	20	25	17						
Nicolum M.A.C.	38		26	20	28					
Stulkawhits M.A.C.							43	30		
18/20 Mile–Manning SRMZ	40	80	50	63	52	40			40	40
Swanee–Maimen–Chilliwack SRMZ					20	40	40			
Greendrop–Chilliwack SRMZ								40	40	
Cattermole Timber^c										
Siwash M.A.C.										
First Nations										
Location to be determined	100	100								

^a M.A.C. – Spotted Owl Matrix Activity Centre.

^b SRMZs – Forest management within SRMZs is to maintain a minimum 67% of forested area older than 100 years.

^c Cattermole Timber will be entitled to approximately 3600 m³/year from the Siwash M.A.C.

APPENDIX H: GLOSSARY

Active owl site	An area where there has been a recent (<5 years) observation of a single owl or pair of spotted owls. This may include confirmed and unconfirmed resident owls.
Adaptive management	A process of implementing policy decision as scientifically driven management experiments that test predictions and assumptions in management plans, and using the resulting information to improve the plan (USDI 1992).
Biodiversity	The diversity of plants, animals and other living organisms in all their forms and levels of organization, and includes the diversity of genes, species and ecosystems, as well as the evolutionary and functional processes that link them (<i>Biodiversity Guidebook</i> 1995).
Biogeoclimatic zone	A geographic area having similar patterns of energy flow, vegetation, and soils as a result of a broadly homogeneous macroclimate (<i>Biodiversity Guidebook</i> 1995).
Blowdown	Trees felled by high wind (USDI 1992).
Canopy	A layer of foliage in a forest stand. This most often refers to the uppermost layer of foliage, but it can be used to describe lower layers in a multi-storied stand (USDI 1992).
Clearcut	An area where the entire stand of trees has been removed in one cutting (USDI 1992).
Coarse woody debris	Portions of a tree that has fallen or been cut and left in the woods (USDI 1992).
Colonization	The establishment of a species in an area not currently occupied by that species. Colonization often involves dispersal across an area of unsuitable habitat (USDI 1992).
Competitive exclusion	The extinction of one species by another in a habitat through competition (Wilson 1992).

Conifer	A tree belonging to the order of Gymnospermae, comprising a wide range of trees that are mostly evergreen (USDI 1992).
Connectivity	A measure of the extent to which intervening habitat truly connects SRMZs for juvenile spotted owls dispersing among them (adopted from USDI 1992).
Corridor	A defined tract of land, usually linear, through which a species must travel to reach habitat suitable for reproduction or other life-sustaining needs (USDI 1992).
Demography	The study of birth rates, death rates, age distributions, sex ratios, and size of populations—a fundamental discipline within the larger field of ecology. Also the properties themselves, as in the demography (demographic traits) of a particular population (Wilson 1992).
Density	The number or size of a population in relation to some unit of space. It is usually expressed as the number of individuals per unit area (USDI 1992).
Dispersal	The movement, usually one direction and on any time scale, of plants and animals from their point of origin to another location where they subsequently produce offspring (USDI 1992).
Dispersal habitat	Habitat that supports the life needs of an individual animal during dispersal. Generally satisfies needs for foraging, roosting and protection from predators (USDI 1992).
Distribution (of a species)	The spatial arrangement of a species within its range (USDI 1992). This may be synonymous with its range or it may be specific to the habitat type in which it occurs within its range.
Disturbance	A significant change in structure and/or composition caused by natural events such as fires and wind or human-caused events such as cutting (USDI 1992).
Ecology	The scientific study of the interaction of organisms with their environment, including the physical environment and the organisms living in it (Wilson 1992).

Ecosystem	The organisms living in a particular environment, such as a lake or forest (or, in increasing scale, and ocean or the whole planet), and the physical part of the environment that impinges on them. The organisms alone are called the community (Wilson 1992).
Endangered species	An indigenous species, subspecies, or geographically separate population that is threatened with imminent extirpation or extinction throughout all or a significant portion of its range (COSEWIC 1993).
Extinction	The termination of any lineage of organisms, from subspecies to species and higher taxonomic categories from genera to phyla. Extinction can be local, in which one or more populations of a species or other unit vanish but others survive elsewhere (see <i>extirpated</i>), or total (global), in which all the populations vanish. When biologists speak of extinction of a particular species without further qualification, they mean total extinction (Wilson 1992).
Extirpated species	An indigenous species, subspecies, or geographically separate population no longer known to exist in the wild in Canada, but occurring elsewhere (COSEWIC 1993).
Floaters	Non-breeding adults and subadults that move and live within a breeding population, often replacing breeding adults that die; non-territorial individuals (USDI 1992).
Forest fragmentation	The change in the forest landscape, from extensive and continuous old forest to a mosaic of younger stand conditions (USDI 1992).
Guideline	A policy statement that is not a mandatory requirement (USDI 1992).
Home range	The area within which an animal conducts its activities during a defined period of time (USDI 1992).
Inbreeding	Mating or crossing of individuals more closely related than average pairs in the population (USDI 1992).

Interspecific competition The condition of rivalry that exists when a number of organisms of different species use common resources that are in short supply. Competition usually is confined to closely related species that eat the same sort of food or live in the same sort of place. Competition typically results in ultimate elimination of the less effective organism from that ecological niche (USDI 1992).

Isolation Absence of genetic crossing among populations because of distances or geographic barriers (USDI 1992).

Juvenile For spotted owls, a juvenile is normally considered to be any bird that is less than one year old (USDI 1992).

Landscape A heterogeneous land area with interacting ecosystems that are repeated in similar form throughout (USDI 1992).

Managed area Delineations of habitat to maintain existing and/or future populations of spotted owls.

Managed forest Any forested land that is treated with silvicultural practices and/or harvested. Generally applied to land that is harvested on a scheduled basis and contributes to an allowable sale quantity (USDI 1992).

Mature stand A mappable stand of trees for which the annual net rate of growth has peaked. Stands are generally greater than 80-100 years old and less than 180-200 years old. Stand age, diameter of dominant trees and stand structure at maturity vary by forest cover types and local site conditions. Mature stands generally contain trees with smaller average diameter, less age class variation and less structural complexity than old stands of the same forest type. Mature stages of some forest types are suitable habitat for spotted owls. However, mature forests are not always spotted owl habitat, and spotted owl habitat is not always mature forest (FEMAT 1993).

Monitoring	The process of collecting information to evaluate if objectives and anticipated or assumed results of a management plan are being realized or if implementation is proceeding as planned (FEMAT 1993).
Multi-layered canopy	Forest stands with two or more distinct tree layers in the canopy (FEMAT 1992).
Old-growth forest	A forest stand with moderate to high canopy closure; a multi-layered, multi-specied canopy dominated by large overstorey trees; a high incidence of large trees with large, broken tops and other indications of decadence; numerous large snags; and heavy accumulations of logs and other woody debris on the ground (USDI 1992).
Overstorey	Trees that provide the uppermost layer of foliage in a forest with more than one layer of canopy (USDI 1992).
Owl site	Any site where there has been a recent or historic observation of a single or pair of spotted owls (USDI 1992).
Potential habitat	A stand of trees of a vegetation type used by spotted owls that is not currently suitable, but is capable of growing or developing into suitable habitat in the future. Generally are stands in an earlier successional stage of forest types used by spotted owls (USDI 1992).
Predator	Any animal that preys externally on others, (i.e., that hunts, kills and generally feeds on a succession of hosts – the prey) (USDI 1992).
Protected area	An area that has protected designation according to provincial or federal statute. Protected areas are land and freshwater or marine areas set aside to protect the province's diverse natural and cultural heritage (<i>Biodiversity Guidebook</i> 1995).
Radio-telemetry	Automatic measurement and transmission of data from remote sources via radio to a receiving station for recording and analysis. In this document, it refers to the tracking of spotted owls by means of small radio transmitters attached to them (USDI 1992).

Range	The geographic area or region over which an organism occurs (USDI 1992).
Recovery	Action that is necessary to reduce or resolve the threats that caused a species to be listed as threatened or endangered (USDI 1992).
Refugia	Havens of safety where populations have a high probability of surviving periods of adversity (USDI 1992).
Regeneration	The actual seedlings and saplings existing in a stand; or the act of establishing young trees naturally or artificially (USDI 1992).
Rescue effect	Immigration of new individuals sufficient to maintain a population that might otherwise decline toward extinction (USDI 1992).
Roost/Roosting	The resting behaviour of an animal (USDI 1992).
Roost sites	A site where an animal roosts. Can refer to daytime and night-time roosting. Sites often provide protection from environmental conditions and from predators (USDI 1992).
Rotation	The planned number of years between the regeneration of an even-aged stand and its final cutting at a specified stage (USDI 1992).
Sapling	A loose term for a young tree no longer a seedling but not yet a pole. It is generally a few feet high and 2 to 4 inches dbh, typically growing vigorously and without dead bark or more than an occasional dead branch (USDI 1992).
Second-growth	Relatively young forests that have developed following a disturbance (for example, harvesting, fire or insect attack) of the previous old forest (USDI 1992).
Sexual dimorphism	The differences in size, weight, color, or other morphological characteristics that are related to the sex of the animal (USDI 1992).
Silviculture	The science and practice of controlling the establishment, composition, and growth of forests (USDI 1992).
Snag	A standing dead tree (USDI 1992).

Species	A group of individuals that have their major characteristics in common and are capable of producing fertile offspring (USDI 1992).
Stand (forest stand)	An aggregation of trees occupying a specific area and sufficiently uniform in composition, age, arrangement, and condition as to be distinguishable from the forest in adjoining areas (USDI 1992).
Standards and guidelines	The primary statement of direction for land managers. In the recovery plan, these are recommended as actions necessary to accomplish recovery (USDI 1992).
Subadult	A young spotted owl that has dispersed but has not yet reached breeding age. Subadults are in their second, or in some cases, third year of life (USDI 1992).
Subpopulation	A well-defined set of interacting individuals that comprise a proportion of a larger, interbreeding population (USDI 1992).
Subspecies	A population of a species occupying a particular geographic area, or less commonly, a distinct habitat, capable of interbreeding with other populations of the same species (USDI 1992).
Successional stage	A stage or recognizable condition of a plant community that occurs during its development from bare ground to climax (USDI 1992).
Suitable habitat	<i>See suitable owl habitat.</i>
Suitable owl habitat	An area of forest vegetation with the current age-class, species of trees, structure, sufficient area, and adequate food source to meet some or all of the life requirements of the northern spotted owl (USDI 1992).
Survivorship	The proportion of individuals that are alive at a given age (USDI 1992).
Territory	The area that an animal defends, usually during the breeding season, against intruders of its own species (USDI 1992).

Threatened species	An indigenous species, subspecies, or geographically separate population likely to become endangered in Canada if the factors affecting its vulnerability are not reversed (COSEWIC 1993).
Understorey	The trees and other woody species growing under a more or less continuous cover of branches and foliage formed collectively by the upper portions of adjacent trees and other woody growth (USDI 1992).
Unsuitable habitat	Forested lands that currently do not meet the habitat needs of spotted owls for nesting, roosting, or foraging but are ecologically capable of doing so. This habitat is deficient in tree size, canopy closure, and/or stand decadence. It results from timber harvest or natural disturbance. Also referred to as potential habitat (USDI 1992).
Viability	The ability of a population to maintain sufficient size so that it persists over time in spite of normal fluctuations in numbers; usually expressed as a probability of maintaining a specific population for a specified period (USDI 1992).
Viable population	A population that contains an adequate number of individuals appropriately distributed to ensure the long-term existence of the species (USDI 1992).
Well distributed	A geographic distribution of habitats that maintains a population throughout a planning area and allows for interaction of individuals through periodic interbreeding and colonization of unoccupied habitats (USDI 1992).
Wildfire	Any wildland fire that is not a prescribed fire (USDI 1992).
Windthrow	A tree or group of trees uprooted by the wind (USDI 1992).