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**THE USE OF  
ALTERNATIVE SILVICULTURAL SYSTEMS  
AND  
ALTERNATIVE HARVESTING PRACTICES  
IN THE VANCOUVER FOREST REGION**

**FINAL REPORT**

A report prepared for the

Silviculture Section  
BC Ministry of Forests  
Vancouver Forest Region

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## **1.0 INTRODUCTION**

It is a time of significant change in forest management practices in British Columbia. Among the most important of the changes are those that involve the choice of silvicultural systems and the use of harvesting practices to retain old-growth forest attributes in managed stands.

In recent years, there has been significant public opposition to clearcutting and considerable interest in the use of alternative silvicultural systems and harvesting practices to meet higher standards for environmental protection, landscape management and maintenance of biological diversity while ensuring healthy regeneration in the coastal forests of British Columbia. The Forest Practices Code states that clearcutting will not be permitted on some sites in the future. If these sites are to be logged, alternative systems will be required. The Vancouver Region is developing a policy for increasing the use of alternative silvicultural systems through the development of district specific strategies for alternative silvicultural systems.

There is not, however, any recent documentation of how widely alternative silvicultural systems to clearcutting are being used at present and what lessons are being learned about their application and suitability. For those foresters and engineers interested in developing these alternative practices, there are very few clearly identified case studies, demonstration sites or research trials from which to learn.

There is also renewed public and professional interest in alternatives to the conventional yarding systems that are used in conjunction with clearcutting, and in measures which will maintain or recreate particular attributes of the old-growth forest in managed areas.

This report documents the current extent of the use of alternative silviculture and harvesting practices and provides a brief description of the sites where these have been undertaken. These are described under three broad headings

- the use of alternative silvicultural systems;
- the use of alternative harvesting systems that can be used in conjunction with alternative silvicultural systems; and
- the use of special techniques to maintain or recreate particular attributes of the old-growth forest.

The report is not a thorough assessment of the feasibility of these alternative practices or of their applicability in any given circumstance or on any particular site. It simply documents what had been done to date. It provides some basic information so that others considering

the use of these systems can know where they have been used and where they can obtain further information.

The focus of the report is on provincial Crown land and on stands that were older than 70 years at the time of cutting. Commercial thinning and logging in stands less than 70 years old has not been included. Some sites on private forest land are included where they are felt to provide good examples or demonstration sites but the list of alternative silvicultural systems and harvesting practices on private land is not complete.

Most attention has been paid to blocks logged since 1990 but some blocks logged as far back as 1985 are also included. The report includes a complete, or near complete, list of those recent sites that meet the definitions and criteria of alternative systems established by the Ministry of Forests. The report does not include sites that were planned or proposed for logging in the summer of 1994. Some of these are briefly referred to in Section 2.5.

The information in the report has been compiled through a combination of visits to Ministry of Forests District offices, interviews and phone calls with government and industry staff, review of PHSP documents and field visits to most of the sites described. Eight of the nine District offices in the Vancouver Forest Region were visited and interviews were conducted with staff in each of those offices. Field visits to sites were completed in each of those Districts.\*

## **2.0 Use of Alternative Silvicultural Systems**

Clearcutting is the dominant silvicultural system used in the Vancouver Region. The following silvicultural systems are described in Ministry of Forests publications, documents and correspondence as alternative silvicultural systems to clearcutting.

- seed tree
- shelterwood, including uniform (or regular), irregular and strip shelterwoods
- selection, including individual tree selection and group selection
- reserves, including dispersed and patch reserves in both clearcutting and partial cutting systems.

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\* The Mid-Coast District office in Bella Coola was not visited and no fieldwork was undertaken in that District. Phone calls with District staff indicated that there were no sites meeting the criteria of alternative silvicultural systems or alternative harvesting practices in that District.

In documenting the use of these systems, careful attention has been paid to the recent definitions of each system being developed by the Ministry. Sites have been described according to those definitions.

## 2.1 Seed Tree Silvicultural Systems

The seed tree silvicultural system is defined as follows:

"An even-aged silvicultural system that leaves selected high quality standing trees scattered throughout the cutblock to provide seed sources for natural regeneration. Dominant trees expressing the best phenotypic qualities, free from damage, disease or insect attack should be retained. The number and distribution of seed trees to be left depends on the species, size, site conditions and additional management objectives including aesthetics. While there are no absolutes, this number may range from 5-20 stems per hectare. Although the establishment of natural regeneration is an objective, planting is acceptable. Seed trees can be harvested at some point in the future, or left to the next rotation." (MOF, 1994)\*

There are approximately seven recent examples of the seed tree silvicultural system on provincial Crown land with an approximate total area of 72 ha. Additional recent examples may exist, but the use of the seed tree system on Crown land in the Vancouver Region has been very limited.

The recent use of the seed tree system has been on sites where Douglas-fir or Western white pine are the preferred regeneration species. All of the seed tree blocks are on southern Vancouver Island, the Sunshine Coast or in the Interior transition zone. Most of the blocks are on very dry sites where significant regeneration problems were anticipated. The number of trees left as seed trees ranges from less than 1 per hectare to 20 trees per hectare. In some of the blocks, small residual trees or deciduous trees have been left as well as the seed trees. Seed trees to be left were generally marked.

The yarding system in five of the seed tree blocks has been ground based - rubber tired or tracked skidders, hoe forwarders or small cats. There are two seed tree blocks on steep terrain where cable yarding systems have been successfully used.

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\* All definitions of silvicultural systems are taken from a March 2, 1994 memorandum re: Silvicultural Systems Program from the Regional Manager to District Managers.

Four of the seven seed tree blocks have been part of research trials or special projects. These include two blocks in a current research trial in alternative silvicultural systems in the dry interior transition zone near Boston Bar and one seed tree trial near Lund on the Sunshine Coast initiated in 1985, monitored and completed in 1991. One seed tree block is part of the Ministry of Forests special project investigating log sales and alternatives to conventional clearcutting in the Duncan and Port Alberni Districts.

These few sites do indicate that the system can be accomplished safely and without damage to residual trees, even with cable yarding systems. However, there has been a lack of seed production on some of the sites. One block on Crown land and one on private land sustained significant blowdown.

The following seed tree blocks have been located:

- Seed tree block in the French Creek headwaters, west of Parksville in the Port Alberni District. CWHxm Biogeoclimatic subzone.

This 16 ha timber sale is located on a dry site at low elevation on the east coast of Vancouver Island. The original stand was a 90-150 year old stand of Douglas-fir with scattered vets. Eleven large Douglas-fir (less than 1 per ha) were left scattered throughout the block as seed trees. The area is on gently sloping terrain and was logged by skidder in 1991 and 1993. There was little tree damage and only one tree has blown down since logging. The area has subsequently been planted.

Contact    Dean Stewart                    Ministry of Forests    Port Alberni    724-9205

- Seed tree block on Hillcrest Road near Duncan in the Duncan District. CWHxm Biogeoclimatic subzone.

This seed tree block was logged as part of the Ministry of Forests Special Project investigating alternatives to clearcutting and log sales. Because of the location close to Duncan and on a public road to a recreation area, the visual management objective was partial retention. The block is intended to serve as a demonstration area. The block was logged in 1993 and is split into two adjacent portions, with a total area of 8.8 ha. The stand prior to logging was 70 year old second growth regenerated following logging.

In the 3.4 ha portion of the block, which was predominantly a single canopy stand of Douglas-fir, 10 dominant Douglas-fir seed trees per ha plus a few non-merchantable Western red cedar were left. The adjacent 5.4 ha portion of the block was a more

mixed stand with several canopy layers. In this area, 10 Douglas-fir per ha have been left as seed trees and in addition, all healthy trees less than 25 cm dbh have been left in clumps of advance regeneration which will be thinned at a later date. The seed trees left are approximately 15% of the original volume of the stand. However, up to 70% of these trees may be logged once regeneration is established and visual quality objectives are met.

The terrain in both blocks is flat or gently sloping and the areas were successfully logged with skidders and a small cat. The area has since been planted but infilling of natural regeneration is anticipated. There has been no blowdown after one winter and the treatment is considered to successfully meet the objectives.

Contact Rob Furness Ministry of Forests Duncan 746-2700

- Seed tree block on Otter Point Road near Sooke in the Duncan District. CWHxm Biogeoclimatic subzone.

Also in the Duncan District are two blocks with a total area of 8 ha on which a seed tree system has been used. The blocks are part of a 34 ha patch of forest which has high recreational values and a partial retention visual quality objection and which is being managed for partial cutting systems.

A total of 63 Douglas-fir seed trees (approximately 8 per ha) have been left scattered through the blocks as well as a few older Douglas-fir vets and large maple trees.

This area is on gently sloping terrain area and was logged with a hoe forwarder in 1993. The area has been planted but infilling of natural regeneration is anticipated.

Contact Rob Furness Ministry of Forests Duncan 746-2700

- Seed tree block near Lund, north of Powell River in the Sunshine Coast District. CWHxm Biogeoclimatic subzone.

In 1985, a 25 ha block was logged on the Malaspina Peninsula near Lund using a seed tree system. The stand was old-growth Douglas-fir with a component of Western red-Western red cedar and Western hemlock on generally flat terrain. It was logged by skidder.

Approximately four seed trees per hectare were retained. The area regenerated to acceptable stocking levels within three years after logging and planting was not necessary. In seven winters, only three of the seed trees blew down. Because suitable stocking had been achieved, the remaining trees were cut in 1992.

Follow up assessment of the area indicates that the seed tree system was successful on this site.

Contact Hal Reveley Ministry of Forests Vancouver 660-7582

Reference Evans R., H. Reveley, R. Scagel. 1993. Application of the Seedtree Silviculture System to a Coastal Douglas-Fir Stand in the CWHxm2 Subzone. Unpublished report. Silviculture Section, Vancouver Region, Ministry of Forests.

- Seed tree block at Soo River near Whistler in the Squamish District. CWHms Biogeoclimatic subzone.

A seed tree system was implemented on a 4.0 ha portion of a 14 ha block logged in 1993 by Richmond Plywood Corporation on a Forest Licence. The original stand was a 130 to 135 year old stand of Douglas-fir established after fire with scattered old-growth veterans. The site is in the dry interior transition zone and was considered marginally productive and difficult to regenerate because of shallow coarse colluvial soils. Seed trees were left to provide natural regeneration to supplement planted stock which was expected to have a high mortality.

Approximately 20-24 Douglas-fir were left per hectare on a 50% slope and the area was logged by grapple yarder. There was no damage to residual trees and to date there has been no blowdown. The company considers this to be a successful seed tree application using cable yarding equipment.

Contact Tom Cole Richmond Plywood Corporation Whistler 938-0856

- Two seed tree blocks in the Boston Bar research trial in the Chilliwack District. IDFww Biogeoclimatic subzone.

The silvicultural systems research trial at Boston Bar includes two seed tree blocks with a total area of 9.3 ha. The original stand was 110-140 year old predominantly Douglas-fir stand regenerated after fire. The site is a dry south aspect. One of the two blocks was gently sloping on benched terrain; the other was moderately steep (50-

70%) with well-defined draws. The common silvicultural prescription of clearcutting followed by planting has had high failure rates on similar sites.

Eighteen Douglas-fir seed trees per hectare were left as 95% of the volume of the stand was removed when the blocks were logged in 1991. The gently sloping block was logged with a feller buncher and ground-based skidding equipment. The other block was too steep for ground-based equipment and was logged with a small skyline yarder with radio-controlled carriage. The logging with both systems was successfully completed with little residual tree damage.

The two years since logging have been poor seed years and little regeneration has established from the seed trees. Regeneration success has been further affected because the open nature of the seed tree stand does not appear to significantly moderate the harsh microclimate. The blocks have now been planted.

A large number of trees have also blown down in the gently sloping block where shallow soils limit rooting depth. The blowdown has been removed using horses.

The preliminary assessment is that the seed tree system is not considered a successful treatment at this location. The seed trees have not provided seed and the open nature of the residual stand has contributed to significantly more blowdown than occurred in the adjacent light removal shelterwood where more trees were retained.

Contact Brian D'Anjou Ministry of Forest Vancouver 660-7531

Reference Green, R. and B. D'Anjou. 1993. Partial Cutting for Regenerating Dry Sites in the Coast Interior Transition. Project Summary, June 1993. Forest Sciences Section Vancouver Forest Region.

- Other seed tree blocks.

The use of seed tree systems on private land in recent years appears to be very limited. Canadian Forest Products logged a block in the Mt Elphinstone area on the Sunshine Coast in 1990, leaving approximately 5-6 large Western white pine scattered over a 12.9 ha area. The block was on gently sloping terrain and was logged with a tracked skidder. All the seed trees blew over after one season. The company does not consider this seed tree block to have been successful.

Several seed tree blocks including four in the Squamish district and several in the Chilliwack district were logged in the Region prior to 1984.

## **2.2 Shelterwood Silvicultural Systems**

The shelterwood silvicultural system is defined as follows:

"A silvicultural system that removes the existing stand in a series of one or more cuttings to promote the establishment and development of an essentially even-aged stand under the overhead or side shelter of the existing one. The number and distribution of leave trees to be left depends on species, size, site conditions and additional management objectives including aesthetics and have the same quality requirements as for the seed tree system. Again, there are no absolutes and the number may range from 30 to 100 stems per ha depending on the shelter and micro-environment requirements of the seedlings to be regenerated and the size of the crowns. Planting is also acceptable in which case the leave tree criteria are less stringent. Leave trees can be harvested at some point in the future or left until the next rotation, however, performance of regeneration will be affected by shading if too many stems are left." (MOF, 1994)

The shelterwood system has been used on ten blocks on Crown land in recent years with an approximate total area of 128 ha. All of these blocks are on dry Douglas-fir sites on the east coast of Vancouver Island, the Sunshine coast or the interior transition zone where regeneration problems were anticipated. The shelterwood blocks on Crown land are all in stands ranging in age from 70 to 140 years. Six of the blocks are uniform or regular shelterwoods. Four blocks, all in the interior transition zone near Pemberton, are strip shelterwoods. There at least three examples of shelterwoods on private land.

Three of the ten shelterwood blocks on Crown land are part of silvicultural systems research trials underway at Boston Bar in the Chilliwack District and at Roberts Creek on the Sunshine Coast. These uniform shelterwoods were logged in 1991 and 1993. Monitoring and research activities continue to determine the micro-climate effects, regeneration response, blowdown and other effects of shelterwood cutting. A fourth shelterwood block is part of the Ministry of Forests special project investigating log sales and alternatives to conventional clearcutting in the Duncan and Port Alberni Districts. A fifth shelterwood is part of a demonstration of alternative silvicultural systems undertaken by Timberwest on Quadra Island.

Four of the shelterwood blocks, and part of a fifth block have been logged with cable yarding systems. These cable yarded shelterwoods include two of the strip shelterwood blocks and three of the research and special project blocks.

The number of trees retained in the uniform shelterwoods ranges from 30 to between 70 and 90 stems per hectare. In some cases, the number of trees retained on-site appears to be quite different than the pre-logging prescription. Blowdown has reduced the effectiveness of the treatment on two of the sites on Crown land and one site on private land. There is some preliminary indication from the research blocks that there has been relatively more blowdown in the shelterwoods where fewer trees are retained and that blowdown could be reduced with a higher level of retention. This appears to be the case in the other shelterwood blocks.

In addition to the shelterwoods on Crown land, three shelterwood blocks are part of the Montane Alternative Silvicultural Systems trial on private Managed Forest # 19 near Courtenay. These shelterwood blocks are old-growth hemlock balsam montane forest where snow and summer drought create regeneration problems. They are the only shelterwoods in the coastal portion of the Vancouver region in old-growth forest and the only ones where Douglas-fir is not the species being regenerated. The number of trees retained in these shelterwood blocks is also higher than in any of the blocks on Crown land. These blocks were logged by hoe forwarder and skidder.

The use of the shelterwood system had been limited but the few sites do demonstrate that it is physically feasible with ground-based and cable yarding equipment on the sites where it has been used.

The following shelterwood sites were identified.

- Uniform shelterwood at Nanoose Bay, south of Parksville in the Port Alberni District. CDFmm Biogeoclimatic subzone.

A 20 ha timber sale was prescribed and laid out as a shelterwood, near Nanoose Bay on eastern Vancouver Island. The site is dry with rocky outcrops on rolling and gently sloping terrain and was considered a difficult site to regenerate. The shelterwood was prescribed to provide a more favorable microclimate for regeneration. The original stand was estimated to be 90-200 years old with scattered Douglas-fir veterans.

Old Douglas-fir vets and approximately 70-90 dominant young Douglas-fir per ha were marked prior to logging and retained as shelter trees. Scattered deciduous trees were also retained. The block was logged in 1986 with a skidder.

The site still has very patchy regeneration and has been planted in an attempt to reach adequate stocking. However, the shelterwood is considered to have been successful

in improving the microclimate and has been an appropriate treatment in an area with high recreational and aesthetic values. There has been little blowdown of leave trees.

Contact    Dean Stewart                    Ministry of Forests    Port Alberni    724-9205

- Uniform shelterwood on Copper Canyon Road near Chemainus in the Duncan District. CWHxm Biogeoclimatic subzone.

As part of the Ministry's special project investigating log sales and alternatives to conventional clearcutting, a shelterwood was undertaken in 1993 on 16 ha of a 22 ha block on Copper Canyon Road near Chemainus. Prior to cutting, this was 60-80 year old stand of second-growth Douglas-fir with a few grand fir and Western red cedar.

Trees were marked prior to cutting with the objective of retaining quality trees at a spacing of 20 metres or approximately 30 trees per ha. This level of retention amounted to approximately 16% of the volume of the stand. A second entry to remove half of the shelter trees is planned in approximately 35-45 years.

The remaining 5 ha portion of the block was a nearly pure alder stand with scattered conifers. This part of the block was clearcut with most of the isolated conifers retained.

The shelterwood area included some flat to gently sloping terraces which were logged with a hoe forwarder and a skidder. In part of the shelterwood area, the slopes between the terraces was steeply sloping. Cable yarding was used on these slopes which were too steep for the hoe forwarder. Trees were felled towards narrow yarding corridors (less than 10 m wide) and a 45 foot tower and chokers were used to yard logs from the block to roadside landings. Some operational problems were encountered with the cable yarding system particularly when fallers got too far ahead and too many felled trees were in the corridors. However, the area was successfully yarded with the tower with little damage to residual trees. Of the 480 trees left following logging, only 12 have blown down to date.

The block has been planted.

Contact    Rob Furness                    Ministry of Forests    Duncan            746-2700

Reference Ministry of Forests 1994. Alternatives to Conventional Clearcutting and Logs Sales Project 1993-1994. Unpublished draft report Small Business Forest Enterprise Program, Duncan Forest District.

- Uniform shelterwood on Quadra Island in the Campbell River District. CWHxm Biogeoclimatic subzone.

The only example of a shelterwood system on crown TFL lands is on TFL 47 on Quadra Island. In response to public concerns for the visual impacts of clearcutting and in order to assess the regeneration response to a partial cut, Timberwest undertook a shelterwood cut on 20.8 ha in 1992. The original stand was 70 years old, predominantly Douglas-fir with occasional Western red-cedar on a gentle (15%) slope.

Approximately 80 dominant, healthy and windfirm Douglas-fir per ha were marked and retained as well as 10-25 suppressed and co-dominant Western red cedar per ha. Approximately 70-75% of the volume on the site was logged. A second entry is planned when regeneration reaches a height of 5 metres, estimated to be approximately 20 years. At that time, the shelter trees will be logged with 5-8 or these large trees per ha retained as potential wildlife trees and to provide structural diversity in the stand.

The area was logged by hoechucking and was successfully completed. There has been virtually no blowdown to date. The area was planted immediately after logging.

Contact Steve Lackey Timberwest Campbell River 286-7362

- Two uniform shelterwood blocks in the Boston Bar research trial in the Chilliwack District. IDFWw Biogeoclimatic subzone.

This silvicultural systems research trial includes two shelterwood blocks with a total area of 20.3 ha in the dry interior transition zone. The original stand was a 110-140 year old predominantly Douglas-fir stand regenerated after fire. The site is a dry south aspect.

Each of the two blocks includes a "heavy removal" shelterwood in which 45 trees per ha were left, and a "light removal" shelterwood in which 83 trees per ha were left. The objectives were to promote regeneration on dry south aspect slopes where regeneration problems are typically encountered following clearcutting and to retain some cover in an area with high deer winter range values.

The upper block (12.7 ha shelterwood) is on gently sloping benched terrain and was felled with a feller buncher and yarded with ground-based equipment. The lower blocks (7.6 ha shelterwood) is on moderately steep terrain (50-70%) with well-

defined draws. It was hand-felled and logged with a skyline yarder. Logging was completed in 1991.

In the cable yarded shelterwoods, seven metre wide yarding corridors were established every 40 metres to match the 20 m lateral yarding capability of the yarder. Trees to be retained as the shelter trees were marked prior to falling and the remaining unmarked trees were felled toward the yarding corridor. The logging is considered to have been very successful with little residual tree damage.

Both the amount of shade contributed by the shelterwood and the amount of blowdown are related to the residual basal area in the treatment area. The light removal shelterwood has suffered less blowdown and provides greater shading and for these reasons, appears to be the more successful treatment to date.

Contact Brian D'Anjou Ministry of Forests Vancouver 660-7531

Reference Green, R. and B. D'Anjou. 1993. Partial Cutting for Regenerating Dry Sites in the Coast Interior Transition. Project Summary, June 1993. Forest Sciences Section Vancouver Forest Region.

- A uniform shelterwood in the Roberts Creek research trial in the Sunshine Coast District. CWHdm Biogeoclimatic subzone.

A shelterwood research trial was initiated at Roberts Creek on the Sunshine Coast in 1993. A shelterwood system was implemented on a 7.7 ha cutblock in 130 year old second growth Douglas-fir on gently sloping (10-15%) terrain. A shelterwood system was prescribed here primarily for aesthetic considerations rather than concern for regeneration. The first entry was completed in 1993 leaving 70 stems per ha (or approximately 25% of the original volume). Leave trees were marked. The leave trees included all 6 old-growth Douglas-fir vets on the site and dominant healthy Douglas-fir and Western red cedar. All hemlock were felled. A second entry is planned in 5 to 10 years to reduce the stand density to 30 stems per ha.

Logging of this site was done in a three pass system and used a 6280 grapple yarder with a carriage and chokers. Trees were used as back spars to improve deflection on the gentle (10%) slope. Yarding corridors of 7-8 m in width and 200 m in length were laid out 30-50 m apart. In the first pass, trees in the corridors were felled and yarded to the roadside. Then trees in the areas between corridors were felled and yarded laterally into the corridor, then to the road side. Finally, damaged trees on the edge of

the corridor which had served as rub trees were felled and yarded. Bumpers to protect trees on the edge of the yarding corridor were available but not often used.

Harvesting with the cable yarding system was considered successful although deflection was not ideal and some ground disturbance occurred in the yarding corridors. There was little yarding damage to leave trees. However, a normal winter wind storm blew over a total of 60 trees or approximately 18% of the leave trees in the first winter after logging and reduced the shelterwood to 43 stems per ha. The blowdown has been attributed to the relatively open structure of the residual stand and to the location of the road through the top of the block.

It is felt that retention of more trees, approximately 100 trees per ha, would have improved the visual appearance and may have reduced the incidence of blowdown. That density would also factor in an allowance for blowdown following logging.

Contact Brian D'Anjou Ministry of Forests Vancouver 660-7531

- Two strip shelterwoods at Phelix Creek near Pemberton in the Squamish District. IDFww Biogeoclimatic subzone.

Two strip shelterwood blocks have been initiated on Woodlot 70 near Pemberton in the dry interior transition zone. The first strip shelterwood was implemented in an area with difficult regeneration and a high level of concern for visibility because of the proximity of Birkenhead Lake Provincial Park. The strip shelterwood system involves the removal of 25% of the volume from a 16 ha block over the first 5 year period.

This first entry was completed in 1991. A second entry to remove a further 25% is planned in years 6 to 10 but strips cut in the second pass will not be adjacent to the strips cut in the first pass. The strip cuttings average 15 m wide and 170 m long. They are oriented in a NW/SE direction to provide maximum shading and visual screening and to reduce exposure to wind. This block was logged according to plan and is felt by the licensee to be a successful application of the strip shelterwood system.

A second strip shelterwood block was logged in 1993. This 1.0 ha block is not visible from the Park but is on similar dry terrain with similar regeneration difficulties. In this block, 40% of the stand volume has been removed in the first entry in 30 m wide strips. The second entry to remove the remaining volume is planned in 20 years. Both blocks have similar 35-40% slopes and both have been logged with a skidder.

Contact Dan Carson Intensive Forest Management Ltd Pemberton 894-6004

- Two strip shelterwoods at North Creek and Railroad Creek, near Pemberton in the Squamish District. IDFWw Biogeoclimatic subzone.

Following the implementation of the strip shelterwood at Phelix Creek, two other strip shelterwoods have been implemented in the interior transition zone near Pemberton. These two blocks have a total area of 26.5 ha and have been logged by Squamish Mills Ltd on a Forest Licence. One block in the Railroad Creek watershed was logged in the winter of 1993 and the second block near North Creek has been logged in the summer of 1994.

The original forest on these two areas was predominantly Douglas-fir with a minor component of lodgepole pine and Western red cedar. The stands range from 130 to 200 years old. Both sites are dry and regeneration problems are commonly experienced on similar areas that are clearcut. A strip shelterwood system was utilized to improve regeneration success.

The blocks have been divided into strips ranging in width from 40 to 150 m. Approximately 40% of the stand in the odd numbered strips has been removed in the first pass and the remaining area will be cut when adjacent areas are free growing or when 11 years have passed.

Both blocks are on much steeper terrain than the Phelix Creek site and were logged with a grapple yarder. Yarding distance were up to 160 m to the roadside landings.

Contact Dan Carson Intensive Forest Management Ltd Pemberton 894-6004

- Shelterwood blocks on private land.

The MASS trial at Iron River near Courtenay, in the Campbell River District. CWHmm Biogeoclimatic subzone.

A uniform shelterwood has been implemented in three blocks with a total area of 28 ha as part of the Montane Alternative Silvicultural Systems (MASS) trial on MacMillan Bloedel private land at Iron River on eastern Vancouver Island, north of Courtenay. This site is an old-growth hemlock balsam stand with a minor component of western red-cedar and yellow cedar situated at 700 m elevation. The objective of a shelterwood on this site is to protect regeneration against snow, wind and temperature extremes and also to enhance the structural diversity of future stands for wildlife and aesthetic values. On similar sites in adjacent large clearcuts, regeneration problems including irregular stocking and slow growth of regeneration may be related to unfavorable microclimates created for shade tolerant species.

In these shelterwood blocks, 150 stems per ha (30% of the original basal area) have been retained following the first pass. Leave trees were marked prior to logging to represent the entire stand profile and to select trees most likely to be windfirm. A second entry is planned to recover up to a further 125 trees per ha (leaving approximately 25 trees per ha) when regeneration reaches 10 m, if it is considered feasible and economic at that time. Approximately 5 trees per ha are planned to be girdled to create snags in 20 years but this treatment may be done sooner.

The three blocks were logged in 1993 using a two pass falling and yarding system. Yarding corridors 15-20 m wide were established approximately 120 m apart and trees in the corridors were felled and yarded first. Adjacent areas were then felled and swung or slid into the corridor by a backhoe (hoe forwarding). All logs were skidded up or down the corridors to roadside with a tracked skidder.

Although this trial will require monitoring over several seasons to determine results, some preliminary observations have been made. Operationally, the shelterwood trial is considered successful. Logging was completed according to the lay-out without significant operational difficulties. There appears to be little serious damage to leave trees, except along the edge of yarding corridors where some damage did occur. There has been little blowdown after one winter. Productivity was reduced and costs were higher compared to conventional clearcutting but not as much as anticipated. Total stump-to-dump cost was increased an average of 40% compared to the clearcut base cost. However, productivity increased and costs decreased with each of the three blocks as the crew became more experienced. In the third block logged, the total stump-to-dump costs were 32% higher than the clearcut base cost. One accident did occur in the shelterwood when a hung-up branch fell and injured a faller. There was also higher breakage resulting from falling trees across each other in order to reduce damage to the leave trees.

This trial indicates that shelterwood can be used successfully in old-growth forest under conditions similar to those present at the Iron River site. It demonstrates the importance of involving logging personnel in all phases of planning and tree marking prior to logging.

Contact Bill Beese MacMillan Bloedel Nanaimo 755-3422

Reference Beese W. J. 1994. Development of Alternative Harvesting Systems for Partial Cutting in Montane Forests in Coastal British Columbia. Report submitted to Industry Science and Technology Canada by Land Use Planning Advisory Team, MacMillan Bloedel, Nanaimo.

Shelterwoods at Paradise Valley, near Powell River in the Sunshine Coast District.  
CWHxm Biogeoclimatic subzone.

MacMillan Bloedel has implemented several alternative silvicultural system demonstrations on 160 ha of private land at Paradise Valley near Powell River. The stands involved are about 70 years old originating from wildfire in 1922. They are predominantly Douglas-fir with Western red cedar and Western hemlock. The objective is to demonstrate the use of a variety of silvicultural systems and to monitor the response of Douglas-fir to different light conditions, and the impact of wind on small openings. The approach is to "learn by doing" rather than undertake rigorous research and the plans for subsequent treatments on these sites have not been determined.

The trials at Paradise Valley include a uniform shelterwood with 30 stems per ha, which has suffered heavy blowdown, an irregular or group shelterwood and three different strip shelterwoods which are elliptical in shape and oriented perpendicular to the wind to minimize windthrow. All the areas have been logged by skidder on flat to gently sloping terrain.

Contact Rod Tysdal MacMillan Bloedel Powell River 485-3109

Shelterwoods at UBC Malcolm Knapp Research Forest, near Maple Ridge. CWHdm  
Biogeoclimatic subzone.

Demonstrations of uniform and strip shelterwoods have been undertaken at the UBC  
Research Forest.

Contact Peter Sanders UBC Research Forest Maple Ridge 463-8148

There are blocks in the Greater Victoria and Greater Vancouver Watersheds that are referred to as shelterwoods but do not meet a number of the criteria defined above. These areas are more properly described under reserves silvicultural system in Section 2.4.2.

## 2.3 Selection Silvicultural Systems

A selection silvicultural system is defined as follows:

"This is an uneven-aged silvicultural system that removes mature timber either as single scattered individuals or in small groups at relatively short intervals, repeated indefinitely. The two variations of this system are group and single tree selection. The sizes, shapes and orientation of openings in group selection must consider such things as: silvics, slope, aspect, harvesting method, wind patterns, light, aesthetics and etc. Opening size should be 0.25 ha to 1 ha depending on shade tolerance of the regeneration. Single tree selection generally involves harvesting trees from each diameter class represented in the stand such that an uneven-aged structure is developed and maintained. Detailed stand analysis is required to carry out this variation of the selection system." (MOF, 1994)

A true group selection silvicultural system requires that each opening created in the stand is small and that there is a plan for further entries into the stand as the earlier openings regenerate in order to create an uneven-aged structure.

Only two cutblocks with a total area of 67 ha (of which 10.5 ha have been logged) were located on which a group selection system meeting these criteria has been implemented on Crown Land in the Vancouver Region. Both are in the same watershed in the Queen Charlotte District area and were planned and logged concurrently.

As defined by the Ministry of Forests, a single tree selection system requires both detailed stand analysis to ensure that trees are harvested from each diameter class represented in the stand, and several entries to ensure that an uneven-aged structure is developed and maintained.

There are a number of blocks in several Districts in the Region that are sometimes referred to as single tree or group selection systems. These include the removal of individual trees or small groups of trees during salvage logging operations such as the removal of small patches of blowdown or individual blown down trees, salvage of pockets of root rot, or salvage of insect damaged trees. They also include blocks where small isolated patches of merchantable timber have been logged and special circumstances such as the selective removal of individual high value trees from within Strathcona Provincial Park. These and other examples do demonstrate that it is physically and safely possible to harvest without clearcutting but they are not a selection silvicultural systems.

Other blocks involving the removal of individual trees from stands where most of the trees are retained to protect fish habitat or to maintain the stability of steep slopes are also referred to as group or single tree selection systems. They include blocks in the Queen Charlotte and Port Alberni Districts that were logged as part of a research trial to evaluate the role of partial cutting systems in maintaining the stability of steep slopes. However, the marking of trees for removal was not based on detailed stand analysis prior to tree marking and removal and there are no clear plans for further cutting in these blocks. The objectives were to protect environmental values rather than to create an uneven-aged stand structure through several entries. Since these blocks do not meet the definition of a selection system they are described as a reserves silvicultural system in Section 2.4.2.

Handlogging is also sometimes referred to as single tree selection system. It is a harvesting system involving the use of a boat to remove trees larger than a specified diameter from areas along the coast. Handlogging does involve the removal of individual trees while leaving most of the trees in the stand. However, it does not meet the criteria established above and is not considered to be a silvicultural system.

No recent examples of single tree selection silvicultural systems involving stands over 70 years of age were found on Crown Land that meets the criteria established above. A single tree selection system involving the removal of approximately 15% of the volume of a 60 year old Douglas-fir stand in several entries at 5-7 year intervals was initiated on Quadra Island in 1993. This is considered a thinning treatment and not included here.

The selection systems located were as follows:

- Two group selection blocks at Lagins Creek in the Queen Charlotte District. CWHwh Biogeoclimatic subzone.

The only examples of a group selection system on Crown Land in the Vancouver region are in the Lagins Creek watershed on Graham Island. A very detailed PHSP was prepared for a group selection system in two cut blocks involving four entries at 15 year intervals. The first pass of logging was completed in 1993.

The Lagins Creek blocks are old-growth Western hemlock-Sitka spruce forest in an area that contains many stream channels and is considered sensitive fish habitat. The two blocks were originally laid out and marked for removal of individual trees. The plan was changed to a group selection system to create more light for regeneration and to avoid the implication of high grading that is inherent in operational marking for individual tree selection that is done without a detailed stand analysis.

Block 1 in Lagins Creek has a total area of 46 ha and has been subdivided into 24 sub-blocks, each roughly 1.5 ha, each of which is further sub-divided into four small cutting units, averaging 0.4 ha in size to be logged in the four entries at 15 year intervals. Block 2 includes a total area of 20.7 ha subdivided into 7 sub-blocks, each with four cutting units averaging 0.4 ha in size. Both blocks also have patches of old-growth and deciduous trees which are not included within the sub-blocks and which will remain as old-growth and deciduous patches within each block following the final entry. Sub-blocks and cutting units are laid out so that cuttings in any one entry are not adjacent to each other. At the end of the fourth entry, the PHSP prescribes that there will be four age classes of young forest and a component of the original old-growth forest.

In 1993, the first entry was completed with one of the small cutting units in each of the sub-blocks in Block 1 and Block 2 being logged. In Block 1, the 24 patches cut ranged in size from 0.07 to 0.54 ha in size and average 0.34 ha. In Block 2, the range is 0.17 to 0.47 with an average of 0.34. Each of these cut areas is surrounded on all four sides by old-growth forest. The total area logged in the two blocks is 10.54 ha from the total area of 66.7 ha. There are no roads within either block and all logs were helicopter yarded to a nearby road and landings.

Engineering and layout costs, administration costs and silviculture costs were all significantly higher than normal but would be reduced if more blocks of this type were being developed. The next entry in the Lagins Creek blocks is scheduled for 2008 but consideration is being given extending the interval to 20 years, with the next pass in 2013.

This group selection trial is considered to have been successful from an operational point of view. Logging was completed safely and efficiently and the completed logging closely matches the plan. Protection of stream channels and riparian areas has been achieved. There is virtually no damage to residual trees on the edges of openings and after one winter there has been no blowdown on the edges of the openings. Waste in the block was higher than normal and planting was more difficult and more expensive because of the lack of road access and the uncompacted slash. The response of planted trees to the reduced light in the small openings is unknown but will be monitored.

Contact Del Williams Ministry of Forests Queen Charlotte City 559-8447

Reference Williams D. R. 1990. Preharvest Silvicultural Prescriptions for TSL A16873, CP 845 Blocks 1 and 2. Unpublished report, Ministry of Forests, Queen Charlotte District.

- Selection systems on private land.

Group selection at the UBC Malcolm Knapp Research Forest, near Maple Ridge. CWHdm Biogeoclimatic subzone.

A group selection demonstration has been initiated at the UBC Research Forest in a 100-150 year old Douglas-fir stand at Blaney Lake. A 28 ha block is being managed on a group selection regime with 10 entries planned at 15 year intervals over a 150 year period. Each entry is planned to log a total of 2 ha in a number of small group selection openings with a portion of the total area to remain as a lakeshore buffer and an area of old-growth. Openings can not be adjacent to each other until 30 years. Logging began in 1991 when 7 small openings ranging in size from 0.1 to 0.6 ha were logged with a skidder.

A second group selection has been implemented in a younger uneven-aged stand of Douglas-fir, hemlock and deciduous species resulting from past selective logging. This 24 ha area is planned for 5 entries at 15 year intervals over a 75 year cycle. The first entry in 1992 removed 3 ha in 7 small blocks with an average size of 0.43 ha.

Contact Peter Sanders UBC Research Forest Maple Ridge 463-8148

## 2.4 Reserves Silvicultural Systems

"Reserves" are used to modify any silvicultural system to meet objectives other than regeneration and the production of timber. In the Vancouver region, "reserves" is recognized as an alternative silvicultural system and is defined as follows:

"A modification of the silvicultural system generally used to benefit resource values other than timber. Trees are left singly or in groups within the boundaries of the prescribed area. These can be veterans, groups of trees around veterans or snags, or trees left in and around swamps, other wet areas or rock knolls. It does not include areas typed out along cutblock boundaries unless specifically identified for retention by a resource agency. The reserves can consist of a variety of sizes and species and can be included with any of the other mentioned silvicultural systems. Reserves offer an opportunity to provide for riparian strips, wildlife trees and snags, etc. and can incorporate streamside management zones." (MOF, 1994)

Clearcutting with reserves describes a system in which relatively few trees or groups of trees are left within a clearcut area to provide for wildlife or other values. It is the silvicultural system that most operational foresters expect to see greater use of in future.

Reserves, however, can modify any silvicultural system. Throughout the Vancouver Region a number of blocks have been located that are not clearcuts, seed tree or shelterwood systems and that do not meet the definitions of selection cutting or clearcutting with reserves. In these blocks, a relatively high proportion of the trees have been left to benefit resource values other than timber while some timber value is extracted and some consideration has been given to regeneration and future stand management. They include blocks where trees have been retained within cutting areas for the protection of fish habitat, visual objectives, wildlife winter range or terrain stability.

This logging has been termed individual tree selection or group selection but it clearly does not meet the definition of a selection system because there is no well defined plan for subsequent entries and the removal of trees has not been based on a detailed stand analysis to ensure that trees from each diameter class are represented in the remaining stand. The blocks do represent a legitimate forest management system and do meet the definition of a "reserves" system. Even in cases where silvicultural objectives have been compromised, the blocks demonstrate that trees can be marked and selectively removed safely and without excessive damage to the remaining stand.

For the purposes of this report, these blocks are referred to as "partial cutting with reserves". This does not conform to currently existing terminology within the Ministry but it allows recognition of a variety of partial cutting blocks in which large numbers of trees are left to benefit non-timber resources.

#### **2.4.1 Clearcutting with Reserves**

Clearcutting with reserves has been described using several other terms including "new forestry", "clearcutting with retention", "green tree retention", and "wildlife tree retention". These refer to essentially the same system although the actual trees left in a block might be different. Trees are left to maintain or protect environmental values rather than to produce seed or to shelter regeneration. The trees reserved to meet those objectives may be dispersed throughout the block, clumped in patches or combined as both dispersed trees and patches within the cut block.

The number of trees to be reserved in a clearcutting with reserve system has not been defined. In the Pacific Northwest of the United States, it is typically 10 trees per acre, or 25 trees per ha. In the Vancouver region, the Squamish District has suggested that up to

25 trees per ha could be left. For the purposes of this report, clearcutting with reserves includes retention of 5 to 25 trees per ha.

There are many examples of clearcut blocks within the Vancouver Region where patches of non-merchantable or low volume forest around wet areas, or trees on rocky knolls and bluffs, on streamsides or within deep gullies have been retained within clearcut areas. Most of these are simply areas excluded from the operable cutting block and are not the result of a specific prescription to retain trees to maintain wildlife habitat, meet visual objectives or retain some of the original stand structure into the second growth forest. In the past, most of these areas would have been felled and left. In recent years, they have been left standing and provide a diversity in stand structure. As the stand around them develops, they will provide useful habitat. This is an important departure from earlier practices, and the number of these sites will increase in future. However, these sites have not been considered within the scope of this report.

A total of 20 blocks with a total area of 248 ha have been located where a specific prescription for the retention of reserves within the clearcut opening was applied to meet specific objectives. More than half of these blocks (12) are on two small timber sale licences on Texada Island.

Most of these blocks involve dispersed retention. Only two of them on Crown land are distinctly a patch retention system involving the retention of patches of trees. Several of the blocks on Texada Island involve retention of a mix of dispersed larger trees and patches of predominantly small trees.

Only three of the 20 blocks involve cable yarding systems. All of these are in the Greater Vancouver watershed. The remainder are all ground based skidding or hoe forwarding. Three of the clearcutting with reserves blocks are on Tree Farm Licence or Forest Licence lands.

The following clearcutting with reserves blocks have been located:

- A clearcutting with dispersed reserve trees at Pryor Road north of Powell River in the Powell River District. CWHxm Biogeoclimatic subzone.

A good example of clearcutting with reserves is a 35 ha block on Pryor Road near Lund, north of Powell River. The stand was an 80 year old stand of Douglas-fir and Western red cedar, with large Douglas-fir vets which were left when the original old-growth stand was logged near the turn of the century.

The large Douglas-fir vets, many with dead tops, broken branches and butt scars, were marked prior to logging and were left standing. In addition, some large Western red cedar and some tall younger fir have also been retained throughout the block. Approximately 3 to 4 trees per hectare were left dispersed over the whole block.

Terrain is generally gently sloping with some areas up to 30%. The area was logged in 1992 by a contractor for International Forest Products on Interfor's Forest Licence. Areas close to the roads were hoe forwarded and other areas were bunched with the hoe and skidded to roadside. The area has been planted.

This is considered to be a successful treatment that has retained trees with potential wildlife value. A number of the cedar and fir have blown down, particularly on a part of the block with shallow rocky soils and in a wet depression.

Contact Mike Scott International Forest Products Sechelt 885-3287

- Clearcuts with dispersed and patch reserves on Texada Island in the Powell River District. CWHxm Biogeoclimatic subzone.

Approximately 12 blocks with a total area of 90 ha have been logged since 1990 on Texada Island using a clearcutting with reserves system. These have been logged by a small company operating on two timber sale licences and provide some good examples of this system. The original forest is old-growth Douglas-fir on dry sites with gentle slopes and rocky outcrops.

Several approaches to reserves have been taken. In most blocks, 4 to 6 trees per ha were marked and have been left as potential wildlife trees scattered throughout the block. These reserve trees are predominantly large Douglas-fir vets usually with broken tops, butt scars or sweep or other defects that are present or potential wildlife trees. In other blocks, fewer of the large trees have been retained but all Western red cedar trees and patches of smaller diameter trees have also been left within the block. A third approach has involved leaving small diameter non-merchantable trees both in patches and scattered throughout the block.

In all the blocks, ground-based yarding equipment has been used and there is little tree damage. Few of the large Douglas-fir vets have blown down but in blocks where tall subdominant trees were left, up to 20% have blown down particularly on shallow soils. This amount of blowdown is not felt to have diminished the value of the clearcutting with reserve system on these sites.

Contact Maurice Potesta Ministry of Forests Powell River 485-0700

- A clearcutting with dispersed reserve trees on Quadra Island in the Campbell River District. CWHxm Biogeoclimatic subzone.

As part of their demonstration site on TFL 47 on Quadra Island, Timberwest logged a 9 ha clearcut with reserve ("green tree retention") block in 1993. Prior to logging the stand was 70 years old, predominantly Douglas-fir with an understory of Western hemlock, Western red cedar and other minor species. It was on flat to gently rolling (5-15% slope) terrain.

Ten to 15 large dominant Douglas-fir per ha were marked prior to logging. These were trees of poor form and log quality but were healthy and windfirm. The objective was to leave some future wildlife trees and a source of structural diversity and future woody debris in the stand and to reduce the visual impact of logging. In addition to the large trees marked for retention, small diameter immature hemlock, cedar and other species were also left following logging. Approximately 95% of the volume was removed during logging. The block was logged with a backhoe and small skidder.

This is considered to be a successful demonstration of this system and has received a favourable reaction from the public on Quadra Island.

Contact Steve Lackey Timberwest Campbell River 286-7362

- A clearcut with combined patch and dispersed retention on a woodlot near Port McNeill. CWHvm Biogeoclimatic subzone.

A clearcut with reserve system has been implemented on a 9 ha block logged on Woodlot 071 near Port McNeill. The original Western red cedar-Western hemlock stand is on gently rolling poorly drained terrain with patches of low volume timber in depressional areas. Under normal practices on adjacent areas, the area would have been clearcut.

Trees were marked prior to cutting with the intention of leaving all cedar and lodgepole pine less than 30 cm and most of large cedar trees which had good form and vigour. Approximately 90% of the volume of the stand has been logged with individual large trees and patches of trees distributed throughout the block.

The area was logged with a backhoe in 1993.

Contact Jim Burgess Woodlot Licencee Port Hardy 949-6860

- Three clearcut with reserves blocks in the Coquitlam and Capilano watersheds in the Greater Vancouver Watershed. CWHvm Biogeoclimatic subzone.

A clearcut with reserve system was used on an 8 ha experimental block in the Seymour watershed. This block was planned to incorporate several types of tree retention and to allow comparison of dispersed and patch retention methods in a block logged with cable yarding equipment.

The PHSP provided for retention of green trees and snags over 15% of the block in narrow strips, patches and dispersed through out the block. However, this trial experienced a number of operational falling and yarding problems around the dispersed reserve trees and many fewer trees than prescribed were actually left. Most of the reserved trees are in two patches, one of which adjoins the block edge and includes a riparian area. Approximately 8 large Douglas-fir vets are dispersed within part of the block. The plan to leave trees in wedges between yarding corridors and in a riparian zone along two small streams was unsuccessful.

On a 6 ha block the management objective was to convert a hemlock-balsam stand susceptible to insect attack to a predominantly yellow cedar stand which will be more resistant to disease. Thus, a component of yellow cedar vets and younger trees were reserved from cutting. In part of the block where yellow cedar was abundant, the objective was to leave 50 yellow cedar stems per ha and the silvicultural system was referred to as a shelterwood with residuals. Over the whole block, many fewer stems per ha were retained when the block was logged in 1992.

In a second block of 7 ha, scattered Douglas-fir vets have been reserved at an estimated 2 stems per ha in a demonstration of a "green tree retention" system. This block was logged in 1992.

The latter two blocks were logged with a Wyssen skyline and demonstrate the capability of that system to yard over standing second growth and to reserve trees.

Contact Derek Bonin Greater Vancouver Watershed North Vancouver 432-6410

Reference Elm T. J. 1993. Managing Forests for Structural Diversity: Principles, Regulatory Constraints and Application. Masters thesis, School of Resource Management, Simon Fraser University.

- A clearcut with patch reserves near Sooke in the Duncan District. CWHvm  
Biogeoclimatic subzone.
- 

A designed clearcut with patch reserves was laid out and logged on a timber sale in the Sandcut Creek watershed near Jordan River. The stand was a mixed old-growth stand of nine commercial tree species at the edge of the Mountain Hemlock zone. It is surrounded by an extensive area of 3-15 year old logging.

In a 50 ha block, six reserve patches ranging in size from 0.5 ha to 1.4 ha were located and retained. The patches incorporate wetland and riparian areas along the upper reaches of Sandcut Creek and two small tributaries that run through the block. Trees in the reserve patches are relatively small and many are non-merchantable trees that would have been felled and left to waste to facilitate yarding in the past. Snags and some larger merchantable trees have also been retained within each patch. The reserves account for approximately 10% of the total area of the block but only 6% of estimated volume.

Slopes in the area are 20% and the whole block was hoe forwarded. This yarding system facilitated the retention of at least two of the patches which would have been felled to accommodate conventional cable yarding.

Contact   Rob Furness                      Ministry of Forests   Duncan                      746-2700

- Clearcuts with patch reserves in the Nimpkish Valley, Port McNeill District. CWHxm  
Biogeoclimatic subzone.

Canadian Forest Products has implemented a clearcutting with patch reserves on two blocks on TFL 37 near Woss. In both blocks, the reserve patches within the block have been located around identified wildlife trees.

In a 28 ha block near Klaklakama Lake, three patches of old-growth (1 ha, 2 ha and 3 ha in size) were identified as important for cavity nesting birds during a co-operative study with Canadian Wildlife Service. One patch contained a raptor nest. These patches were reserved within the surrounding clearcut opening to provide habitat for birds, and also to provide sufficient no-work zones around the large Douglas-fir snags which contain the raptor nest and provide habitat for cavity nesters.

In an 8 ha block adjacent to the Davie River, one circular patch with 2 large snags with wildlife use has been left as a reserve within the clearcut area. A second patch within the block includes snags and large trees adjacent to a small stream which runs

through the block. The reserve incorporates the streamside management zone but is larger than the area required for stream protection alone.

Both blocks were hoe forwarded.

Contact John Deal Canadian Forest Products Woss 281-2481

- Clearcutting with dispersed reserve trees on private land

The MASS trial at Iron River, near Courtenay, in the Campbell River District. CWHxm Biogeoclimatic subzone.

The MASS trial (described in Section 2.2) provides three good examples of dispersed retention. In three "green tree retention" treatment units, 25 stems per ha of lower value dominant and co-dominant trees were marked and left at approximately even spacing of 20 m. Healthy understory trees were also left throughout the block.

The area was manually felled and trees were removed by hoe-chucking. There appears to have been little tree damage and a minor amount of blowdown after the first winter. The treatment is considered to have been successfully implemented according to the plan.

Falling and yarding costs of this retention treatment were on average higher than anticipated but declined rapidly as the crew became more experienced. In the last of the three blocks logged, falling and yarding costs were actually lower than in the clearcut base case and the total stump to dump cost was only 14% higher reflecting the extra costs incurred in marking and layout and in supervision. There has also been additional breakage associated with falling trees away from the leave trees.

Monitoring to determine the effectiveness of this treatment continues but it has been observed that the use of clumped or patch retention would have reduced the costs and possibly breakage and may have provided more benefits to wildlife particularly if snags could be retained in the patches.

Contact Bill Beese MacMillan Bloedel Nanaimo 755-3422

Reference Beese W. J. 1994. Development of Alternative Harvesting Systems for Partial Cutting in Montane Forests in Coastal British Columbia. Report submitted to Industry Science and Technology Canada by Land Use Planning Advisory Team, MacMillan Bloedel, Nanaimo.

Clearcutting with reserves at Paradise Valley, near Powell River in the Sunshine Coast District. CWHxm Biogeoclimatic subzone.

The demonstration site at Paradise Valley near Powell River includes two demonstrations of clearcutting with reserves with a total area of 11 ha. In one block five dominant Douglas fir trees have been retained as future snags and wildlife trees; in the other block, 20 trees have been retained. The area was logged with a skidder.

The area with 20 stems per ha has suffered heavy blowdown.

Contact Rod Tysdal MacMillan Bloedel Powell River 485-3109

Clearcutting with dispersed reserve trees has been used on several other private land holdings on the east coast of Vancouver Island.

#### **2.4.2 Partial Cutting with Reserves**

Partial cutting with reserves is used to describe a reserves silvicultural system where more than 25 trees per ha have been left to benefit resource values other than timber while some timber value is extracted and some consideration has been given to regeneration and future stand management.

This system has been carried out in four different areas on Crown land in the Vancouver Region involving 20 different blocks with a total area of approximately 195 ha. Most of this cutting has occurred in one logging operation in the Queen Charlotte District. The remaining three areas involve two alternative silvicultural systems research trials and a block logged as part of the Ministry of Forests Special Project investigating alternatives to clearcutting and log sales. Three of the four areas have been logged by helicopter. The fourth used a ground-based yarding system. An additional site of partial cutting with reserves is located on the Chapman plateau in the Mountain hemlock zone near Sechelt.

- A group seed tree with reserves near Bowser in the Port Alberni District. CDFmm Biogeoclimatic subzone.

As part of the experimental Ministry of Forests Special Project investigating alternatives to clearcutting and log sales, a 6.5 ha opening was logged in 1993 using a group seed tree system with reserves. This site is on Crossley Road near the community of Bowser and is adjacent to but not visible from the Vancouver Island highway. It has high recreational value and wildlife use. The original stand was a 140

year old Douglas-fir and Western red cedar stand with scattered old-growth Douglas-fir vets. The objective was to maintain cover for aesthetics and wildlife and to recruit a component of old-growth in the new stand. All Douglas-fir vets as well as 3 to 4 groups of 5 to 10 trees per ha were marked prior to logging and were reserved from cutting.

The area was successfully logged with minimal damage by hoe chucking and rubber tired skidder. Trees are now well distributed through the opening as individual vets, or in patches of trees and understory vegetation. It provides a good demonstration site.

Contact Dean Stewart Ministry of Forests Port Alberni 724-9205

- Partial cutting with reserves at Naden Harbour in the Queen Charlotte District. CWHwh Biogeoclimatic subzone.

Partial cutting was introduced on a Forest Licence in the Queen Charlotte Islands by Husby Forest Products in 1986 and was described as individual tree selection. It involved the removal of individual trees from environmentally sensitive floodplains, islands and riparian areas with numerous small streams, where clearcutting was not permitted. Individual trees were marked for cutting, felled in groups of two or three trees and yarded up through the remaining canopy by Sikorsky S64-E SkyCrane helicopter. Between 1986 and 1989, 141 hectares in 14 blocks were logged using this system in several watersheds in the Naden Harbour area of Graham Island. No detailed stand analyses were done prior to tree marking and there is no schedule for further entries. In some blocks, trees were marked with the objective of removing approximately 30% of the volume of the stand with representation of all species, diameters and grades. In other blocks, higher volumes and higher grades were marked so that a high percentage of the volume was removed with a relatively low percentage of the stems.

This cutting was operationally successful. It was safely and efficiently completed and the degree of environmental protection was high. In most blocks with 30% or less of the stems removed, a relatively intact canopy was maintained and there has been very little blowdown in the years since logging was complete. Blowdown did occur in blocks where more volume was removed and a more open canopy was left.

Damage to remaining trees was also low with the helicopter yarding. Concern has been expressed about the growth and health of residual trees and new trees in the shaded conditions under the canopy and about a number of other management

concerns. Regeneration surveys have not been completed. Further partial cutting of this type has not been approved in this area since 1990. Despite the silvicultural concerns, the blocks do demonstrate the ability to remove individual marked trees from an old-growth stand with a heavy lift helicopter.

Contact    Arnold Pertile            Husby Forest Products            Delta 940-1234

Reference Moore M. K. 1990. Partial Cutting and Helicopter Yarding on Environmentally Sensitive Floodplains in Old-Growth Hemlock Spruce Forests FRDA Report 166, Research Branch, BC Ministry of Forests.

- Partial cutting with reserves in Rennell Sound in the Queen Charlotte District. CWHvh Biogeoclimatic subzone.

A Fish Forest Interaction Program (FFIP) research project in Rennell Sound on the Queen Charlottes is evaluating the impact of logging individual marked trees from steep marginally stable hillsides. The project was initiated to determine whether some trees could be removed from these hillsides without increasing the risk of slope failure. It was hypothesized that if a sufficient number of trees are retained, an intact network of tree roots will maintain the stability of the slopes. Prior to logging, the stands were old-growth Sitka spruce and western hemlock with isolated Western red cedar on gullied slopes in excess of 70%. Clearcutting on similar slopes in the general area has resulted in greatly increased landslide activity.

In the Gregory Creek watershed, individual marked trees representing a diversity of species, diameters and grades were evenly distributed throughout the area prior to cutting. The objective was to remove 25% of the volume from a 9 ha portion of the research block and to remove 15% of the volume from an adjacent area within the block. In the nearby Hangover Creek watershed, trees were similarly marked to remove approximately 25% of the volume in a 10 ha portion of the block. The areas are referred to as individual tree selection but do not meet the definition of that system.

The marked trees were felled and successfully yarded with a Sikorsky S-64E SkyCrane helicopter in 1992. From a distance the canopy appears intact and it is difficult to determine where the logging has occurred. There appears to have been little falling or yarding damage to the remaining trees and very little blowdown has occurred in the two winters following logging. Research and monitoring continue to determine the growth response of understory residual trees and planted trees and to

evaluate the effectiveness of the treatment in reducing the incidence of landslides following logging on steep slopes.

Trees were also removed from small patches of approximately 0.4 ha in size in the two research blocks. Patch cutting was laid out at two levels of intensity - a 25% cut which removed 25% of the volume from the treatment unit area and a 50% cut which removed 50% of the volume. In the Gregory Creek watershed, 16 of these small patches were logged from a 15 ha treatment unit. In the Hangover watershed, 31 patches were logged from a 20 ha unit. These small patch cuts were also logged with the SkyCrane helicopter. Some blowdown has occurred on the perimeter of patches particularly in the areas of the heaviest density of patches and the 25% patch logging appears to have been generally a more successful treatment than the 50% removal.

Although monitoring continues in this project, the blocks do demonstrate that group selection or partial cutting with reserves systems can be used in conjunction with helicopter yarding in areas where retention of old-growth forest is desired. More attention to stand analysis prior to marking and to the distribution of patch cuts will be required to more precisely meet whatever objectives for removal are prescribed.

Contact	Steve Chatwin	Ministry of Forests	Victoria	387-5887
	Ray Krag	FERIC	Vancouver	228-1555

Reference Moore M. K. 1992. A Summary of Observations on the Helicopter Logging Research and Demonstration Project, Rennell Sound and Tartu Inlet, Queen Charlotte Islands. Unpublished report submitted to Research Branch, Ministry of Forests, Victoria.

- Partial cutting with reserves at Cats Ears Creek, Port Alberni District. CWHvm Biogeoclimatic subzone.

In conjunction with the research project at Rennell Sound described above, a similar trial was undertaken in the Cats Ears Creek area west of Port Alberni. Prior to logging, this area was an old-growth hemlock balsam forest on steep terrain.

The research design was similar to the Rennell Sound project but on a smaller scale. Trees were marked in a 4.3 ha area to represent the distribution of species and grades to allow for removal of 25% of the volume in the treatment unit. In addition cutting of eight small patches was planned on a 6.2 ha unit to remove 25% of the volume. In this trial, three subsequent entries are planned at 25 year intervals and the plan approximates a selection silvicultural system.

The first entry was completed in 1992 using a Sikorsky S-61 helicopter. Research continues on this project but initial observations indicate that there were a number of operational falling and yarding problems on the individual tree selection portion of the block. Fallers were unable to safely fall the marked trees on the steep hillside and the helicopter was unable to successfully lift trees vertically through the remaining standing trees. The area marked for individual tree removal more closely resembles a patch cut. In some parts of the block, all trees have been cut and in other parts all trees have been left.

Contact	Frank Pendl	Ministry of Forests	Vancouver	660-7538
	Greg Cawston	Ministry of Forests	Port Alberni	724-9205

## **2.5 Extent of Use of Alternative Silvicultural Systems in the Vancouver Region**

The extent of use of alternative silvicultural systems in the Vancouver Region is very limited. The sites of alternative harvesting systems described above include a total of 59 cut blocks with a total area of approximately 654 ha. This includes areas logged over an 8 year period between 1986 and 1993. Two timber licences on Texada Island and two Forest Licences in the Naden Harbour area of the Queen Charlotte District account for 26 (44%) of the blocks and 35% of the area logged. The areas described in this report have been located through interviews in Ministry of Forests District offices and with staff of forest companies. Most sites have been visited. It is probable that with further investigation and more field work and with a different set of definitions and criteria, some additional sites would be located.

Based on the information collected for this report, it is estimated that the current use of alternative silvicultural systems to clearcutting, as defined in this report, is approximately 100 to 150 ha per year on Crown land in the Vancouver Region. This amounts to less than 0.4% of the approximately 30,000 ha logged annually in the Region. This estimate does not include those areas where non-merchantable trees, or tree in gullies, stream draws, around swamps and on inaccessible rock knolls have been left within clearcut areas as described on page 22.

A substantial portion of the use of alternative systems in recent years is accounted for in the research trials initiated by the Ministry of Forests at Boston Bar, Roberts Creek, Rennell Sound and Cat's Ears Creek, and in the Ministry of Forests special project to investigate alternatives to clearcutting and log sales in the Duncan and Port Alberni Districts.

The use of alternative silvicultural systems is conspicuously absent on most Tree Farm Licence lands. Only four of the examples of alternative systems described above have been located on Crown land within TFL's - two clearcuts with patch retention on TFL 37, and a

shelterwood and a clearcut with dispersed reserve on TFL 47. The total area is 66 ha out of the total area of approximately 10,000 ha logged annually on Crown land within Tree Farm Licences.

Also as noted, the use of alternative systems is heavily weighted to the drier Douglas-fir sites on Southern Vancouver Island, the Sunshine coast and nearby islands and the interior transition zone. More than half of the sites located are in the very dry maritime subzone of the Coastal Western Hemlock zone (CWHxm) or in the Interior Douglas fir zone (IDFww). Most of these sites are older second growth stands. The selection cutting and partial cutting with reserves in the CWH wet hypermaritime and very wet hypermaritime subzones on the Queen Charlotte Islands and the MASS trial on private land are notable exceptions.

At present, there is no readily available, accurate statistical information on the extent of the use of alternative silvicultural systems to clearcutting in the Vancouver Region that confirm these estimates. Information on the annual use of alternative silvicultural systems is not rigorously compiled at the District level and not reported in Ministry documents. Some information on alternative systems is being recorded Forest Tenure Administrative System (FTAS) at the District level but review of this information indicated it was not consistently or rigorously recorded. It did not provide a reasonable estimate of the extent of use of alternative systems. The new Integrated Silviculture Information System (ISIS) is designed to record the use of all silvicultural systems according to precise definitions and will provide this information in future.

Table C-5 of the Ministry of Forests Annual Reports does provide an annual summary of the area harvested in the Vancouver Region separated into two "harvesting methods" - clearcutting and "selective cutting", a term used up until the 1992/1993 Annual Report, or "partial cutting", a term used in the 1992/1993 report.

In the 1992/93 report, the area reported as "partial cutting" totals 982 ha of which 56 ha is reported as partial cutting on TFL lands. These figures suggest that 3.3% of the 29,772 ha cut on Crown land was by partial cutting methods.

However, partial cutting is defined in the Annual Report as "the sum of seed tree, shelterwood, selection, and coppice silvicultural systems plus diameter limit and salvage harvesting operations". The reported area, therefore, includes handlogging, salvage of blowdown, insect and fire killed timber on a selective basis and commercial thinning as well as alternative silvicultural systems. It does not include clearcutting with reserves.

Information obtained from the Silviculture Branch and from FTAS indicates that salvage logging amounted to 140 ha and handlogging to approximately 500 ha in 1992/93. Commercial thinning is estimated to amount to approximately 300 ha. All of the 56 ha

reported as partial cutting on TFL lands are salvage logging. These figures therefore tend to confirm the estimate of 100 to 150 ha per year logged with alternative silvicultural systems.

During the course of compiling information for this report, a number of alternative silvicultural systems trials or demonstrations planned for 1994 or 1995 were identified. These include the use of alternative systems at the Whistler Demonstration Forest and at Ring Creek in the Squamish District, in the Upper Taylor River and at least three sites in Clayoquot Sound in the Port Alberni District, at Kyuquot in the Campbell River District, at Yale Creek in the Chilliwack District and at Lois Lake and Nelson Island in the Sunshine Coast District. With recent initiatives by the Vancouver Region and the increasing number of demonstration sites, the use of alternative silvicultural systems appears to be growing. Considerable interest is also reported in the MASS trial near Courtenay and in the research sites at Boston Bar, Roberts Creek and in the Queen Charlottes.

The obstacles to greater use of alternative silvicultural systems are numerous. First and most important, there is a widespread and deeply held belief that clearcutting is the only appropriate, practical, safe and economic silvicultural system on most sites in the Vancouver Region. Clearcutting is regarded as the simplest, safest and least expensive way to log and to regenerate the old-growth forests and is therefore virtually the only system in use.

There is also a significant lack of expertise and experience in the planning, layout and implementation of alternative silvicultural systems on the ground. There is also a lack of logging expertise that will facilitate the use of alternative systems and a lack of the flexibility in large companies and unions that is required to make the site specific decisions in seed-tree, shelterwood and selection systems. Much of the use of alternative systems has been by smaller companies.

Company and government foresters express a reluctance to develop the alternative systems. There is a fear that if successful in one area, they will be required to use the systems on a widespread basis. There is also concern for the greater planning and administrative time required. Companies fear that meeting PHSP requirements and getting approvals for a relatively simple silvicultural system like clearcutting is already too time consuming and they are reluctant to embark on systems that will involve more planning and administrative time and cost to get approval.

Finally, while government has initiated research trials to provide background information, experience and training opportunities and recently initiated a "log sales" project using alternative silvicultural systems, there has been relatively little emphasis on expanding the operational use of alternative silvicultural systems. In recent years, the focus in the Coast

Planning Guidelines and other documents has been on reducing the size of clearcuts rather than requiring the use of alternative systems to clearcutting on specific sites. The success of the research trials, the development of policy within the Vancouver Region and new requirements in the Forest Practices Code and Coastal Biodiversity Guidelines will put greater emphasis on the use of alternative silvicultural systems in future.

### **3.0 Use of Alternative Harvesting Systems**

#### **3.1 Skyline Harvesting Systems**

Skyline yarding utilizes a 30 m or larger steel tower and a slack pulling carriage to provide full suspension of logs with yarding distances up to or greater than 1000 m.

Approximately ten skyline machines of various makes and using a variety of carriages are presently operating in the Vancouver Region, almost all of them on Vancouver Island. To date, all have been used in clearcutting usually for long yarding situations to harvest timber on slopes inaccessible by road and conventional cable yarding equipment or to avoid the need for road on sensitive terrain. There appear to be only two sites where long yarding skyline machines have been used in alternative silvicultural systems. Both of these involve the Wyssen skyline machine in the Greater Vancouver watershed in a reserves system. It is the only Wyssen operating in the province and has previously been used in long yarding situations.

Skylines with carriages with a side pulling capability could be used in shelterwood, true group or single tree selection or partial cutting with reserve systems. These would require long yarding corridors into which trees from the adjacent stand could be pulled by the carriage. This type of harvesting has been successfully done with conventional grapple yarders or small skyline machines at Roberts Creek, Boston Bar, Copper Canyon and the Greater Victoria watershed but has not been done with a long yarding skyline machine.

#### **3.2 Helicopter Harvesting Systems**

Helicopter logging has grown rapidly in all Districts in the Vancouver Region in recent years and is now considered a conventional harvesting system. At least five helicopter yarding companies with a variety of sizes and makes of helicopters are involved.

Most of the helicopter logging is in conventional clearcuts without roads. Logs are flown by the helicopter to nearby roads and landings or water drop sites up to 2 kilometers away. A more limited use of helicopters is in conventional clearcut blocks with roads

where most of the block is yarded by cable or ground-based yarding equipment. In these situations, the helicopter is used to log small portions of the blocks that are within gullies, across streams or out of deflection, in order to reduce ground disturbance and site degradation with conventional yarding.

The heavy lift helicopters with lifting capability of up to 8000 kg (for example the Sikorsky S-64E SkyCrane) can lift logs straight up through a canopy of standing trees safely and without damage to remaining trees. This capability to remove trees individually or in small groups has been demonstrated in the group selection and partial cutting with reserves at Lagins Creek, Naden Harbour and Rennell Sound in the Queen Charlottes.

Greater use of helicopter yarding in partial cutting with reserves is anticipated in areas similar to those described with unstable terrain, retention visual quality objectives, wildlife winter range or other important environmental values. Use of a helicopter with adequate vertical lift, attention to outstanding safety issues and provision for regeneration is required.

### **3.3 Balloon Harvesting Systems**

Balloon logging in the Vancouver region has been very limited in recent years and used only with clearcutting. The long yarding and aerial lifting capabilities of a balloon allow it to access sites where road access is not desirable or feasible and areas which are out of deflection for conventional cable systems. The aerial lift of the balloon allows this system to yard logs clear of the ground and to yard over standing timber in riparian areas for example. The balloon is much slower but generally cheaper than a helicopter.

Only one company in British Columbia is involved in balloon logging. Skyhook Enterprises in Campbell River has two helium filled balloons and has been logging in the Region since 1990. With two new balloons operating, they can log approximately 40,000 m<sup>3</sup> annually. In the last four years, the balloon system has logged clearcut areas in Seymour Inlet, Phillips Arm and at Williams Creek, a tributary of the San Juan River near Mesachie Lake on Vancouver Island.

The capability of the balloon system to log with alternative silvicultural systems is severely limited. During yarding, the balloon and the mainline which controls it, move laterally in the wind. Because of this lateral movement and the running haul back line, clearcutting is greatly favoured. Partial cutting in openings along a wide corridor would be possible but a very wide yarding corridor (probably in the order of 100 m in width) would be required to provide for safe operation of the running lines. This has not been tried in BC.

The balloon can fully suspend logs across streamside leave areas but requires wide corridors through the leave area. The width of the corridor depends on the distance of the corridor from the yarding machine. In 1991, logs were flown across a streamside leave area in Seymour Inlet that was close to the yarding machine. An attempt to fly logs over standing timber in Phillips Arm resulted in considerable damage to the standing trees.

#### **4.0 Use of Special Techniques to Maintain Old-growth Forest Attributes**

Two important structural attributes of old-growth coastal forests that are desirable to retain in managed forests are snags and patches of original old-growth trees, particularly as leave strips along riparian areas as wildlife corridors or habitat patches.

Snags provide habitat for a large number of birds, small mammals and insects but in coastal BC, all snags are required to be felled concurrent with logging operations in order to avoid hazard to workers. Several special techniques have been proposed for creating or re-establishing snags following logging so that they become a component of second growth forests and provide habitat not otherwise available in those forests.

Creation of snags during or after logging has been developed in the United States as part of New Forestry and includes techniques such as creating snags from live trees either by girdling following logging, cutting them off high above the ground (stub creation) or by blasting tops off with primacord. One technique being studied in a research project near Okanagan Falls in the interior of the province involves the use of a feller buncher machine to create stubs or very high stumps.

A second snag creation technique involves "planting" snags following logging by up-ending available non-merchantable logs and pieces of trees and placing them in a hole.

A major obstacle to maintaining old-growth trees along riparian area or in corridors or patches within clearcut openings has been the risk of blowdown. Two special techniques have been proposed as methods to reduce this risk. One technique involves topping and or limbing trees to reduce the crown area exposed to the wind. The second technique involves the removal of selected trees from an edge to remove the trees most susceptible to blowdown and to allow more penetration of wind. It is referred to as edge feathering.

Although these four techniques are often discussed and proposed as methods to assist in retaining or re-creating old-growth attributes in managed stands, there is little information on how widely they are used. In compiling information for this report, sites demonstrating each technique have been located.

## 4.1 Snag Creation

One example of snag creation was located on Crown land. It involves stub creation by feller buncher.

- Stub creation from live trees on Texada Island in the Sunshine Coast District.

In a small cut block on Texada Island, three to five meter high stubs were created using a 22" feller buncher cutting head mounted on a small excavator. The machine reaches up the tree to its maximum extension and cuts the tree off. The stubs are relatively small Douglas-fir trees and are being created in patches of advanced regeneration and understory trees in a 20 ha cutblock where large vets and other green trees are also being left. This has been done on the initiative of the licensee and with the agreement of the Ministry of Forests but no monitoring is planned.

Contact Maurice Potesta Ministry of Forests Powell River 485-0700

Other techniques of snag creation used in the United States involve the use of prima cord to blast the tops off trees and girdling of live trees. Fire, chemicals and liquid nitrogen have also been proposed as ways of killing trees to create snags. None of these techniques for snag creation appear to have been used anywhere in coastal BC and there does not appear to be any research underway into methods of snag creation. It is proposed in the MASS research project at Iron River.

## 4.2 Snag Planting

Five locations of snag planting were located and other sites probably exist. This is a relatively simple and cheap procedure and is probably being implemented as part of on-going road deactivation programs in areas other than the ones described.

- Snag planting at the UBC Malcolm Knapp Research Forest in the Chilliwack District.

The first use of snag planting appears to have been on the UBC Malcolm Knapp Research Forest in 1991. The objective was to demonstrate that it was safe, relatively easy, and cheap to "snag" an area following clearcutting. Six 4-5 metre long felled snags and cull logs were up-ended by a small excavator with an operator-protected cab and planted in 1.5 m holes. At the time, it was estimated that an area could be planted with snags at a cost of \$25 per snag and that perches could be added for relatively little additional cost. There has been no monitoring of wildlife use.

Contact Peter Sanders UBC Research Forest Maple Ridge 463-8148

- **Snag planting in the Nimpkish Valley, Port McNeill District.**

Although snag planting was first demonstrated at the UBC Research Forest, the technique has been developed and modified as an operational practice at the Canadian Forest Products operation at Woss on Northern Vancouver Island.

Canfor began planting snags in 1992 and now has a total of 6 cut blocks in which approximately 275 snags have been planted. The first block included snags planted off roads in a clearcut area but subsequent treatments has planted snags in conjunction with road deactivation or debuilding only. Material is selected from available roadside logging debris and planted by the machine doing deactivation. Originally they were planted singly, but snags are now planted in groups of 5 to 10 snags of different diameters and heights approximately every 50 to 100 m of road. Incremental operational costs are in the order of \$20 per snag.

Three of the blocks in which snags have been planted are part of a 6 year study to determine the utilization by birds of the planted snags, and to compare the use of areas with planted snags with areas without snags. Artificial nesting boxes are also being included. Ultimately this project will give useful information about the utilization of planted snags and will provide guidelines about the most effective heights and diameters of snags and the best distribution.

Contact    John Deal    Canadian Forest Products    Woss    281-2481

- **Snag planting near Boulton Lake, Graham Island, Queen Charlotte District.**

On the Queen Charlotte Islands, 12 snags were planted within a timber sale area in 1992 during mechanical site preparation (mounding using a tracked backhoe) near Boulton Lake on Graham Island. The snags range in height from 4 to 20 m. They are not being monitored for wildlife use but are all still standing.

Contact    Del Williams    Ministry of Forests    Queen Charlotte City    559-8447

- **Snag planting at Hunation Creek in Jervis Inlet and Jackson Creek watersheds at Sechelt in the Powell River District.**

The International Forest Products Sechelt operation has planted snags in two sites as part of road deactivation. The snag material is being selected randomly from available roadside material and is a mix of species, diameters, and heights. The snags are

planted singly at a density of roughly every 50 m (approximately 20 snags per km) along a deactivated road. Approximately 10 km of road have been completed.

Contact    Mike Scott    International Forest Products Sechelt        885-3287

- Snag planting in Upper Braden Creek, near Port Renfrew in the Duncan District

As part of routine road deactivation, Timberwest planted approximately 24 snags on 4 spur roads in the Upper Braden Creek watershed in 1993. The snags planted are predominantly cedar. They will be monitored for decay and for sign of utilization by wildlife.

Contact    Dave Lindsay        Timberwest    Crofton        246-9332

The wildlife benefits of snag planting are not yet determined but it is a simple and cheap practice that can easily be incorporated into operational activities particularly during road deactivation or mechanical site preparation.

#### **4.3    Tree topping and limbing**

In suburban areas and along utility corridors trees are topped and limbed to reduce the "sail area" exposed to wind in order to make individual trees and stands less likely to blowdown. These techniques could have application to reduce blowdown in riparian areas, areas reserved for wildlife, on cut block edges and in patches of forest "reserved" within cut blocks. Some preliminary guidelines for topping and pruning have been prepared and are included in the Coastal Fisheries Forestry Guidelines training workshops. But there has been little experience with tree topping and limbing techniques in operational forestry.

Topping and limbing has been undertaken in three areas on northern Vancouver Island by three different companies, utilizing different techniques. Two of the areas were set up as research trials and are being monitored over time. Preliminary indications are that all three have been successful in reducing blowdown. All three areas are accessible as demonstration sites.

- Tree topping and limbing at Akan Creek, north of Sayward in the Campbell River District.

The first use of tree topping and limbing occurred in 1991 on the boundaries of a 40 ha cutblock at Akan Creek, a tributary of the Tsitika River. Windthrow was evident in the natural stand and the boundaries were located along a marginally stable escarpment and narrow floodplain and on gently sloping upland areas with deep soils. These cut block edges were believed to be vulnerable to blowdown.

A research trial was initiated and topping and pruning was undertaken on a total of 300-350 trees in four 120 meter long treatment units located on three sides of the block. Control plots where there was no treatment were also established. The work was done by fallers who climbed the trees with the aid of ropes. The larger trees were topped and had large branches removed. Smaller trees (10-20 m tall) were limbed as part of the formal research trial. Topping and limbing extended for 20 meters back into the stand.

The area was surveyed in 1992 after treatment and will be re-surveyed in 1994. Observations to date indicate are that there has been some blowdown in the control plots and the topping and limbing treatments appear to have been effective in reducing blowdown.

Contact	Terry Rollerson	Ministry of Forests	Vancouver	660-0045
	Michel deBellefeuille	MacMillan Bloedel	Eve River	287-7473

- Tree topping and limbing along the Nahwitti River, west of Port Hardy in the Port McNeill District.

Topping and limbing was used to reduce the incidence of windthrow in a riparian corridor along a cutblock on the west side of the Nahwitti River that was experiencing blowdown following logging. This work was undertaken by Richmond Plywood Corporation Ltd in January of 1992 after joint field inspections with government agencies. Approximately 150-200 trees were topped and/or limbed in patches along a 1 km stretch of the river. The work was done by fallers who climbed the trees with the aid of ropes. Dominant hemlock and balsam trees were topped and limbed and co-dominant and suppressed trees were limbed.

This area was not set up as a research trial and is not being monitored. However, after two winters, the corridor does not appear to have suffered additional extensive

windthrow and the topping and limbing is felt to have been successful. Some balsam trees are reported to be showing signs of dying following topping.

Contact Tom Cole Richmond Plywood Corporation Whistler 938-0856

- Tree topping and limbing along the Keogh River, near Port McNeill in the Port McNeill District.

Topping and limbing has also been done along the Keogh River. Western Forest Products initiated an operational research trial here in association with FERIC in the spring of 1994. This trial is evaluating both conventional tree topping and limbing in which fallers climb trees with the use of ropes, and the use of helicopter-borne cone shear and cone rakes for topping and limbing. The relative merits of topping, various types of limbing and a combination of topping and limbing are being tested.

Approximately 175 trees have been topped, pruned or both in 6 treatment units along 700 metres of a 30 m wide riparian corridor that has high fisheries and recreational value along the Keogh River. The riparian corridor is a mix of typical northern Vancouver Island hemlock balsam stands. One part of the treatment area is a dense even-age stand originating from a major windstorm in 1908; the other part is a multi-story old-growth stand with components of younger mature trees, advance regeneration and snags. Soils in the riparian area are deep, fine textured and wet, and scattered blowdown was present throughout. These stands on flat terrain frequently suffer extensive blowdown when they are opened to wind.

In the six treatment units, 65 trees were treated with the helicopter rake and shear; 109 were topped and limbed by hand. On the manually treated trees, approximately one-third of the crown of dominant trees was removed by topping and one third of the crown of the sub-dominants was removed by cutting branches.

The use of a cone rake to strip branches from the tops of trees and a cone shear to cut tops was found to be much quicker and appears to be much cheaper than climbing trees to top and limb them by hand. However, because the equipment was designed for cone collection, it was not able to cut tops in excess of 3 1/2" and was not able to shear branches larger than 1 1/2" in diameter. The shear was quite ineffective on balsam because the form of the tree and the rigidity of the upper limbs prevented the shear from penetrating the canopy. The helicopter supported equipment was not able to remove as large tops or as many branches as were removed by fallers.

Work will continue on monitoring the extent of blowdown in the treated stand, the costs of each treatment and the response of the treated trees. However, it is felt that while the helicopter borne equipment was unable to top and prune to the degree that manual fallers can, the lower cost offers a significant advantage. Further research and development on prototypes of helicopter supported equipment to handle larger tops and limbs is underway.

Contact    Kerry McGourlick    Western Forest Products    Port McNeill    956-3311  
              Brian Boswell         FERIC                            Vancouver        228-1555

#### **4.4    Edge Feathering**

Cutting trees from the edges of clearcut openings to allow more penetration of wind and to remove the trees most susceptible to blowdown is referred to as edge feathering. Although it is being commonly discussed and appears to be used occasionally in most Districts, there has been little research and operational experience in edge feathering.

Two trials to test the effectiveness of edge feathering were located.

- Edge feathering at Akan Creek, north of Sayward in the Campbell River District.

Research to test the feasibility and effectiveness of edge feathering is included in the Akan Creek research area described above. In addition to the topping and pruning plots, three plots approximately 120 m long were laid out on different edges of the block. Ten to 20% of the trees were marked up to 30 m into the stand and were felled. The trees marked for removal were unsound trees particularly those with large crowns, asymmetric or stilt roots and those growing on unstable substrates. The trees were felled in 1991 and were removed by a backhoe which pulled them into the clearcut opening.

Re-survey of the plots will be undertaken in 1994 but preliminary observations indicate that the feathered edge plots have had less blowdown than the controls. Edge feathering at this site appears to have been as successful as the topping and pruning and was done for much lower cost because the felled trees were recovered and paid for the cost of treatment.

Contact    Terry Rollerson        Ministry of Forests    Vancouver    660-0045  
              Michel deBellefeuille    MacMillan Bloedel    Eve River    287-7473

- Edge feathering in the Seymour Watershed in the Greater Vancouver Watershed.

Edge feathering was included in the plan for the 8 ha experimental block in the Seymour watershed in the Greater Vancouver Watershed. Feathering was prescribed along 3 sides of the block and was planned to extend 10 m into the stand to create a tapered canopy height. Feathering was possible only on the gentle slopes and only along the edge of the block. It was not feasible on a significant part of the planned area and did not achieve the desired tapered canopy height or the degree and depth of treatment. However, the feathering that was done is felt to have had some benefit in reducing edge blowdown in an area that had significant windthrow prior to logging.

Contact Derek Bonin Greater Vancouver Watershed North Vancouver 432-6410

Reference Elm T. J. 1993. Managing Forests for Structural Diversity: Principles, Regulatory Constraints and Application. Masters thesis, School of Resource Management, Simon Fraser University.

Attempts to feather edges are reported on a few cutblocks in most districts but it is not apparently a widespread or routine practice. There appears to have been little follow-up to determine if the feathering planned on blocks could be operationally completed and if it had any effect of the incidence of blowdown. Slope and the species and diameters of the trees involved are limiting factors to the extent to which edge feathering can be used.