Grizzly Bear Forage Trial Review

Trial Assessment Summary and Discussion

March 2000

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1.0 Background

In the mid to late 80's a number of research projects identified alluvial floodplains and lower slope seepage ecosystems as key seasonal foraging areas for grizzly bears in coastal British Columbia. Grizzly bears utilize herbaceous species such as skunk cabbage and lady fern early in the year, and berry producing shrubs such as devil's club, salmonberry, elderberry, and red raspberry later in the summer.

Studies completed in the mid eighties identified grizzlies as solitary foragers with extensive home ranges and, consequently, identified the need to provide foraging areas across watersheds slated for harvest. Subsequent analyses of the silviculture activities required after harvesting and the grizzly's dependence on extensive forage sources identified a potential conflict between these two management objectives.

The silvicultural activities needed to establish free growing conifers on high brush hazard sites were considered incompatible with the need to maintain extensive supplies of grizzly forage across the landscape. The stocking standards of the day required intensive control of non crop vegetation to establish the required number of seedlings within free growing timeframes. To aid crop tree establishment, control of non crop vegetation was achieved using aerial applications of herbicide, glyphosate in particular. Treatment of non crop vegetation with glyphosate was shown to negatively impact the quality and quantity of available grizzly forage and create short-term forage deficits.

The use of herbicides was predicted to further exacerbate the forage deficit because they increased survival of crop trees and resulted in a continuous distribution of seedlings. These evenly spaced, relatively dense, conifer stands close canopy more quickly than discontinuous natural stands and create light environments too low for production of healthy forage communities. Thus, the initial short-term forage reductions caused by herbicide application were predicted to eventually become long-term deficits. In many drainages this deficit is heightened by historic harvest patterns of progressive clearcutting at low elevations. The front to back, bottom to top mentality of the day reduces overall forage availability as old growth stands with variable canopy closure and frequent canopy gaps are replaced with dense young homogeneous closed canopy managed forests.

To alleviate the conflict between the need for an extensive long-term supply of grizzly forage and continued timber harvest from alluvial floodplains and seepage ecosystems, the Ministry of Environment Lands and Parks (MoE) proposed a compromise between these demands. As a result of industry and Ministry of Forests (MoF) input at the summer meeting of the Coast Silviculture Committee in June of 1991, it was agreed that stocking standards on alluvial and seepage sites would be reduced to lengthen the time it took for canopy closure. To increase the area capable of producing forage and localize conifer production to optimal microsites, the concept was further modified by suggesting that conifers be planted in clusters of up to eight trees.

In 1992, a contract was awarded to Johnson - Schwarz Forest Management and Oikos Ecological Services Ltd. to develop silviculture systems using the reduced stocking standards and to design and establish a series of adaptive management trials. The trials would be structured to determine the impacts of the stocking standards on grizzly forage and conifer growth and yield. As the trial design developed, the initial concept of cluster planting was expanded to include a range of clusters from seven to thirty trees. The expanded number of trees per cluster was required to create a sufficiently wide range of gap openings and light regimes that would produce measurable differences in forage production and species composition. Initially, trees in clusters were planted at an inter-tree distance of one meter to maximize the amount of area in gaps. In later trials, inter-tree distances were expanded to include a range of distances from 1.0 to 2.5 meters to allow measurement of conifer performance and yield as a function of inter-tree spacing.

To match the available site conditions with the trial design, three levels of trial establishment were proposed for this project. Formal trials were designated for freshly disturbed areas where homogeneous site factors allow implementation of the full experimental design. Informal trials were designed for blocks where site heterogeneity due to site series variation or stock distribution prevented establishment of the full trial. Monitoring areas were proposed for sites which fell within the grizzly stocking guidelines and could indicate trends in the relationship between forage quality and gap size without management intervention.

From the fall of 1992 to the spring of 1997, candidate sites were reviewed and a number of trials were established with the co-operation of licensees and MoF staff. Trial sites range in size from 1.2 hectares to 54.7 hectares. Eighteen trials totalling 280 hectares were established throughout the Coastal Western Hemlock (CWH) Zone of the Vancouver and Prince Rupert Forest Regions over the five year period. The status of trial sites at the time of establishment included recently logged and backlog sites and sites scheduled for fill planting. Following the project working plan, first year monitoring was completed on 80 percent of the established trials. However, due to a lack of funding, the remaining 20% of the trials have not been monitored and no baseline data has been collected. Funding constraints have also prevented completion of two and five year monitoring as scheduled in the trial working plan.

1.1 Goals and Objectives

The current project was undertaken to assess the status of established trials and heighten proponents' awareness of the trial sites. Revisiting the established trials was important because they had not been assessed since 1996 and their stocking status was largely unknown. The goals of this project were to

- qualitatively assess the status of the established trials,
- conduct summary assessments of conifer stocking and vigour,
- complete cursory assessments of forage quality and cover, and
- provide direction on how to proceed with monitoring and data analysis in the future.

2.0 Methodology

In an attempt to gauge the status of the trial and prioritize blocks for visitation, proponents of all trials were contacted to discuss the trials and ascertain the stand tending activities completed in the last four years (see Table 1). Stocked blocks with current access were deemed to have the highest priority for visitation. Two blocks were considered not worth visiting on the basis of proponent feed back. The International Forest Products trial in Taleomey River, Block 319C, was not visited because Doug Grant indicated the area was not sufficiently stocked, and that fill planting had not followed the trial design because suitable microsites were difficult to find. The Scott Paper trial on Block 7 in the Homathko River watershed was also excluded. This area is very small and access costs and the high degree of edge effect make the visitation priority low.

Trial sites were evaluated using a walk through assessment in which representative clusters gaps in each treatment unit were assessed to determine conifer performance and forage potential. A qualitative assessment of survival was completed within each treatment unit. Quantitative data was collected to provide an estimate of seedling height and vigour. On average, 5 heights were measured in each treatment unit visited. Height data was averaged by treatment unit to determine if trends could be detected at the different inter-tree spacings or cluster sizes. However, no trends were noted for the limited amount of data collected, and height is presented by species as an average for the trial as a whole. Damage factors affecting conifer performance were also tallied. Forage potential was estimated using percent cover and the height of non crop vegetation in representative gaps. Wildlife use of trial sites was mentioned when sign was encountered in an installation. Photos were taken to provide visuals of conifer performance and forage potential in representative treatment units. Aerial Pictures were taken of the older installations to show how clusters are distributed at a stand level. Photos for each installation are included in Section 3.0 following the site assessment summary.

Table 1: History of established trials proposed for walk through assessment in 1999.

MoF District	Licensee	Location	Block Name	Log Yr.	Layout Yr.	Site Prep	Plant Yr.	Fill Plant	Veg Man	Visit	Area
Campbell River	Weyerhaeuser	Phillips Arm	EM - X	1975	1996	1996	1997	1999	1998	Y	18.5
Kalum	Skeena Sawmills	Cecil Creek	2-2-17	1984,87	1993		1993		1993,94, 95	Y	4.3
Kalum	Ministry of Forests	Central Humphries	Opening 318	?	1994	1993	1994	1996	1996	Y	26.5
Kalum	Skeena Sawmills	Kitimat River	5-5-9	1986,89	1993		1993		1993,94, 95	Y	3.7
Kalum	Ministry of Forests	Wedeene River	E, Polygon 5	1970	1995	1995	1996			Y	54.7
Mid Coast	Ministry of Forests	Chuckwalla/Kilbella	TSL A34824	1993	1994		1994			Y	35.0
Mid Coast	Western Forest Products	Kimsquit River	20	1986,88	1994		1994		1994, 95	Y	22.3
Mid Coast	Western Forest Products	Kimsquit River	110-B	1990	1993		1993		1994, 95	Y	4.0
Mid Coast	Western Forest Products	Kimsquit River	155	1993	1994		1994			Y	11.7
Mid Coast	Western Forest Products	Kimsquit River	245	1993	1995		1995			Y	5.7
Mid Coast	International Forest Products	Talchako River	62-2	1990	1994		1994	1997,99		Y	12.0
Mid Coast	International Forest Products	Talchako River	64-1B	1995			1996			Y	6.5
Mid Coast	International Forest Products	Taleomey River	319C	1994	1995		1995	1996, 97		N	6.2
Port McNeill	International Forest Products	Kingcome River	24B	1993	1994		1994		1996,98	Y	12.8
Port McNeill	International Forest Products	Kingcome River	99	1991	1997		1997	1998	1997	Y	36.0
Sunshine Coast	Scott Paper	Homathko River	7	1993	1993		1993			N	1.2
Sunshine Coast	MoF SBFEP	Orford River	A46904-1A	1993	1994		1994		1995, 97,99	Y	10.9
Sunshine Coast	MoF SBFEP	Orford River	A46904-2B	1993	1994		1994			Y	5.7
Total Area											**277.7**

3.0 Trial Results

A summary of assessment results is presented in the following sections. Results are discussed on a trial by trial basis in a format which can be included in the three ring binder of site assessment information. Trial success is measured against either the silviculture prescription (SP) where there is one for the trial or against the proposed stocking standards as presented in the working plan for this project. A discussion of success of the grizzly forage program as a whole is presented in Section 4.0, and a discussion of future recommendations is presented in Section 5.0.

LICENSEE: Weyerhaeuser
CONTACT: Rudy van Zwaaij
FOREST DISTRICT: Campbell River
LOCATION: Phillips Arm
BLOCK: EM X
TRIAL AREA: 18.9 ha

ECOLOGICAL CLASSIFICATION	
Subzone	CWHvm1
Site Series	09 - Ss Salmonberry
Soil Great Group	Cumulic Regosol
Soil Texture	Sandy loam

SITE HISTORY	
1975	Logged
1976	Planted
1996	Piling and bunching of weevilled spruce
1996	Mechanical site preparation of cluster centres
1997	Planted to Grizzly Stocking Guidelines
1998	Backpack spot spray
1999	Fill plant
1999	Apply cedar tents
1999	Walk through

VEGETATION			
Species	**1996 Cover** (%)	**Current Cover** (%)	**Height** (cm)
Salmonberry	30	5	120
Red elderberry	10	-	
Willow	-	4	190
Grass	-	40	50
Fireweed	30	3	170

Note: Important bear forage species are bolded.

The vegetation community at present is dominated by grass. Forage potential is moderate to low. Salmonberry cover has decreased significantly as a result of site preparation and herbicide application. Site prepared and herbicide treated areas are now dominated by grass complexes. Continued monitoring of vegetation on this site should be completed to document the changes in vegetative cover over time in relation to herbicide use and canopy closure. Deer use was found throughout the trial.

SILVICULTURE STATUS
This block appears to meet stocking standards. The western red cedar exhibit excellent vigour at an average height of 66 centimetres. The current years growth could not be measured because trees had been tented this year. Approximately 10 percent of the cedar tents have fallen over as a result of animals or wind action. Deer damage does not appear significant and cedar will outgrow the tents in 3 years at which time they must be removed. The Pacific silver fir in the block exhibit moderate to fair vigour. Balsam average 37 centimetres in height and 7 centimetres of leader growth. Grass cover appears to reduce balsam vigour. Balsam are not overtopped and it appears that the negative impacts of grass are due to below ground competition. Because the balsam do not occupy their growing space, further mortality is expected and approximately 20 percent of the remaining balsam will die.

Cottonwood exhibit excellent vigour on this site. Survival is high and it is estimated that 90 percent of planted whips have survived. Basal scarring was evident on 30 percent of the cottonwood. Scarring is a result of planting damage to the phloem which occurred when planters kicked the planting hole shut with their boots. Other damaging agents were ruled out because teeth marks of voles were not evident and there was no evidence to indicate damage was caused by accidental overspraying of herbicides.

RECOMMENDATION

The long-term stability of this trial site is uncertain because there has been significant lateral movement of the Phillips River. In the last six years the river has eroded 10 meters of the block a year. Since the trial was laid out in 1996, 20 meters of buffer have disappeared into the river and some of the clusters are now being lost in places. Significant portions of the trial may be lost without corrective action to arrest the lateral flow of the river in this area.

In 2000, three year baseline monitoring should be completed to determine stocking levels, and forage cover and productivity of the treatment units. In 2001, four year monitoring data should be completed to ensure that survival remains within target stocking standards. Forage data gathered in the three and four year monitoring will provide an indication of trends in forage development. In 2004 cedar tents should be removed from the cedar to ensure that tents do not restrain the cedar and cause problems with sapling form. Once tents are removed, cedar will meet free growing criteria without further treatment.

Vigour of the Pacific silver fir on this block requires monitoring and further fill planting may be needed if significant mortality occurs as result of below ground competition with grass species. If poor performance continues, establish a trial to assess whether placment of brush mats around the balsam improves performance. Set up a small trial using thirty matted and unmatted balsam in 2000. Where brush mats have been used in the Wedeene River trial, the balsam performance is improved and seedlings appear to occupy their growing space more quickly than unmatted trees. Complete 5 year monitoring in 2004. Assess cottonwood competition at this time and remove cottonwood from the cluster edge if they form a closed canopy above the cluster or if leader growth is significantly lower than that of open grown seedlings. Complete 10 year monitoring in 2009.

IMPLEMENTATION DATES

2000 2yr monitoring
2001 3yr monitoring
2004 remove cedar tents
2004 5yr monitoring - assess cottonwood competition
2009 10yr monitoring

LICENSEE: Skeena Sawmills
CONTACT: Damian Keating
FOREST DISTRICT: Kalum
LOCATION: Cecil Creek
BLOCK: 2-2-17
TRIAL AREA: 4.3 ha

ECOLOGICAL CLASSIFICATION	
Subzone	CWHws1
Site Series	06 - Ba Cw Devil's club
Soil Great Group	Orthic regosol
Soil Texture	Sandy Loam

SITE HISTORY	
1984,87	Logged
1985	Broadcast burned
1986,89-90	Planted
1993	Planted to Grizzly Stocking Guidelines
1993,94,95	Manual brushing
1995	2 yr. monitoring
1999	Walk through

VEGETATION			
Species	**1993 Cover** (%)	**Current Cover** (%)	**Height** (cm)
Salmonberry	15	15	70
Thimbleberry	10	10	70
Willow	40	20	160
Fireweed	65	35	110
Grass	-	10	60

Note: Important bear forage species are bolded.

The forage potential on this block is low. The block is dominated by willow and fireweed with only scattered components of salmonberry and thimbleberry.

SILVICULTURE STATUS
This trial is not sufficiently restocked. Many of the damaged western red cedar identified in the 1995 monitoring have died. At 25 percent, survival of the planted trees is very low as a result of damage from frost, brushing, and moose browse. Consequently, the lack of trees and standing centre stakes makes it difficult to find the original cluster centres. Trees which have survived on this block exhibit moderate vigour. The hemlock average 108 centimetres with 33 centimetre leaders and the cedar average 80 centimetres with 31 centimetre leaders. In most cases trees on this site will reach free growing criteria without further treatment.

RECOMMENDATIONS

This area should be dropped from the program. The clusters which were established on this site have poor survival and the area is not sufficiently restocked. Schedule a regeneration survey of the trial area and fill plant to SP standards - maximum 900, minimum 500 stems per hectare - in the spring of 2001. Plant pine PSB 415 1+0 stock to establish species which sill quickly occupy this site. Manually brush seedlings in 2000, 2001, and 2002 to ensure they meet free growing timeframes as soon as possible.

IMPLEMENTATION DATES:

2000 survey this area to ascertain stocking levels
2001 fill plant Pl PSB 415 1+0 pine
2001 manually brush around crop trees
2002 manually brush around crop trees
2003 manually brush around crop trees

LICENSEE: Ministry of Forests
CONTACT: Art Moi
FOREST DISTRICT: Kalum
LOCATION: Central Humphries Creek
BLOCK: E
TRIAL AREA: 26.5 ha

ECOLOGICAL CLASSIFICATION	
Subzone	CWHws1
Site Series	07 - Ss Salmonberry
Soil Great Group	Orthic Regosol
Soil Texture	Silt Loam

SITE HISTORY	
199-	Logged
199-	Planted
1993	Site Prepared - Hydroaxe
1994	Planted to Grizzly Stocking Guidelines
1996	Fill Planted to Grizzly Stocking Guidelines
1996	Manual brushing
1996	2yr monitoring
1999	Walk through

VEGETATION			
Species	**1994 Cover** (%)	**Current Cover** (%)	**Height** (cm)
Salmonberry	15	20	110
Thimbleberry	25	20	90
Red elderberry	5	1	150
Prickly rose	-	2	130
Fireweed	25	25	120
Grass	-	15	50

Note: Important bear forage species are bolded.

The forage values on this trial are high. The forage community is dominated by thimbleberry and salmonberry. Within the clusters manual brushing has shifted competing vegetation to grass in many places. Wildlife use, particularly by moose and beaver, is high in this area.

SILVICULTURE STATUS
Stocking levels on this block are estimated at approximately 450 stems per hectare. Estimates are down slightly from the monitoring completed in 1996 due to a lack of vegetation management and flood related mortality. A full survey is required to confirm the actual stocking density and the extent of flooding. Game trails are found throughout the block and moose damage occurs on 30 percent of the western red cedar and Pacific silver fir. Seedling vigour ranges from good for the spruce to moderate for the cedar and hemlock and fair for the balsam. Total height and leader height are summarized by species in the table below.

Species	Total Height (cm)	Leader Height (cm)
Hw	60	24
Ba	39	10
Sx	137	34
Cw	79	22

Spruce will meet free growing criteria without further treatment but they will become infected with weevil once they are above the competing vegetation. Of the cedar and hemlock tallied, 80 percent will reach free growing criteria without treatment. Of the balsam 60 percent will survive and become free growing. The largest factors which limit free growing status will be the animal and insect damage on this site. Stocking losses are a significant concern as much of the stocking in the control has been lost to flooding caused by beaver dams in the centre of the block.

RECOMMENDATION

This block should be resurveyed in the spring of 2000 to determine the stocking status of each treatment unit. Stocking is expected to meet targets and it is recommended that this unit be maintained as a formal trial. Because cluster centres have fallen over or are no longer visible, they must be re-established with aluminium rods in 2000. At this time permanent sample points and seedling numbers on sample trees should also be re-established. Brushing and animal damage has destroyed many of the numbers marking the sample trees. In the summer of 2000, manually brush the clusters to ensure the balsam have sufficient light to occupy their growing space. One treatment should be sufficient to get the balsam established. Complete 5year monitoring in 2001 and 10 year monitoring in 2006.

IMPLEMENTATION DATES

2000 regeneration survey
2000 restake clusters
2000 renumber permanent sample points and trees
2000 brush clusters
2001 5yr monitoring
2006 10 yr. monitoring

LICENSEE: Skeena Sawmills
CONTACT: Damian Keating
FOREST DISTRICT: Kalum
LOCATION: Kitimat River
BLOCK: 5-5-9
TREATMENT AREA: 3.7 ha

ECOLOGICAL CLASSIFICATION	
Subzone	CWHws1
Site Series	07 - Ss Salmonberry
Soil Great Group	Cumulic Regosol
Soil Texture	Clay loam

SITE HISTORY	
1986-89	Logged
1987	Broadcast Burn
1988-90	Planted
1993	Planted to Grizzly Stocking Guidelines
1993,94,95	Manual Brushing
1995	2yr monitoring
1999	Walk Through

VEGETATION			
Species	**1993 Cover** (%)	**Current Cover** (%)	**Height** (cm)
Red elderberry	15	-	
Devil's club	10	-	
Cottonwood	15	-	
Red alder	10	-	
Lady fern	10	-	
Fireweed		30	140
Grass		50	30

Note: Important bear forage species are bolded.

The forage community on this block is only marginally productive because the plant community is dominated by fireweed and grass. At present, few forage species are available for grizzly use and the amount of devil's club in the area has decreased over time.

SILVICULTURE STATUS
This area is well stocked. Spruce from the 1990 plantation occupy the site at a density of 400 stems per hectare. The spruce are growing vigorously but weevils have attacked 60 percent of the seedlings in the last two years. Currently the spruce meet form criteria but weevil attacks and damage are projected to increase in the next five years. A number of hemlock naturals have also become established since cluster planting in 1993. In the clusters survival is poor and few clusters are still evident. Seedlings in the clusters have little chance to occupy their growing space because they are much shorter than the spruce and competing vegetation is high. Overall the trial meets the target stocking standards for high bench flood plain sites but forage producing gaps will be lost once the canopy of the 1990 spruce closes. A summary of average tree heights is provided below.

Species	Height (cm)	Leader growth (cm)
Hw	90	17
Ba	52	7
Cw	168	21
Sx	406	22

RECOMMENDATION

This trial should be abandoned. The area meets grizzly stocking guidelines with the evenly spaced spruce. In addition, clusters are irregular due to the high mortality of the planted Pacific silver fir and the competition from the vegetation and spruce. This area is also small and the amount of edge effect would significantly influence the quality of data collected from the site.

IMPLEMENTATION DATES

2000 abandon trial

LICENSEE: Ministry of Forests
CONTACT: Art Moi
FOREST DISTRICT: Kalum
LOCATION: Wedeene River
BLOCK: Unit E, Polygon #5
TREATMENT AREA: 54.7 ha

ECOLOGICAL CLASSIFICATION	
Subzone	CWHvm1
Site Series	09 - Ss Salmonberry
Soil Great Group	Orthic Regosol
Soil Texture	Loamy sand

SITE HISTORY	
1970	Logged
1971	Broadcast Burned
1983	Pest - clip and burn
1990	Site Preparation
1991	Planted
1994	Eco mapped
1995	Backlog SP
1995	Spot Mechanical Preparation
1996	Planted and brush matted to Grizzly Stocking Guidelines
1999	Walk Through

VEGETATION			
Species	**1995 Cover** (%)	**Current Cover** (%)	**Height** (cm)
Salmonberry	1	-	
Red elderberry	1	-	
Thimbleberry	1	1	70
Red raspberry	3	-	
Twinberry	2	-	
Fireweed	45	35	110
Grass	10	37	50
Lady fern	1	5	70

Note: Important bear forage species are bolded.

At present this block provides little grizzly forage. The plant community is still dominated by fireweed and grass and only small amounts of forage in the form of scattered thimbleberry patches are found. Grass cover has not significantly reduced conifer performance as brush mats appear to effectively reduce root zone competition.

SILVICULTURE STATUS
This block appears to meet target stocking standards. Based on the walk through assessment, conifer survival ranges from 80 to 90 percent of planted seedlings. Survival is lowest for the Pacific silver fir and highest for the Western hemlock. In general seedlings exhibit good vigour. Average height and leader growth are presented in the following table.

Species	Height (cm)	Leader Growth (cm)
Western hemlock	77	29
Pacific silver fir	38	11
Western red cedar	50	19
Lodgepole pine	107	36

Lodgepole pine have the best vigour of all species on the block. These trees have survived well in the dry harsh rocky substrates of the skeletal areas in which they were planted. Pine effectively outcompete the grass in these areas and are predominantly free growing.

Of the clusters planted trees, the western hemlock have the best vigour and most strongly occupy their growing space. Of the seedlings present, 90 percent will become free growing. Western red cedar is the second most vigorous species but its height is more variable due to its suseptibility to frost and moose damage. Damage was found on less than 5 percent of the planted seedlings . All trees were acceptable because less than 50 percent of the foliage was damaged or removed. Of the planted cedar, 80 percent will go on to meet free growing criteria. Pacific silver fir are the least vigorous of the species on the block. Less than 5 percent of trees are affected by frost damage or moose browse but 15 percent exhibit poor vigour. Of the four species planted, balsam vigour is generally the most affected by grass competition. Brush mats have been effective as they reduce root zone competition in areas where grass cover developed after spot scarification. Approximately 70 percent of the planted balsam will reach free growing criteria.

Because much of the original competing vegetation was left intact when this area was spot site prepared and because significant grass cover developed on site prepared areas, ingress of naturals has not been significant. The conifers left standing after the area was rehabilitated with the Hydroaxe in 1990, continue to perform well and contribute structure and hiding cover to the current stand. Density control is not required on this block.

The cottonwood which were established as overstory cover had terrible survival. Approximately 20 percent of the whips flushed initially but only 10 percent became established. The poor cottonwood survival is related to the hot dry weather at the time of planting. Dry soils apparently had insufficient soil moisture to support root growth. Surviving cottonwood exhibit poor vigour and are unlikely to reach maturity.

RECOMMENDATION

This site should be maintained as a formal trial. Conifer survival appears adequate and most clusters are stocked at 500 to 600 stems per hectare. A thorough survey should be completed to confirm stocking. Complete a regeneration survey in the spring of 2000. At that time, re-establish cluster centres using the fallen cedar stakes and repaint any stakes which are no longer visible. In the summer of 2000, establish permanent sample points and complete four year monitoring of the trial. Brushing is not required on this trial because seedlings adequately outcompete the fireweed and will likely outcompete the grass. Treatment of grass cover would be beneficial but there are no economic control options available for grass. Complete 5 year monitoring in 2001. Completion of monitoring in 2001 will get this block back on the monitoring schedule proposed in the trial working plan. Complete 10 year monitoring in 2006.

IMPLEMENTATION DATES

2000 Regeneration survey and repaint cluster centres
2000 Complete 4 yr. monitoring
2001 Complete 5 yr. monitoring
2006 Complete 10 yr. monitoring

LICENSEE: Ministry of Forests
CONTACT: Pierre Le Bouder
FOREST DISTRICT: Mid Coast
LOCATION: Chuckwalla / Kilbella River
BLOCK: TSL A34824
TRIAL AREA: 35.0 ha

ECOLOGICAL CLASSIFICATION	
Subzone	CWHvm1
Site Series	09 - Ss Salmonberry
Soil Great Group	Cumulic Regosol
Soil Texture	Silt Loam

SITE HISTORY	
1993	Logged
1994	Planted to Grizzly Stocking Guidelines
1995	1yr monitoring
1999	Walk Through

VEGETATION			
Species	**1993 Cover** (%)	**Current Cover** (%)	**Height** (cm)
Salmonberry	-	60	160
Trailing black current	-	5	70
Red elderberry	-	3	210
Lady fern	-	5	120
Grass	-	20	70

Note: Important bear forage species are bolded. In 1994 no cover was tallied because plant communities had not developed after harvest.

Grizzly forage species are vigorous on this block. Salmonberry and red elderberry, the main forage species present, are found throughout the majority of the block except for the east side of Block 3 where vegetation has shifted to a grass dominated community. No animal use was noted in this area as the salmonberry is so thick it is almost impenetrable.

SILVICULTURE STATUS

Block 1

Survival is poor as predicted in the 1995 monitoring. In TU 4 of this unit only 5 of 15 trees planted in the cluster survived - a survival rate of 33 percent. All units in this block are poorly stocked and the only seedlings to survive are the spruce. The spruce exhibit moderate to good vigour at an average height of 239 centimetres and leader growth of 48 centimetres. There are also a small number of surviving western red cedar but they are not performing well at an average height of 80 centimetres. The poor cedar performance is due to its inability to compete with the high level of salmonberry cover. Spruce will meet free growing criteria without further treatment.

Block 2

This area was planted with conifers under a cottonwood overstory in the clusters. Cottonwood survival was excellent at 90 percent in both units, but conifer survival is low at 15 percent. The cottonwood are an average of 850 centimetres tall with excellent vigour. Saplings are approximately 14 centimetres in diameter. Currently there is little evidence of inter-tree competition among the cottonwood, but it may appear once trees begin to vie for growing space in the larger clusters.

Conifer stocking in Block 2 is marginal. On average, the spruce are 240 centimetres high with 42 centimetre leaders. In the larger clusters, there is a significant difference in the growth rate between conifers on the perimeter of the cluster and those in the interior. Trees on the outside exhibit 260 percent more growth than those in the interior.

Originally, the cottonwood overstory in the cluster was established as a nurse crop to reduce the competing vegetation within the cluster and make establishment of conifers easier. The overstory has effectively reduced competing vegetation within the clusters but the cottonwood have also significantly reduced conifer performance because they drastically reduce light levels at the cluster centre. Under this regime, conifer performance appears better in the 15 tree clusters because more seedlings are on the cluster perimeter where they benefit from the higher light levels at the edge of the cluster and the reduced vegetative competition inside the cluster.

Block 3

This block has a number of problems which are inconsistent with the other blocks of the trial. Unlike the rest of the block, cottonwood survival is poor. Poor survival may be due to the fact that this area was planted last and that whip viability had decreased due to poor storage. Vole damage may have contributed to poor survival as basal scarring was found on 20 percent of the standing cottonwood. Overall cottonwood survival appears to average 20 percent at an average height of 650 centimetres.

The average spruce in this block is 131 centimetres tall with a 47 centimetre leader. Clusters are not evident on the east side of the road but remnants of the clusters can be found on the west side of the road. Survival appears similar to the rest of the block at 30 percent. Spruce will reach free growing without further treatment.

RECOMMENDATION

This block has been plagued with problems. The area is difficult to get to, there is no longer any active logging in the drainage, and there were problems with implementation of the trial design. Cottonwood stocking in Block 3 is much lower than expected and cottonwood were planted throughout the wide spacing control of TU 2 in Block 1. To make matters worse brushing was never completed and all balsam seedlings died under the intense salmonberry competition. The planted spruce have survived and spruce will meet free growing criteria in five years at current growth rates. However, there are insufficient spruce to meet SP stocking targets. This area should have been fill planted in 1996 as prescribed in the monitoring assessment but reforestation of this unit has not been a priority with the Mid Coast Forest District.

Block 1

This unit is no longer acceptable as a formal trial. Stocking levels are below minimum stocking standards and once clusters are fill planted conifer data will be too variable to provide an indication of trends between treatment units. To establish conifers on this site, spot site preparation will be required to create competition free clusters amongst the salmonberry. In the fall of 2001, layout cluster centres and use an excavator with a brush rake and mechanical thumb to spot site prepare plantable spots in the clusters. Where possible work the excavator around the existing spruce stock. Fill plant this block with large PSB 615 1+0 cedar stock in the spring of 2002. Install plastic tents to protect the cedar from the deer found in the area. Schedule three brushing treatments for the summers of 2002, 2003, and 2004 using either manual or chemical methods depending on the political climate of the area. To ensure the success of this project, brushing funds must be secured for the full three years of treatment prior to commencement of site preparation. Without secured funds and pesticide use permits the initial investment on this site will be lost as staff scramble to get permits and funds in place on a year to year basis. Move TU 2 into Block 2 and use it as the control for the formal data to be collected. Maintain this site as a monitoring area once stocking is established or abandon the block if the Ministry of Forests is going to drop its obligation to meet regeneration delay.

Block 2

Continue to monitor this section of the trial as a formal installation. Shift the focus of measurement from the conifers to cottonwood in the clusters. Use TU 2 of Block 1 as the control for this set of measurements. Amend the silviculture prescription to indicate this block will be managed for cottonwood. Analysis of data from this area will provide interesting information about the growth and yield of cluster grown cottonwood and their impact on forage production when compared with evenly distributed stands. In 2000, re-establish cluster centres and complete six year monitoring of permanent sample points. At this time attempt to collect height growth data for 1995, 96 and 99 using bud scale scars. In 2004, complete 10 year monitoring of cottonwood growth and forage production.

Block 3

This unit is no longer acceptable as a formal trial as the area is not satisfactorily restocked. Stocking appears to be below minimum standards and a survey, in the summer of 2000, is required to determine current stocking. Survey results are expected to indicate fill planting is required. In the fall of 2001, layout and spot site prepare clusters to create competition free spots amongst the salmonberry. Use an excavator with a brush rake and mechanical thumb to spot site prepare plantable spots in the clusters. Where possible work the excavator around the existing spruce stock. Fill plant this block with large PSB 615 1+0 cedar stock in the spring of 2002. Install cedar tents to protect the cedar from the deer found in the area. Schedule three brushing treatments for the summers of 2002, 2003, and 2004 using either manual or chemical methods depending on the political climate of the area. To make this project successful, brushing funds must be secured for the full three years of treatment prior to commencement of site preparation. Without secured funds and pesticide use permits the initial investment on this site will be lost as staff scramble to get permits and funds in place on a year to year basis. Maintain this site as a monitoring area after it is fill planted or abandon the block if the Ministry of Forests is going to drop its obligation to meet regeneration delay.

IMPLEMENTATION DATES

2000 re-establish cluster centres in formal cottonwood trial area
2000 6 yr. monitoring of cottonwood clusters in Block 2
2000 survey Block 3 to establish stocking levels
2000 develop a silviculture plan to achieve full stocking on this trial
2001 spot site prepare Blocks 1 and 3
2002 fill plant clusters in Blocks 1 and 3
2002 manual brush Blocks 1 and 3
2003 manual brush Blocks 1 and 3
2004 manual brush Blocks 1 and 3
2004 10 yr. monitoring Block 2

LICENSEE: Western Forest Products
CONTACT: Gary Skabeikis
FOREST DISTRICT: Mid Coast
LOCATION: Kimsquit River
BLOCK: 20
TRIAL AREA: 22.3 ha

ECOLOGICAL CLASSIFICATION	
Subzone	CWHws2
Site Series	06 - Ba Cw Devil's Club
Soil Great Group	Orthic Humo Ferric Podzol
Soil Texture	Silt loam

SITE HISTORY	
1986-88	Logged
1987, 89	Planted
1994	Planted to Grizzly Stocking Guidelines
1994, 95	Backpack chemical application - Vision
1995	1yr monitoring
1996	2yr monitoring
1999	Walk through

VEGETATION			
Species	**1993 Cover** (%)	**Current Cover** (%)	**Height** (cm)
Salmonberry	1	-	
Red raspberry	35	3	120
Red elderberry	-	1	170
False azalea	-	3	170
Alaska Blueberry	3	1	40
Red osier dogwood	40	-	
Fireweed	-	50	130

Note: Important bear forage species are bolded.

The quality and quantity of forage on this block is low. Vegetation is still dominated by fireweed and forage species have low cover values. Continued monitoring of this block is worthwhile in order to chronicle dynamics of the vegetation community and monitor cover shifts. Wildlife use of this block was not evident from the walk through.

SILVICULTURE STATUS
Stocking in this unit appears to reflect the estimates established during the monitoring completed in 1996. All clusters are well stocked with vigorous spruce. When monitoring was completed in 1996 there was concern that herbicide application had damaged crop trees; however, damage has not had a lasting effect and no dead or damaged trees were tallied in the 1999 assessment. The spruce, at an average height of 154 centimetres, are equal in height with the competing vegetation. With leader growth of 41 centimetres, spruce will be free growing in three years. Overall, stocking is above maximum density due to natural regeneration along the edge of the opening and recovery of seedlings from previous fill planting. Natural regeneration is most dense in a 100 meter strip along the northern and eastern boundaries.

RECOMMENDATION

Despite the recent loss of access to the Kimsquit Valley, continue to monitor this trial as a formal installation. Monitoring will be expensive, but the quality of data provided by these uniformly stocked clusters and conifer free gaps will outweigh the costs. In 2000 replace cluster centres with aluminium posts, re-establish permanent sample points and check individual tree tags. In 2000 complete 6 year monitoring concurrently with removal of trees from within the cluster gaps. The density control prescription will state that only trees less than 10 centimetres will be removed. This criteria will ensure the larger Pacific silver fir in the gaps are retained to increase the species and structural diversity of the future stand. Retain no more than 500 large diameter trees per hectare. Complete 10 year monitoring in 2004.

IMPLEMENTATION DATE

2000 re-establish cluster centres and permanent sample points
2000 complete 6 yr. monitoring
2000 conduct density control of gap conifers
2004 complete 10 yr. monitoring

LICENSEE: Western Forest Products
CONTACT: Gary Skabeikis
FOREST DISTRICT: Mid-Coast
LOCATION: Kimsquit River
BLOCK: 110-B
TRIAL AREA: 4.0 ha

ECOLOGICAL CLASSIFICATION	
Subzone	CWHws2
Site Series	06 - Ba Cw Devil's Club
Soil Great Group	Dystric Brunisol
Soil Texture	Silty Loam

SITE HISTORY	
1990	Logged
1990	Planted
1993	Planted to Grizzly Stocking Guidelines
1994, 95	Backpack chemical brushing - Vision
1995	1yr monitoring
1996	2yr monitoring
1999	Walk through

VEGETATION			
Species	**1993 Cover** (%)	**Current Cover** (%)	**Height** (cm)
Red raspberry	35	20	130
Thimbleberry	-	5	70
Red elderberry	5	2	170
Devil's club	2	-	
Cow parsnip	15	-	
Fireweed	25	10	130
Grass	-	15	30

Note: Important bear forage species are bolded.

Forage quality on this site is moderate. The high density of conifers seriously reduce forage quantity and will continue to do so without density control in the future. Wildlife use of this opening is high as indicated by the moose damage found on the cedar.

SILVICULTURE STATUS
On average this area is well stocked. The area is overstocked along the mainline to the east and marginally stocked along the river in the west. Survival levels in the clusters appear to be similar to those established in 1995. The spruce are vigorous free growing trees without any noticeable pest damage. Spruce are on average 151 centimetres tall with 37 centimetre leaders. Cedar on the other hand are still struggling with the competing vegetation and prevalent moose damage. Cedar are an average of 94 centimetres tall with 24 centimetre leaders. Of the cedar measured, 87 percent had been damaged by moose. As a whole this block exceeds maximum density criteria because a significant number of naturals established after planting and more planted trees than predicted survived from the original plantation.

RECOMMENDATIONS

Access to this area is no longer possible now that the Kimsquit Mainline has been fully deactivated. As a result of the high cost of monitoring in the future and the high variability of data from the area, this trial has outlived its usefulness. Downgrade this trial to a monitoring area. In the initial phases of the project, this area provided an opportunity to test the operational suitability of the cluster planting concept and see what clusters looked like on the ground. At present the area has three major problems. The first problem relates to the significant variation in conifer heights created by moose damage of the cedar and the inclusion of fill planted trees in the clusters. The second problem relates to the small size of trial units and the high degree of edge effect which will reduce data quality. Thirdly, there are a significant number of additional trees in the gaps and removal would be required to continue formal monitoring.

This trial should be surveyed to determine the density of total conifers and ensure that stocking targets are met on the site. In 2003 remove the conifers in the gaps to ensure maintenance of forage quality. Downgrade the status of this trial to a monitoring area.

IMPLEMENTATION DATES

2000 complete regeneration survey to determine stocking
2000 down grade to a monitoring area
2003 space natural regeneration and planted trees from gaps

LICENSEE: Western Forest Products
CONTACT: Gary Skabeikis
FOREST DISTRICT: Mid Coast
LOCATION: Kimsquit River
BLOCK: 155
TRIAL AREA: 11.7 ha

ECOLOGICAL CLASSIFICATION	
Subzone	CWHws2
Site Series	06 - Ba Cw Devil's Club
Soil Great Group	Orthic Regosol
Soil Texture	Loamy Sand

SITE HISTORY	
1993	Logged
1994	Spot site preparation
1994	Planted to Grizzly Stocking Guidelines
1995	1yr monitoring
1996	2yr monitoring
1999	Walk through

VEGETATION			
Species	**Pre-harvest Cover** (%)	**Current Cover** (%)	**Height** (cm)
Salmonberry	3	10	70
Thimbleberry	-	13	117
Red elderberry	1	1	128
Devil's club	15	-	-
Alaska Blueberry	15	5	60
Fireweed	-	15	120

Note: Important bear forage species are bolded.

The forage community on this block is well established and salmonberry and thimbleberry cover are increasing with time. Bear use is not apparent but it should increase with increasing berry production.

SILVICULTURE STATUS
This trial is well stocked. Conifers in the clusters are well established, vigorous, spruce with an tree height of 196 centimetres and leader growth of 47 centimetres. No disease or damage is evident on any of the conifers in the trial. Inter-tree competition appears to be starting in the one meter inter-tree clusters as marked differences in vigour are beginning to appear. Seedlings in the clusters will be free growing in two years. A significant number of naturals have become established in the block and most treatment units exceed maximum density. Spacing will be required to maintain forage production in the gaps particularly along the block boundary.

RECOMMENDATION
Despite the fact that access is no longer available in the Kimsquit valley, this block should be maintained as a formal trial. Deactivation of the Kimsquit Mainline will result in high cost for monitoring but the quality of results from this well stocked trial will outweigh the costs. Cluster stocking and gap orientation are superb and the forage community is developing well. Significant changes in forage species have occurred on this block and the shifts should be chronicled.

Restake cluster centres with colour coded aluminium stakes in the summer of 2000. Re-establish permanent cluster samples and check seedling numbering within clusters at this time. Complete 6 year monitoring of the trial in 2000 and 10 year monitoring in 2004. Space the trial in 2004 to remove conifers from the gaps and ensure the integrity of results. Declare the block free growing at this time.

IMPLEMENTATION DATES

2000 restake clusters and permanent plots
2000 complete 6 year monitoring
2004 space naturals from inter cluster gaps
2004 complete 10 yr. monitoring

LICENSEE: Western Forest Products
CONTACT: Gary Skabeikis
FOREST DISTRICT: Mid Coast
LOCATION: Kimsquit River
BLOCK: 245
TRIAL AREA: 5.7 ha

ECOLOGICAL CLASSIFICATION	
Subzone	CWHws2
Site Series	06 - Ba Cw Devil's Club
Soil Great Group	Orthic Regosol
Soil Texture	Sandy Loam

SITE HISTORY	
1993	Logged
1995	Planted to Grizzly Stocking Guidelines
1996	1yr monitoring
1999	Walk through

VEGETATION			
Species	**Pre-harvest Cover** (%)	**Current Cover** (%)	**Height** (cm)
Devil's club	25	-	
Alaska blueberry	15	-	
Highbush cranberry	5	-	
Red elderberry	-	5	180
Red raspberry	-	1	120
Red huckleberry	3	-	
Fireweed	-	60	210
Spiny wood fern	-	5	40
Lady fern	-	1	70

Note: Important bear forage species are bolded.

The forage community in this unit is vigorous and now beginning to produce a significant berry crop; however, wildlife use of the area was not noted.

SILVICULTURE STATUS
The Ministry of Environment requested this site be managed under Grizzly Bear Stocking Guidelines. The site was included as a monitoring area and, at the licensee's request, the area was planted using a clustered distribution of conifers. To make allowance for the variable substrate and ensure seedlings were established on the best microsites, clusters were placed anywhere along the prescribed inter-cluster distance.

Stocking on this unit is variable. Monitoring results from 1996 indicate that 73 percent of seedlings died in TU 1, 28 percent died in TU 2, 70 percent died in TU 3, and 36 percent died in TU 4. Natural regeneration has compensated for the poor survival of the planted trees and stocking targets, as an average for the trial area, are achieved. Natural regeneration is most frequent on the mesic ridges that had significant exposure of mineral soil during yarding. TU 1, 2, and 3 appear stocked with approximately 600 well spaced stems per hectare but TU 4 is poorly stocked as a result of drought related mortality on the dry skeletal ridges and competition related mortality in the high brush hazard depressions.

RECOMMENDATIONS

This site should continue to be included as a monitoring trial. The area needs further monitoring to determine if stocking meets the target established for the trial. It is expected that survey results will indicate fill planting is required. Fill plant this area in the spring of 2001 with large western red cedar PSB 615 1+0 stock. TU 4 in particular is very poorly stocked. Cluster centres on this unit are no longer visible and re-establishment is not recommended as the trial will only be a monitoring area. Manually brush the fill planted cedar in the summer of 2001 and 2002 to ensure they have sufficient light to become established. Conduct 10 year monitoring of the area in 2005.

IMPLEMENTATION DATES

2000 regeneration Survey
2001 fill plant
2001 manually brush or herbicide
2002 manually brush or herbicide
2005 10yr monitoring

LICENSEE: International Forest Products
CONTACT: Doug Grant
FOREST DISTRICT: Mid Coast
LOCATION: Talchako River
BLOCK: 62-2
TRIAL AREA: 12.0 ha

ECOLOGICAL CLASSIFICATION	
Subzone	CWHds2
Site Series	08 - Ss Salmonberry
Soil Great Group	Cumulic Regosol
Soil Texture	Sandy Loam

SITE HISTORY	
1990	Logged
1990,91,92	Planted
1994,95	Ac overstory planted
1995	Regeneration survey
1997	Fill planted conifers
1999	Fill planted conifers
1999	Walk Through

VEGETATION		
Species	**Current Cover** (%)	**Height** (cm)
Thimbleberry	10	100
Red raspberry	5	80
Red osier dogwood	10	120
Cottonwood	5	500
Willow	3	250
Fireweed	20	140
Grass	20	50

Note: Important bear forage species are bolded.

Vegetation on this unit produces moderate quality forage. The forage community is dominated by fireweed and thimbleberry. There has been little change in the composition of the plant community despite an even distribution of conifers. At present conifer and cottonwood stocking is scattered and canopy closure has not yet started.

SILVICULTURE STATUS

Prior to identifying this area as a candidate trial, it was marginally stocked with fair vigour cedar after three planting attempts. In 1993, the possibility of establishing a trial to assess the effectiveness of nurse tree shelterwoods at ameliorating frost damage in conifer clusters was discussed with International Forest Products. In 1994, a two phase trial was designed. Phase one involved establishment of a nurse crop of cottonwood and phase two involved establishment of cedar clusters under the cottonwood once they were established. Cottonwood whips were planted in 1994. However, a regeneration survey conducted in 1995 indicated survival was dismal due to poor strorage of the whips prior to planting. The area was replanted with cottonwood cuttings in 1995 but they also had poor survival and no further attempts were made to establish the cottonwood overstory.

Phase two, establishment of conifer clusters, was never completed because it became evident that sufficient cedar had survived from the previous plantations to meet grizzly stocking standards and the addition of clusters was unnecessary. The cedar planted from 1991-93 are almost free growing at an average height of 203 centimetres. The cedar planted in 1994 and 95 are on average 103 centimetres and the recently fill planted seedlings, 1997 and 99, are 35 centimetres. International Forest Products' survey results from 1999 indicate there are 600 cedar per hectare on this site and 450 are well spaced. Cottonwood were tallied at a density of 2000 stems per hectare but the distribution is very patchy and will not significantly impact free growing status.

RECOMMENDATIONS

Continue to include this block as a monitoring trial because it provides useful anecdotal data on the effects of even spacing on forage quality. This area will never produce formal information because clusters were not established and the height of well spaced cedar is too variable to provide meaningful trends that reflect the effects of management. Furthermore, it is not possible to sample the cedar on the basis of establishment date because the reduced growth of older cedar in low microsites makes it difficult to discern them from similar size younger cedar on suitable microsites.

International Forest Products staff expressed the belief that cedar growing under the cottonwood canopy were performing better than the open grown trees, but based on a small sample during the walk through it appears that the most important factor in conifer performance is actually the height of the microsite. Trees on raised microsites clearly outperform all other trees.

Continue to conduct walk through assessments to collect anecdotal information about forage quality and quantity when the grizzly stocking standards are applied using an even distribution of conifers.

IMPLEMENTATION DATES

2005 walk through assessment

LICENSEE: International Forest Products
CONTACT: Doug Grant
FOREST DISTRICT: Mid-Coast
LOCATION: 88 km Talchako River
BLOCK: 64-1B
TRIAL AREA: 6.5 HA

ECOLOGICAL CLASSIFICATION	
Subzone	CWHds2
Site Series	07 - Cw Devil's club
Soil Great Group	Orthic Regosol
Soil Texture	Loamy sand

SITE HISTORY	
1995	Logged
1996	Planted
1999	Walk through

VEGETATION			
Species	**Pre-harvest Cover** (%)	**Current Cover** (%)	**Height** (cm)
Devil's club	15	5	110
Red osier dogwood	-	1	130
Alaska Blueberry	5	-	
Highbush cranberry	-	1	132
Douglas maple	2	-	
Lady fern	-	5	100
Fireweed	-	1	120

Note: Important bear forage species are bolded.

At this point, the pre and post-harvest communities remain similar with each having moderate forage production. However, composition of the forage community has shifted from devil's club cover in the pre-harvest community to increased fern cover in the post-harvest community. Development of the forage community should be monitored to determine the impact that canopy closure of the overstory and understory cedar has on forage species composition and productivity.

SILVICULTURE STATUS
This area was logged as per the silviculture prescription. A series of patches were made on the east side of the mainline with many patches opening directly on the mainline. The openings are an average of 17 meters on the north south axis and 20 to 30 meters on the east west axis.

Openings are well stocked with western red cedar planted at an inter-tree distance of 2.0 meters on average. As one moves from west to east across the gap, there is an apparent increase in seedling height which corresponds to the increase in light intensity as one moves from the low light regime western edge to the higher light regime eastern edge. The height growth trend for the cedar is presented in the table below.

Position	Species	Height (cm)	Leader Growth (cm)
East Edge	Cw	155	34
Gap Centre	Cw	118	25
West Edge	Cw	96	18
Gap Ave.	Cw	123	26
Clearcut	Cw	155	31

When compared with the clearcut section of Block 64-1A, cedar performance appears lower in the group selection openings than in the clearcut. However, growth reductions may be offset by reduced conifer damage in the group selection system wher snow accumulations and vegetative cover are lower. In the clearcut the fireweed cover and the snow accumulation were higher and, consequently, there was more snow and vegetation press. Approximately 20 percent of the cedar were damaged in the clearcut.

RECOMMENDATION

This trial should be identified as a formal trial because it provides an opportunity to measure the impact of group selection and the subsequent effects of overstory and understory canopy closure on forage production. Methods of monitoring similar to those proposed in the retrospective analysis of gaps should be used. The area is well stocked and cedar are vigorous. Measurements of conifer performance and forage production should be established and stratified on the basis of gap position or light regime. Changes in the light regime across the gap should also be measured over time so they can be correlated with forage production within the gap. Establish permanent sample points in the summer of 2000. Complete forage assessments and seedling measurements at this time. Resurvey at 5 year intervals going forward. Use the adjacent clearcut area of 64-1A as the control.

IMPLEMENTATION DATES

2000 monitor light quality and forage in gaps post-harvest
2005 monitor light quality and forage in gaps post-harvest

LICENSEE: International Forest Products
CONTACT: Doug Grant
FOREST DISTRICT: Mid Coast
LOCATION: Taleomey River
BLOCK: 319C
TRIAL AREA: 5.2 ha

ECOLOGICAL CLASSIFICATION	
Subzone	CWHms2
Site Series	07 - Ss Salmonberry
Soil Great Group	Humic Regosol
Soil Texture	Si

SITE HISTORY	
1994	Logged
1995	Planted to Grizzly Stocking Guidelines
1996	Fill planted to Grizzly Stocking Guidelines
1997	Fill planted even distribution

VEGETATION
The status of vegetation on this site is unknown as the area was not visited.

SILVICULTURE STATUS
Based on International Forest Products' assessments of this block, it is currently not satisfactorily restocked. After three attempts to plant this area, 95 percent of the cedar have died due to the presence of a high water table at the base of the seepage slope and frosts associated with high outflow winds on the flats along the river.

RECOMMENDATION
This trial should be abandoned. The area is small and the second fill plant was not done according to the cluster planting template. Gaps, consequently, have conifers in them and the height difference of fill planted trees will confound analysis of formal data. Attempts to re-establish a formal trial on this site are not recommended because the limiting factors and the variability of suitable microsites make it difficult to establish clusters on an even spacing. This trial should be abandoned as similar information can be gathered from monitoring the development of Block 62-2 in the Talchako. International Forest Products plans to establish a cottonwood nurse tree shelterwood to ameliorate environmental conditions on this site in 2000. Establish cottonwood whips in the spring of 2000 and plant PSB 615 1+0 cedar stock in 2002 once the cottonwood canopy is established.

IMPLEMENTATION DATES
2000 establish a nurse tree shelterwood on this site
2002 plant cedar under the cottonwood canopy
2002 walk through assessment

LICENSEE: International Forest Products
CONTACT: Lisa Mulder
FOREST DISTRICT: Campbell River
LOCATION: Kingcome River
BLOCK: 24B
TREATMENT AREA: 12.8 ha

ECOLOGICAL CLASSIFICATION	
Subzone	CWHvm1
Site Series	07 - Ba Cw - Salmonberry
Soil Great Group	Dystric Brunisol
Soil Texture	SiL

Note: northern portion is 30% 06 - Hw Ba Cw - deer fern

SITE HISTORY	
1993	Logged
1994	Planted to Grizzly Stocking Guidelines
1995	1yr monitoring
1996	2yr monitoring
1996,98	Mechanical brushing

VEGETATION			
Species	**1994 Cover** (%)	**Current Cover** (%)	**Height** (cm)
Salmonberry	20	35	131
Thimbleberry	-	20	160
Red elderberry	10		
Red alder	-	10	500
False Azalea	-	2	130
Fireweed	15	3	150
Lady fern	-	10	160
Spiny wood fern	-	25	50

Note: Important bear forage species are bolded.

The vegetative community on this block has continued to expand and increase in height and productivity, and currently, the forage potential is rated high. There is a well established community of salmonberry and thimbleberry. The northern section of the trial has much higher alder cover than the south but the forage community appears similar. Bear use of the area is still evident.

SILVICULTURE STATUS
This block is overstocked. Survival is excellent within the clusters and the natural regeneration which established in the gaps after logging has survived. The block is almost free growing because 89 percent of the measured seedlings meet free growing criteria. The remaining seedlings will meet free growing criteria in 3 years. The average western red cedar is 226 centimetres in height.

RECOMMENDATIONS

Continue to monitor this trial as a formal installation. Because cluster stakes have disappeared in most treatment units, colour coded aluminium stakes will be installed at cluster centres to facilitate future identification. In 2000, re-establish cluster centres and permanent sample plots, check the numbering of sample seedlings and complete seven year monitoring of this trial. In the past, numbering of seedlings was difficult because there were so many naturals in the clusters. Monitoring should be conducted concurrently with removal of naturals from the gaps and clusters so quality control of stand tending can be completed at the same time. Remove all natural conifers and deciduous trees from within the gaps in the summer of 2000. Complete 10 year monitoring of this site in 2004.

IMPLEMENTATION DATES

2000 ammend SP stocking standards
2000 restake cluster centres
2000 complete 7yr monitoring
2000 space naturals to meet target stocking
2004 complete 10 year monitoring

LICENSEE: International Forest Products
CONTACT: Lisa Mulder
FOREST DISTRICT: Campbell River
LOCATION: Kingcome River
BLOCK: 99
TRIAL AREA: 15.4 ha

ECOLOGICAL CLASSIFICATION	
Subzone	CWHws2
Site Series	06 - Ba Cw Devil's Club
Soil Great Group	Cumulic Regosol
Soil Texture	Loamy sand

SITE HISTORY	
1991	Logged
1992	Planted
1993	Planted to Grizzly Stocking Guidelines 2.5ha
1995	2yr monitoring
1995	Tubed
1996	Laid out trial on 15.4 ha
1997	Planted to Grizzly Stocking Guidelines 2.5ha
1997	Sprayed
1998	Fill planted
1998	Tubes removed
1999	Walk through

VEGETATION			
Species	**Pre-harvest Cover** (%)	**Current Cover** (%)	**Height** (cm)
Salmonberry	40	35	150
Thimbleberry		20	150
Devil's club	5	2	50
Red elderberry	2	2	300
Red alder	-	15	600
Lady fern	5	5	70
Fireweed		15	150

Note: Important bear forage species are bolded.

This area continues to provide an excellent source of grizzly forage. The community of salmonberry and thimbleberry is lush and abundant. Although clusters are poorly defined and there are a significant number of trees growing in the gaps, seedling mortality has, by default, created a series of natural gaps which are sufficiently large that they will be maintained well into the next rotation.

SILVICULTURE STATUS
Establishment of a trial in this area has been problematic from the start because International Forest Products had difficulties procuring funding and pesticide use permits to control competing vegetation. The original Pacific silver fir stock used in the 1993 trial had very low survival and could not compete with the vigorous salmonberry growth. This trial was subsequently abandoned in 1995 after monitoring indicated balsam survival was only 56 percent. A significant number of seedlings were tallied in the gaps and the area was expected to meet grizzly stocking standards without further treatment.

During the summer of 1996 discussions were held with International Forest Products to establish a new trial and amend the silviculture prescription to apply grizzly stocking standards to the whole area west of the Chaunard Mainline. The area was laid out in the fall of 1996 with site preparation was planned for the same season. However, the site preparation was never completed and the clusters were planted in the spring of 1997 anyways. The area was subsequently sprayed in 1997 to control competing vegetation within the clusters.

The vigour of the planted seedlings is moderate to low. Overall, survival in the clusters is 50 percent with 70 percent of the cedar surviving and only 20 percent of the Pacific silver fir surviving. The cedar exhibit moderate vigour at an average height of 50 centimetres. The Pacific silver fir are still in planting shock and exhibit low vigour at an average height of 46 centimetres with leaders of 4 centimetres. Seedlings from the 1992 plantation and the natural hemlock which regenerated after logging are free growing at an approximate density of 350 stems per hectare. In total this block is stocked with approximately 700 stems per hectare. The conifer distribution is patchy and high quality forage gaps are maintained throughout the area.

RECOMMENDATIONS

Downgrade this trial to a monitoring area. Fotmal monitoring of this area is no longer appropriate because clusters have poor survival and stocking gaps are irregular. Analysis of gap size and its effects on forage production will be impossible due to the variability of tree heights. Based on the walk through it appears the block will meet grizzly stocking standards because there are at least 600 well spaced stems per hectare and there are a number of sizeable irregular gaps in the conifer distribution. In 2000, survey this area to confirm it is stocked to grizzly standards. Continue to manage vegetation to ensure the 1997 cedar meet free growing standards. Use a backpack application of herbicide or a manual treatment to remove salmonberry from a one meter cylinder around encumbered crop trees in 2000. Further treatment should not be required as the cedar will be sufficiently established to compete with the salmonberry cover after this point.

IMPLEMENTATION DATES

2000 ammend SP stocking standards
2000 regeneration Survey to Grizzly Stocking Standards
2000 manual or chemical brushing and weeding
2006 free growing survey

LICENSEE: Ministry of Forests
CONTACT: Mark Scott
FOREST DISTRICT: Sunshine Coast
LOCATION: Orford River
BLOCK: A46904 - 1A
TRIAL AREA: 10.9 ha

ECOLOGICAL CLASSIFICATION	
Subzone	CWHdm
Site Series	07 - Cw Foam Flower
Soil Great Group	Melanic Brunisol
Soil Texture	Sandy Loam - skeletal

SITE HISTORY	
1993	Logged
1994	Planted to Grizzly Stocking Guidelines
1995	Restaked to improve visibility
1995	Manual brushing
1995	1yr monitoring
1996	2yr monitoring
1997	Manual brushing
1999	Manual brushing
1999	Walk through

VEGETATION					
Species	**Pre-harvest Cover** (%)	**Current Cover B**(%)	**Current Height B**(cm)	**Current Cover C**(%)	**Current Height C**(cm)
Salmonberry	15	45	200	15	125
Thimbleberry	-	10	100	-	
Red raspberry	-	5	50	10	100
Devil's club	-	2	75	-	
Red huckleberry	-	-		2	150
Red alder	10	15	200	-	
Big leaf maple	10	10	300	-	
Red elderberry	10	-		-	
Bracken fern	-	-		15	175
Spiny wood fern	-	15	60	15	60
Lady fern	-	5	70	1	70

Note: Important bear forage species are bolded.

This block provides an excellent source of grizzly forage. Productivity decreases when you move up the hill into Unit C because the site is not as rich as Unit B. Both units, however, have a vigorous community of salmonberry and thimbleberry. The gaps are generally free of natural conifers except when you approach the south-east boundary of Unit C where western hemlock have naturally regenerated on the exposed mineral soil substrate. In all units but C4 densities are below acceptable maximums. There are also very few deciduous species in the gaps.

SILVICULTURE STATUS
This block is well stocked at levels similar to those tallied when the block was monitored in 1996. Saplings in Unit B are free growing at an average height of 386 centimetres for Douglas fir, 240 centimetres for western red cedar, and 143 centimetres for Pacific silver fir. Leader growth on all species is excellent. In Unit C, where soils are

skeletal and productivity is lower, Douglas fir average 166 centimetres, western red cedar average 189 centimetres and western hemlock average 166 centimetres. In the larger clusters there is some evidence that inter-tree competition may be starting, but it is still hard to differentiate whether reduced growth is due to microsite selection or competition for resources.

RECOMMENDATIONS

This trial is one of the best installations of the project. The Sunshine Coast silviculture staff have done an excellent job of maintaining the trial and scheduling brushing to ensure stock survives and meets free growing criteria. No further treatments are required as the clusters are free growing. The aluminium stakes used to mark cluster centres are by and large still standing. The paint has worn off but trees are big enough that treatments and cluster locations are obvious. Permanent sample points need to be re-established and sample tree numbers within clusters need to be checked and replaced. Brush control has resulted in the loss of sample tree numbers when saw blades hit the pigtail wires. Sufficient numbers are present that missing numbers can be re-established easily.

This trial should be remeasured to collect data on current seedling performance as it appears inter-tree competition is starting in some of the larger clusters. Complete 6 year monitoring in 2000 when permanent sample points are re-established. Complete 10 year monitoring in 2004.

IMPLEMENTATION DATES

2000 re-establish permanent points and tree numbers
2000 complete 6 year monitoring
2004 complete 10 year monitoring

LICENSEE: Ministry of Forests
CONTACT: Mark Scott
FOREST DISTRICT: Sunshine Coast
LOCATION: Orford River
BLOCK: A46904 - 2B
TRIAL AREA: 5.7 ha

ECOLOGICAL CLASSIFICATION	
Subzone	CWHdm
Site Series	09 - Red osier dogwood
Soil Great Group	-
Soil Texture	-

SITE HISTORY	
1993	Logged
1994	Planted to Grizzly Stocking Guidelines
1995	1yr monitoring
1996	2yr monitoring

VEGETATION
No ground visit was made on this unit due to budget and time constraints. Based on an aerial reconnaissance, it appears that significant differences in competing vegetation and forage are present at the different cottonwood densities. No forage was visible at the dense stockings of TU 4 and 3 and only limited forage was available in TU 2. Forage appeared abundant at the low density of TU 1. The major component of the community appears to be thimbleberry.

SILVICULTURE STATUS
This site is well stocked and survival in each unit appears to meet stocking standards. Based on an aerial assessment cottonwood stocking appears to be similar to the levels established in the 1996 monitoring. Vigour is excellent but inter-tree competition may be appearing in the higher density units.

RECOMMENDATIONS
The difference in forage quality at different cottonwood spacings should be assessed because cottonwood are often assumed to have little impact on forage quantity and quality. In reality there appears to be a significant difference in forage quantitiy at the current spacing densities in this trial. The need to chronicle the dynamics of forage development as inter-tree competition begins to cause self thinning at higher densities is important to understand if the mortality of inter-tree competition results in a convergence of forage communities over time and the period of time that it takes the different densities to converge. Monitor this trial in the summer of 2000 and establish an appropriate monitoring schedule based on the changes that have occurred since the area was monitored in 1996.

IMPLEMENTATION DATES
2000 6 year monitoring to assess forage, cottonwood, and conifer performance
2000 establish a monitoring plan
2004 10 year monitoring

4.0 Discussion

This section of the report provides a summary and analysis of trial success and failure. Over the course of the field visits, it became apparent there were several trends in a number of administrative and ecological components that related to the success or failure of the trials. The probability of trial success appears to rest on the interaction of the following seven components - proponent staffing, SP status, trial size, pre-establishment disturbance, implementation support, species selection, and brush hazard. Examples of successful and unsuccessful trials are discussed as they relate to each of the components in the subsections below. The most successful trials are found where there was continuity of proponent staff, an approved SP, and an aggressive vegetation management plan.

4.1 Proponent Staffing

The key component of a successful trial is that the proponent is backed by a stable, committed, management team. The Orford River trial is successful because there has been little staff turnover in the Sunshine Coast Forest District. Staff understand the trial objectives and are dedicated to tending this project to free growing. Management commitment to the trial has ensured funds were budgeted and acquired for treatment when needed. The wealth of local experience possessed by a stable staff is also important because knowledge of local site conditions allows them to develop appropriate monitoring regimes that ensure treatments are scheduled and implemented within the bounds of local treatment windows.

Where staff turnover is high, the rate of trial failure is also high. Problems are most apparent on high brush hazard sites such as Block 99 in the Kingcome and Chuckwalla / Kilbella. In the Kingcome, staff turnover led to two problems. The first was that required SP amendments were not followed up with the MoF, and the second was that treatment windows for fill planting and control of competing vegetation were missed. In the Chuckwalla / Kilbella trial, staff turnover meant that fill planting and brushing windows were missed, and that eventually the trial was written off.

From an administrative point of view, stable staffing ensures there is continuity of personnel pushing for required SP amendments. From a biological perspective, staff continuity provides local knowledge of site conditions which can be used to tailor monitoring regimes to the site and take advantage of treatment windows when benefits are highest. Often in the time it takes new staff to become oriented in their job, planning or treatment windows are missed. It also appears that without the initial involvement in a project, staff are less willing to take appropriate action to keep a trial going and are more inclined to write off problem trials like the Chuckwalla / Kilbella.

4.2 Silviculture Prescription Status

Trial success is improved if objectives and actions are documented in a prescription. The most effective form of prescription is an approved SP or backlog SP describing trial objectives and details of design, layout, and stand tending. An SP is most effective because it is a legal document with detailed standards which must be met at free growing on a specific landbase, the Standard Unit. The signature requirements of the District Manager and a signing authority of the licensee in the approval process ensure that all levels of management support the trial concept. Involving upper management of the licensee helps to offset the loss of continuity in technical staff where turnover is high. The legal imperative of an SP also ensures that people consult it to determine the actions required to meet management standards when responsibility for an area shifts due to changes in staff or licensee responsibility.

The existence of a detailed SP for the Phillips River trial has helped maintain the integrity of the trial because the standards in the document are legally binding. Changes to the FRBC delivery model have resulted in transfer of trial management from the MoF staff in the Campbell River Forest District to Weyerhaeuser and finally to Weyerhaeuser's FRBC contractor. The SP has provided a reference for new managers when they assumed responsibility for the site and the trial continues to be successful despite shifts in management.

Trial success is lower where areas had SPs with operational stocking standards at the time of selection. Reduced success on these sites relates to the difficulty of getting amendments to reduce stocking standards to the grizzly guidelines approved. Often the timing of reforestation activities on candidate sites meant the planting window arrived before amendments were finalized. The uncertainty and short term nature of funding for the implementation contract further aggravated this situation because funding arrived late in the year and could not be carried forward to the next field season. Prior to establishing trials, agreements were made with proponents and the MoF to reduce stocking standards in principle, but amendments have never been finalized on some blocks. This problem is most extreme in Kingcome River where SPs have not been amended to reflect trial standards. In this area there appears to be a reluctance on the part of the MoF to reduce stocking standards, and International Forest Products has not had the continuity of staff to pursue the issue.

The second problem with SPs occurred in the Kalum Forest District where the District Manager decided that the trials proposed in 1992 were small enough that a SP amendment was not required. This approach seemed expedient at the time because trials could be established without jumping through the time consuming bureaucratic hoops of the amendment process. However, in hindsight, failure to amend the SPs and identify the trial as a specific standard unit within the SP was counter productive. Without an SP, history record prompts were not created to ensure treatments were scheduled, monitored, and completed in a timely fashion. Consequently, when funding for this project stopped, and a MoE representative was not directly involved with the trial, proponents were no longer reminded of their obligations, and trials such as those in Cecil Creek and Kitimat River failed.

4.3 Trial Size

A key factor in the success of a trial appears to be its size. Once trials are larger than five hectares they are more successful for the simple reason that larger blocks are more visible if they show up as not satisfactorily restocked. Large trials are also more successful because District Managers require them to have SPs. At a size of less than five hectares, some District Managers did not require that trials have SPs and, without a mapped standard unit, the failure to meet trial standards at regeneration delay or free growing can be hidden among the more well stocked strata of a larger block. Likewise a trial without an approved SP can simply revert to standard operational densities if fill planting is required.

4.4 Pre-establishment Disturbance

The type of disturbance prior to establishment of a grizzly forage trial is important because it influences the administrative requirements of the site. Where trials were established in current logging (Kimsquit 155) or in recent stand conversions (Orford River), they were more successful because the MoE requested management to grizzly forage standards at the forest development planning stage. In order to log these sites SPs were developed using grizzly standards from the outset. Where trials are established in large backlog rehabilitation projects, they are also successful. In these areas (Wedeene and Phillips Rivers), detailed SPs were prepared to grizzly standards by the implementation contractor at the inception of the project. Trials are least successful where they were established on current openings which required fill planting. Lack of success is generally due to the fact that SP amendments were not completed and licensees are not legally bound to take the trial to free growing. Fill planted areas are also problematic because more trees survived than expected and maximum density is often exceeded as in the case of Block 110-B in the Kimsquit.

4.5 Implementation Support

The other administrative factor which appears crucial to successful establishment is the involvement of the MoE contract representative during the implementation phase of the project. All projects which are slated to be abandoned were projects where representatives were unavailable to help with the implementation and ensure that the concept of the trial was understood by the planting crew. Availability of MoE staff at the time of planting is important because they can work directly with planters to ensure they understand the importance of spacing requirements. The most glaring problem in this regard is the Chuckwalla / Kilbella block where MoE representatives were unable to help with the planting and decisions were made which impacted the integrity of the trial design.

4.6 Species Selection

The choice of species dramatically impacts the success of a trial. Overall, spruce appear to have the best chance of survival and are the strongest competitors in high brush areas. As an indication of the tenacity of spruce, they are the only seedlings to survive in the untreated, highly competitive, environment of the Chuckwalla / Kilbella trial. All other conifer species have died in the clusters as a result of salmonberry competition. In the Kimsquit trials of Blocks 20 and 155, spruce survival has been 90 percent on average. However, in much of the CWH, the risk of weevil infection once spruce emerge above competing vegetation is too high to support prescriptions of spruce monocultures. This risk is highest in the Kitimat Valley where weevil infestations are found at epidemic levels.

Cedar and hemlock have moderate abilities to compete with vegetation but cedar has the added problem of palatability. Cedar is a moderate competitor but its performance is hampered by moose and deer browsing. Browse damage is variable - Block 24B in the Kingcome has had no browse damage, the Phillips River trial has been protected from deer damage by tenting all cedar, and in Humphries Creek moose have browsed 30 percent of cedar. The worst browse is found in Block 110-B where moose browse was found on 87 percent of the cedar.

Pacific silver fir is the least robust and has the poorest survival of trees planted in high competition environments. The majority of failed trials had a high component of Pacific silver fir. This species was prescribed to provide a buffer against losses to browse or spruce weevil but in many cases, as in the Chuckwalla / Kilbella and Phillips River, it was the first to die. Where this species is prescribed to reduce the risks of pest damage, large stock must be planted in combination with an aggressive, well planned, program to control competing vegetation. The ideal prescription involves a managment regime similar to the Wedeene River trial where spot site preparation, and brush mats have dramatically improved balsam survival and vigour. Where brush mats were not used at the time of planting, the resultant grass cover on site prepared spots seems to drastically reduce vigour. Chemical control of vegetation does little to reduce grass cover and often makes competition more intense as grasses expand into growing space previously occupied by susceptible species.

4.7 Brush Hazard

The largest factor which governs the success of a trial is the relative brush hazard of the site. Trials such as 24B in the Kingcome and 155 in the Kimsquit are largely successful because they were installed on moderate brush hazard sites. On these sites, the problems described above are less significant because after trees are established they often survive without further treatment. Trials established on higher brush hazard sites such as the Phillips and Wedeene River have been successful because the treatment area was site prepared prior to planting. Survival in the Wedeene trial was further enhanced with the use of brush mats to control below ground grass competition with the Pacific silver fir. Where site preparation was not an option, as in the Orford River block, trials have been successful because frequent manual brushing treatments were completed. Where brushing windows were missed because pesticide use permits were not granted or manual treatments were deemed too expensive, areas such as Block 99 in the Kingcome and the Chuckwalla / Kilbella trial, have ended up as failures.

The establishment of nurse tree crops in high brush hazard sites has not yet proven effective. In the Chuckwalla / Kilbella, where cottonwood were established directly over conifer clusters, cottonwood in clusters of greater than 15 trees had negative effects on conifer performance because the light regime at the cluster centre was too low for conifer survival. At clusters of 15 trees or less, the cottonwood appear to provide an advantage for trees on the outside edge of the cluster because conifers can take advantage of the reduced competing vegetation inside the cluster and the improved light regime at the cluster edge. In the Phillips River trial, the cottonwood canopy has not yet closed cover and it has not had any effect on competing vegetation. In the Wedeene the nurse tree crop was a failure because soil moisture was too dry at the time of planting and cottonwood survival was extremely poor.

5.0 Summary and Future Recommendations

5.1 Summary of Methodology

This project was initiated to review the status and heighten the profile of the 18 grizzly forage trials established in the CWH zone of the Vancouver and Prince Rupert Forest Regions from 1993 to 1997. Licensee and MoF proponents were canvassed to determine the establishment or stand tending activities they had completed to ensure trials meet free growing timeframes and to determine the current status of the trial. Using this information the trial database was updated and sites were prioritized for visitation on the basis of stocking status, size, and access.

Eighteen trials were reviewed initially, 15 were visited on the ground, one was assessed with an aerial reconnaissance, and two were not visited because conifer survival was poor or access costs exceeded budgetary constraints. In trials selected for ground visitation, a walk through was completed to qualitatively assess the success of each trial. Sample trees were measured in representative clusters to provide an indication of the range and average productivity of conifers in the different treatment units. The variability of the conifer data and the small size of the sample made demonstratation of trends in performance between treatment units impossible. A larger sample size is required but the current data will be useful to estimate the sample intensity required for future remeasurement. Because differences in cover were also not visible between treatment units, cover values for forage species were sampled from a single representative plot in the trial. Photos were taken and labelled to provide visual evidence to support trial evaluations and recommendations. Recommendations were developed for future assessment and remeasurement based on the summary of field data and the prioritization scheme presented below.

5.2 Trial Prioritization

Table 2 presents a prioritized list of sites based on the summary of walk through assessments of established trials. The criteria used for prioritiztion and their weighting are shown in Table 3. Four criteria were used - current status, stocking status, access, and size. Current status, which was determined upon completion of the walk through assessment, refers to the recommended monitoring regime for the trial. Monitoing regimes are defined in the project working plan. Stocking status is used because it indicates the risk of plantation failure and indicates the variability of conifer growth and yield data if the area has been or will be fill planted. Access is important because it provides an indication of the fixed costs of monitoring and the probability of completing silviculture treatments to maintain gap integrity. It is assumed that poorer access areas are less likely to recieve silviculture treatments due to the high cost of mobilizing crews. Size is a major criteria because it provides an indication of three key factors which affect trial integrity - the degree of edge effect, the number of treatment units, and the number of replicates of each treatment. As trials increase in size edge effect decreases and the number of treatment units and replicates increase. The larger trials also provide more detailed information on conifer response to clustering because they have treatment units which explore a variety of inter-tree distances between conifers. Larger trials also have the potential to provide significant foraging areas. Trials are listed in order of priority based on the ranking of the above criteria.

Table 2: Summary of ranking for trials assessed in 1999

MoF District	Licensee	Location	Block Name	Area	Previous Status	Current Status	Stocking	Access	Size	Points	Rank
Sunshine Coast	MoF SBFEP	Orford River	A46904-1A	10.9	F	F	SR	G	L	50	**H**
Kalum	Ministry of Forests	Wedeene River	E, Polygon 5	54.7	F	F	SR	G	L	50	**H**
Sunshine Coast	MoF SBFEP	Orford River	A46904-2B	5.7	F	F	SR	G	M	45	**H**
Campbell River	Weyerhaeuser	Phillips Arm	EM - X	18.5	F	F	MSR	G	L	45	**H**
Kalum	Ministry of Forests	Central Humphries	Opening 318	26.5	F	F	MSR	G	L	45	**H**
Mid Coast	Ministry of Forests	Chuckwalla/ Kilbella	TSL A34824	8.4	F	F	SR	M	M	40	**H**
Port McNeill	International Forest Products	Kingcome River	24B	12.8	F	F	OSR	H	L	40	**H**
Mid Coast	Western Forest Products	Kimsquit River	20	22.3	F	F	OSR	H	L	40	**H**
Mid Coast	Western Forest Products	Kimsquit River	155	11.7	F	F	SR	H	L	40	**H**
Mid Coast	International Forest Products	Talchako River	64-1B	6.5	M	F	SR	M	M	40	**H**
Mid Coast	International Forest Products	Talchako River	62-2	12.0	I	M	MSR	G	L	35	M
Mid Coast	Western Forest Products	Kimsquit River	245	5.7	M	M	MSR	H	M	25	L
Port McNeill	International Forest Products	Kingcome River	99	36.0	F	M	MSR	H	L	25	L
Mid Coast	Ministry of Forests	Chuckwalla/ Kilbella	TSL A34824	26.6	F	M	NSR	M	L	25	L
Mid Coast	Western Forest Products	Kimsquit River	110-B	4.0	I	M	OSR	H	S	21	L
Kalum	Skeena Sawmills	Kitimat River	5-5-9	3.7	I	A	MSR	G	S	21	L
Sunshine Coast	Scott Paper	Homathko River	7	1.2	F	A	UK	G	S	16	L
Mid Coast	International Forest Products	Taleomey River	319C	6.2	F	A	NSR	P	M	12	L
Kalum	Skeena Sawmills	Cecil Creek	2-2-17	4.3	I	A	NSR	M	S	11	L
Total Area				**277.7**							

Table 3: Ranking criteria.

Ranking Codes													
Current Status	**Monitoring Intensity**	**Points**	**Stocking**	**Stocking Density**	**Points**	**Access**	**Vehicle**	**Points**	**Size**	**Area (ha)**	**Points**	**Rank**	**Points**
F	Formal	15	OSR	>Max Den	10	G	2WD	15	L	>10.0	10	H	>36
I	Informal	10	SR	TSS	10	M	4WD	10	M	5.0-9.9	5	M	26-35
M	Monitoring	5	MSR	TSS-MSS	5	P	>2km Walk	7	S	0.0-4.5	1	L	16-25
A	Abandon	0	NSR	<MSS	0	H	Helicopter	5				N	0-15

5.3 Recommendations

As a result of field assessment and subsequent prioritization, it is recommended that 4 of the trials be abandoned (see those listed at the bottom of Table 2). These areas are small and not satisfactorily restocked because stand tending was not sufficient to ensure that the cluster seedlings outcompeted the brush. In most cases the trials to be abandoned are blocks which were scheduled for fill planting when the trial was established. The Cecil Creek trial is not satisfactorily restocked and the Kitimat River trial is marginally stocked. Data collected from these installations would become highly variable with further fill planting. The Taleomey block was abandoned because it is high risk and currently not satisfactorily restocked and the Homathko River block was abandoned because the trial area is small and access is expensive. Further monitoring of these blocks was considered unnecessary because they would provide information similar to that from Talchako 62-2 and the Chuckwalla / Kilbella trial. Talchako 62-2 is a monitoring area with an evenly distributed conifer crop and similar limiting factors to those found in the Taleomey. The clustered cottonwood concept of the Homathko river block will be more adequately represented by the large area of clustered cottonwood available for formal evaluation in the Chuckwalla / Kilbella.

In two cases trials have been demoted to monitoring areas because either the cluster planting failed, as in the case of Kingcome Block 99, or stocking density is too high, as in the case of Kimsquit 110-B. In Kingcome Block 99, the combination of surviving seedlings from the clusters and trees from previous plantations meets the Grizzly Stocking Standards and provides sufficiently large gaps that forage production will be enhanced above operational stocking standards. This trial will provide a comparison between planned and ad hoc management regimes which arise due to natural variation within a site. In Kimsquit Block 110-B, the trial has a variety of overstocked and understocked areas which will provide comparisons to help determine an appropriate maximum density for grizzly stocking trials.

The monitoring trial in Talchako 64-1B has been upgraded to a formal trial because it provides an opportunity to assess the impacts of partial cutting on grizzly forage. A portion of the Chuckwalla / Kilbella installation has been retained as a formal trial. This area provides an excellent opportunity to assess the impact of evenly spaced or clustered cottonwood plantations on forage production. The remainder of this trial should be reduced to a monitoring installation until the area is rehabilitated.

Currently, the application of the grizzly stocking guidelines is expanding to subzones in the Interior of B.C. - particularly the Interior Cedar Hemlock and Engelmann Spruce Subalpine Fir zones. Consideration should be given to establishment of further trials because there may be significant differences in the relationship between gap size and forage production when compared with the CWH. Conifer growth rates are much lower in the interior and less area may be required in gaps due to the reduced rate of canopy closure. Using the knowledge gained from the success and failure of trials in the CWH, the following guidelines should be used to establish new trials -

- all trials should have a detailed SP,
- be 5.0 hectares or larger,
- have sufficient funding to provide for higher than average implementation costs,
- use large stock *Abies* species to increase survival and vigour, and
- have an established source of funds committed for stand tending.

The stand tending budget should be based on treating the trial with manual methods as a contingency to cover failures to obtain pesticide use permits. In general two to three vegetation treatments will be required to ensure trials reach free growing.

In the coming field season we recommend that sites be visited and treated following the prioritization listed in Table 2. Specific treatments required for each site are listed in the site summaries in Section 3.0. The number of sites to visit and treat, or monitor, will be a function of funds available. Table 2 can be used to prioritize the work once long term funding is available. A detailed working plan with scheduling and cost estimates to complete the work for 2000 will be provided as requested. Getting an early start on the preparation of schedules for 2000 is important due to constraints imposed by berry and flowering phenology of forage shrubs, and by the considerable planning involved to co-ordinate with proponents and access sites. A key consideration for this project is the need to provide a source of long term funding (5-10 years) which will allow sites to be monitored according to the schedule laid out in the working plan, and allow for longer term planning and continuity of project staff.