

FREP

ADM RESOURCE
STEWARDSHIP
REPORT

December 2013

FOREST AND RANGE EVALUATION PROGRAM

ASSISTANT DEPUTY MINISTER RESOURCE STEWARDSHIP REPORT: RESULTS AND RECOMMENDATIONS OF THE FOREST AND RANGE EVALUATION PROGRAM



*The Howsons
Photo credit: Aaron Benterud*



MESSAGE FROM THE ASSISTANT DEPUTY MINISTER OF RESOURCE STEWARDSHIP



Forest management in British Columbia is governed by a hierarchy of legislation, plans, and resource management objectives. Federal and provincial acts and regulations, land use plans, forest stewardship plans, and protected areas and other set-aside areas collectively contribute to achieving balanced

environmental, social, and economic objectives. The *Forest and Range Practices Act (FRPA)* both establishes the minimum legal requirements that forest licensees must achieve and provides freedom to manage within the context of meeting these legal requirements and maintaining high environmental standards. A fundamental principle of *FRPA*'s results-based model is that stewardship is not expected to be defined or delivered solely by minimum legal requirements. For the resource values measured in this report, monitoring has shown that environmental standards have generally been maintained or improved under *FRPA* at the provincial level, compared to the *Forest Practices Code*.

It is understood and accepted that development of natural resources influences and impacts ecological states and dynamics. In this report, stewardship trends are shown using impact ratings of "very low," "low," "medium," and "high." Government's stewardship objectives may be achieved with a range of these impact ratings, depending on specific local social, economic, and environmental conditions. The discussion of what level of impact on natural resource values is acceptable and what actions to take occurs at the provincial, regional, and local (district) levels and should always consider environmental, social, and economic factors. For example, land-use planning and objective setting at a regional level typically establishes trade-offs between social, economic, and environmental values and impacts. At the local level, district manager commentaries in multiple resource value assessment reports reflect consideration of what is an appropriate balance. Forest and Range Evaluation Program (FREP) effectiveness evaluations help determine whether resource development impacts are consistent with expected outcomes and (or) achieve acceptable/sustainable levels of resource development. The purpose of this report is to provide resource professionals and decision makers with

information about the environmental component of this "balance" so that they can assess the consistency of actual outcomes with their expectations.

The *FRPA* lists 11 resource values essential to sustainable forest management: biodiversity, cultural heritage, fish/riparian and watershed, forage and associated plant communities, recreation, resource features, soils, timber, visual quality, water, and wildlife. This report summarizes field-based assessments of the environmental condition of these values at a "resource-area scale." Field assessments are generally conducted on, or near, recently harvested cutblocks and therefore evaluate the stand (site)-level effects of industrial activity rather than the condition of the value overall (i.e., these assessments do not take into account the approximately 21% of the land base set aside for old-growth management areas, ungulate winter ranges, wildlife habitat areas, and parks where no harvest is permitted). Most of the report is focussed on the ecological state of the values and provides useful information to resource managers and professionals on the outcomes of their plans and practices. This information is also valuable for communicating resource management outcomes to stakeholders, First Nations, and the public, and as a foundation for refining government's expectations for sustainable resource management in specific areas of the province.

I encourage readers to review this report and direct any questions or comments to the appropriate district office.

Tom Ethier
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Resource Stewardship Division
Ministry of Forests, Lands and Natural Resource Operations

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FREP monitoring identifies resource practices that have proven to be effective in sustainably managing forest and range resource values and it also highlights opportunities for continued improvement.

The FREP Mission:

To be a world leader in resource stewardship monitoring and effectiveness evaluations, communicating science-based information to enhance the knowledge of resource professionals and inform balanced decision-making and continuous improvement of British Columbia's forest and range practices, policies and legislation. <http://www.for.gov.bc.ca/hfp/frep/index.htm>



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INTRODUCTION

This fourth annual overview of the Forest and Range Evaluation Program (FREP) summarizes high-level program findings and makes recommendations for continued improvement of on-the-ground resource management practices and decision-making. With a target audience of natural resource professionals and decision-makers, this report aims to encourage dialogue and inform balanced decision-making among those who manage British Columbia’s natural resource values on behalf of the public.

The development of the *Forest and Range Practices Act (FRPA)* had several key goals, including:

- simplifying the forest management legal framework
- creating a “freedom to manage” approach for defined results
- maintaining the high environmental standards laid out in the *Forest Practices Code of British Columbia Act (FPC)*

A recurring theme during *FRPA*’s development was the need for science-based information that could define acceptable standards of risk for the proposed management regime. To address this need and to build public confidence in *FRPA*, the provincial government committed to conduct effectiveness evaluations and publicly report the monitoring results. The intent was to establish a credible source of empirical data to ascertain how well the *FRPA* framework and the professional reliance management model achieved the government’s objectives of maintaining high environmental standards and ensuring the sustainable management of public resources.

FREP began collecting monitoring data on 11 *FRPA* resource values in 2005. Table 1 lists the current monitoring status of these values and shows the number of assessments completed to 2012. Figure 1 illustrates the spatial distribution of FREP resource stewardship monitoring completed to the end of the 2012 field season. By providing science-based monitoring and evaluation information to resource managers, FREP supports professional reliance and the continuous improvement of land and resource stewardship. Ultimately, this information is used to make necessary adjustments to practices, policies, and legislation. For more information on FREP, please go to: <http://www.for.gov.bc.ca/hfp/frep/index.htm>

This annual report focuses on stewardship trends at the provincial level. Overall stewardship trends are shown for the North, South and Coast areas using the change in

resource development impact rating categories for values with sufficient data. Impact ratings of “very low” or “low” are considered to be consistent with government’s goal of sustainable resource management of the public’s natural resources. These impact ratings are based on the results of stand-level and landscape-level FREP monitoring conducted at a natural resource district scale (or smaller) and documented in multiple resource value assessment (MRVA) reports (see, “Important Context for Understanding this Report”¹ highlighted text below). As such, MRVA reports and the findings summarized here provide a stewardship assessment of resource development practices rather than an assessment of the landscape as a whole.

Important Context for Understanding this Report

*The site-level “resource development impact ratings” contained in this report are based on assessments conducted within the working land base (e.g. areas where resource extraction takes place) and do not reflect the ecological contributions of parks, protected areas, and other conservancy areas. The role of effectiveness evaluations is to help us understand the state of the public’s natural resource values (status, trends, and causal factors). It is accepted that development of natural resources influences and impacts ecological states and dynamics. Effectiveness evaluations **do not assess compliance with legal requirements**; instead, these evaluations assess the effects of development activities and natural influences on the condition of resource values, regardless of whether practices are in compliance with legislation. These evaluations help resource managers:*

- assess whether the impacts of resource development result in a sustainable level of resource management
- provide transparency and accountability for the management of public resources
- support the decision-making balance between environmental, social, and economic factors
- guide the ongoing improvement of resource management practices, policies, and legislation

¹ For a detailed description of the MRVA methodology, please go to: <http://www.for.gov.bc.ca/hfp/frep/publications/mrva.htm>.”

Table 1. The current status of Forest and Range Practices Act resource value monitoring under FREP

FRPA resource value and team lead(s)	Monitoring status
Biodiversity Nancy Densmore Nancy.Densmore@gov.bc.ca Richard Thompson Richard.Thompson@gov.bc.ca Barry Elliott (landscape) Barry.Elliott@gov.bc.ca	2,056 harvest openings sampled from 2006 to 2012 Province wide implementation In collaboration with the Forest Practices Board, indicators and provincial data are available for landscape-level biodiversity; ranking of these values is currently underway
Cultural Heritage Kathleen Hebb Kathleen.Hebb@gov.bc.ca Nicole Pressey Nicole.Pressey@gov.bc.ca Peter Bradford Peter.Bradford@gov.bc.ca	144 harvest openings sampled from 2009 to 2012 Implementation based on district priorities
Fish/Riparian Peter Tschaplinski Peter.Tschaplinski@gov.bc.ca	1,783 stream reaches sampled from 2006 to 2012 Province wide implementation
Forage (Range) Doug Fraser Doug.Fraser@gov.bc.ca Matthew Braun Matthew.Braun@gov.bc.ca	Over 800 range assessments (including upland areas, wetlands, and streams) from 2006 to 2012. 45 streams, 141 uplands, and 52 wetlands in 2012 Implementation by range program staff members, often linked to licence changes or renewals and land-based investment fund allocations
Recreation Bill Marshall Bill.Marshall@gov.bc.ca	120 recreation sites evaluated and reported (2006) Inactive for last several years
Resource Features Christina Mardell Christina.A.Mardell@gov.bc.ca	Karst monitoring protocol used for continued pilot testing on Vancouver Island, with completion of five karst samples in the North Island/Central Coast Natural Resource District in 2012
Soils Stephane Dubé Stephane.Dube@gov.bc.ca Shannon Berch Shannon.Berch@gov.bc.ca Chuck Bulmer Chuck.Bulmer@gov.bc.ca	150 cutblocks sampled from 2008 to 2010, with an additional 21 cutblocks in the Cascades Natural Resource District sampled in 2012 Implementation based on district priorities
Timber (Stand Development) Stefan Zeglen Stefan.Zeglen@gov.bc.ca Frank Barber Frank.Barber@gov.bc.ca	514 inventory polygons sampled from 2009 to 2012 2009–2010 were pilot years for the Stand Development Monitoring protocol Province-wide implementation in 2011
Visual Quality Jacques Marc Jacques.Marc@gov.bc.ca	628 landforms assessed from 2007 to 2012 Province wide implementation (currently 17 districts for FPC and 27 for FRPA)

FRPA resource value and team lead(s)	Monitoring status
Water Quality (Fine Sediment) Dave Maloney David.Maloney@gov.bc.ca	<ul style="list-style-type: none"> 4,033 road segments (fine sediment) assessments and 194 range (cattle impact) assessments conducted from 2008 to 2012 Province wide implementation
Wildlife Kathy Paige Kathy.Paige@gov.bc.ca Melissa Todd Melissa.Todd@gov.bc.ca Laura Darling Laura.Darling@gov.bc.ca	<ul style="list-style-type: none"> Implementation of Coastal Tailed Frog Wildlife Habitat Area (WHA) monitoring in the South Area Research and monitoring relevant to tailed frog WHA effectiveness monitoring in the North Area Development and testing of wildlife indicators and protocols to evaluate the effectiveness of ungulate winter ranges for nine species, including mountain goats and; mountain, northern, and boreal caribou

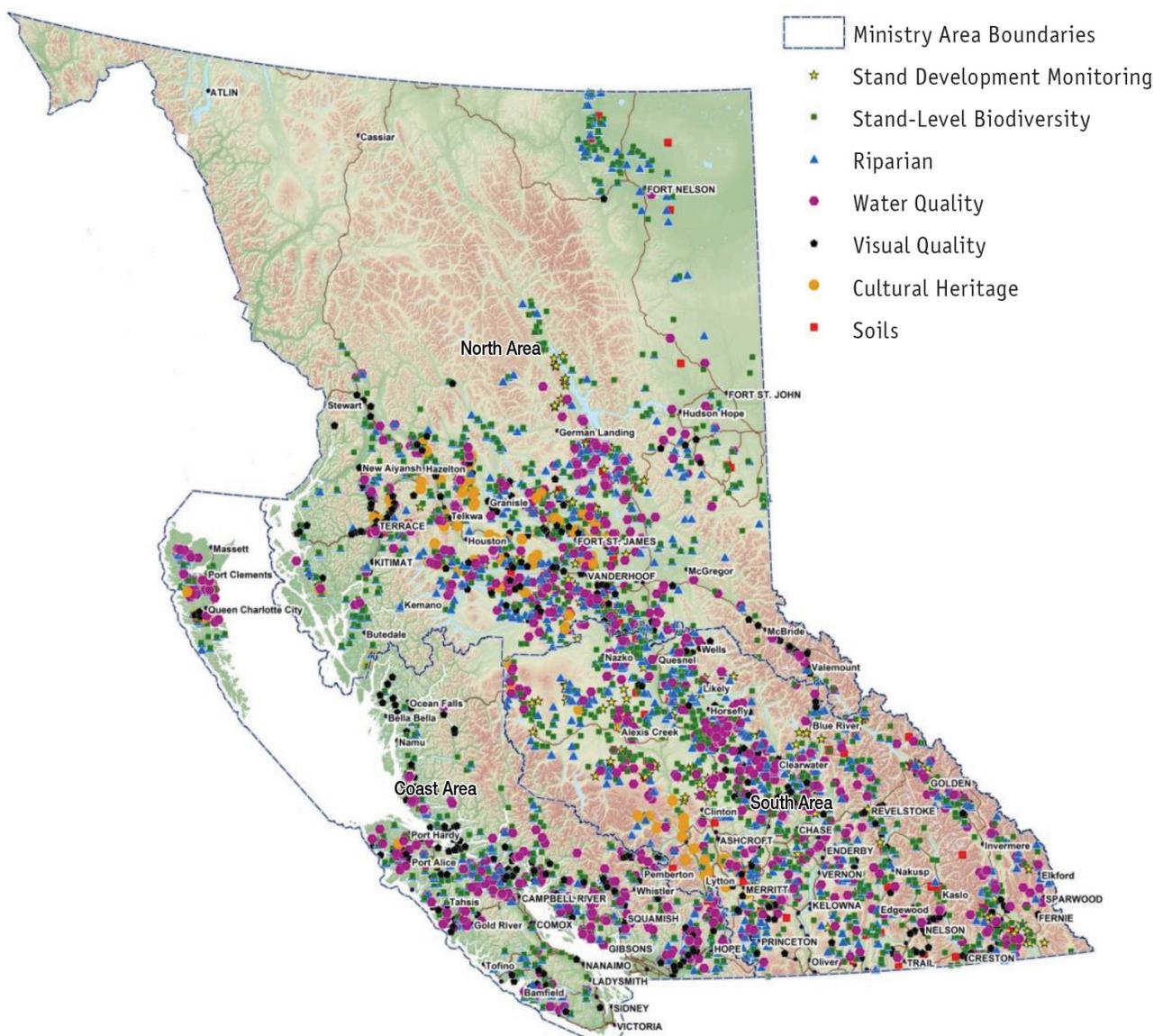


Figure 1. Sample locations of FREP Resource Stewardship Monitoring for seven resource values.

FISH/RIPARIAN

The key FREP evaluation question for the fish/riparian resource value is: *Are riparian forestry and range practices effective in maintaining the structural integrity and functions of stream ecosystems and other aquatic resource features over both the short term and long term?* To answer this question, the impact of resource development and natural conditions is assessed for sampled stream reaches.

The riparian methodology assesses the functioning condition of stream reaches by determining the state of 15 aspects of riparian function.² The four functioning conditions and their equivalent resource development impact ratings are:

1. “Properly Functioning Condition” – equivalent to “Very Low” impact
2. “Properly Functioning Limited Impact” – equivalent to “Low” impact
3. “Properly Functioning With Impacts” – equivalent to “Medium” impact
4. “Not Properly Functioning” – equivalent to “High” impact

Trends for the fish/riparian resource value are assessed by timber harvest year and related to the legislation in effect when the development impacts may have occurred.

- Harvested before 2004 – considered the “FPC era”
- Harvested 2004–2006 – considered the “FPC–FRPA transition era”
- Harvested after 2006 – considered the “FRPA era”.

Although post 2006 cutblocks are not confirmed to have a Forest Stewardship Plan under FRPA, they will have been heavily influenced by the FRPA legislative framework.

North Area Results

In the North Area, the top sources of riparian-related forest management impacts are:

- fine sediment introduction into streams
- reduced abundance of in-stream moss, indicative of elevated levels of fine sediment, increased levels of

² Stream reaches that are in properly functioning condition are not necessarily pristine streams that lack any kind of human or natural disturbance. Rather, they are streams that can withstand normal peak flood events without experiencing accelerated soil loss, channel movement or bank movement; can filter runoff; can store and safely release water; can maintain aquatic habitat connectivity within the stream network and between the stream and adjacent riparian area; can maintain an adequate root network or large woody debris supply; and can provide shade and reduce bank microclimate change.

streambed scour, or unstable stream channels (either separately or in combination)

- reduced aquatic connectivity as seen by impeded movement of water, inorganic sediments, organic debris, and sometimes fish (impediments were frequently linked to the introduction of excess debris associated with falling and yarding near and across small [S6] streams)
- reduced diversity of aquatic invertebrates, indicative of elevated levels of fine sediments and/or unstable streambeds.

Table 2. Stream class description and associated FRPA riparian management default requirements. S1-4 are fish bearing, S5 and 6 do not have fish.

Riparian class	Average channel width (m)	Reserve (no harvest) zone width (m)	Management zone width (m)	Total width of RMA (m)	
Fish-bearing	S1-large	> 100 m (for 1 km stream length)	0	100	100
	S1	> 20	50	20	70
	S2	> 5 to ≤ 20	30	20	50
	S3	1.5 to ≤ 5	20	20	40
	S4	< 1.5	0	30	30
Without fish	S5	> 3	0	30	30
	S6	≤ 3	0	20	20

Although there is little obvious change in riparian resource development impact rating outcomes overall between the FPC, FPC–FRPA transition and FRPA legislative eras, improvements have occurred in the amount and condition of riparian vegetation retained within the first 10 metres of the streambank (see Figure 2).

Of those stream sites with “High” resource development impact ratings:

- 82% had impacts related to logging (e.g. low retention, windthrow, falling and yarding)
- 50% had impacts related to road crossings
- 14% had impacts related to livestock and wildlife
- 54% had impacts related to natural disturbances

Four of the streams with “High” impact ratings were affected only by natural events (e.g., floods and high natural background sediment).

Table 3 shows that 69% of sampled streams were classified as S4–S6 streams, which have no mandatory Riparian Management Area tree retention requirements. Of these streams, 38% had at least 10 metres of treed streambank

buffer and most of these (80%) were rated as having a “Very Low” or “Low” resource development impact, using MRVA scoring.

Table 3. Percentage of sampled streams within each area, by stream class and resource development impact rating

Stream Class	Resource Development Impact Rating														
	North Area					South Area					Coast Area				
	High	Medium	Low	Very Low	Total (%)	High	Medium	Low	Very Low	Total (%)	High	Medium	Low	Very Low	Total (%)
S1	0.0	0.0	0.2	0.3	0.5	0.0	0.1	0.1	0.0	0.3	0.0	0.0	0.2	0.4	0.7
S2	0.2	0.6	2.1	1.8	4.7	0.0	0.6	1.6	4.3	6.5	0.0	1.8	1.8	4.2	7.8
S3	1.7	3.8	8.4	12.4	26.3	0.9	2.7	6.2	11.5	21.2	0.7	1.3	3.3	6.0	11.3
S4	3.1	6.0	9.5	5.4	23.9	1.3	3.7	4.9	6.5	16.4	1.3	0.7	1.8	1.8	5.5
S5	0.2	0.8	0.9	2.1	4.0	0.1	0.9	0.6	3.1	4.7	1.8	2.7	2.9	10.4	17.7
S6	5.0	8.3	15.4	11.9	40.7	8.0	12.5	12.1	18.3	50.9	14.0	17.5	14.9	10.6	57.0
Total (%)	10	19	37	34	100	10	21	26	44	100	18	24	25	33	100

South Area Results

In the South Area, the top sources of riparian-related forest management impacts are:

- fine sediment introduction into streams
- reduced abundance of in-stream moss, indicative of elevated levels of fine sediment, increased levels of streambed scour, or unstable stream channels (either separately or in combination)
- reduced aquatic connectivity, as seen by impeded movements of water, inorganic sediments, organic debris, and sometimes fish

Little change in riparian resource development impact rating outcomes is evident between the three legislative

eras (see Figure 2). Of those stream sites with “High” resource development impact ratings:

- 91% had impacts related to logging (e.g. low retention, windthrow, falling, and yarding)
- 58% had impacts related to road crossings
- 23% had impacts related to livestock
- 52% had impacts related to natural disturbances such as wind, beetles, and naturally high background sediment levels

One stream had only natural impacts (fire and avalanche).

Table 3 shows that 72% of sampled streams were classified as S4–S6 streams, which have no mandatory Riparian Management Area tree retention requirements. Of these

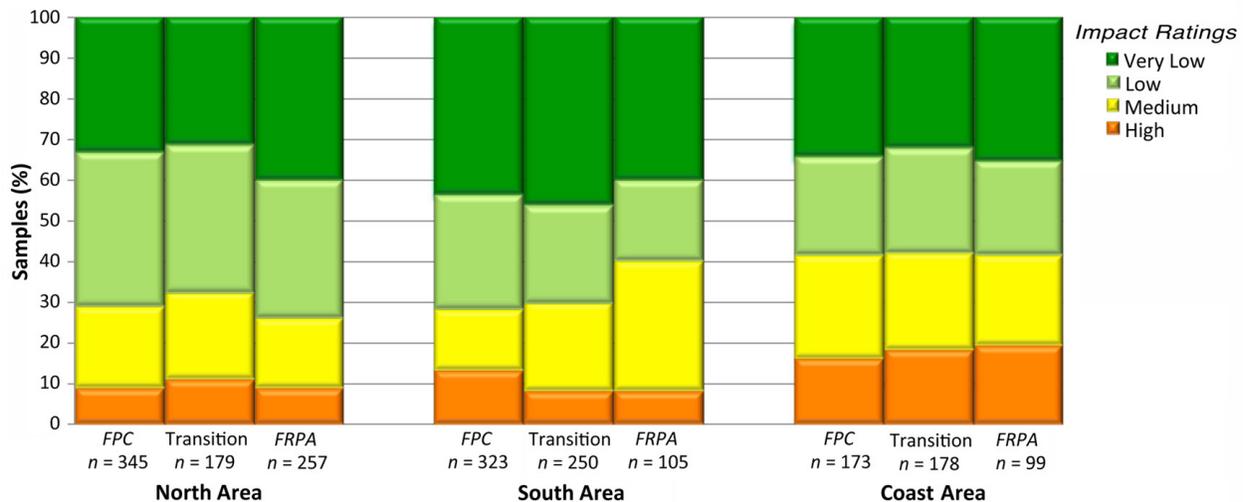


Figure 2. Resource development impacts on stream function for three areas, showing trends by harvest era.

streams, 40% had at least 10 metres of treed buffer and most of these (77%) were rated as having a “Very Low” or “Low” resource development impact, using MRVA scoring.

Coast Area Results

In the Coast Area, the top sources of riparian-related forest management impacts are:

- reduced aquatic connectivity, as seen by impeded movements of water, inorganic sediments, organic debris, and sometimes fish
- sediment introduction into streams
- disturbed woody debris characteristics and processes, including excessive in-stream logging slash from cross-stream and near-stream falling and yarding
- removed riparian vegetation within the first 10 metres of the streambank

There is no obvious change in the riparian stewardship outcomes between the three legislative eras (see Figure 2). Of those stream sites with “High” resource development impact ratings:

- 100% had impacts related to logging (e.g. falling, yarding, and low levels of tree retention)
- 31% had impacts related to roads and road crossings
- 24% had impacts related to natural disturbances.

Table 3 shows that 80% of sampled streams were classified as S4–S6 streams, which have no mandatory Riparian Management Area tree retention requirements. Of these streams, 31% had at least 10 metres of treed buffer and most of these (85%) were rated as having a “Very Low” or “Low” resource development impact, using MRVA scoring.

Provincial Opportunities for Improvement in Fish/Riparian Management Based on Practices Associated with the Most Successful Monitoring Outcomes

For All Areas

Roads should be designed, built and maintained to minimize the amount of sediment entering streams. Excessive fine sediments are an indicator of channel instability. Fine sediment can affect fish populations by filling in resting spaces, blanketing the streambed, and reducing egg survival rates. The best monitoring results are associated with road-building and maintenance activities that avoid long gradients and the accumulation

of run-off coming up to stream crossings, and that promptly re-vegetate bare soils.

The trend to maintain at least 10 metres of intact riparian buffer around small streams should be continued, with an emphasis on class S4 fish-bearing streams and perennial class S5 and S6 streams that flow directly into fish-bearing waters or community watersheds. Small streams are important for the entire watershed because of their influence on water temperature, pH balance, inorganic nutrients, plant material, and invertebrates and vertebrates in downstream reaches. Where it is not possible to leave a fully treed wind firm buffer, take care to leave deep-rooted vegetation adjacent to the stream. This vegetation helps to maintain stable banks, which resist erosion and disturbance related to storms. Stable, overhanging streambanks provide important fish habitat.

Coast Area

Timber harvesters must take care during falling and yarding to keep slash out of streams. They should fall and yard away from streams whenever possible.

Summary

When assessed at the broad “area” scale, strong trends in stewardship outcomes are not apparent for stream sites (segments or “reaches”) sampled within or adjacent to cutblocks harvested during the three legislative eras. However, some trends are evident at the resource-district scale. Details concerning these trends are included in individual Multiple Resource Value Assessment reports located on the FREP website. [<http://www.for.gov.bc.ca/hfp/frep/publications/mrva.htm>]

WATER QUALITY (FINE SEDIMENT)

The key FREP evaluation question for the water quality resource value is: *Are forest practices effective in protecting water quality (fine sediments)?* To answer this question, the impact of roads and natural events on water quality is assessed.

The water quality monitoring protocol for fine sediment assesses the “sediment generation potential” for road segments near streams or stream crossings. The five sediment generation potential categories and their four equivalent resource development impact ratings are:

1. “Very Low” sediment generation potential – equivalent to “Very Low” impact

2. “Low” sediment generation potential – equivalent to “Low” impact
3. “Moderate” sediment generation potential – equivalent to “Medium” impact
4. “High” and “Very High” sediment generation potential (two categories merged) – equivalent to “High” impact

To capture the yearly variations in traffic patterns and road maintenance, water quality trends were analyzed by the year the samples were collected. The age of the road (how well it was planned and built) also affects this outcome, although information about the age of the road is not always readily accessible. District staff who are familiar with road systems in their areas would be able to provide more precise data. Some of the suggested improvements for road segments with “High” or “Medium” resource development impact ratings are related to maintenance, while others refer to future road construction.

Between 2008 and 2012, the water quality effectiveness evaluation (WQEE) protocol was used to assess 4,033 randomly selected sites. Of these sites, 34% were rated as having a “Very Low” resource development impact (using multiple resource value assessment scoring), 37% were rated as “Low”, 24% were rated as “Medium”, and 5% were rated as “High”. When evaluations were conducted on a subset of 398 sites located upstream of drinking water intakes, the results were similar: 28% of the sites had a “Very Low” resource development impact on water quality, 39% were “Low”, 29% were “Medium”, and 4% were “High”.

During the assessment process, challenges related to road management (and associated solutions) focused on five operational areas:

1. road location
2. design of roads and cutblocks
3. road construction and harvesting
4. road maintenance
5. road deactivation

The importance of addressing the reduction of fine sediment is apparent through all stages of a road’s life, especially when roads are located near a stream.

The use of appropriate techniques for the design, construction, and maintenance of road networks can mitigate many potential negative impacts on water quality. Generally, the risk of fine sediment generation ends only when a road is properly deactivated. The

water quality assessment procedure evaluates how the generation and transport of road and (road-related) fine-textured sediments could affect natural water bodies.

In addition to the more than 4,000 evaluations for potential in-stream sediment linked to forest harvesting, 194 range evaluations took place. These evaluations assess the potential for cattle-related impacts on water quality in areas with livestock and the presence of downstream domestic water intakes. The range evaluations were completed between 2008 and 2012 in nine districts. Approximately 68% of the samples indicated a potential for impacts on water quality by fecal contamination. The main indicators identified as leading to a risk of fecal contamination were a lack of livestock control structures, evidence of livestock drinking directly from a stream, and the presence of livestock feces immediately adjacent to streambanks.

Provincial-level Water Quality Results by Area

North Area Results

Little change was evident by survey year in the overall resource development impact ratings, apart from a potentially minor decrease in quality in the 2012 sample year compared to earlier years (see Figure 3). Of those road segments and streams with “High” or “Medium” impact ratings, 3% were within watersheds used for drinking water, 9% were in areas with sensitive soil, and 5% had potential livestock concerns.

South Area Results

Little change was evident by survey year in the overall resource development impact ratings (see Figure 3). Of those road segments and streams with “High” or “Medium” impact ratings, 28% were within watersheds used for drinking water, 14% were in areas with sensitive soil, and 16% had potential livestock concerns.

Coast Area Results

Little change was evident by survey year in the overall resource development impact ratings (see Figure 3). Of those road segments and streams with “High” or “Medium” impact ratings, 15% were in watersheds used for drinking water and 13% were in areas with sensitive soil.

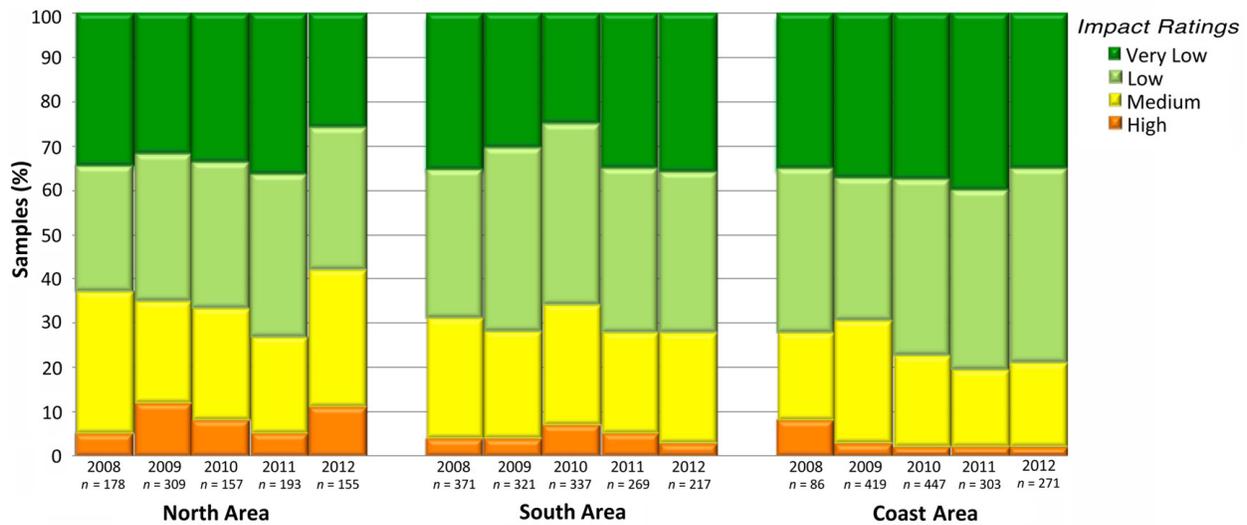


Figure 3. Resource development impacts on water quality (fine sediment) for three areas, showing trends by evaluation year.

Provincial Opportunities for Improvement in Water Quality Management Based on Practices Associated with the Most Successful Monitoring Outcomes

For all road segments and streams with “High” or “Medium” resource development impact ratings, the following practices are most frequently suggested to improve water quality management outcomes.

- Use cross-ditches or kickouts to move water and sediment off roads and onto the forest floor.
- Increase the number of strategically located culverts to maintain natural drainage patterns and limit the potential for increased erosion related to the accumulation of ditchline water.
- Remove berms that channel water and sediment into streams.
- Armour, seed, and protect bare soil as soon as possible after soil has been disturbed.

Monitoring results show that the above practices reduce the amount of exposed sediment and reduce water volume and velocity.

STAND-LEVEL BIODIVERSITY

The FREP evaluation question for the stand-level biodiversity resource value is: *Is stand-level retention providing the range of habitat and the structural attributes understood to be necessary for maintaining species dependent on wildlife trees and coarse woody debris?* To answer this question, the impact of harvesting on stand-level biodiversity attributes is assessed.

Stand-level biodiversity trends are assessed using harvest-era data to investigate differences in biodiversity planning and in harvest layout and impact over time. The resource development impact rating for biodiversity has four components:

1. percentage of treed retention
2. retention quality
3. coarse woody debris volume
4. coarse woody debris quality

Provincial-level Biodiversity Results by Area

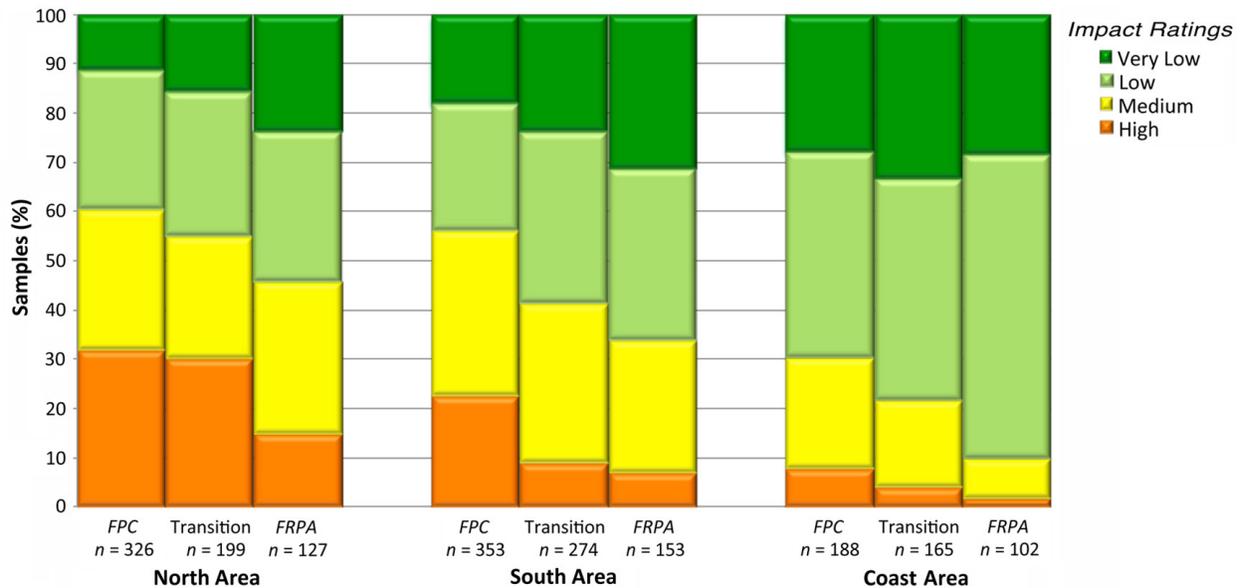


Figure 4. Resource development impacts on stand-level biodiversity for three areas, showing trends by harvest era.

North Area Results

An improving stewardship trend is evident in the North Area from the FPC era through to the FRPA era, which was driven by increasing retention levels and retention quality (see Figure 4). Average retention increased from 12.8% during the FPC legislative era to 15.1% during the FPC–FRPA transition years, and to 16.6% during the FRPA era.

In particular, the percentage of cutblocks with more than 3.5% retention increased from 68% during the FPC era to 76% in the transition years, and to 86% in the FRPA era. An increase in retention quality through the three legislative eras was related to increased use of dispersed retention, increased patch retention, increased density of large snags retained, and increased tree species diversity retained. Coarse woody debris (CWD) volume was consistent through the legislative eras, with a range slightly lower than found in retention patches. The quality of CWD was also lower than the baseline, although a potential density increase for big pieces of CWD occurred during the FRPA era.

South Area Results

An improving stewardship trend is evident for the South Area from the FPC era through to the FRPA era, which was driven by increasing retention quality and CWD quality (see Figure 4). Average retention was fairly constant at 16.6% during the FPC era, 16.1% during the FPC–FRPA

transition years, and 17.2% during the FRPA era. An increasing percentage of cutblocks contained more than 3.5% retention: 77% in the FPC era, 79% in the transition years, and 84% in the FRPA era. A small increase in retention quality was related to the continual (and slightly increasing) retention of large-diameter trees. The volume of CWD increased from 104–131 m³/ha to 148 m³/ha in harvested areas during the FRPA legislative era, with the quality of CWD increasing to a lesser extent.

Coast Area Results

An improving stewardship trend is evident for the Coast Area from the FPC era through to the FRPA era, which was driven by increasing CWD quantity and quality (see Figure 4). Average treed retention was 18.3% during the FPC era, 21.8% during the FPC–FRPA transition years, and 19.0% during the FRPA era. The percentage of blocks with more than 3.5% retention increased from 90% during the FPC legislative era to 95% in the transition years and 97% in the FRPA era. Retention quality did not change through the three legislative eras. The volume of CWD in harvested areas increased from 346 m³/ha during the FPC era to 386 m³/ha in the transition years and 457 m³/ha during the FRPA era. The two CWD quality indicators also increased: volume of harvest area CWD from 30 cm diameter and greater pieces; and pieces per hectare of big CWD (≥ 20 cm diameter and ≥ 10 m length) in the harvest areas.

Provincial Opportunities for Improvement in Stand-level Biodiversity Management

North Area

- Large dead and live trees are important wildlife habitat. Retain as many large trees (≥ 40 to 50 cm in diameter) as possible within retention areas (patches and dispersed).
- Continue the trend toward increased density of big pieces of CWD within harvested areas. (Big CWD pieces help maintain soil moisture, provide soils with organic material, and provide important wildlife habitat.)

South Area

- Retain the full range of tree species found before harvesting, to help maintain a diversity of species.
- Continue the trend toward increased density of big trees and big pieces of CWD within harvested areas.

Coast Area

- Improve retention quality by increasing the density of large trees (≥ 70 cm dbh) for the site.
- Continue the trend toward increased density of big pieces of CWD within harvested areas.

LANDSCAPE-LEVEL BIODIVERSITY

A Geographic Information System (GIS) model that incorporates publicly available forest cover information for the province has been developed in co-operation with the Forest Practices Board. This model uses the following three landscape-level biodiversity indicators:

1. age class (old, mature, mid-age, and young)
2. interior old forest (interior habitat)
3. site index by leading tree species (surrogate for site quality)

Each of these three indicators can be reported within the following three administrative reporting strata:

1. protected land base (e.g. parks, old-growth management areas, ungulate winter ranges and wildlife habitat areas, with minimal harvesting allowed)
2. non-contributing land base (i.e. a term used to describe areas that are outside the timber harvesting land base and not protected)
3. timber harvesting land base

The Microsoft Excel output from the GIS model allows for easy querying and summarizing of data by timber supply area, landscape unit, specific biogeoclimatic ecosystem classification zone or a subzone within a management unit.

VISUAL QUALITY

The FREP evaluation question for the visual quality resource value is: *How are we managing views in scenic areas and achieving visual quality objectives (VQOs)?* To answer this question, we assess how resource development affects visual quality objectives on specific landforms.

The visual quality methodology evaluates the achievement of VQOs by assessing block design, percentage of landform altered, roads, tree retention, and viewpoint importance. The five VQO achievement categories and their equivalent resource development impact ratings are:

- “Well Met” – equivalent to “Very Low” impact
- “Met” – equivalent to “Low” impact
- “Borderline”³ – equivalent to “Medium” impact
- “Not Met” – equivalent to “High” impact
- “Clearly Not Met” – equivalent to “High” impact

Trends in VQO achievement are analyzed between cutblocks harvested under *FPC* (with forest development plans) and cutblocks harvested under *FRPA* (with forest stewardship plans).

³ For the visual quality value, a resource development impact rating of “borderline” indicates that one of two assessment methodologies showed visual quality objectives were met and the other method indicated that objectives were not met.

Provincial-level Visual Quality Results by Area

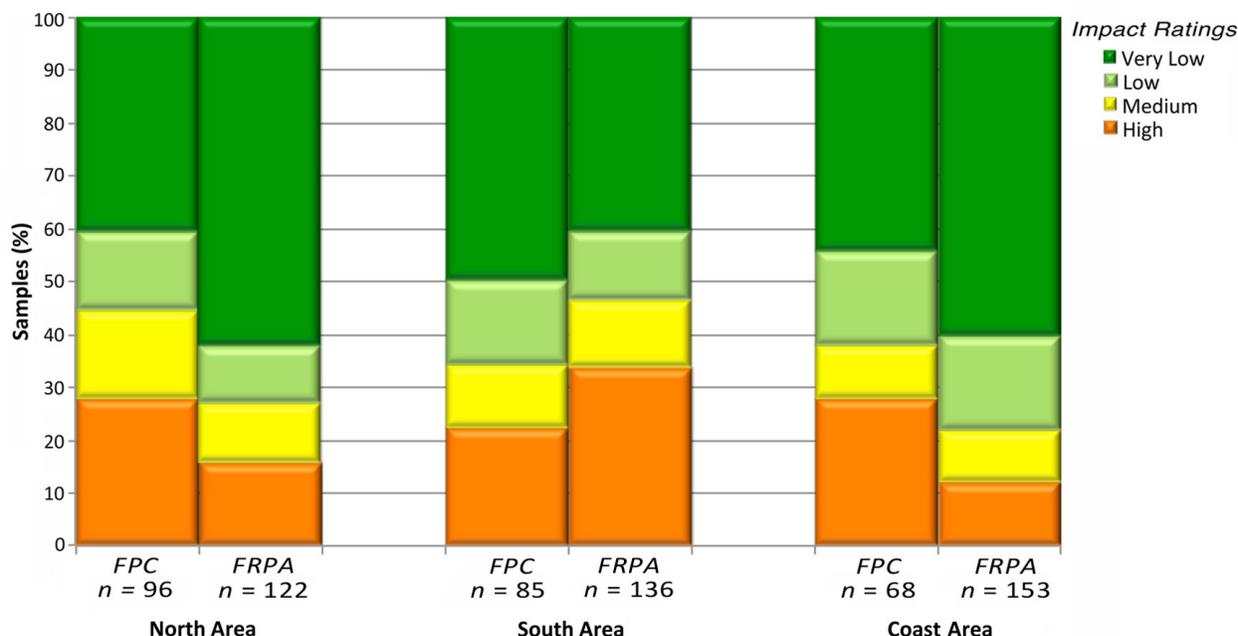


Figure 5. Resource development impacts on visual quality for the three areas, showing trends by FPC and FRPA.

North Area Results

In the North Area, increasing numbers of cutblocks met VQOs during the FRPA years (see Figure 5). Under FPC, 55% of the assessed landforms had an impact rating of “Very Low” or “Low” in terms of achieving VQOs, using multiple resource value assessment (MRVA) scoring. Under FRPA, 74% of the assessed landforms were rated as “Very Low” or “Low”. Combining the two legislative eras, 65% of the cutblocks were rated as “Very Low” or “Low”. Table 3 shows the breakdown of VQO impact ratings.

Table 3. North Area percentage of landforms (of total) by VQO and resource development impact rating

VQO	High	Medium	Low	Very Low	Total (%)
Maximum Modification			0.5		0.5
Modification	3.2	3.7	3.2	21.6	31.7
Partial Retention	13.8	6.4	6.9	25.2	52.3
Retention	4.1	2.3	1.8	6.0	14.2
Preservation		0.9			0.9
Total (%)	21.1	13.0	12.4	52.8	100

The overall trend indicates VQOs were met more often during the FRPA years than under the FPC. Average per cent alteration (i.e. the amount of visible ground on a landform that has not reached visually effective green-up) was 7.2% for FPC and 5.5% for FRPA. An important consideration for future harvesting is that many of the harvesting practices used in achieving VQOs were implemented better under the FPC. For example, 25% of the FPC openings contained visually effective levels of tree retention (> 22% by volume or stem count), whereas only 18% of the FRPA openings did. In addition, 44% of the FPC openings had good visual quality design (cutblock shaping), whereas this occurred on 38% of the FRPA openings.

South Area Results

In the South Area, VQOs were met less often during the *FRPA* years (see Figure 5). Under the *FPC*, 65% of the assessed landforms had an impact rating of “Very Low” or “Low” in terms of achieving VQOs, using MRVA

scoring. Under the *FRPA*, 54% of the assessed landforms were rated as “Very Low” or “Low”. Combining the two legislative eras, 58% cutblocks were rated as “Very Low” or “Low”. Table 4 shows the breakdown of VQO by resource development impact rating for the South Area.

Table 4. South Area percentage of landforms (of total) by VQO and resource development impact rating

VQO	High	Medium	Low	Very Low	Total (%)
Maximum Modification		0.9		0.5	1.4
Modification	5.0	2.3	4.1	17.6	29.0
Partial Retention	19.5	7.7	9.0	23.5	59.7
Retention	5.0	1.4	0.9	2.7	10.0
Total (%)	29.4	12.2	14.0	44.3	100

Twenty-nine per cent of the *FPC*-era openings contained visually effective levels of tree retention (> 22% by volume or stem count), whereas only 10% of the *FRPA* openings did. Forty-one per cent of the *FPC* openings had good visual design (cutblock shaping), but only 23% of the *FRPA* openings did. The average amount of alteration was 6.4% for *FPC* openings and 8.5% for *FRPA* openings. Greater landscape alteration and inconsistent implementation of visual design techniques have resulted in higher resource development impact ratings in the South Area under *FRPA*.

Coast Area Results

The trend in the Coast Area indicates that VQOs were met more often during the *FRPA* legislative era (see Figure 5). Under *FPC*, 62% of the assessed landforms were rated as “Very Low” or “Low” in terms of achieving VQOs, using MRVA scoring. Under *FRPA*, 78% of the assessed landforms were rated as “Very Low” or “Low”. Combining the two legislative eras, 73% of cutblocks were rated as having a “Very Low” or “Low” impact. Table 5 shows the breakdown of VQOs by impact ratings for the Coast Area.

Table 5. Coast Area percentage of landforms by VQO and resource development impact rating

VQO	High	Medium	Low	Very Low	Total (%)
Maximum Modification			0.5	1.8	2.3
Modification	0.5	2.7	4.5	15.4	23.1
Partial Retention	13.1	6.3	11.8	36.2	67.4
Retention	3.2	0.9	1.4	1.8	7.2
Total (%)	16.7	10.0	18.1	55.2	100

Four per cent of the *FPC* openings contained visually effective levels of tree retention (> 22% by volume or stem count), whereas 11% of the *FRPA* openings did. Thirty-two per cent of the *FPC* openings had good visual design (cutblock shaping) and 43% of the *FRPA* openings did. The average amount of alteration was 5.6% for *FPC* openings and 5.2% for *FRPA* openings. Overall, improved visual design techniques seem to be contributing to the better scores in the Coast Area under *FRPA*.

Provincial Opportunities for Improvement in Visual Quality Management Based on Practices Associated with the Most Successful Monitoring Outcomes

Results from *FRPA* visual quality evaluations show there is significant room to improve visual quality outcomes in the North and South areas. In-block tree retention was used less frequently and the amount of partial cutting has dropped substantially. The Coast Area showed a modest improvement in the application of visual design and a

slight increase in the use of effective in-block retention. The following practices have been shown to be effective VQO management:

- During harvest development in designated scenic areas, implement visual design concepts and principles to ensure that harvested areas blend in better with the natural landscape.
- Where feasible, retain higher levels of designed in-block tree retention to create a more natural appearance in harvested areas.
- Where feasible, use partial-cutting silvicultural systems (e.g. single-tree selection and dispersed retention) to create a more natural appearance in harvested areas. This can also provide an opportunity to harvest a larger area and remove a greater volume of wood than with clearcutting, while meeting the same VQOs. For example, research shows that using a clearcut system to meet a partial retention VQO, it is possible to remove 7% of the area (7% volume) from a hillside; if using a selection cut, up to 60% of the volume could be removed.

Applying the following administrative practices could improve visual performance outcomes.

- Review forest stewardship plan “results” and “strategies” to ensure consistency with VQOs and confirm that the results and strategies are measurable and verifiable.
- Reference VQOs as a “result” in forest stewardship plans, since VQOs contribute to a result defined by legislation.

- Support government staff and licensee staff in obtaining the training necessary to develop visual design skills and implement on-the-ground visual management practices (e.g. increasing in-block retention using partial cutting, or visual design principles).

CULTURAL HERITAGE RESOURCES

The FREP evaluation question for the cultural heritage resource value is: *Are cultural heritage resources being conserved and, where necessary, protected for First Nations cultural and traditional activities?* To answer this question, the resource development impact of forest harvesting on known cultural heritage resources is assessed.

Cultural heritage resource value assessments are primarily focused on evaluating the impacts of resource development on cultural features, such as culturally modified trees, cultural trails, traditional use sites, and other areas of specific interest and ongoing importance to First Nations. Sites assessed by FREP include those managed under *FRPA* and the *Heritage Conservation Act* (i.e. archaeological sites). The resource development impact ratings for cultural heritage are based on evaluations of individual cultural features and an overall assessment of cutblock management, including any evidence (and extent) of damage to features, operational limitations, and strategies used to conserve values.

Provincial-level Cultural Heritage Resource Results by Area

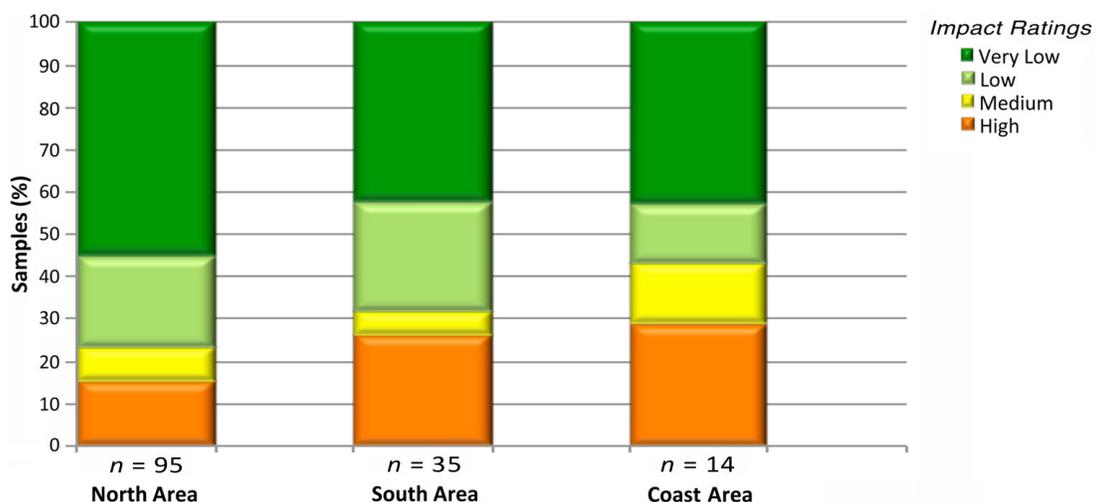


Figure 6. Resource development impacts on cultural heritage resources for three areas.

North Area Results

FREP monitoring has assessed 95 cutblocks in the North Area (see Figure 6). Seventy-seven per cent of these blocks were rated as having a “Very Low” or “Low” resource development impact. Overall, 61% of cutblocks were considered “Well” to “Very Well” managed, 24% were “Moderately” managed, and 15% were “Poorly” to “Very Poorly” managed, according to FREP evaluation protocols. At the cultural feature level, 50% of cut blocks showed no evidence of damage, whereas 50% showed evidence of damage. Twenty-one per cent of damaged features showed irreversible damage and/or were rendered unsuitable for continued use. The primary causes of the damage included removal of features (40%) and windthrow (20%).

South Area Results

All South Area monitoring data came from the Cascades Natural Resource District, where FREP evaluators have assessed 35 cutblocks (see Figure 6). Sixty-nine per cent of these blocks were rated as having a “Very Low” or “Low” resource development impact. According to FREP evaluation protocols, 43% of the cut blocks were considered “Well” to “Very Well” managed, 31% were “Moderately” managed, and 25% were “Poorly” to “Very Poorly” managed. At the cultural feature level, 54% showed no evidence of damage, whereas 46% showed evidence of damage. Thirty-three per cent of damaged features showed irreversible damage and/or were rendered unsuitable for continued use.

The primary causes of damage included removal of cultural features (45%), fire (13%, mostly escaped pile burning but some wildfire), and windthrow (13%).

Coast Area Results

FREP evaluators have assessed 14 cutblocks in the Coast Area (see Figure 6). Fifty-seven per cent of these blocks were rated as having a “Very Low” or “Low” resource development impact. According to FREP evaluation protocols, 43% of the blocks were considered “Well Managed,” 29% were “Moderately” managed, and 29% were “Poorly Managed.” At the cultural feature level, 56% showed no evidence of damage, whereas 43% showed evidence of damage. Fifty per cent of damaged features showed irreversible damage and/or were rendered unsuitable for continued use. The primary causes of damage included windthrow (60%) and removal of features (20%).

Although the Coast Area has the greatest number of “High” resource development impact ratings compared to the North and South areas, the majority of damage to features there was caused by windthrow. It is important to establish sufficient windfirm buffers around cultural features such as culturally modified trees.

Provincial Opportunities for Improvement in Cultural Heritage Resource Management Based on Practices Associated with the Most Successful Monitoring Outcomes

Applying the following management practices could improve cultural heritage resource outcomes.

- Better understand local First Nations’ perspectives and expectations through direct contact and the sharing of information, starting at the planning phase.
- Use readily available cultural heritage resource information, recommendations, and/or requirements (e.g. Preliminary Field Reconnaissance Reports, Archaeological Impact Assessments, Site Plans).
- Avoid the disturbance of cultural heritage resource features by excluding them from harvest areas and/or providing effective levels of tree retention (buffers) to protect these features where necessary.

TIMBER (STAND DEVELOPMENT MONITORING)

The FREP evaluation question for the timber resource value is: *What is the overall health and productivity of managed 20-year-old to 40-year-old stands?* To answer this question, the impact of forest practices and forest health factors on stand stocking is assessed.

The Stand Development Monitoring (SDM) protocol is designed to assess the health and productivity of young stands between the ages of 20 and 40 years. This assessment determines how stand attributes change in managed forests and provides input for silviculture and inventory policy decision-making. The SDM protocol looks at inventory polygons (which designate areas of consistent forest cover) for older regenerated stands. These polygons are assessed for the level of damaging agents (abiotic and biotic) and tree stocking. Using the protocol, evaluators collect data and provide an introductory analysis in five specific areas:

1. stand density (total, well-spaced and free-growing stems per hectare)
2. stand species composition
3. stand health
4. stand basal area
5. site index

Provincial-level Stand Development Monitoring Results by Area

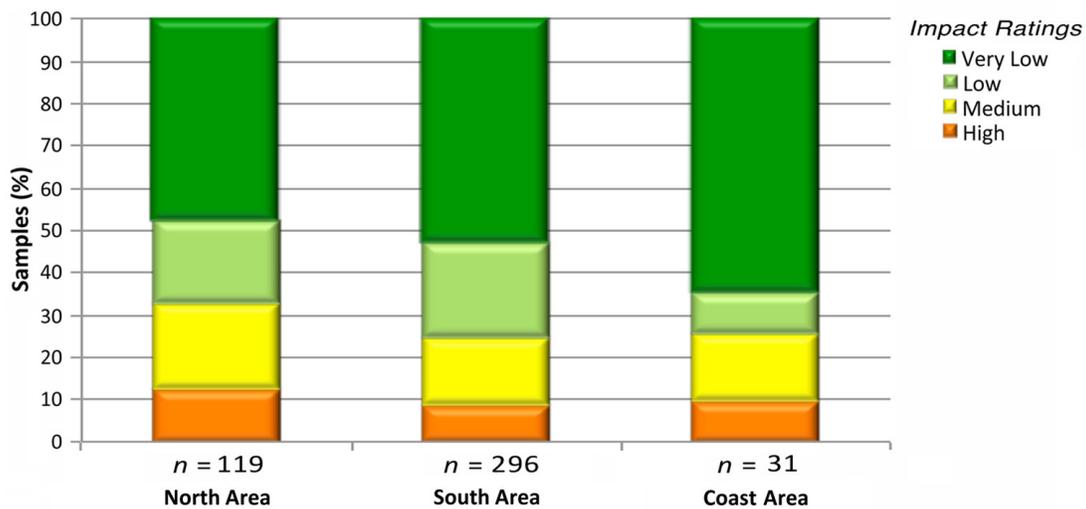


Figure 7. Resource development impacts on stand health and productivity for three areas.

North Area Results

FREP evaluators assessed 119 inventory polygons in the North Area (see Figure 7). Of these polygons, 67.3% had a “Very Low” or “Low” resource development impact rating using MRVA scoring, 20.2% were rated as “Medium” and 12.5% were rated as “High”. Eighty-seven per cent of the assessed polygons showed no changes in leading species since declaration of free growing. Free growing is a term that means a stand of healthy commercially valuable tree species has been established. The weighted average stand density of all assessed stands was 87% of the target stocking standard.

South Area Results

FREP evaluators assessed 296 inventory polygons in the South Area (see Figure 7). Of these polygons, 75% had a “Very Low” or “Low” resource development impact rating using MRVA scoring, 16% were rated as “Medium” and 9% were rated as “High”. Eighty-three per cent of the assessed polygons showed no changes in leading species, since declaration of free growing. The weighted average stand density of all assessed stands was 83% of the target stocking standard.

Coast Area Results

FREP evaluators assessed 31 inventory polygons in the Coast Area (see Figure 7). Of these polygons, 74% had a “Very Low” or “Low” resource development impact rating using MRVA scoring, 16% were rated as “Medium” and 10% as “High”. Ninety per cent of the assessed polygons showed no changes in leading species since declaration of free growing. The weighted average stand density of all stands assessed was 84% of the target stocking standard.

Provincial Opportunities for Improvement in Stand Development Monitoring

By assessing specific indicators of health and stand productivity, silviculturists compare issues expressed in 20-year-old to 40-year-old managed stands with current silvicultural practices and decision-making (e.g. aligning regeneration stocking targets and species selection with identified and/or potential forest health issues in order to establish healthy productive forests for the future).

SOILS

The FREP evaluation question for the soils resource value is: *Are forest practices successful in preventing site disturbances that are detrimental to soil productivity and hydrologic function?* To answer this question, the impact of forest harvesting on the soil resource was assessed by considering factors such as access, natural drainage patterns, soil disturbance and the presence of mature forests, and coarse woody debris.

A process called “expert elicitation” is used to assess the soils resource value. This is a structured process where cutblock images are examined by a minimum of three soils experts. Each expert responds to soil conservation questions for each image and assesses the overall extent

to which the observed results are consistent with soil conservation objectives. The questions include:

- Does the total amount of permanent access seem excessive, given the site conditions?
- Are there areas of un-rehabilitated access that should have been rehabilitated?
- Is there evidence that harvesting, access construction, or maintenance have led to (or increased the potential for) landslides or erosion?

In 2012, high-resolution aerial photographs were obtained for the Merritt timber supply area (21 samples) and the Lakes timber supply area (22 samples). The work in Merritt is in support of the Cumulative Effects Assessment pilot project.

Soils Resource Results by Timber Supply Area

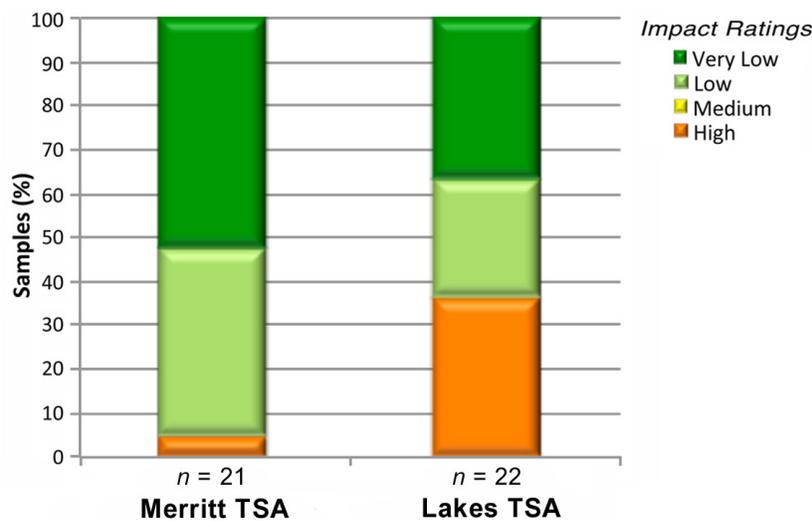


Figure 8. Resource development impacts on soils resource for two timber supply areas.

Merritt Timber Supply Area Results

Of the 21 cutblocks assessed, 95% had a “Very Low” or “Low” resource development impact rating using MRVA scoring (see Figure 8). Overall, the observed forest practices appear to conserve the major aspects of soil productivity. Results from most of the assessed cutblocks showed that good planning and implementation minimized the amount of soil disturbance associated with access development, roadside work areas, and dispersed machine traffic. Nevertheless, in some cases, inefficient

conservation of coarse woody debris and un-rehabilitated temporary access led to more soil disturbance than was necessary to efficiently harvest the cutblock.

Lakes Timber Supply Area Results

Of the 22 cutblocks assessed, 63% had a “Very Low” or “Low” resource development impact rating, using MRVA scoring (see Figure 8). Although a majority of cutblocks showed good planning and implementation to minimize soil disturbance, unrehabilitated temporary access and excessive temporary and permanent access development

led to more soil disturbance than was necessary to efficiently harvest the cutblock.

Provincial Opportunities for Improvement in Soils Management Based on Practices Associated with the Most Successful Monitoring Outcomes

Applying the following management practices could improve soils resource value outcomes.

- continue existing good practices and ensure that all temporary access structures are rehabilitated.
- plan any operations in roadside work areas to minimize soil disturbance.
- continue to implement measures to conserve coarse woody debris.

WILDLIFE (TAILED FROG)

The FREP evaluation questions for the wildlife resource value are: *Do ungulate winter ranges and wildlife habitat areas maintain the habitats, structures, and functions necessary to meet the goals of the area? Do the amount, quality, and distribution of these areas contribute effectively to the surrounding land base (including protected areas and managed land base areas) to ensure the survival of the species now and over time?*

In 2012, wildlife evaluations were completed for coastal tailed frog wildlife habitat areas (WHAs) in the South and Coast Areas. Forty-five randomly selected sites were sampled, 17 for coastal tailed frog WHAs and 28 for similar non-WHA streams in occupied basins (for future comparative analysis). Of the WHA sites that were assessed, 95% had a “Very Low” or “Low” resource development impact rating using MRVA scoring. Only one site was rated as “Medium”. A GIS assessment of basin-level development pressures found that six WHA sites are in basins with a “Medium” or “High” level of disturbance, resulting in an increased risk at those sites. Key disturbance pressures include road density (particularly in riparian areas) and stream crossing density. Work is continuing on data analysis, reporting formats, and threshold development.

Provincial Opportunities for Improvement in Tailed Frog Management Based on Practices Associated with the Most Successful Monitoring Outcomes

Applying the following management practices could improve wildlife resource value outcomes.

- Tailed frogs were detected at many of the suitable non-WHA sites. Conduct further inventories in the South Area to help determine the strategic placement of any additional WHAs.
- In basins that are occupied by tailed frogs (or with highly suitable natal habitat), manage road density and stream crossing density upstream of WHAs or similar core larval streams. Wherever possible, avoid stream crossings upstream of WHAs, in highly suitable natal and breeding habitats or on reaches of any direct tributaries. (When crossings are necessary, open-bottom structures are preferred.) Manage fine sediment production at stream crossings within tailed frog habitat (and direct tributaries to occupied or suitable streams) so sediment production is kept below a “Moderate” rating as determined by FREP’s *Protocol for Evaluating the Potential Impact of Forestry and Range Use on Water Quality*. (<http://www.for.gov.bc.ca/ftp/hfp/external!/publish/frep/indicators/Indicators-WaterQuality-Protocol-2009.pdf>).

FORAGE (RANGE)

The FREP evaluation questions for the forage (range) resource value are: *What impact are range practices having on the desired plant succession? What impact are range practices having on the water cycle/hydrologic function?* To answer these questions, land under Crown grazing tenure (where grazing is the primary use) is assessed to determine the impact of livestock grazing on range health.

Range program staff perform the majority of inspections linked to licence changes or renewals and to land-based investment fund allocations, which are designed to improve ecosystem function. In addition, Range program staff, supported by district staff, performed four carrying capacity evaluations on large individual tenures (<http://www.for.gov.bc.ca/ftp/hfp/external!/publish/frep/indicators/Forage-Supply-Analysis-Methods-Range.pdf>). Staff also completed carrying capacity modelling to evaluate available forage in the entire Thompson Rivers Natural Resource District.

Depending on the type of assessment, 10–16 different aspects of ecosystem function are used to evaluate an area's overall health. They are generally grouped into four components of ecosystem functionality:

1. water cycling
2. plant and animal succession
3. mineral cycling
4. energy flow

Based on the ecosystem's functionality, the five range health categories and their four equivalent resource development impact ratings are:

- "Properly Functioning Condition" – equivalent to "Very Low" impact rating
- "Slightly at Risk" – equivalent to top end of "Low" impact
- "Moderately at Risk" – equivalent to bottom end of "Low" impact to top end of "Medium" impact
- "Highly at Risk" – equivalent to bottom end of "Medium" impact to top end of "High" impact
- "Non-functional" – equivalent to bottom end of "High" impact

Provincial-level Forage Resource Results

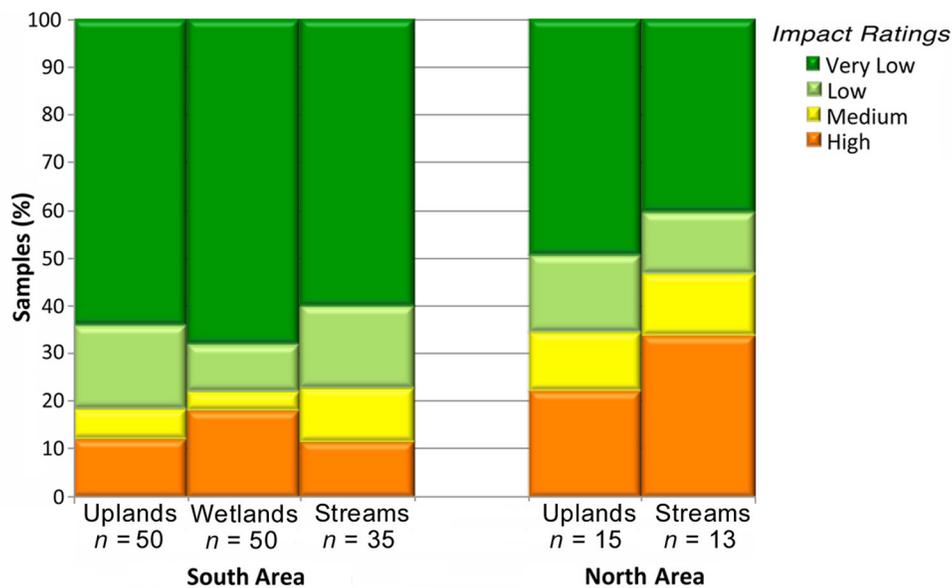


Figure 9. Resource development impacts on forage resources for two areas, showing trends by assessment type.

For the 2012 South Area assessments, 64% of uplands, 68% of wetlands, and 60% of streams were considered in "Very Low" impact condition (Figure 9). There were slightly higher impacts in the North area. The discussion below applies to data from both areas.

On most of the assessed upland sites, normal biological breakdown of grass litter and dung is occurring and that material is being incorporated into the soil. Soil compaction is generally not an issue for upland areas, where there is sufficient water infiltration to prevent overland flow. The two most frequently cited problems were the vigour of desirable plants and the condition of habitat and vegetation structure. Decreased vigour of desirable plants can affect the long-term productivity of the range plant community. A decrease in habitat and

vegetation structure indicates that in heavily grazed areas, tall forbs (herbaceous flowering plants other than grasses), grasses, and sometimes shrubs have been replaced by lower-growing plants that are better able to withstand grazing.

Most wetland health assessments indicate that the detritus food chain is not affected by livestock grazing. Also, most wetlands have maintained a diverse structure that provides habitat for other animals and protects shorelines from erosion. The issues most frequently cited during these assessments were a decrease in the average soil water content and the amount of exposed soil.

Both of these issues could be caused by livestock grazing and compaction, leading to a change in the plant community and a decrease in water filtering capability.

Stream health assessments, on average, showed that most streambeds were relatively stable and that most streams did not have excessive algae growth, which could be linked to livestock excrement. The most common issue identified in the assessments was a decrease in the amount of vegetation falling into the stream, reducing the detritus component of the food chain. This could be due to grazing actively removing too much streamside vegetation. The most frequently noted problem with streams is compacted or exposed soil, caused by livestock access.

Range practices can have an impact on plant succession. Like other disturbances, grazing alters plant energy dynamics, favouring some plants over others. If applied too often and without enough rest between disturbances, grazing can decrease the quality of the forage by changing plants species composition. The goal of range managers is to balance the production of forage with ecosystem function. This is in the best interest of livestock producers and land managers. As grazing pressure increases, the impact on plant succession and water quality increases and the need for greater management also increases.

Provincial Opportunities for Improvement in Forage Management Based on Practices Associated with the Most Successful Monitoring Outcomes

Preserve natural range barriers (vegetation and downed woody debris) to help limit livestock access to streams, wetlands, and lakes. Removal of natural range barriers during timber harvesting and road building can give livestock new access to streams, wetlands, and lakes and result in trampling damage. Co-ordinating timber harvesting, road building, and range use can help ensure that natural range barriers in riparian areas remain effective. Stakeholders should also follow well-established best management practices, including:

- Build planned "rest" periods into the annual grazing plan for bunchgrass range (e.g. rest-rotation grazing systems rest one-quarter of pastures from livestock use each year).

- Adjust grazing use levels and stocking rates according to seral stage and rangeland health. Ideally, early-seral range should be used lightly (17–25% of annual forage production), whereas healthy mid-seral and late-seral range is best used moderately (30–40% of annual production).
- Allow dormant season (winter) grazing on low-elevation bunchgrass range that has not been grazed during the growing season, as this activity has less impact on grass plants and biological soil crusts than grazing during the growing season.
- Determine a range's carrying capacity using the approved procedure, as capacity varies widely.

RECREATION

The FREP evaluation question for the recreation resource value is: *Are recreation sites providing healthy and safe recreational experiences?*

In 2012, no FREP activity was conducted to assess recreation resource value. Evaluation of recreation trails is the next recreation monitoring project that will be undertaken when resources allow.

RESOURCE FEATURES

The FREP evaluation question for the resource features resource value is: *Are current forest practices adequately protecting and maintaining the integrity of karst features?*

In 2012, field staff in the North Island–Central Coast Natural Resource District continued pilot-testing field assessment procedures to determine the impacts of resource management activities on karst features, such as sink-holes, cave entrances, and sinking streams.

When finalized, the protocol and field cards will allow for optional monitoring of karst features province-wide.

SUMMARY

As a summary of FREP monitoring results to date, this fourth annual program report communicates continuous improvement perspectives and recommendations to natural resource professionals and managers. This information is intended to support and promote dialogue necessary to achieve short-term and long-term sustainable resource management goals in British Columbia. Natural resource professionals are strongly encouraged to consider this information in their practice, along with FREP reports, extension notes, monitoring protocols, and other relevant data. This information should help resource professionals understand the outcomes associated with their plans and practices and also inform their recommendations and decisions, particularly where these need to balance environmental, social, and economic values.

To ensure the resource management community gains the maximum value from FREP, natural resource professionals are encouraged to:

1. Carefully review this report in the context of individual roles and responsibilities (you can find additional detail in FREP reports, extension notes, and data).
2. Contact your resource district to discuss local results and/or see how data is collected in the field. Local data is available to individual licensees for their own analysis and interpretation. Contact Nancy Densmore (Nancy.Densmore@gov.bc.ca) for access to FREP data and interpretation of results.
3. Visit the FREP website at <http://www.for.gov.bc.ca/hfp/frep/index.htm>
4. Contact any of the FREP Resource Value Team Leads (see Table 1) for detailed information on monitoring protocols, indicators, and results.
5. Review the FREP monitoring protocols. These documents identify the best available information on key attributes and indicators of forest and range resource health and sustainability.
6. Send any feedback or questions relating to this report, or FREP in general, to Peter Bradford, Peter.Bradford@gov.bc.ca or by telephone at 250-356-2134.