BRITISH COLUMBIA

FOREST IN-GROWTH AND ENCROACHMENT

A provincial overview from a range management perspective

FOREST SERVICE · BRITISH COLUMBIA ·

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Executive summary

In-growth is the process whereby previously open forest becomes more dense and treed grasslands become more densely covered, with young trees. Encroachment is the intrusion or establishment of trees on grassland that may not have been previously forested. Both issues impact the quantity and quality of livestock forage and are considered issues of significance to the livestock industry, particularly in areas where fire is considered to be important in the maintenance of the stand or area characteristics. Other resource values are impacted as well, including wildlife, timber, residential lands, and recreation, though the degree and extent of these impacts are not documented in this report.

This paper discusses the history of in-growth and encroachment from a range management perspective. It starts from the time period of their initial identification some 80 years ago to the recent implementation of operational trials. Looking at approximately the time period of the last 80 years, the provincial area extent of in-growth is approximately 963,000 hectares and the provincial area extent of encroachment is approximately 91,000 hectares.

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Introduction

This report is a brief provincial overview of forest in-growth and encroachment on range lands in British Columbia.

The complicated and interactive aspects of these issues, where multiple resource users, government jurisdictions and impacts on other values must be considered, are not the focus of this report. However, a history and general impact statement of these issues from a range management perspective are provided.

Background

Ministry of Forests executive toured areas where in-growth and encroachment occur and are considered serious and; they believed the issues should be addressed. Thus the Chief Forester tasked Range section of Forest Practices Branch with providing an overview of these two issues from a range management perspective. That overview is the basis of this report.

History of issues

There has been a documented steady decrease in the amount of available forage on Crown range in some areas of British Columbia over the last 30 years. This loss has been attributed to a number of factors including increased urbanization, changes in land use and, reduced forage productivity (i.e. quality, quantity, and species composition) due to forest in-growth and encroachment.

Forest encroachment onto BC grasslands was noted some 80 years ago by Whitford and Craig. The Ministry of Forests (Ministry or MOF) Forest and Range Resource Analysis Report 1994 noted encroachment as a serious problem for the coming decades. In 1997 and 1998, the BC Cattleman's Association indicated that encroachment needed to be addressed.

What is in-growth and encroachment?

In this review, in-growth refers to the process whereby previously open forest becomes more dense and treed grasslands become more densely covered, with young trees. Encroachment refers to the intrusion or establishment of a significant number of trees on grasslands that may not have been previously forested. The area impact of in-growth or encroachment may occur fairly rapidly or over very long periods of time. The time frame used for estimation of these effects in this report is about 80 years.

Both of these issues are normally associated with fire maintained forests (natural disturbance type 4) of ponderosa pine and interior Douglas-fir biogeoclimatic zones and, with late-seral and climax grasslands and shrublands found in the bunchgrass biogeoclimatic zone. These zones are concentrated in the Nelson, Kamloops and Cariboo forest regions. Some parts of ecosystems with frequent stand initiating events (natural disturbance type 3) such as the dry parts of the interior cedar hemlock zone, may also be effected. Aspen encroachment on grasslands, aspen in-growth in aspen and cottonwood stands and, spruce in-growth of aspen stands are of concern in the Prince Rupert and Prince George regions.

Why are these issues considered important?

Range managers consider in-growth and encroachment to be responsible in part for:

- loss and or change in forage species composition;
- diminished forage production as increases in canopy closure reduces solar energy and moisture availability;
- reduced forage production and quality where native bunchgrasses that produce high protein levels and nutritious forage throughout the year are replaced with less nutritious, late curing species such as pinegrass;
- reduced livestock movement between and within in-grown stands;
- loss of open forest and grassland types that support a unique set of organisms;
- influences on ecosystem and species diversity by reducing stand diversity and affecting ecotonal boundary changes;
- reduced capacity of range lands to support livestock and;
- shifting of grazing and browsing to remaining open forest and grassland areas potentially leading to overgrazing by livestock and wild ungulates (and, increased presence and spread of noxious weeds).

Some areas where encroachment and or in-growth are considered problems were temporarily saved from drastic forage reduction because substitute forage was found in transitory areas such as clear-cuts. Some areas were closely monitored, experienced reductions in livestock numbers and had specified allowed livestock grazing periods instituted. Other areas have seen increased grazing pressure on the grasslands and open areas with subsequent perceived and demonstrated decreases in range condition, forage quality and production. The impacts listed above vary in their intensity and perceived importance across the province.

There can be considerable social and economic losses to the Crown and province from a reduction in forage values. Though these losses have been documented on a site specific basis, provincial estimates of social and economic losses are not available.

Relevant studies on the issues

Provincially

Approximately eighty years ago the advancement of forests into grasslands was noted by Whitford and Craig. Tisdale in 1950 in a review of livestock grazing in the interior of BC, concluded that the invasion of open or semi-open areas by tree growth was common over much of the interior.

Gayton has described the effects of forest in-growth on the forage base of fire maintained stands. He notes that with in-growth there has been shown to be a reverse relationship between understory forage production and the density of the forest canopy; as canopy closure increases through forest in-growth, forage production decreases. This relationship between crown closure and understory forage production is however not universally accepted or proven.

The historical role of fire in maintaining open forests and grasslands in many parts of the province has been documented by Parminter and Daigle. They reported that "surface fires that burn through the understory of dry interior forests keep them open, healthy, productive, diverse and resilient. These fires historically occurred as a result of natural lightning ignitions and

some purposeful burning in specific locations by aboriginal peoples carried out mainly to: (among other purposes) improve horse grazing areas and facilitate travel through grasslands and open forests".

Cariboo

A study of encroachment near Riske Creek, by Strang and others, suggested forest encroachment on open grasslands could be attributed to a combination of absence of fire, absence of grass/tree seedling competition and micro-site soil moisture availability.

Ross, in a study of in-growth and encroachment in the Bald Mountain and Becher's Prairie areas near William's Lake, compared aerial photographs of the same areas over a 30 year period of 1962 to 1993. Field reconnaissance and aerial photo-interpretation was used to classify polygons representing four cover classes for each set of years. Polygons were digitized to calculate areas in each class and to allow for derivative maps for the two sets of years. The area of each class was reported and then generated for each date. Comparisons of class coverage on sites between dates enabled the determination of area and rate of change. Observations were that about 3,000 animal unit months (AUMS) of forage was lost to in-growth and encroachment processes. Grassland area decreased 30 to 40%, and both treed grassland and open forests experienced in-growth of up to 30%. Douglas-fir in Bald Mountain and lodgepole pine in Becher's Prairie were determined to be the primary in-growth/encroachment species. Some other observations were that 1) encroachment was more prevalent than in-growth and that in-growth may have already occurred on most sites; 2) there was not clear evidence to support a relationship between litter/fine fuels and grazing; 3) in-growth may have reached its limits in these areas; 4) the absence of fire in the last 30 years may have contributed to in-growth and; 5) the grassland/forest ecotone is the location of forest in-growth and encroachment and, trees have established in topographically favourable sites.

A future project by Thompson of Agriculture Canada proposes to document the impacts of fire and cutting on Douglas-fir encroachment into grassland sites in the Chilcotin Forest District.

Kamloops

Dodd, McLean and Brink documented that understory forage production decreases linearly with forest in-growth in various Douglas-fir and lodgepole pine stands.

Studies are underway by Thompson of Agriculture Canada on germination of lodgepole pine and Douglas-fir seeds in various grassland and forest soils including those with impacts from livestock grazing.

Nelson

In 1990, the East Kootenay Trench Agriculture Wildlife Committee project was started to consider, among other things, issues on wildlife cattle interactions. The ministries of Environment, Lands and Parks, Ministry of Forests and the Ministry of Agriculture and Food had equal status and representation on the committee. In its final report of 1998, the committee identified in-growth as a contributing factor to cattle/wildlife interactions and recommended the creation of more forage by thinning and/or burning in-grown forest stands.

The Ecosystem Maintenance Burning Evaluation and Research (EMBER), a joint

federal-provincial project which began in this region in 1992, was "a pilot project to lay the groundwork for a coordinated Ministry program to reintroduce prescribed fire to fire maintained ecosystems" (in some parts of the Rocky Mountain Trench). The project's objectives are to "plan, execute and document a series of pilot burns in conjunction with District staff, to determine the feasibility and technical merit of an expanded burning program". Results for a project where aerial photographs over a thirty year period were compared, conclude that grassland types were converted to forests at a rate of slightly more than 1% per year, with subsequent loss of livestock forage. Open and moderately closed forest types used for cattle forage experienced about 3% per year increase in crown closures over the same time period. Effective fire suppression on these fire maintained types was considered a significant contributing factor to increased encroachment and in-growth processes.

The BC Knowledge Network, in its Westland series, has recently aired a program titled "Grasslands and Biological Diversity". The program documents the role of fire on forest stand structure and its impacts on other resources such as forage.

The Enhanced Forest Management Pilot project, a joint Ministry of Forests and Ministry of Environment, Lands and Parks effort, started in Invermere in 1995. One of its activities, that of implementation of an ecosystem restoration plan involving fire and restoration harvesting for the Sheep Creek north range unit, is currently underway. Impacts on the forage resource are being evaluated.

In-growth and encroachment and subsequent loss of livestock forage quantity and quality were documented by Egan in a case study commissioned by Forest Renewal BC. The study investigates existing regional restoration initiatives, proposes a restoration strategy considering various tools and recommends the initiation of a pilot project.

In 1998, the Grazing Enhancement Fund sponsored an in-growth study by Tim Ross in the Grasmere range unit of Cranbrook district.

Prince George

No formal studies on in-growth and encroachment have been conducted as they are considered minor management issues. Aspen has encroached on some grasslands and in-grown in forested types, most notably in the Francois Lake area. Increased harvesting of aspen stands may accelerate the impact of in-growth on the forage resources. The extent the limited area of Douglas-fir is impacted by in-growth is unknown.

Prince Rupert

No formal studies have been conducted. Encroachment of aspen and in-growth of spruce into aspen stands may be affecting forage availability to livestock and wildlife.

Vancouver

Forest in-growth and encroachment are not considered important range management issues in this region.

Other relationships or interactions

Land Use planning

Land use plans have been developed or are being developed for many areas of the province. Where there is Crown range, plans normally require development of strategies to address forage supply. Objectives for maintaining or enhancing the forage supply are often agreed to without reference to specific management tools to be used to achieve these objectives. A need exists to determine suitable tools and define areas where these tools can be applied.

The concept of permanent range can help where defining areas for specific management strategies and tools is required. Permanent range can be used in classifying land for landscape unit planning and, resource management and decision making.

Permanent range

Permanent range is "grasslands and dry open forests that provide substantial livestock forage throughout most or all successional stages". A recent refinement of permanent range definition refers to it as "land supporting vegetation which at all seral stages is suitable for grazing. This includes grasslands, sedge meadows, alpine, and open forested land on which the understory native vegetation is predominately grass, grass-like plants, forbs or shrubs". This definition would include land considered susceptible to encroachment and some open forests, such as those in the 6-15% crown closure classes. Transitory range has been defined as "land supporting vegetation which at early and mid-seral stages is suitable for grazing". These lands could include open forests up to 35% crown closure and, recently logged areas.

Periodic fires are considered fundamental to the ecology of some permanent range. Some forested permanent range was considered to have developed under a regime of frequent low-intensity fires resulting in an open stand structure, as for example permanent range that occurs in natural disturbance type 4 and a number of drier ecosystems in natural disturbance type 3. In some permanent forested range, such as alpine and open park-land in Engelman spruce/sub-alpine fir natural disturbance types 5, fire is not considered to have been fundamental to its ecology.

For this report, range types were defined and used by provincial range and ecology specialists to provide provincial estimates of the area extent of in-growth and encroachment.

Current planning initiatives

Regional land use, land and resource management, landscape unit, range use and forest development plans may consider in-growth and encroachment issues.

In the Cariboo, a committee comprised of representatives from various government and non-government agencies will develop a strategy to address and monitor the impacts of in-growth and encroachment and report to the regional resource board with recommendations.

In-growth and encroachment management strategies for the Lillooet and Okanagan/Shuswap land and resource management plans are being developed. In addition, a joint Ministry of Environment, Lands and Parks and Ministry of Forests committee will look at the in-growth and encroachment issues for dry Douglas-fir forests from a regional perspective. The

committee hopes to raise awareness of in-growth and encroachment and provide perspectives on related issues such as stocking standards, stand thinning programs and the use of fire as a management tool.

Both Invermere and Cranbrook are working on Ecosystem Restoration Plans by range unit. These plans go through a public process, with Cranbrook following that of a Co-ordinated Resource Management plan. Invermere will have completed all its plans for NDT 4 by year end. Cranbrook has a target date of the year 2000 for completion of plans.

Operational activities conducted to mitigate effects.

Activities have been varied and specific.

Staff in parts of the Cariboo region responded to suggestions of researchers that livestock grazing encouraged encroachment by reducing livestock stocking rates. Forage on in-grown stands and encroached areas was improved by using prescribed burns and hand or machine felling followed by piling and burning. However few detailed treatment records exist and limited monitoring has been conducted on these treatments to determine their efficacy in controlling in-growth or encroachment.

Staff in Invermere and Cranbrook forest districts in Nelson region have detailed landscape plans and are manipulating in-grown stands through various combinations of harvesting, slashing, thinning and/or prescribed burning. Initial success in reducing the area extent of in-growth is evident. Monitoring and reporting on these management techniques is on-going. Boundary district is considering similar stand management activities.

Kamloops region has expressed interest in a burn trial for forage enhancement.

Protection Branch is considering trials in the Cariboo region to determine fire fuel ratings of grassland types for input to revisions to the current Canadian Fire Fuel Rating Index.

Area estimation of in-growth and encroachment procedure

Approach

An area report of old biogeoclimatic ecosystem classification (BEC) by sub-zone for the province was produced. This report was adjusted for new BEC standards. The adjusted report was sent to MOF regions and districts with a request for estimates of the percent and/or area extent of in-growth and encroachment by sub-zone.

Results

A summary of the results of the request for estimates of percent and/or area of in-growth and encroachment are in Table 1.

Table 1: In-growth and Encroachment - British Columbia area estimate by BEC sub-zone

BEC sub-zone	In-growth crown closure 6-15% (ha)	In-growth crown closure 16-35% (ha)	In-growth crown closure >35% (ha)	Total In-growth all crown closure (ha)	Encroachment (ha)	Total In-growth and encroachment (ha)
AT	0	0	0	0	25	25
BG	5,000	16,000	0	21,000	3,000	24,000
BWBS	1,000	2,000	3,000	6,000	5,000	11,000
ESSF	0	1,000	11,000	12,000	200	12,200
ICH	1,000	10,000	4,000	15,000	200	15,200
IDF.	50,000	514,000	181,000	745,000	53,000	798,000
MS	1,000	5,000	0	6,000	1,000	7,000
PP	22,000	60,000	46,000	128,000	16,000	144,000
SBS	27	4,000	22,000	26,027	8,000	34,027
SWB	0	6,000	0	6,000	5,000	11,000
Total (ha)	80,000	617,000	266,000	963,000	91,000	1,056,000

note: This estimated data was summarized from regional and variant level of detail. Hectares were rounded following summation of detailed estimates.

Observations

A number of trends emerge:

1) The provincial total area of concern for in-growth is approximately 963,000 hectares.

2) The provincial total area of concern for encroachment is approximately 91,000 hectares.

3) In terms of hectares, encroachment is about 23 times greater in the interior Douglas-fir and ponderosa pine sub-zones than in the Bunchgrass sub-zone.

4) In terms of hectares, ingrowth in all crown closure classes is about 42 times greater in the interior Douglas-fir and ponderosa pine sub-zones than in the Bunchgrass sub-zone.

5) In terms of hectares, the issue of in-growth is about 10 times greater than encroachment.

6) In terms of hectares, in-growth in the 16-35% crown closure class is approximately eight times greater than the 6-15% class and two times greater than the >35% crown closure classes, comparing totals for all regions for these classes.

Summary

In-growth and encroachment have significant impacts on the range resource. Their area extent is about 963,000 hectares for in-growth (about 9% of the 11 million hectares of forested range in British Columbia) and 91,000 hectares for encroachment (about 8% of the 1.2 million hectares of grassland in British Columbia).

Considering that the area of encroachment is normally grassland types and that the forage productivity of grasslands can be from 5 to 10 times that of forested range and these types often provide critical spring and fall forage, the impacts of encroachment on forage supply may be more comparable to that of in-growth than a simple comparison of area extent may imply. Also, encroached areas could become in-grown as their conversion to a forested state progresses.

Though in-growth is mainly a phenomenon of fire maintained ecosystems, concern has been raised that it could have effects in aspen stands in Prince George and Prince Rupert regions where increased harvesting of these stands is occurring.

Interestingly, the United States Forest Service has recently adopted a policy to integrate and internalize fire operations into annual land management decisions and to use grazing, thinning, building codes and fire as tools to meet fire management objectives.

Concerted and coordinated appropriate management measures to reduce the impacts of forest in-growth and encroachment on the range resource could help ensure forage for the future.

For additional information or discussion of these topics, please contact one or more of the following Ministry of Forests staff:

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Prince Rupert region	**Don Russell**	**250-847-7443**
Prince George region	**Perry Grilz**	**250-565-6774**
Kamloops region	**Andrea Sissons**	**250-828-4096**
Nelson region	**Val Miller**	**250-354-6245**
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