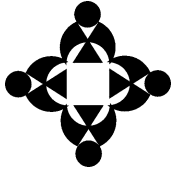




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# Integration of Timber and Range Resources: “Where are We?”

Workshop Summary Report



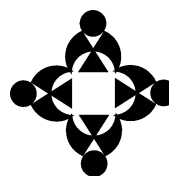
Southern Interior  
Forest Extension and  
Research Partnership

# Integration of Timber and Range Resources: “Where are We?”

Workshop Summary Report

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Kathie Swift and Reg Newman



Southern Interior  
Forest Extension and  
Research Partnership

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## **ABSTRACT**

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On October 3, 2000, a Forest Grazing Workshop hosted by the B.C. Ministry of Forests Research Branch and the Southern Interior Forest Extension and Research Partnership took place in Kamloops. The intent of this workshop was to bring together those with concerns about the management of cattle in cutblocks, present the latest scientific information on forest grazing, outline the implications of various management options on growth and yield, and discuss unresolved cattle/tree conflicts, potential solutions, further extension and research needs.

The workshop's morning session was dedicated to providing those involved in the grass-tree-cattle interaction with an open forum to present their perspectives. The afternoon session was devoted to the presentation of results generated from a long-term research trial located in the Montane Spruce, very dry, cool, biogeoclimatic subzone. The workshop closed with an hour-long open discussion that explored possible opportunities to work together on some of the problems identified throughout the day.

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## **INTRODUCTION**

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On October 3, 2000 a Forest Grazing Workshop hosted by the B.C. Ministry of Forests Research Branch and the Southern Interior Forest Extension and Research Partnership took place in Kamloops. Funding for this workshop was provided by Forest Renewal BC, with Agriculture and Agri-Food Canada supplying the facilities. The intent of this workshop was to:

- bring together those with concerns about the management of cattle in cutblocks;
- present the latest scientific information on forest grazing;
- outline the implications of various management options on growth and yield; and
- discuss unresolved cattle/tree conflicts, potential solutions, further extension and research needs.

The day was divided into two sessions. The morning session was dedicated to providing those involved in the grass-tree-cattle interaction with an open forum to present their perspectives. The afternoon session was devoted to the presentation of results generated from a long-term research trial located in the Montane Spruce, very dry, cool, biogeoclimatic subzone. The workshop closed with an hour-long open discussion that explored possible opportunities to work together on some of the problems identified throughout the day.

## **THE MORNING SESSION**

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Michael Pitt, associate professor and research scientist from the University of British Columbia, opened the morning session with a lively introduction, which put the grass-tree-cattle interaction into context from both an historical and a legislative perspective.

Michael's 1989 assessment of the effects of seeding and grazing on backlog reforestation (and 5-year research plan) was instrumental in setting the direction for grass-tree-cattle research in British Columbia. Many factors were found to contribute to forest lands remaining classified as "backlog" or "not satisfactorily restocked" (NSR); however, competition with seeded forages and damage to trees from livestock added additional constraints to successful regeneration of the new forest crop. Michael also reported that skepticism remained regarding grass-tree-cattle compatibility, despite research by McLean and Clark in the 1970s and 1980s, which demonstrated compatibility among cattle, grass, and trees. A subsequent Forest Resources Development Agreement (FRDA)-sponsored research program, which investigated the interactions between cattle grazing and forest production on cutblocks of interior British Columbia, followed many of Michael's primary recommendations.

Michael believes that despite our best research efforts, many questions will remain unanswered. He repeated a caution that was included in his 1989 report:

*New information will not solve all problems associated with grass/tree/cattle interactions, many of which result from insufficient communication rather than lack of information. For integrated forest and range management to be successful, all resource participants must strive to minimize personal bias, and be willing to compromise specific resource objectives to achieve maximum productivity of the forest and range resources.*

## **The Ministry of Forests Perspective**

Following Dr. Pitt were representatives from the British Columbia Ministry of Forests who provided a forest district perspective on cutblock grazing. The first to speak was Phil Youwe, Range Officer for the Kamloops Forest District. Phil provided a brief historical account of cutblock grazing in the Kamloops region. He noted how polarized positions have shifted over time from “cows are good/trees are bad,” to a more integrated approach that recognizes the value of both resources. This approach is now the primary objective for range management in the area. New guidelines that include increased communications and the development of Range Plantation Protection Plans (RaPP plans) evolved from this approach. However, the need still exists to focus on the “bigger picture.” The Ministry is trying to encourage the use of the Forest Development Planning process to discuss all possible RaPP plan items and to reach agreement on the appropriate approaches. The Ministry feels that good communication between the ranchers and forest licensees is the key to the successful co-ordination and integration of timber and range resources. They also feel, or expect, that the licensees and the ranchers will do the bulk of the work to make this planning process work. “They must work together to predict where problems could arise, to develop the methods appropriate to address them, and to revisit and readjust the plans according to what is happening on the ground.” Phil acknowledged that this new way of doing business is not perfect and outlined some of the challenges for tomorrow.

These challenges include:

- continuing to work with ranchers and forest companies in the development of RaPP plans;
- continuing to see that the agreements outlined in the RaPP plans are brought into the operational plans of the Silviculture Plan and Range Use Plan; and
- continuing to look to new initiatives that can help improve the integration of timber and range such as:
  - new advances in riparian management
  - seeding for improved livestock control
  - scheduling of logging and planting
  - sharing grazing summaries with the forest companies
  - providing the location of range improvements and administrative boundaries to forest companies on a regular basis
  - providing forest companies with the information for mapping with local place names to help improve communication.

Glenn Heyes, Range Officer for the Merritt Forest District spoke next. Glenn has dealt with livestock/tree seedling conflicts for over twenty years. In his district, timber licensees must plan tree seedling protection measures with ranchers before harvesting. At the licensee’s discretion, this can be documented in either the Forest Development Plan or Silviculture Plan. Where planned blocks are potentially at risk of cattle damage, a strategy to prevent damage must be determined and documented. If livestock damage to tree seedlings does occur, then the district will encourage the timber licensee and rancher to solve the problem. If the timber licensee and the rancher cannot agree on necessary measures, the district staff are willing to mediate, using the Kamloops Forest Region Cutblock Grazing Guidelines.

## ***Experiences with the Forest Grazing Research Project***

Glenn's main expectation of the Forest Grazing Project was to discover an attribute, which was readily observable on the ground (such as forage utilization), that could provide a gauge of an acceptable level of tree seedling damage. This would be useful for setting grazing plan criteria that would protect tree seedlings. It would also be useful for ranchers, and timber company and ministry staff to monitor an approaching problem more easily. He was also looking for a better understanding of the impact of trampling damage on tree seedlings.

Glenn provided examples of how Forest Grazing Project research had influenced thinking at the district:

- now more sympathetic to the silviculturalist's concerns about forage seeding causing difficulties with tree seedling establishment;
- now less concerned about slightly scarred seedlings; and
- no longer advocates the use of large numbers of cattle for a short period of time on cutblocks.

## ***Solutions***

Glenn emphasized that there are no magic solutions that would be generally acceptable in all situations. Each site may require some different tweaking. He recommends obstacle planting as one of the best actions to minimize tree seedling damage by livestock. Glenn believes that obstacle planting should be a standard procedure when practising reforestation in livestock tenured areas.

## **The Forest Licensee Perspective**

Shane Browne-Clayton and Bob Johnson, representing Riverside Forest Products Ltd, outlined the management of cattle on cutblocks from a forest industry perspective. Specifically, their talk focused on a silviculturist's point of view; that is, of trying to achieve plantation survival, regeneration, and eventual free-growing status when legal obligation and liability for the stand transfers from the forest company back to the Crown. Many factors will affect the forest company silviculturist's final goal of attaining free-growing status—factors that are controllable and factors that are not. Cattle are considered one of the controllable factors, and the best control is good cattle management.

Shane and Bob also presented some realities that exist within their forest company.

- Riverside is reducing the amount of site preparation they are doing, and instead are focusing on raw planting (now up to 50% of their planting program). They feel that the seedlings perform better with the forest floor layer remaining intact. They acknowledged that with less mineral soil exposure, there would be less forage production for the cattle.
- The bark beetle epidemic has derailed the forest planning process, leaving large continuous openings and eliminating natural barriers, neither of which help the ranching community in their attempts to practise good cattle management.
- Because of the increased cost of doing business, the forest industry is not getting a good return on their investment and, consequently cannot afford to do a lot of fencing or replanting of damaged areas.

They also presented some of their concerns regarding the impact that cattle appear to have on their plantations. Some of these concerns include:

- Increased seedling mortality due to trampling, which seems to occur when the seedlings are under other stresses such as drought.
- Reduced crop tree stocking, which means that the higher target stocking may not be achievable and they must, therefore, rely on minimum targets. Relying on these minimum targets has a significant negative effect on the stand's ability to meet the free-growing declaration, as well as future timber supply implications. Relying on minimum targets also raises the concern of reduced wood quality for future products.
- Reduced growth rates: if trampling of the seedlings results in a reduced growth rates, then there are, again, substantial negative implications to future timber supplies.
- Increased effects of cattle at higher elevations because of the shorter growing season in which the seedling has to recover.
- Over-committed range resources in some districts: cattle movements are not possible when a problem arises. Why?

### ***Some Possible Solutions?***

- Obstacle planting is an effective technique to reduce cattle damage. However, coarse woody debris and stumps are needed to make this work; in some ecosystems, such as the Interior Douglas-fir (IDF), this can be a problem.
- Range unit boundaries should be revised to ensure that they follow natural barriers as much as possible.
- More forest and range planning should be encouraged, which includes better communication and the development of RaPP plans.
- More working sessions, in which the sharing of information can take place, are needed.
- Range enclosures can help to illustrate cattle management problems.
- Present system of measuring cattle damage requires evaluation.
- Ministry of Forests needs to accept that cattle damage happens and provide relief to licensees, such as accepting creative ideas in silvicultural prescriptions (e.g., cluster planting).

### ***Some Parting Words***

- Need good cattle/range management as much as we need good forest management.
- Rewards are required for good management and penalties are needed for poor management.

### **The Ranching Perspective**

Judy Guichon, the rancher on whose range unit the research project was conducted, provided insights into the perspective of the ranching community. Judy runs a full-time ranch of 60 000 acres for 600 cow/calf pairs, monitored by two range riders. She has expended a lot of time and energy putting up fences, cattle guards, and water troughs for the project. As a participant in the study, Judy felt that some of the research treatments designed did not reflect all of the options used by the range community. For example, the treatment termed “short duration” was not a true reflection of what a rancher interprets as short duration. To the ranching

community, short duration means running the cattle for short days (0.5 to 1 day) at high concentrations. This treatment was never studied and therefore the ranchers feel that perhaps all of the options have not been evaluated.

Judy expressed support for the planning environment that was being advocated under the new range guidelines, but felt that the focus on the pine beetle epidemic has caused the planning environment to change and become less predictable. She also felt that earlier, more in-depth planning was needed as well as training and educational opportunities for both the ranching and forestry community. Cross-cultural training could help to clarify terminology (e.g., what is meant by scarring, tree damage, lasting damage, how much can a tree sustain, soil compaction), as well as provide the forestry community with an insight into the ranching world. Judy also provided a list of ideas that she felt would help bridge some of the difficulties that seem to currently exist. Some of her ideas included:

- Having the forestry community recognize that the range community schedules two weeks in February, every year, to plan the movement of cattle for the whole year. Forestry planning seems to take place in August, and for the range community, this is too late.
- Joint planning sessions are needed to time activities to coincide with each other. If timing of activities cannot be changed, then these planning sessions would at least make people aware of when certain activities are scheduled to proceed.
- The range and forestry communities need to compare goals and objectives. For the ranching community, the goal is to put weight on their cows. What are the goals of the forestry community? If the two communities are to work together, the range community needs to know these goals.
- Cattle are a “tool” that can help in managing forests; the range community has many other tools that can work, as well—they just need to be explored.
- Joint monitoring procedures are needed. When goals are set, they should be monitored to ascertain how well they are being achieved.
- Finger-pointing around the issue of fencing needs to be reduced. Is there any way that fencing can be viewed in terms of a long-term investment towards the life of the future stand?

At the end of her presentation, Judy expressed real regret that the research project was shutting down because of funding reductions. To her, more work is still required because a lot of questions need answering.

Len Bawtree from the BC Cattlemen’s Association was given the last word on the ranching viewpoint. Len suggested that a broader picture was needed on the issue and on the implications it has in today’s world. He described some of the many changes that have occurred in this country—how there used to be an abundance of grasslands and wide-open spaces. Len remarked that: “Today, there is only 20% of that environment left. The other 80% is growing trees, in some cases lots of trees, with no range opportunities.” Len also expressed concerns about the sustainability of the cattle industry. He cited the following threats to the sustainability of ranching:

- a change in fire history has created a loss of habitat for some species, as well as forage and biodiversity;
- prescribed fire is no longer an acceptable form of site disturbance;
- grass seeding is no longer an available tool; and
- forestry is moving towards selective harvesting.

Len offered a number of possible solutions that he felt should be considered if the ranching industry is to remain in business. His ideas included:

- The need of performance standards to grow grass for seeding cutovers, roads, ditches, and landings. Standards are also needed to ensure that the correct types of seed are used under the different conditions.
- Timber harvest scheduling so that transitory range is always available. This is being done, but when forest health concerns take precedence, problems in transitory range become an issue, and potentially a threat to the survival of some range tenures.
- Ranchers need to be consulted about road deactivation activities. Access by four-wheel drive vehicles must be maintained on a priority basis or according to an access management plan.
- The cost of fencing, due to the elimination of natural barriers, should not be the burden of the ranching community.
- Silviculture prescriptions must identify how the range resource will be managed within the area under license.

In his concluding remarks, Mr. Bawtree provided a list of contributions that range land makes to the province's economy. These include:

- A rural environment, with large open spaces, that is valued by tourists and urbanites
- An environment conducive to the conservation of red- and blue-listed species
- Better control of fire hazards
- Benefits with carbon tie-ups
- Home for deer and bears

His final words voiced a concern for the future: "We must recognize that with every cutblock not grass-seeded, or road replanted, we may be losing our ranching heritage."

## **THE AFTERNOON SESSION: WHAT RESEARCH IS TELLING US**

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The second part of the workshop was spent presenting the research information obtained from the last ten years of work. Brian Wikeem set the stage by outlining some of the history and background of the long-term forest grazing trial.

In 1986, the Forest Research and Development Agreement (FRDA) funded a project examining two components:

1. seeding and grazing on conifer survival and growth, and
2. basal scarring and shoot damage on conifer survival and growth.

The objectives of the seeding and grazing component of the project were to determine the effects of forage seeding rates and grazing intensity on conifer survival and growth, forage production, changes in composition of native vegetation, and cow and calf weight gains. The primary objective of the basal scarring experiment was to clarify and describe the effects of basal scarring and leader damage on survival and growth of lodgepole pine. The project was a co-operative venture of the Ministry of Forests (Research Branch and the Kamloops Forest Region), Agriculture Canada, and the University of British Columbia. Funding and technical support for the project were provided by FRDA, the Ministry of Forests (Kamloops Forest

Region, Kamloops Forest District, and Merritt Forest District), forest licensees (Ainsworth Lumber (1987) Ltd. and Aspen Planers Ltd.), and livestock producers (Gardens Creek Ranch, Indian Gardens Ranch Ltd., and Guichon Cattle Co. Ltd.).

## **Methods**

Three cutblocks totalling 120 ha were used in the experiments. Two of the cutblocks were located at Forge Mountain (Tunkwa), about 30 km south of Savona. The third cutblock was located adjacent to the Helmer Lake exchange of the Coquihalla Highway, between Kamloops and Merritt. All three blocks occur in the Montane Spruce (MSxk) biogeoclimatic subzone and except for aspect, they are relatively similar in elevation, slope, and soils. Harvesting occurred in 1985 and 1986. At Tunkwa Lake, slash was windrowed and the area was scarified. At Helmer Lake, the entire site was rough-bunched. The sites were burned in November 1987. All three cutblocks were aerially seeded in early May 1988. Each cutblock was planted to lodgepole pine immediately after the forage seeding was completed. The cutblocks were fenced into 5-ha pastures and grazed, starting in 1989. Cows and calves grazed each pasture for one month between mid-July and mid-August.

As with all research, the pursuit of knowledge with specific questions in mind often leads to new ideas and new questions to be answered. Since 1995, other components have been added to address further issues and ideas concerning the integration of livestock and forest regeneration in British Columbia.

## **Summary of Research Results from the Tunkwa and Helmer Lake Cutblock Trials**

Because of the amount of information that was presented by the speakers during the afternoon session, only a summary is presented here.

### ***Understanding Cattle Damage on Cutblocks (Reg Newman, B.C. Ministry of Forests, Research Branch)***

#### **BROWSING DAMAGE**

Cattle don't usually browse lodgepole pine as it is not a preferred forage species. However, if preferred forage is no longer available, lodgepole pine will be eaten. If browsed, usually the leader or the first whorl is taken (the most succulent part of the tree). The switch to browsing can occur in a matter of days. Voles, moose, and deer can also damage lodgepole pine in similar ways.

#### **TRAMPLING DAMAGE**

Trampling is a chance event—the more cattle present and the longer they are on the site, the more likely that a seedling will be damaged. Trampling damage at normally prescribed cattle stocking rates (0.5 – 1 Animal Unit Months per hectare) was between 20–30% for 2–3-year-old trees. The taller the tree, the less likely it is to sustain damage. Trees taller than 50 cm are seldom damaged. Not all trampled trees die. Mortality varies with age. For example, when trampled:

- 43% of 2-year-old trees die,
- 30% of 3-year-old trees die, and
- 5% of 6-year-old trees die.

The size of the scar is important. Large scars (averaging 90% of stem circumference) resulted in 50% mortality of younger trees. Scars under 50% of the stem circumference killed very few trees. The average scar size is 25% of the stem circumference. This information is relevant to lodgepole pine only.

#### **FORAGE PRODUCTION ON SEEDED CUTBLOCKS**

The additional vegetation competition from forage seeding can kill young lodgepole pine seedlings. Alsike clover is the most competitive forage species in the seed mix. For example:

- forage seeding at 12 kg/ha resulted in 30% mortality of lodgepole pine
- forage seeding at 3 kg/ha resulted in 7% mortality of lodgepole pine

Trampling damage will also increase because of the additional cattle that a seeded pasture can support.

#### **OUTSTANDING QUESTIONS**

- Do these results coincide with other environmental conditions and other tree species?
- Will scarring affect the breaking point of the tree when faced with snowpress at higher elevations?

#### ***Cattle-induced Soil Compaction in Forest Plantations: Is It Real? (Klaas Broersma, Agriculture and Agri-Food Canada)***

Long-term grazing will result in a greater soil bulk density, but this is well below the critical limit for lodgepole pine root growth ability. Generally, seeding with forage species tends to reduce soil bulk density and increase water infiltration. The greater cattle stocking rates in these pastures tended to nullify the ameliorating benefits of the forage on soil compaction. Grazing should have very limited impacts on soil compaction, as long as cows are well distributed and managed.

Q: Over the longer term (>10 years), would more compaction be expected?

A: No—unless more cattle were added.

Q: What is the expectation on finer-textured soils?

A: Compaction would be more severe and the soil would require a longer period of time to recover to the pre-grazing condition after use is completed.

#### ***Soil Quality Changes Following Harvesting and Grazing (Maja Krzic, University of British Columbia)***

Cattle grazing and harvesting treatments did not have a negative effect on soil properties. Greater soil carbon and cation exchange capacity on treatments disturbed by harvesting or grazing might improve these soils as rooting media compared to the undisturbed forest. Ten years of grazing at 50% forage use did not compact the soil above root-restricting thresholds. Cattle grazing on forest cutblocks with coarse soils and good drainage is not a problematic practice in terms of effects on soil quality. Caution is appropriate in attempting to extrapolate these findings to other site conditions.

## ***Cattle Production and Nitrogen Cycling in Forest Grazing Systems*** ***(Don Thompson, Agriculture and Agri-Food Canada)***

Results are speculative because of the lack of site-specific research data. Nitrogen and the N-cycle is key to maintaining the long-term productivity of many sites. For the soil component, little data exists about the effects of seeded forage on erosion, runoff, and leaching losses of N or of N additions from cattle excreta. Seeded forage increases the carrying capacity for cattle and provides more nutritious feed during the early years of stand re-establishment, but it does appear to have the potential to negatively affect N if grazed for a long time period. In the initial years, increased losses due to grazing may be balanced by the greater ability of seeded species to take up the flush of nutrients released after clearcutting. Careful management is required to retain the valuable roles of forage in improving nutrient capture and N fixation and to prevent damage to tree seedlings. Proper cattle management involves preventing excessive forage consumption and improving cattle distribution.

## ***Impacts of Cattle Damage on Growth and Yield*** ***(Reg Newman, B.C. Ministry of Forests Research Branch)***

### **EFFECTS OF GRAZING ON GROWTH OF LODGEPOLE PINE**

Two-year-old trees heavily scarred (greater than 50% of stem circumference) during the active growing season showed no change in growth. Two-year-old trees heavily scarred after terminal elongation showed a 20% reduction in diameter growth. Results from older trees (> 7 years old) show that if trees survive scarring, they heal over without any effects on height or diameter growth.

### **EFFECTS ON STAND DENSITY OF LODGEPOLE PINE**

The primary impact of grazing is on tree survival, not growth. Eight years of grazing at 50% forage use resulted in 15% mortality of lodgepole pine compared to ungrazed areas. Improper management of cattle can result in the declaration of a cutblock as not satisfactorily stocked (NSR). This is attributed to cumulative mortality. Prescribed management doesn't result in a declaration of NSR for cutblocks.

### **PREDICTING MERCHANTABLE VOLUME USING TASS**

Lodgepole pine survival data from the forest grazing study, starting at age 3, were used to predict the potential long-term effects of grazing damage on merchantable volumes. The Tree and Stand Simulator (TASS) model was used for prediction. This prediction was conducted for discussion purposes only. The development of a working predictive model will require more extensive data and rigorous verification.

Assumptions made included:

- No fill planting
- No ingrowth by naturals
- Operational adjustment factors 1 and 2 = 1
- Site index for lodgepole pine = 19 m

## RESULTS

- 12 kg/ha forage seed rate with grazing at 80% forage use resulted in a 25% reduction in volume at rotation age
- 3 kg/ha forage seed rate with grazing at 50% forage use resulted in an 8% reduction in volume at rotation age
- No forage seeding with grazing at 50% forage use resulted in a 1% reduction in volume at rotation age

Q: Forage results in a decrease in lodgepole pine volume, but a gain in beef. What is the balance?

## **DISCUSSION: WORKING TOWARDS A SOLUTION**

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Towards the end of the day, time was set aside for an open discussion of opportunities for next steps. From the discussions and information presented during the day, a number of themes, common to both the forest licensee and the range community were observed and presented as potential building blocks for future co-operative opportunities. These common themes suggest that both industries:

- depend on a Crown-owned natural resource;
- are trying to survive as an industry in a constantly changing environment;
- do not want to be over-regulated;
- cannot afford to bear the total financial obligation for all treatment options (e.g., fencing);
- identified the need for better communication within and between groups;
- identified the need to work together to enable each industry to survive; and
- agreed that proper management was the answer.

Although these common themes were presented to the participants for discussion, the focus still seemed to deviate to the identification of outstanding issues of concern. What follows is a list of these concerns, in no specific order.

- An ever-increasing number of cutblocks, to the point where there are too many for the ranching community to keep an eye on.
- Maintaining access to deactivated sites: what is the balance?
- The sustainability of forage: either naturally occurring or artificially created. What is the effect of reductions in site preparation? Does site preparation have a future role?
- What are the opportunities for seeding? Where can it be used as an appropriate tool in plantation protection plans? Can it be a tool that is cost-shared between the parties?
- Is damage to seedlings the problem, or is it the distribution of the cattle (or damage) over the landscape (bigger picture)?
- What is the role of coarse woody debris (CWD)? Current practices may hinder the rancher's ability to move cattle out of an area rather than actually keeping the cattle out of the cutblock. A fear for the well-being of the range horse was expressed in relation to the current methods of distributing the CWD. Is there a way that CWD redistribution can take place that will work for both communities?
- What will be the consequences of our guidelines and practices down the road? Are we influencing other values?

- Does the public like what it sees?
- Is there a long-term commitment from government for Animal Unit Months? Will there be a decrease in the future?
- Do current practices limit the sustainability of one industry? How can we sustain both industries?
- Are current practices “natural and sustainable”?
- Is there a strategy to deal with forest ingrowth (short term, long term)?
- The time for optimum use of our resources is past. We are constantly dealing with a shrinking land base and fighting with each other over every inch. We must think of compromise and sharing. Is there a process in place by which these compromises can be built? What is the role of government in dealing with these compromises?
- Because of the current forest health problems, some ranchers are facing no new blocks for forage opportunities. These ranchers have a fixed number of cattle, but no range for them. Is there any way to work together to create larger range units with neighbouring licences? Is there any way to revisit range unit boundaries?
- Is there any way to encourage mobility of range units to follow logging patterns?

## CONCLUSION

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Clearly, many outstanding concerns must be resolved. The next steps will likely involve a group commitment to follow up on some of the key issues identified during this workshop. Recommendations from this workshop could play an important role in the future integration of timber range resources.

## REFERENCES

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For more information on the topics covered in this report, please refer to the following.

### UNDERSTANDING CATTLE DAMAGE ON CUTBLOCKS:

Extension note: [www.for.gov.bc.ca/hfd/pubs/docs/en/en13.htm](http://www.for.gov.bc.ca/hfd/pubs/docs/en/en13.htm)

Proceedings: [www.for.gov.bc.ca/hfd/pubs/Docs/Wp/Wp34-2.pfd](http://www.for.gov.bc.ca/hfd/pubs/Docs/Wp/Wp34-2.pfd) (5th document in)

Journal paper: [uvalde.tamu.edu/jrm/jul98/pitt.htm](http://uvalde.tamu.edu/jrm/jul98/pitt.htm)

### CATTLE-INDUCED SOIL COMPACTION IN FOREST PLANTATIONS: IS IT REAL?

Extension note: [www.for.gov.bc.ca/hfd/pubs/Docs/En/En34.htm](http://www.for.gov.bc.ca/hfd/pubs/Docs/En/En34.htm)

Journal paper: [uvalde.tamu.edu/jrm/nov99/krzic.htm](http://uvalde.tamu.edu/jrm/nov99/krzic.htm)

### SOIL QUALITY CHANGES FOLLOWING HARVESTING AND GRAZING:

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