BOOM, BUST, and BUGS:

Central Interior BC's Forest Systems Under Stress

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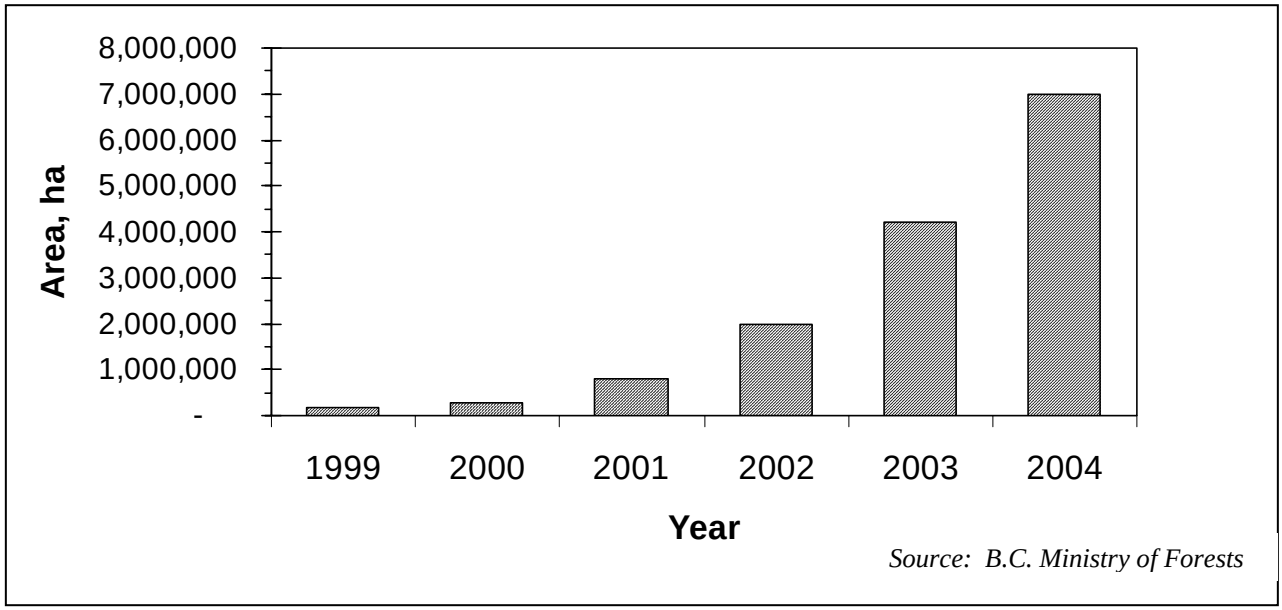
Central Interior BC's Forest Systems Under Stress

The Central Interior of British Columbia is a diverse landscape resulting from years of disturbance. The frequency and intensity of ecosystem stressors depend on a number of factors, particularly yearly weather conditions, long-term climate trends, and forest management practices. These disturbances have created a mosaic of forest ecosystems differing in species composition, age class, and structure.

In recent years, British Columbia experienced an increase in the intensity of insect-related disturbance, particularly the mountain pine beetle (MPB). At endemic levels, MPB is an integral component of a healthy functioning ecosystem. Conversely, at epidemic levels, MPB has the potential for negative large-scale impacts on forest health and socio-economics.

Analysis of the current MPB outbreak indicates epidemic levels at an order of magnitude higher than any previous outbreak in Canada – both in area of land infested and volume of trees killed. Chart 1 shows the exponential rise in the area of forest infested by MPB over the past five years. As of 2004, MPB covered about 7 million hectares of forest. In addition to volume loss, outbreaks of MPB infestations outside of parks upset harvesting plans, reduce the timber volume and the monetary gains of the high value mature trees, and cause marketing and operational problems. At the same time, environmental problems, such as loss of critical wildlife habitat, displacement of animals, and erosion of landscapes, arise when large volumes of dead pine are harvested for control and salvage purposes.

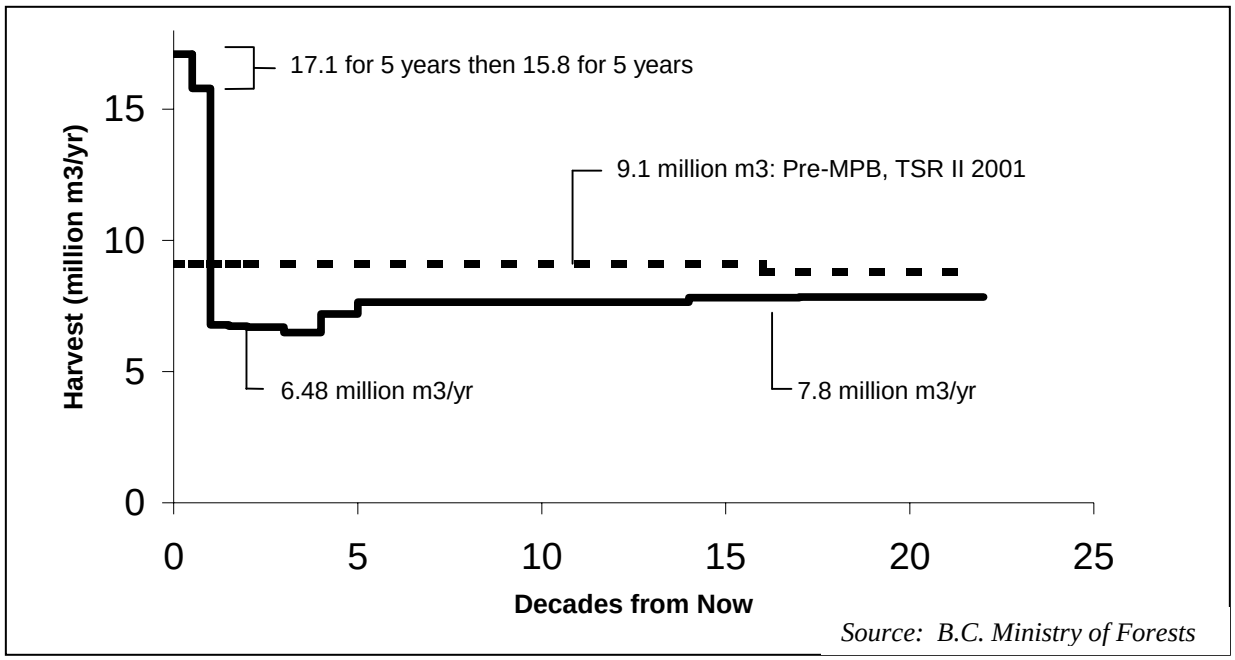
Chart 1. Progress of the MPB Outbreak, 1999 to 2004.



Source: B.C. Ministry of Forests

The impact on timber supply raises critical questions about the potential boom that results from higher levels of harvest and about the potential bust when the MPB-killed timber supply runs out. Chart 2 shows one forecast for the Prince George area. We can surmise that a more dramatic story unfolds for Central Interior BC, with greater highs and a more significant drop in timber supply levels over the next ten years. Beyond ten years the forecasted level of timber supply is significantly below pre-MPB harvest levels, which presents socio-economic and ecological challenges. After the boom of raised harvest levels, the "uplift" period, what happens when the jobs disappear? What happens to the ecological integrity of the forest?

Chart 2. Prince George Timber Supply Area Forecast



Natural History of the MPB Epidemic

The mountain pine beetle (*Dendroctonus ponderosae*) is an insect native to western North America, where it may attack large trees of any pine species. In the past 85 years, there have been four or five large-scale outbreaks of mountain pine beetle in the pine forests of British Columbia. However, in the Central Interior of British Columbia, infestation of mountain pine beetle in lodgepole pine (*Pinus contorta*) stands has reached unprecedented proportions.

The life cycle of the mountain pine beetle, its host trees, and associated fungi and other species represents a dance that sometimes spins out of control. Mature beetles (about the size of a grain of rice) burrow into the inner bark of pine trees where they lay eggs in networks of connected burrows and galleries. Upon hatching, the larvae munch their way around the tree before they emerge as adults to attack more trees. Beetle flight in mid-summer, though modest in distance, is normally focussed on a few trees by pheromone chemicals emitted by the insects. Attacked trees typically die over the course of a growing season because the function of their vascular tissue is compromised, a process that is further exacerbated by a blue-stain fungus that is symbiotically transmitted by the pine beetle.

Trees may resist attack if they are healthy and if the number of beetles is small; resin produced by trees can physically "pitch out" dozens of beetles trying to attack a tree. But if the number of surviving beetles is too high and damage by larvae too great, tree foliage will yellow over the next year or two, and the tree soon dies and all its needles turn red. Such insect attack and tree mortality has long been an integral part of natural ecological processes in pure and mixed pine forests west of the Rocky Mountains, killing mature pine trees in scattered pockets or, occasionally, in landscape-wide outbreaks. Normally limited to feeding on mature pine trees (greater than 80 years old), high populations of beetles may spill over into smaller trees (as little as 12 cm in stem diameter), though the success of larvae raised in smaller trees is poor.

The current epidemic in B.C. appears to have been spawned by a combination of human and natural circumstances. Historically, the lodgepole pine ecosystem has relied on the interaction of beetle and fire events to create a mosaic of forest age-classes across the landscape. However, widespread forest fires in the late 1800s and early 1900s (perhaps associated with exploration and settlement) have resulted in large homogeneous areas of lodgepole pine across B.C.'s Central Interior. Effective suppression of wildfires over the last 50 years has meant that much of this forest has escaped from fires that otherwise would have recycled such forests every 100 to 150 years. Consequently, this area is now largely dominated by even-aged stands of mature pine trees that are vulnerable to attack by the mountain pine beetle.

Q. Why are we facing a devastating beetle outbreak here and now?

A. With an increased number of mature lodgepole pine stands and milder weather conditions, the food source for beetles has increased and the beetle populations have exploded.

- Fire history and suppression policies have resulted in an abundance of mature, homogenous pine stands.
- Mountain pine beetle prefers mature timber (>80 years old).
- The area of forest in this age class has increased three-fold since 1910.
- Dry summers affect leave pine trees weakened and more susceptible to attack.
- Extreme winter temperatures that previously kept pine beetle populations in check have become rare.

Change in weather patterns has also contributed to the current pine beetle crisis. Dry, hot summers mean that pine trees are drought stressed and typically more susceptible to beetle attack because, under stress, they cannot produce enough resin to resist beetle attacks. Milder winters have also allowed greater numbers of beetle larvae to survive. In the past, prolonged temperature extremes (approximately -25^{o}C in the early fall or late spring) along with severe winter temperatures of (below –40^{o}C) have kept beetle numbers in check. Such extremes are now relatively rare.

Timber Impacts

Aerial surveys of red-attack (recently dead) trees have revealed that the area of forest attacked by mountain pine beetle has doubled every year or two since 1996. There were concerns that the outbreak may have originated in Tweedsmuir Provincial Park, where the lack of control actions allowed it to expand onto industrial forest lands. However, recent research has indicated that outbreaks have simultaneously sprung up throughout the range of mountain pine beetle across B.C. The B.C. Ministry of Forests now estimates that 7,000,000 ha are infected to some extent,

and the Council of Forest Industries estimates that this includes 285 million cubic metres of commercially valuable timber. There are no signs of the outbreak abating. Projections show that by 2010 the beetle will affect 10 million ha and 700 million cubic metres of timber in B.C. This area of forest represents approximately 40% of the commercial forest (or 17% of the total forest) of all B.C., and a slightly lower proportion of industrial timber stocks.

Mild winters and prevailing winds from the southwest mean the outbreak is extending further to the northeast than ever before, crossing the Rocky Mountains in the Dawson Creek area, and threatening the lodgepole pine forests of Alberta. Indeed, if the insect spreads into Alberta's boreal forests where it can feed on jack pine (*Pinus banksiana*) then there may be nothing that will prevent it from spreading across the contiguous forests of Canada and into the eastern United States.

The wood in attacked trees may take 15 years to decline to a state where it is no longer commercially useful, though decay rates vary with climate and site conditions and are the topic of active research. Forest products companies are trying to determine how long their existing facilities can use the dead trees to make lumber and pulp and paper, or whether new technologies can use the fibre to make oriented strandboard (OSB), pellet fuel, or alternative products such as bio-diesel fuel.

The province's Chief Forester is in charge of ensuring sustainable levels of timber harvest from public lands. In an attempt to stop the spread of mountain pine beetle and harvest as many trees as possible before they have no economic value, his office has twice increased the Allowable Annual Cut (AAC) in selected districts. For example, prior to the epidemic, the pre-beetle AAC in the Prince George timber supply area was 9.1 million cubic metres per year (Chart 2, above). In 2005, after the increases, the AAC is now 17.1 million cubic metres, an increase of about 88%.

Economic Benefits – Present and Future

There are now more jobs in B.C.'s Central Interior forest sector because of increased logging activity. The highways are busy with logging trucks, the log yards are full, and most mills are running at full capacity with three shifts. This increased activity means that the regional economy (including retail and service sectors) is also experiencing a boom. However, these immediate benefits to loggers, mill workers and the region as a whole are temporary. When all the usable trees are logged and when the AAC is re-adjusted downward to sustainable levels, there will be fewer jobs related to logging in forest-dependent areas.

Many of B.C.'s towns and small cities in the Interior are heavily dependent on the direct and indirect benefits of forest industries (Chart 3). The forest sector is the dominant employer in areas such as

The logging boom and bust:

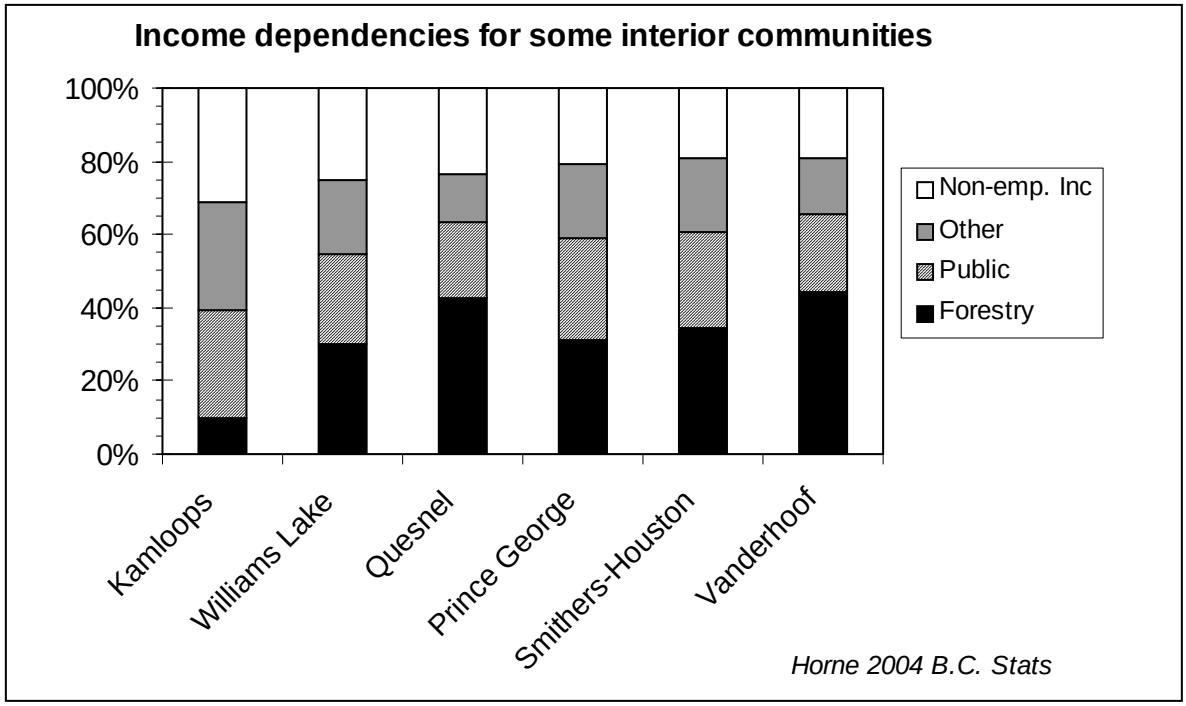
Trees under attack by the MPB may take 3 to 15 years to decline to a state where they are no longer commercially useful. To facilitate the harvesting of trees before they are no longer useful, the AAC has been temporarily increased. The increase means there is a current "boom" in the logging industry. However, this boom is temporary -- the AAC will be adjusted downward in the future to compensate for the temporary increase.

In the future, there will be a shortage of mature trees to support the forest industry because:

1) many remaining stands will contain trees no longer useable;
2) the current increase in logging is taking trees that had been counted on for future timber supply; and
3) there is a shortage of juvenile stands or middle-aged plantations that might bridge the timber supply gap.

Williams Lake, Prince George, and the Bulkley Valley; more than 40% of the income in Quesnel and Vanderhoof is directly dependent on forest harvesting, milling, and silviculture. For every forestry job in B.C., there are another 0.5 to 0.7 associated support jobs. These employment patterns make community health and vigour potentially sensitive to changes in forestry activity, with implications to the housing and construction sectors, retail businesses, schools and recreation needs, and so on.

Chart 3. Income Dependencies for Interior BC.

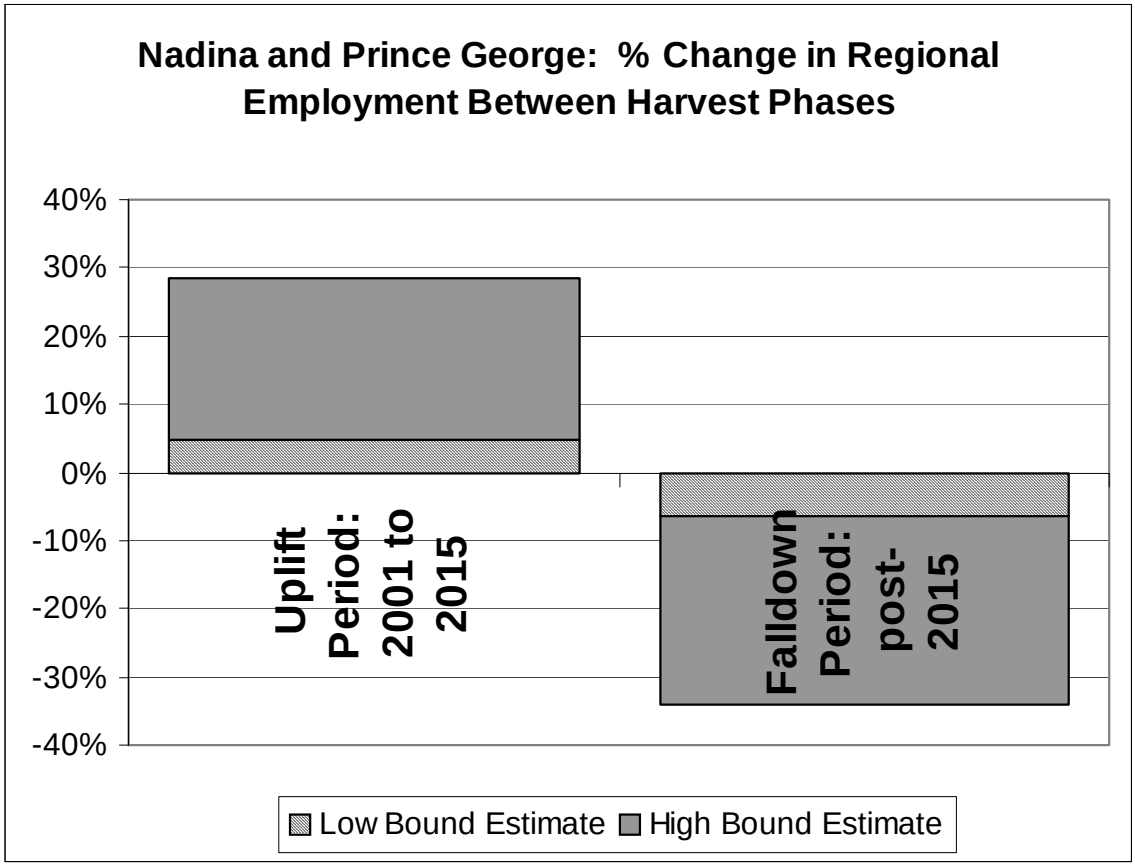


Socio-economic impacts have been forecast using complex models or simple employment multipliers. In the Prince George area, for example, one scenario forecasts that in fifteen years, there will be approximately a 15% decrease in the AAC from pre-uplift levels. Total regional revenues are then projected to drop by about 5.5% (ca. $580 million) and there will be a loss of about 2600 jobs with an accompanying decrease in total labour income of about $99 million (Patriquin 2005).

Chart 3 (on following page) shows potential economic impacts of the change in harvest levels. The first bar is the low and high bound estimate of percentage change in employment (2001 base year employment) for the Nadina and Prince George Forest Regions (includes Burns Lake, Vanderhoof, and Prince George) during the "uplift" period. The second bar is similar, using the uplift employment level as the base, but for the “falldown” period (shown as post-2015). The lower bound estimate assumes a small impact on new forestry sector employment generated by the increased harvest levels and a low impact on employment generation in other sectors of the regional economy. The upper bound assumes the opposite. These bounds were estimated using published estimates on harvest-forest sector employment multipliers and provincial forest sector employment multipliers.

Economic impacts studies suggest two very different futures. The most likely scenarios fall within the low-bound estimates. Yet, there is lots of uncertainty with regard to the magnitude, timing, and specific geographical location of the impacts. It is not known, for example, exactly if or where new mills might be built or existing mills might expand. Where do

Chart 3. Percent Change in Regional Employment



employees reside and spend money? Which mills will be closed when the timber supply decreases?

It may be possible to offset the impact of job loss through planning. For example, development of a secondary wood product sector could keep people employed in wood related industries or an increase in mining activity could also keep the economy going. Development of tourist attractions could bring visitors to come to the area, creating employment and keeping retail and service sectors engaged. However, tourism is seasonal so work in this sector would be seasonal and wages would be lower. Therefore, the post-beetle economy is likely to be somewhat depressed when compared to present levels.

Ecosystem Impacts of the Mountain Pine Beetle

Dead forests mean altered hydrology. Reduced transpiration means that water tables will rise and some soils will become waterlogged. The effect of waterlogged soils is already being felt by logging contractors and forest firefighters as heavy equipment becomes bogged down in the wet soil of sites that would normally pose no problems.

The current scale of clearcut logging is unprecedented in western North America. In an attempt to offset the impact of this logging the Chief Forester has ordered a 20% retention of within-stand structure (e.g., wildlife tree patches, streamside buffer strips) in logging plans. Whether these patches of standing trees, often dead or limited to the edges of cutblocks or on wet ground, will maintain wildlife habitat and ecological integrity has yet to be determined.

Accelerated logging and access development mean greater habitat fragmentation and easy access for hunters and poachers. While woodpeckers enjoy feeding on the larvae of pine beetles, marten and squirrel habitat is reduced because both of these species need closed conifer cover for food and nesting. There are also concerns that wide expanses of fallen trees, ten to twenty years from now, will obstruct caribou migration.

Environmental Impacts:

- Altered forest hydrology is having an impact on forest soils, with consequences for site ecology and equipment operation.
- Retention patches may help to maintain ecosystem integrity within the large cutblocks now being made, but their quality and effectiveness are uncertain.
- Animal habitat and movements will be affected. Beetle larvae provide an increased food source for some woodpeckers but habitat for animals that depend on closed canopy structure is being reduced.
- Intensive roads and forest fragmentation provide easy access for hunters and poachers, and may promote some predators and invasive species.
- Amenity values in parks, campgrounds value may be compromised; residential property values may decline.
- Future planning may include planting of mixed species stands, relaxed fire control efforts in selected areas, and prescribed burns in an attempt to control future outbreaks.

Based on what has been learned about the spread of mountain pine beetle in homogenous stands of pine, thought is being given to replanting mixed species stands. Consideration is also being given to broader “let burn” policies in unroaded wilderness, and to the use of prescribed fires to control pine beetle populations and induce forest renewal.

Amenity values of parks, campgrounds, rest areas, and private residential property are being compromised. Will people visit parks, campgrounds, and fishing lodges that are dominated by dead trees or clearcuts? Will residential property values decline as the beetle invades private property in towns, cities, rural subdivisions and ranches?

Points to Ponder

This case study of ecological disturbance and associated community impacts raises a number of unresolved questions and concerns:

- Could such an outbreak have been prevented or at least predicted? What key elements of scientific research or forest policy were inadequate?
- Are Provincial policies of fire control and timber supply regulation based on a sound understanding of ecosystem dynamics?
- Will mixed species planting or the use of prescribed fires help to control future beetle outbreaks?
- Are we paying the price for homogeneous forests and single-industry towns?
- What will the economy of Prince George and area really be like in 15 or 20 years? Are dependencies on the forest industry really that tight, or is there great resilience in the health and vigour of our communities?
- Are we planning adequately for an economic downturn? How can such planning be improved?
- Should residential property owners be compensated for beetle damage on private property?
- Is job creation and economic diversification through increased tourism a realistic vision for the future in this area?

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