

Technical Background Information
A Progress Report on the 2006 ABCFP¹ Status of Forest Inventory
Recommendations: Detailed Findings and Comments²
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Introduction

In 2006 the Association of BC Forest Professionals (ABCFP) commissioned a report on the Assessment of the status of forest inventories in British Columbia (Moss *et al.* 2006). The report contained a vision of the inventory along with 19 recommendations. The purpose of this report was to determine what progress has been made in fulfilling the 2006 vision and recommendations. The vision and recommendations were reviewed on October 4, 2011 in an interview with Ministry of Forests, Lands and Natural Resource Operations representatives. The discussion was confined to the subject matter at hand as a means of providing factual information related to the issues raised in the original report. The results of this discussion are reported herein as findings. On the basis of these findings overall conclusions are then made independently as to the current status of the inventory.

Background

The 2006 report was written at a time when responsibility for the vegetation inventory was recently returned to the Chief Forester and the Ministry of Forests and Range (MoFR) after being housed within the Ministry of Sustainable Resource Management. The Ministry of Forests was in the process of undertaking a “value for money” review (Anonymous. 2009) with extensive input from the community of interest, including professionals in government and industry (including consulting) who were involved in some way with inventory design, development and implementation following from the introduction of new Vegetation Resource Inventory Standard (Resource Inventory Committee 1995). During this period of time inventories were initiated at the request of licensees subject to submission of an inventory business case and with ensuing inventory implementation plans, all subject to approval by the Ministry of Forests and Range. Funding was provided through the Forest Investment Account (FIA), an account funded by the BC Government, and administered by Price Waterhouse Coopers (PwC). The Vegetation Inventory Advisory Council was also being initiated to provide strategic oversight for the VRI program by clarifying issues, developing and assessing options, and making recommendations for consideration by the Chief Forester.

Since the time of the ABCFP 2006 report there have been substantial changes in the forest inventory management environment. Provincial forest related revenues have declined sharply (MoFR 2010). Mountain Pine Beetle damage continued to accrue with an estimated 17.5 million hectares affected as of 2010 (MFLNRO 2011e). Forest fires burned an estimated 331 thousand hectares in 2010 and 229 thousand hectares in 2009 (MOFLNRO 2011). Direct changes in the forest inventory program are as follows:

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- In October 2010 the Ministry of Forests and Range was split in two to produce the Ministry of Forests, Mines and Lands and Ministry of Natural Resource Operations (Parfitt 2011b). In March 2011 another shuffle reconnected the former Ministry of Forests into the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) as of March 2011 under a “One Land Manager” concept (MFLNRO 2011).
- Funding and management of forest inventory activities under the Forest Invest Account (FIA) Land Based Investment Program (LBIP) were transferred to the MFoR from PriceWaterhouseCoopers (PwC), starting in 2011/2012 and continued as part of the operating budget for MFLNRO.
- In 2010 Ministry of Forests layoffs amounted to 245 positions with a total staff reduction of 1006 positions since 2001 (Parfitt 2010). In the workforce adjustments of 2009-2010, reductions in the number of inventory positions was moderate relative to staff reductions in other programs.
- As of October, 2011, the inventory program has 24 staff listed as being dedicated exclusively to forest inventory and several additional staff providing part time support in areas such as IT, biometrics, inventory database management and reporting, financial and administrative support, and branch management). The total number of Full Time Equivalents (FTE's) dedicated to the program is 27 plus 4 additional staff working on the Tree and Stand Simulator (TASS) who were transferred from the now defunct Research Branch.

Table 1. Estimated annual BC Inventory staffing levels and expenditures between 2004/05 and 2011/12 fiscal years.

Fiscal Year	Inventory Staff FTE's	Expenditure \$ (millions)
2004/05	40	6.4
2005/06	38	10
2006/07	40	13.3
2007/08	41.5	13.7
2008/09	35.5	12.2
2009/10	34.5	4.6
2010/11	27	6.1
2011/12	27	8.4

Status of Forest Inventory – 2006: Update

This report provides an indication of the level of progress toward fulfilling the 2006 ABCFP inventory vision and recommendations. It is not a comprehensive assessment, such that certain aspects of the findings may require further verification.

This update will start with a restatement of the vision provided in the 2006 report. This will be followed a statement regarding a summary of its current status and comments will be added as needed to provide context and that may provide further assessments identifying related concerns that are require further substantiation. A similar format will then be applied to address each of the 19

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recommendations made in the summary report in the order that they were presented. The subject will be closed with a few concluding remarks.

1) Vision

The inventory of BC forests is sufficiently well developed and managed to support the design, development and implementation of timely, efficient and effective forest management practices necessary to produce strategically desired outcomes and impacts across large landscapes and areas of the province in perpetuity.

In particular it should:

- provide useful information as needed and on time, allowing managers and practitioners to make effective forest management decisions;
- be supported with sufficient resources to be current, of known standards and degrees of reliability, and represent complete coverage for forested lands of BC as a whole;
- be continuously improved through investment in research, development and implementation of new technologies and techniques for data acquisition, organization, analysis and reporting results;
- be routinely assessed with reports made on the current state of the inventory, recent applications, and progress made in research and development, and adoption of new technologies and techniques; and,
- be guided by the development and implementation of an annually updated strategic plan, including a forecast of the resources necessary to achieve the plan.

Finding

One important application of the current inventory is by the Chief Forester in undertaking strategic Timber Supply Reviews. In these reviews the Chief Forester outlines any concerns relating to inventory and gives direction as to where deficiencies are to be resolved in time for the next review. Given the limited inventory budget, the level of disturbances, particularly MPB and the downstream effects on communities and resources, re-working adequate inventories simply to get them to conform to the VRI standard is not a priority. Instead investments in inventory are currently being directed according to principles of risk management, primarily driven by the rate of change in inventory characteristics (e.g. shelf life of trees for timber), potential economic and social impacts of these changes (e.g. employment and community stability), and resolution of uncertainties important to mitigate the impacts where rapid change is occurring or has occurred (e.g. knowledge of levels of stocking, sizes, distributions and species composition of understory trees important for estimating mid-term timber supplies).

Comment

Additional commentary on the importance of inventory to forest management was provided at a recent public meeting under the sponsorship of the Healthy Forests, Healthy Communities initiative in Port Alberni (Appendix A4). The discussion clearly identified inventory as being critical to the estimation of “sustainable yield”, and as a result as being necessary to underwrite “infrastructure investment”. Industry was identified as needing to be “active and willing partners” in the inventory process, underscoring inventory as a shared responsibility, potentially involving many stakeholders. The public meeting was remarkable from the standpoint of recognition of these linkages, underlining the importance of the above mentioned Vision.

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2) Clear Lines of Responsibility

Recommendation #2: Responsibility for the forest inventory should be returned to the Chief Forester under the *Forest Act* (Government of British Columbia 2011).

Finding

The Chief Forester has responsibility for inventory. This responsibility has not changed since the Chief Forester was reinstated with this responsibility during the closing of the Ministry of Sustainable Resource Management (Ministry of Forests and Range, 2005). With this responsibility the Chief Forester has direct line authority over the inventory staff, budget, and program. There is no reference in the current BC Forest Act assigning responsibility of inventories to the Chief Forester (Government of British Columbia, 2011).

Comment

“The British Columbia Forest Act (1978) states that the Chief Forester shall develop and maintain an inventory of the land and forests in the Province, and shall assess the land in the Province for its potential for growing trees continuously, providing forest oriented recreation, producing forage for livestock and wildlife, and for accommodating other forest uses. Also, the Ministry of Forests Act (1978) requires a periodic resource analyst report containing a description of the inventory of the forest and range resources in the Province, a description of the location and extent of areas of forest land in the Province that have been denuded of timber through harvesting or otherwise and have not become restocked with a commercially valuable species of timber, or are producing timber at the rate that is substantially lower than their potential. In addition, the Minister of Forests is required to submit to the Lieutenant-Governor in Council an annual report which must include a summary of forest land in the Province, showing areas denuded of forest during the year, areas restocked during the year and areas the productivity of which has been improved during the year.”

Ministry of Forests 1982

The clause relating to, “... development and maintenance of an inventory of the land and forests of the Province” is no longer in the Forest Act (see [RSBC 1996] Chapter 157 Part 2 – Classification and Management of Forests and Forest Lands and Regulation of Cutting Rights). In 2007 the Chief Forester indicated to the ABCFP that legislation did not necessarily protect stability of the program and that he was therefore satisfied that legislation was not required.

Recommendation #6: We endorse the formation of a vegetation inventory council and encourage the group to play a major role in strategic planning for the forest inventory as well as providing general advice on inventory issues.

Finding

- The Council has been disbanded. Interest waned as the delivery model changed and with the reduction in inventory foresters in industry.

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Comment

A number of factors led to the disbandment of the council including:

- The Forest Investment Account no longer supports funding of inventories and as a result Licensee funding has declined. Inventories are now funded under the Land Based Investment program.
- There has been decline in Inventory Foresters employed by the forest products industry.

Internal MoFR business processes fulfill some or all of the functions executed by the Council. Specific details as to how this is done and with what kinds of results was beyond the scope of this review. In 2006/07 the council was just in the process of being formed.

3) Stable and Adequate Funding

Recommendation #1: Secured, multiyear targeted funding sufficient to support annual inventory costs should be sought, preferably from the BC Treasury Board.

Finding

- Operating funds (excluding salaries and office expenses) for 2011/2012 are at 6.2 million dollars (Table 1 estimates include Salaries; Note that the 2011/12 to 2013/14 MFLNRO (2010b) Land Based Investment Strategy indicates \$ 61.1million for 2011/12. Specific activities are also highlighted in Appendix 2, pages 20 to 24).
- The total budget allocation for this year is estimated at \$8.4 million (Appendix 2; Nussbaum and Snetsinger, 2011). This compares with 6.1 million allocated in 2009/10, 6.1 million allocated in 2010/11, and to the long term average (April 1989 to March 2012) of 15.4 million.
- The 2011/12 Forest Analysis & Inventory Branch Business plan has a proposed budget allocation of \$12.065 million, with 5.045 allocated to salaries, \$0.8 million allocated to operating funds, and \$6.22 million allocated through the Land Base Investment (LBIS) program.

Comment

Funds continue to be acquired on a year-to-year basis but forest inventory remains a high priority within the BC MFLNRO, subject to limitations of funding allocations. The MFLNRO competes with other Ministries for annual funding allocations from Treasury Board according to the priorities of the elected Government. In the original summary report this recommendation was prefaced by the following remarks (Moss et al. 2006):

“... Most of the current funding in BC is dependent upon forest licensee support through the Forest Investment Account allocation. This is not consistent across the province or over time. Furthermore, maintaining an update and reinventory process to ensure currency of information, and effectively storing and managing archival data are difficult without adequate baseline funding.”

The MFLNRO now retains full responsibility for the funding of inventory programs through Treasury Board and for delivery of inventory products. The outstanding issues are with respect to the need for “multiyear” funding as identified in the recommendation, and whether or not inventory funds are “stable” and “adequate” as identified in the title to this section. The funds are “targeted” following the risk management process deployed within Forest Analysis and Inventory Branch.

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Exactly what constitutes adequate funding and for not purpose was not clearly articulated in the 2006 report. This piece of information is necessary for a more complete evaluation of this criteria. The following base activities are suggested for inclusion:

- inventory updates (natural and human disturbances and landscape dynamics),
- reinventory,
- growth and yield (permanent sample plots, volume and biomass estimation, carbon flux and balance estimation, site productivity and climate change, multilayer and complex tree and stand dynamics, species and species-x-site interactions, regeneration and understory characteristics, stand damaging agents and the potential for further natural disturbances),
- monitoring (comparison of strategic versus operational outcomes on the scale of individual TSA's or operating units underwritten by proper ground sampling and measurement/remeasurement protocols as is common in many jurisdictions in Canada and throughout the world), and
- routine (5 year) reporting (change in inventory due to growth and depletion, including sources of depletion, and inventory accounting procedures, on the scale of TSA's and the Province as a whole and accompanies by maps indicating where the changes have taken place).

Based on conversations with a number of individuals knowledgeable about inventory requirements, preliminary estimates of sufficient funding ranged from \$10 to \$25 million per year, with a suggested "reasonable figure" of 15 million per year.

Recommendation #12: To ensure continuity and develop expertise in the full range of forest inventory activities, including field measurements, photo interpretation and data storage, analysis and reporting, additional staff should be hired within government.

Findings

- As of October, 2011, the inventory program has 24 staff dedicated exclusively to forest inventory (see Appendices 1 and 2), and several additional staff providing part time support in the areas of IT, biometrics, inventory database management and reporting, administrative support and management (see Table 1). The total current compliment of staff is equal to 27 full time equivalent (FTE). In 2006 there were 40 FTE devoted to forest inventory within the MoFR.
- Nussbaum and Snetsinger (2011) report the following "Forest Analysis and Inventory Challenges to Achieve Success":
 - "Staff levels – The number of branch staff has declined in recent years with workforce adjustment and restrictions on filling vacated positions. Low staff levels pose a challenge to program capacity and continuity in many work areas. Risk from low staffing levels are being partially addressed through contracting certain tasks, careful program planning and priority setting, optimal matching of staff to projects, and cross training. When opportunities arise through the ministry's Managed Staffing Strategy, the branch will seek permission to fill vacancies."
 - "Increased Operational Role – The change in inventory delivery model has increased the operational role for inventory staff. This shift creates challenges as staff are undertaking roles they have not played for some years (such as directly managing large inventory contracts). These risks and challenges are being managed by the designation of the LBIS program administrator, the implementation of sound project management processes,

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- targeted additional training on contract management, and the formation of staff groups (such as VRI operations group) to share best practices.
- “IT restrictions – Over the last few years, expenditures on IT have been tightly constrained. The work of the branch is heavily dependent on IT. IT restrictions pose risk to continuity of programs and hamper efforts to improve efficiency. To address IT risk, the branch will continue to put forward business cases to IMG (Information Management Group) for IT spending at every opportunity. In addition, the director will champion the branches IT’s needs at senior levels.”
 - The Forest Practices Board (2011; Board Commentary):
 - “The Board also has two immediate concerns regarding the reductions in forest ministry staff dedicated to reporting [harvesting and silviculture activities]³. First, the unexpected loss of one or two individuals would put the entire reporting system in jeopardy – there is little or no redundancy. Second, there is a great deal of very useful and valuable information about the history of forest management contained within the database. Unfortunately, there are few people (perhaps only one or two) who have a complete understanding of the data. It is critical that those people pass that understanding on before they leave the field.”

Comment

Direct comparisons are difficult but this figure appears to represent the lowest compliment of staff in the last 10 years. The current compliment of staff is able to manage the existing program at 6.2 million of funding and all of the necessary functions necessary to implement the program as designed are fulfilled (see findings under “Forecasting and Linking Historical and Spatial Data”, recommendation #8 below). The focus is on delivery of Phase I (unadjusted photo interpreted) inventory, and inventory audit with consideration for Phase II inventory at a broader regional level. Any loss or reduction in staff would cause a gap in the delivery of these functions. Attrition targets within government constrain the ability to plan for and manage staff succession, but the Forest Analysis and Inventory Branch is pursuing utilization of University Cooperative programs in the future (next year) to introduce new people to the field and to encourage development of expertise that could help to fill positions when that becomes a possible.

The delivery of the inventory program is partly dependent on staff and also on their ability to acquire (also a funding issue), access and manage information technology needs to obtain maximum effectiveness and efficiencies. This amounts to requiring the necessary tools and the ability to access those same tools to do the job. Forest inventory work is computationally demanding in terms of the volumes of data that must be handled and their complexity. It requires sophisticated software and hardware that can be adapted to manage and analyze data for the purpose of producing customized information (i.e. fit for purpose) necessary to support effective and efficient strategic allocation of funds throughout the Province. A complete understanding of the adequacy of staffing levels requires that these issues also be addressed. It is suggested that more control over these kinds of resources, including access to manage them “as needs be, when needs be” is required to better meet the inventory needs.

³ Information in parenthesis added for completeness.

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4) Effective Quality Assurance System

Recommendation #19: The quality assurance system needs to be monitored for effectiveness, and modified when necessary, as the inventory system evolves.

Findings

- There is a quality assurance process for delivery of Phase I and Phase II Vegetation Resource Inventory.
- All contract work is overseen by MoFR inventory professionals.
- The inventory program follows a direct delivery model, ultimately responsible to the Chief Forester.
- There is a formal change management process in place that allows for users of the inventory as well as inventory specialists to make recommendations as to changes in the inventory.
- See Forest Practices Board (2011) findings under point number 9 below.

5) Accessibility of Data Products

Recommendation # 9: Public access to summarized products should be supported.

Finding

- Public access is being supported through various government portals (e.g. MapviewBC, GeoBC) and has advanced since 2006, but there is no one location where inventory data and information can be obtained.
- The entire provincial inventory (polygon attributes and spatial file) is available for download. Users can access this data through the Forest Analysis and Inventory Branch (FAIB) web site: <http://www.for.gov.bc.ca/hts/vridata/>, GeoBC's data distribution site: <http://apps.gov.bc.ca/pub/dwds/home.so>, and DataBC.
- The FAIB web site contains many products (reports, data sets, and maps) that provide public access to inventory information
- There is not complete inventory coverage, particularly as it pertains to some Tree Farm Licenses, Parks, and private lands.

6) Reporting

Recommendation # 18: A regular series of reports, applicable to broad regions in the province should be produced to inform the public on the state of the forest. In association with these reports, appropriate metadata should be documented for possible future use by practitioners.

Finding

- BC State of the Forests reports were produced in 2004, 2006 and 2010 (MFLNRO 2011c).
- The ministry summarizes forest inventory information each year and posts the summaries on the web (see for example the 2009 summaries at: http://www.for.gov.bc.ca/hts/vridata/reports/2009/report_2009.html).
- There is no formal, routine, periodic regional or subregional (e.g. TSA) inventory reconciliation reports on estimated and ground verified changes due to growth, depletion according to various sources, and reinventory.

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Comment

Inventory updates are being executed for manmade (anthropogenic) disturbances. The status of this activity with respect to salvage logging in small patches of forest was not included as part of this update. Natural disturbances due to MPB and fire as well as other agents are being mapped on an annual basis but this information is recorded separately and used in the process of developing initial forest conditions for the purpose of Timber Supply Review. With an algorithm based on Landsat data, a preliminary partition of polygon volumes into live and dead has been completed for all MPB-affected areas. The ministry plans to refine this adjustment over time and replace it as re-inventory progresses. This review did not address the question of whether or not these records are up to date in terms of entering the data and making these available for analyses. Emphasis with respect to ensuring that the data is current and complete is placed on those areas of the province where Timber Supply Reviews are soon to be initiated.

7) Support of Innovation and Research

Recommendation # 11: A component should be included in the baseline inventory budget to support research into possible new technologies and methods that could be used to improve forest inventory procedures.

Finding

- There are approximately 200 thousand dollars of operating funds and 300 thousand dollars of staff time allocated to innovation.
- Upon dissolution of the Research Branch, 4 members of staff conducting work in maintaining TASS II and in developing TASS III (a combined single layered, multi-layered and complex individual tree and stand simulator that is being developed for 3rd party use) have been transferred to Forest Analyses and Inventory Branch, but are not included as part of the Inventory Staff identified in Appendix I. The development of TASS III is continuing and has been eagerly anticipated by the broader growth and yield user community.

The following activities were identified in this category:

- Landscape Vegetation Inventory (LVI): This is an initiative to populate the VRI inventory using a combination of Landsat imagery and small scale Digital Camera System (DCS) stereo photo pairs (e.g. similar to the older 70 mm lens photography) that are used to provide sample points for Vegetation Resource Inventory Phase I labeling. The photo plot locations and data are related to Landsat Imagery derived polygons for the purpose of imputing VRI attributes in polygons without photo plot samples. This work has been carried out in Wells Gray Park and Quesnel and is continuing to be developed for use in other areas.
- Digital Camera System: The ministry has developed its own camera system and image processing for this technology. In addition to its use on LVI (above), DCS technology has been used to sample understory characteristics in MPB impacted stands.
- MPB Year of Death mapping: Using Landsat for temporal change detection, year of death from MPB was estimated for grid cells over the entire MPB affected area and applied to the provincial inventory.

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- New forms of imagery: Technological change is rapid in the field of imagery. The ministry monitors development in this field, and tests and adopts new imagery as it becomes economically viable. For example, in 2011 the ministry is testing high resolution satellite data for polygon delineation and attribution, and the ministry switched from film to digital imagery for the majority of its air photo acquisition.
- A forest inventory pilot study was done using LiDAR and multispectral imaging with University of Victoria in TFL 18 (Niemann, 2007).
- Inventory staff are responsible for staying up to date with advancements in technologies in their fields. As part of their broader responsibilities, two members provide reports and recommendations as requested by the Chief Forester.

Comment

The philosophy is that is that technology will lead the way as it becomes cheaper to purchase and deploy. Where the technology can compete with more conventional Phase I photo interpreted Vegetation Resource Inventory consideration will be given to deploying it on a more operational scale. The degree to which such technologies can fulfill user's needs is a matter to be evaluated as part of the innovation process, but once again, the primary focus is on high-level, strategic uses of the inventory such as Timber Supply Reviews.

8) Currency

Recommendation # 15: The existing inventory update program should be supported and used throughout the forest lands of BC.

Finding

- There is no fundamental disagreement about this recommendation.
- See separate document accompanying this report: "InventoryData Vintage 2011-05-18.pdf"
 - Data gaps (some TFLs and private land) show as grey.
 - Most of the oldest inventories (red, pink, and orange) are in the larger parks and in the more remote portions of the Cassiar, Nass, western Fort Nelson, and northern Mackenzie TSAs.
 - Several of the inventory projects underway this year are targeted in the remaining red, pink, and orange (oldest inventory) areas - including the re-inventories of Haida Gwaii, Mid-coast, and 100 Mile House TSAs that are currently underway.
 - New inventory projects planned for 2012-13 will address additional red/pink/orange areas. For example, we plan to use the new LVI method in the western portion of Williams Lake TSA where some areas with very old inventory exist.
 - The map portrays mapsheets. The table below provides a count of mapsheets by inventory vintage class from the attached map. The data was extracted May 2011 so some recently updated mapsheets are not shown as updated.

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Table 2. Number of mapsheets and % of mapsheets by inventory year as of May, 2011. The figures are approximately correct.

Inventory Source Year	# maps	% of mapsheets
< 1960	129	1.8
1960-1969	295	4.2
1970-1979	1670	23.9
1980-1989	842	12.0
1990-1994	1015	14.5
1995-1999	1437	20.5
2000-2004	548	7.8
2005 +	<u>1058</u>	<u>15.1</u>
All	<u>6994</u>	<u>100.0</u>

Comment

The extent to which this being carried out is contained within the risk management paradigm used to administer provincial inventory activities.

9) Coverage and Sufficiency

Recommendation # 3: Higher priority should be placed on obtaining current, complete coverage of all forest lands, using VRI standards at least at a basic level of forest inventory information. The basic level inventory information should be sufficient for the Chief Forester’s mandate of sustainable forest management at the provincial level.

Findings

- There are budget restrictions.
- At the moment within the risk management paradigm the most pressing needs are identified with respect to estimating the amount of live and dead timber in MPB affected stands and in estimating understory characteristics within the confines of the Phase I Vegetation Resource Inventory. This is given priority over obtaining complete and current inventory in some remote areas of the province.
- As re-inventories progress, gaps in coverage are being filled.

Some gaps remain (primarily private land and some TFLs; Parks are included in the inventory but some of the inventories are very old).

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Recommendation # 4: For all areas currently under development, complete and current inventory information at a more detailed level should be available that allows the Chief Forester to minimize the risks of decisions at a management unit level.

Finding

- There are budget restrictions.
- The current focus of the inventory program is to ensure that the data of sufficient quality and currency to underwrite periodic Timber Supply Reviews and other high-level, strategic uses. The focus is not on advancing higher resolution more detailed and accurate inventories in areas with an adequate, basic inventory, if this kind of investment is to be had at the expense of improving a poor inventory somewhere else in the province where the need is very high.
- The prioritization process, and the ongoing activities of the inventory program, result in continuous improvement in inventory information and more current, complete and detailed information for priority areas.
- The Forest Practices Board (2011) recently completed a review on the state of government's database and that houses the annual Licensee Reporting requirements (REporting Silviculture Updates and Land status Tracking System or RESULTS) under Section 86 of the Forest Planning and Practices Regulation. Their findings are as follows:
 - "Reports about the location and amount of area harvested were submitted as required. However, for the requirement to submit and update forest cover maps there were high-levels of non-compliance because of a combination of late, missing and incorrect information. This non-compliance has, at least in part, caused government to have limited success in updating the province-wide forest cover map. As a result, the map cannot be used to portray the consequences of forestry activities in the landscape context."
 - "The reports about trees retained for wildlife and biodiversity are fraught with problems. There have been several changes in reporting procedures over time, and the reporting system has never enforced the correct procedure. The result is very high rates of incorrect reporting. Since 1995 government and the forest industry have put significant effort into retaining wildlife tree patches for wildlife habitat and biodiversity, but government is unable to consistently identify where those areas are and thus cannot protect them from future harvesting.
 - "Government has not put in place a process for reporting wildlife habitat features or resource features, which is not a problem yet because – with very few exceptions – government hasn't identified any of these values in the legislation, so there is nothing to report. But as wildlife habitat features and resource features are identified, this will become a problem in the future."
 - "The section of legislation requiring reporting of road construction and deactivation were repealed in 2008, and the system for recording the information was eliminated. This reporting requirement was supposed to be transferred to new resource roads legislation, but the legislation is not in place. As a result, since 2008, the effects of roads, outside of cutblocks, on forested landscape are unknown.
- Vegetation Resource Information Management System (VRIMS) is now undergoing final testing and will be operational this year. It will incorporate depletion data provided by licensees to update the inventory on an annual basis. The currency and quality of the updates will be dependent on data submissions into RESULTS, new Landsat imagery, and all other available

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sources. Quality assurance mechanisms are in place to maintain data integrity. Over the coming year, we will be developing criteria for inventory replacement or enhancement.

Recommendation # 17: Regular periodic reviews of forest information needs in light of present inventory standards and procedures and expected future changes should be conducted.

Finding

- The MFLNRO (2011f) has a formal process for change management that was implemented in 2004/05, 2005/06, 2006/07 and 2008/09 and is currently underway as of writing this update in 2011.
- Several processes, ranging from informal discussion with data users to more formal processes such as TSR, provide the inventory program with reviews of forest information needs.

Comment

Also see change related activities that are being implemented by MFLNRO (2011d).

10) Forecasting and Linking Historical and Spatial Data

Recommendation # 7: A program to forecast inventory attributes for strategic planning and decision making under a variety of stand conditions should be part of the forest inventory program and should be part of the strategic plan.

Findings

- A program to forecast inventory attributes is part of the larger forest inventory program and part of the strategic plan as reflected in the 2011-12 FAIB Business Plan (<http://www.for.gov.bc.ca/hts/vri/>).
- TASS II is an individual tree, distance dependent model that has been used extensively in Timber Supply Reviews to simulate regenerated (planted) stands (primarily even aged). Outputs from this model are delivered for use in Timber Supply Analysis via TIPSy.
- TASS III is also an individual tree, distance dependent model. It continues to be under development, ultimately for use by third parties, after responsibility for this activity was transferred from the former Ministry of Forests and Range Research Branch to the Inventory Section, Forest Analysis and Inventory Branch, along with 4 members of staff. The initial model development focuses on Interior Douglas-fir and lodgepole pine in single layered, multi-layered and complex stands. Longer term plans are to continue development with incorporation of other species.
- VDYP7 has been predominantly used to forecast the growth and yield of natural stands; this model is a whole stand model with limited inputs relating to structural differences.
- SORTIE is an individual tree, distance dependent model that has increased flexibility to explore impacts of a wide variety of ecosystem and ecophysiological parameters on patterns of stand development.
- PrognosisBC is an individual tree, distance independent growth model that has been calibrated for use primarily in multi-layered and complex stands of various species in a number of biogeoclimatic variants in the southern and central portions of the BC interior. This model continues to be available for use but is no longer being supported for development.

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Comment

Completion of the first phase of development in TASS III has been delayed while technical issues are being resolved. The primary concern is the length of time it will take adapt this model to the wide variety of stand conditions in the Province. This concern is exacerbated by the decision to no longer support development of PrognosisBC, presumably due to limitations in staff and funding. The allocation of funds for further development of SORTIE was not addressed in this review. Work involving the use of permanent sample plots is currently being undertaken by Forest Analysis Branch to compare the tree projections produced by all of these models relative to the actual measured changes in plot characteristics over time.

The primary concern is that it may be a number of years before individual tree growth and yield models are developed for the wide variety of sites, species compositions and stand structure conditions found in the province. In addition, there is currently no systematic way for utilizing individual tree models in conjunction with the inventory since the inventory does not carry information at the scale of individual trees (i.e. tree lists or stand and stock tables assigned to individual inventory polygons or groups of polygons). These kinds of (individual tree) models are believed to be more realistic in their accounting of growth trajectories in terms of changes in diameter distributions, but they have not generally been found to perform better than whole stand models in terms of forecasting changes in whole stand statistics involving height, crown closure, basal area, stems per hectare and volume for example. The importance of these issues is recognized by MFLNRO. The scope of development activities are limited by funding and competing priorities.

Recommendation # 8: The program to maintain and measure a system of repeatedly measured ground plots (permanent sample plots) must be continued and augmented as part of the forest inventory program to support the development of forecast models and to monitor stand dynamics.

Findings

- The ministry no longer adhere's to a fixed remeasurement schedule for its PSP's. No inventory program PSPs have been remeasured in the last two years. Research program EPs continue to be re-measured.
- PSPs are stored in a secure location.
- They are currently being used for validation purposes as described above.
- The plots are being maintained by periodic visits to ensure that tree tags and plot centre locations remain intact and in place.
- The ministry is initiating a re-measured permanent monitoring plot program targeting young stands in MPB affected areas.
- The MFLNRO (2011g) recently published a discussion paper on, "A framework for implementing second growth stand monitoring in British Columbia". This proposal would contribute to increasing knowledge of the early development phases (between free growing and 50 years of age) of stand development; an area that is deficient at the moment.

Comments

Consideration is being given to remeasuring MPB impacted plots. Given the concern for climate change, the need to estimate carbon balances, and the centrality of having an empirical understand of growth as well as yield; this being central to the sustainability of forests, the decision to put the program in

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abeyance is a concern. Limited budgets and perhaps a lack of recognition of the potential to utilize these plots for a broader set of applications has led to this decision, along with competing priorities. The discussion paper referred to above may be a necessary component of monitoring forest and stand development patterns, but it would not be sufficient for representing the wide range of stand conditions within the Province.

Recommendation # 10: Historical records of past inventory data, procedures and standards should be archived to the greatest extent possible.

Findings

- Forest inventories have been archived annually since 2002 and an archive is available as of 1990.
- The change management procedures provide documentation of proposed and accepted recommendations regarding changes to inventory procedures.
- Ground sample data is stored in database format extending back to 1936.
- Ministry library and web sites house a rich collection of historical records of past inventory data, procedures and standards.

Recommendation # 16: Explicit mechanisms for linking inventory data with other sources of data relevant to a particular area and time and needed.

Findings

- The inventory can be (and routinely is) related to other sources of data recorded in a geospatial format.
- The inventory is explicitly linked to RESULTS, and through this link to both Forest Tenure Administration (FTA) system and Electronic Commerce Appraisal System (ECAS).
- No effort is being made to link the inventory up to survey data such as cruise plot data for example, where each plot has a UTM location.

Comment

This recommendation, like others is open to interpretation, but is better understood by referring to the 2006 prolog leading up to it. The intent was that there are systematic surveys, including for example the collection of cruise plot data, but this might also include site series mapping in support of silviculture prescriptions as well as other kinds of surveys, that could be used to provide more insight into inventory characteristics. Some discussion has been had along these lines (this is not new) but no action has been taken.

11) Scalability

Recommendation # 5: Inventory information requirements for specific local areas, requiring a high level of spatial resolution and detail, should be outside of the base funding for the inventory program.

Finding

- There is no disagreement on this issue.

Comment

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This recommendation has bearing on other recommendations, findings and comments made above and below.

Recommendation # 14: A commitment to moving towards higher resolution of inventory information should be included in the mandate of the inventory program.

Finding

- The ongoing inventory program results in overall improvements in accuracy and currency. For example, as re-inventory targets areas with out-of-date inventory or inaccurate inventory and replaces with current data interpreted to VRI standards.
- This is not currently included as part of the mandate.

Comment

In order to reconcile this recommendation with the one above there would have to be a clear rationale as to the circumstances where a higher resolution inventory might be warranted from a cost –benefit or risk (potential for regret)-reward point of view. At the moment there is no basis or information available to help formulate some guidelines for implementing this kind of a mandate so that it could be put into action. However, this is an important issue to address, particularly where complex and mixed species stands predominate. The costs and benefits associated with gains in accuracy (reduced bias) and precision, resolution (e.g. from 10 hectare polygons down to 20 m x 20 m grid cells) and level of detail (from whole stand statistics to individual tree level of information) needs more thorough review. This is particularly so where these data are to be used in spatial explicit forest estate models such that the nature and location of the objectives and constraints force significant trade-offs in land use and resource utilization allocations. This is a bit of a chicken and egg problem. The problem may seem to be there when it isn't or vice versa. The risk is that inventories with relatively low levels of accuracy, precision, resolution and detail may be misleading when applied in geospatial forest estate models. The questions are: to what degree, at what cost to fix the problem, and with what gains in benefit.

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Appendix 1. Twenty four BC Vegetation Resource Inventory positions plus the Branch Director listed as being filled by the BC MFLNRO (2011b) as of October 6, 2011.

(Director, Forest Analysis and Inventory Branch)
Acting Manager, Forest Inventory
Senior Inventory Technician
VRI Monitoring Coordinator
Remote Sensing Application Specialist
Inventory Forester (Coastal - Nanaimo)
Vegetation Update Technician (Southern Interior - Kamloops)
Resource Inventory Forester - Growth and Yield
VRI Team Lead
Vegetation Update Technician (Southern Interior - Kamloops)
Inventory Investment Team Lead
Forest Inventory Team Lead (Southern Interior - Kamloops)
VRI Ground Sampling Technician
VRI Analyst & VRI Data Entry
Inventory Forester (Southern Interior - Kamloops)
Inventory/Remote Sensing Forester
Inventory Forester (Southern Interior - Nelson)
Statistical and Biometrics Support Team Lead
Growth and Yield, Site Productivity
Team Lead Vegetation Update Team (Kamloops)
Team Lead Data Management
NVAF, Volume & Decay, and PSP
Vegetation Inventory Coordinator Forester (Coastal - Campbell River)
Forest Productivity and Sample Data Team Lead
Forest Mensurationist & Data Analyst
Team Lead Remote Sensing & Geospatial Applications

Appendix 2. Estimated annual inventory funding in British Columbia, 1989/90 to 2011/12 and staffing levels, 2004 to 2011.

Best estimates of the annual inventory expenditures in British Columbia were made for the period 1989/90 to 2011/12 (Table A2.1 and Figure A2.1). To the extent possible, these figures include:

- Expenditures by industry under the Forest Investment Account (FIA) Program.
- Expenditures by the Ministry of Forests and/or related agencies (e.g. Ministry of Sustainable Resource Management) including staff costs.
- Funds provided under the federal Mountain Pine Beetle initiative program.

Over the period there have been many different funding sources and delivery models as well as transition years with mixed models in place. It is often difficult to determine exactly what has been allocated to “forest inventory” versus some other kind of inventory or activity.

Ministry of Forests “core” inventory staffing levels have declined since 2004 from 40 Full Time Equivalents (FTE’s) to 27 in 2011 (Table A2.2; Figure A2.2). These figures are also difficult to assemble given various reorganizations that have occurred during this period. While traditional or “core” forest inventory staff can be tracked reasonably well, support staff including Information Technology (IT), additional biometrics support, aerial photography acquisition, management staff, etc., can be difficult to estimate. The “core” functions are identified in Appendix 1. Appendix I, Table A2.2, and Figure A2.2 do not include 4 additional positions that have been added to the program following the closure of the Ministry of Forests’ Research Branch. These are all related to the maintenance and calibration of the individual tree distance dependent Tree and Stand Simulator (TASS). Note that figures were unavailable regarding numbers of personnel-days or FTE’s providing support from consulting and contractor communities.

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Table A2.1. Best estimates of annual British Columbia Provincial inventory funding. Gilbert's (2000) figures are also provided for comparison purposes.

Fiscal Year	Estimate ^{1,2,3,4}	Gilbert ⁵
1989/90	13.5	9
1990/91	13.2	8.9
1991/92	22.1	21.5
1992/93	22.4	22
1993/94	24.5	16
1994/95	20.3	17.5
1995/96	22.4	19
1996/97	31.2	22.5
1997/98	30.8	22.5
1998/99	20.5	11
1999/00	13.4	4.9
2000/01	14.9	
2000/02	7.9	
2002/03	15	
2003/04	7.8	
2004/05	6.4	
2005/06	10	
2006/07	13.3	
2007/08	13.7	
2008/09	12.2	
2009/10	4.6	
2010/11	6.1	
2011/12	8.4	

1. For the period from 1989/90 estimates were primarily derive from MoFR Annual Reports: <http://www.for.gov.bc.ca/mof/annualreports.htm>. Note that these kinds of reports go back to 1911.
2. For the period from 1994 to 1999 information was also available from Forest Renewal British Columbia Reports <http://www.for.gov.bc.ca/hfd/pubs/docs/mr/annual/FRBCAnnualrpt.htm> [accessed Nov 10 2011].
3. Very little information was available for the period from 2000/01 to 2003/04 (4 years). This is a period of uncertainty. Best estimates were made.
4. For the period from 2002 to 2010 annual reports from the forest investment account provided some information. https://www.fialicensees.com/static_content/documents.asp?ID=9A5FA575 [accessed Nov 10 2011]. From 2000/01 to 2010/2011 information was also available from BC Ministry of Forests Service plans and business plans (also see footnote 1). <http://www.for.gov.bc.ca/mof/serviceplans.htm> [accessed Nov 10 2011]
5. See Gilbert (2000) in references.

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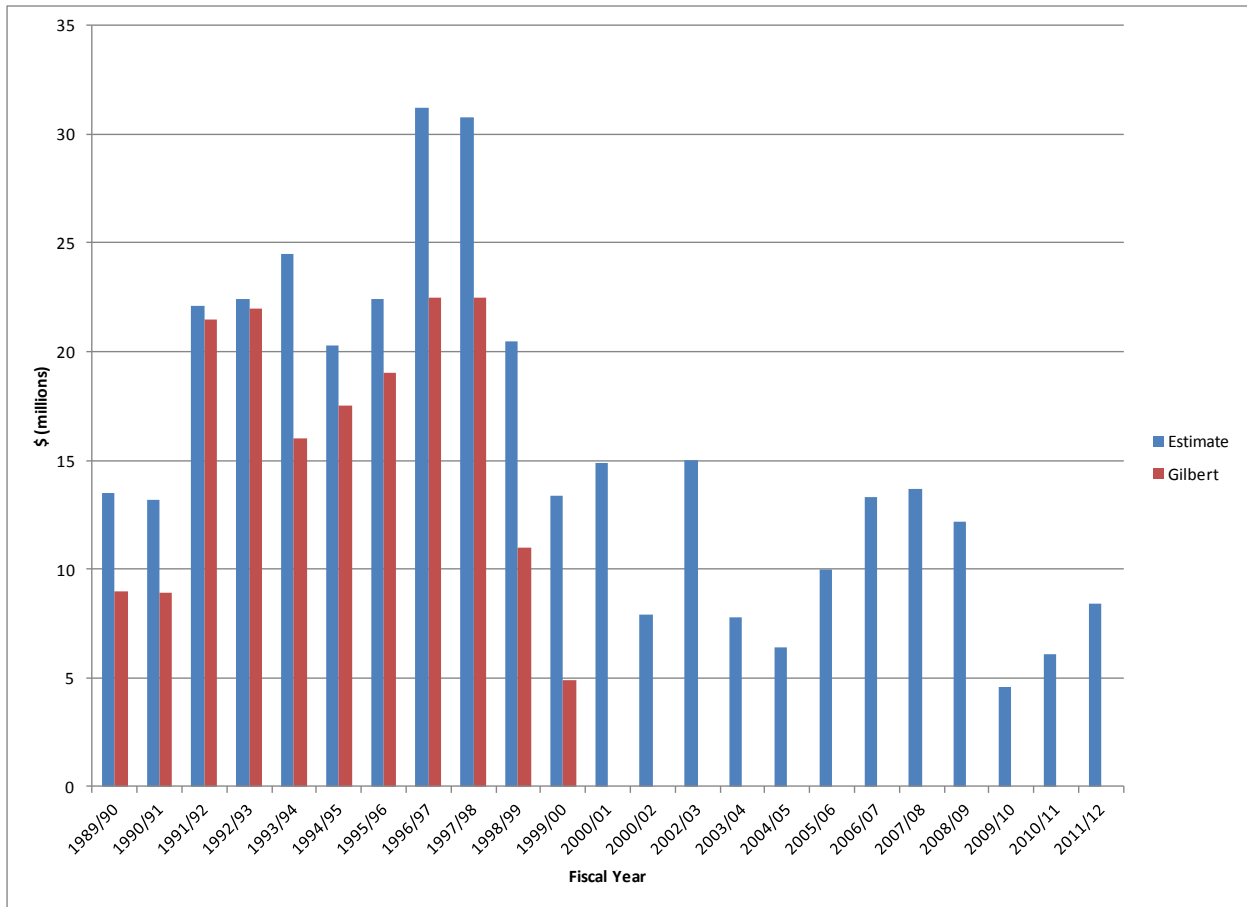


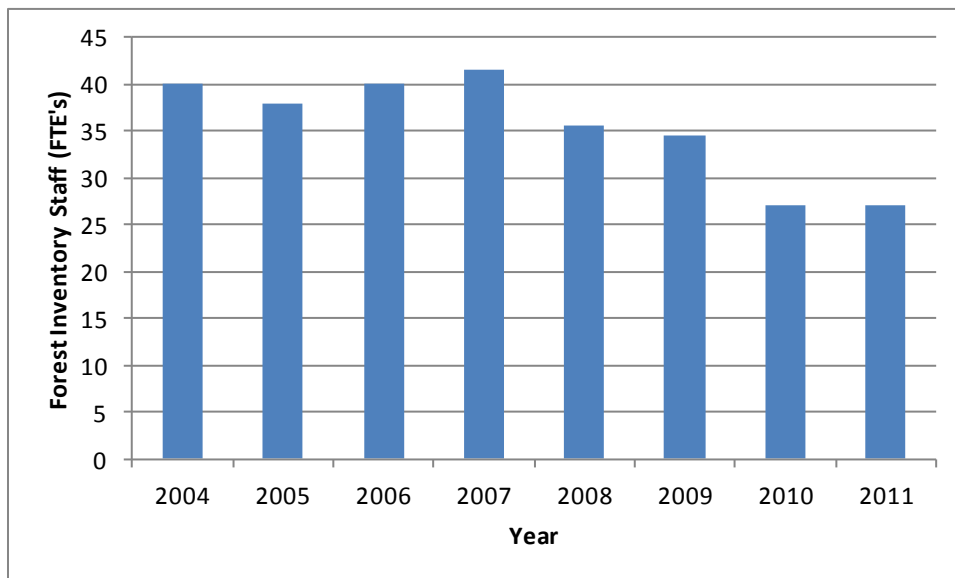
Figure A2.1. Best estimates of annual British Columbia Provincial inventory funding. Gilbert's (2000) figures are also provided for comparison purposes.

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Table A2.2. Ministry of Forests “core” inventory staff levels, 2004 to 2011 (Full Time Equivalents or FTE’s).

Year	Inventory Staff
2004	40.0
2005	38.0
2006	40.0
2007	41.5
2008	35.5
2009	34.5
2010	27.0
2011	27.0

Figure A2.2. Ministry of Forests “core” inventory staff levels, 2004 to 2011 (Full Time Equivalents or FTE’s).



Appendix A3. Vintage of the BC Inventory.

The status of the forest inventory can be summarized as follows (see Figures A3.1 and A3.2):

- There are some data gaps primarily related to Tree Farm Licenses and private land (grey).
- Most of the inventories older than 1980 (red, pink, and orange) are in larger parks and in the more remote portions of the Cassiar, Nass western Fort Nelson, and northern Mackenzie TSAs.
- Several of the inventory projects underway this year are targeted in the remaining area older than 1980, including the reinventory of Haida Gwaii, Mid-Coast, and 100 Mile House TSAs that are currently underway.
- New inventory projects planned for 2012-13 will address additional areas older than 1980. For example there is a plan to apply the Landscape Vegetation Inventory procedure in the western portion of the Williams Lake TSA.

The data extracted for the map and figures was May 2011. The figures are also not exact. Some problems were encountered when extracting the data but the figures are believed to be approximately correct.

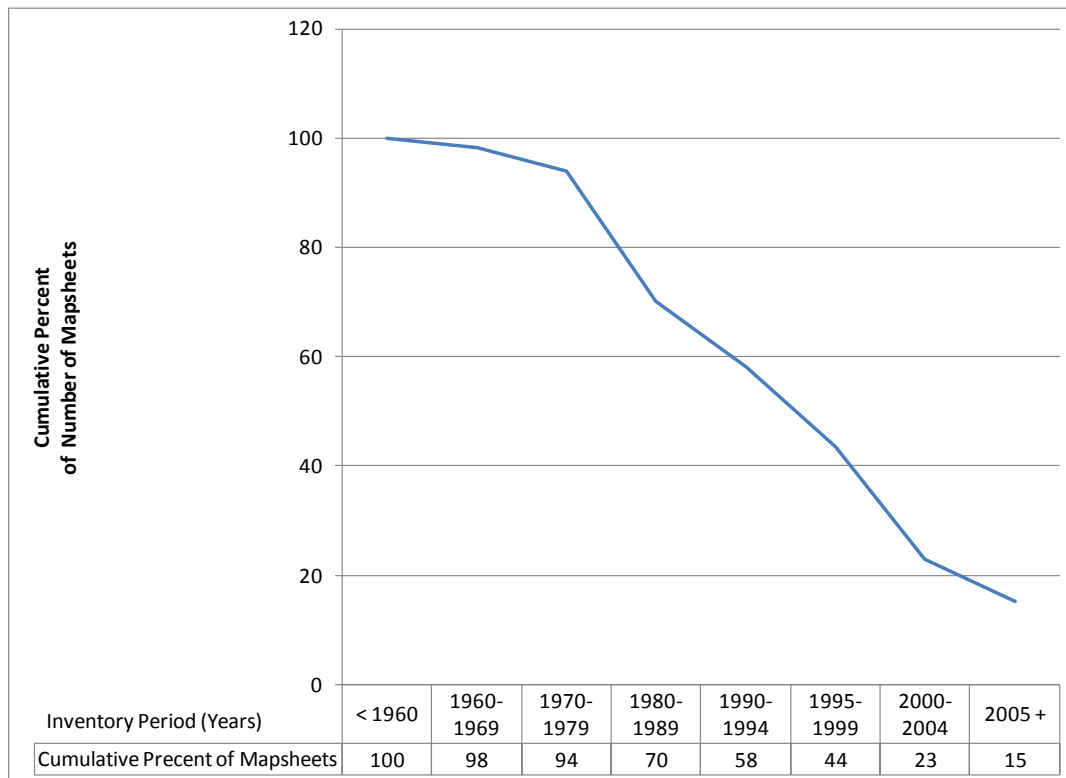


Figure A3.1. The percent of mapsheets less than or equal to a given vintage. For example, 58 % of the forest inventory mapsheets have been inventoried since 1990.

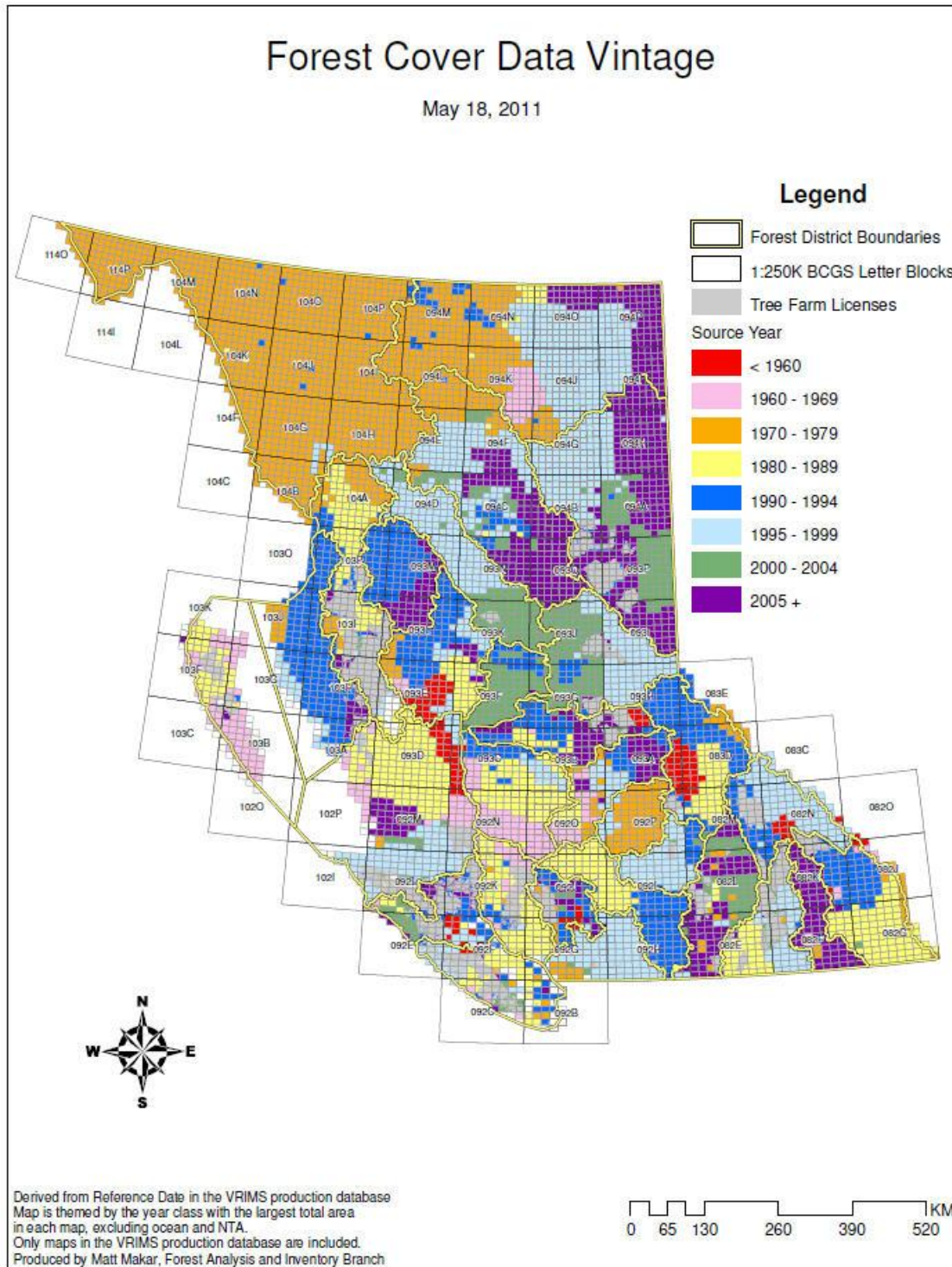


Figure A3.2. Current status of the inventory according to source year.

Appendix A4. Healthy Forests, Healthy Communities: The Importance of Inventory

The following is a synopsis by Gerald Michael Laporte⁴ “of the critical issues that is hampering the commitment and investment needed to give re-birth to BCs forest industry” produced in an email on November 15, 2011. The synopsis was produced by Gerald’s working group in a public meeting of the Healthy Forests, Healthy Communities initiative, held in Port Alberni, Monday, November 14, 2011.

INDUSTRIAL THRUSTS AREA

The forest industry can be thought of in terms of three key industrial thrust areas. Although each of these thrust areas are linked to be somewhat dependent on each other, they also requiring their own strategic vision and commitment in terms of an intellectual investment as well as a financial investment. These areas are:

- a) Developing reliable and sustainable sources of fibre.
- b) Investing in a contemporary manufacturing infrastructure for today’s market.
- c) Building product diversity to satisfy broad market demands.

SYNOPSIS

From the panel discussion it appears that there are some very big decisions that need to be made in order to renew the forestry in each of these Thrust Areas. These decisions involve critical information such as:

- a) What and where are the viable wood stands;
- b) Where should major industrial and infrastructural investments be made; and
- c) How do we build markets for innovative forest products?

INVENTORY

To make good decisions it is fundamental to attain a legitimate assessment of the INVENTORY of forest stocks. This includes the following major tasks:

- a) Inventory of Crown lands needs to be updated; and
- b) Access to “proprietary information” gathered by private companies about their own lands must be included.

In the absences of a credible INVENTORY, you cannot formulate an accurate: SUSTAINABLE YIELD

In the absence of a credible appreciation of SUSTAINABLE YIELD it is impossible, or at least risky to make decisions on product choices and hence the needed: INFRASTRUCTURE INVESTMENT

BIG CHALLENGE

To be able to make the smart decisions that will enable an integrated Canadian industrial strategy that includes involves all the major Thrust Areas, it is essential that a legitimate INVENTORY be attained. In

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essence there appears to be a need for a central depository of INVENTORY information from all sources that will benefit all players in the forest industry while respecting any private investment.

This appears to be a challenge where government must take a lead. This can be either as a broker for forestry INVENTORY information or, at least, by establishing policies that motivate industry to perform this task. With either approach, industry will need to be very active and willing partners.