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*Our claims to sustainability rest on our ability to predict the future forest.*



# **Long-term Growth and Yield Data Strategy for the BC Southern Interior**

(with relevance to the province)

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Funded by Forest Investment Account (Landbase) allocation transfers from SIGY Members

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## 1. BACKGROUND

The Southern Interior Growth and Yield (SIGY) Co-operative was incorporated in 1999 under the BC Co-operative Association Act. SIGY currently has 21 shareholding members comprised of 20 forest companies holding Crown Forest Licenses in the Southern Interior Forest Region, and the provincial resource ministries on behalf of the Crown. Since its inception, SIGY has focused on strategic and educational projects in support of member investment decisions related to growth and yield (G&Y). FIA-Landbase allocation transfers from member licensees are SIGY's main source of project funds.

The need to revisit long-term G&Y data strategies has been documented in recent strategic reports produced by the Forest Productivity Council (2001), the inter-Ministry G&Y Coordinating Committee (2002) and SIGY itself (2003). Two main issues are driving strategic re-rationalization at this time: 1) changes in responsibilities and funding threaten the large existing legacy of long-term G&Y plots and 2) the new interest in monitoring needs to be integrated in a long-term data strategy. This strategy addresses the future needs and roles, if any, for data from three types of long-term G&Y plots: permanent sample plots (PSPs), experimental plots (EPs) and monitoring plots.

Development of this strategy took place during FY2003-04 with funding from member FIA-Landbase allocations. The process incorporated input from licensee representatives (SIGY Directors) and G&Y experts from the academic, consulting, government and industrial sectors. The preliminary discussion paper released prior to holding two strategic discussion meetings in Kamloops, December 9 and February 3, is available on SIGY's website along with other ancillary documents.

This report examines recent changes in the G&Y business environment that have brought about the need to re-rationalize the business case for investments in long-term G&Y data. The report then summarizes key goals, objectives and implementation strategies to help guide the individual, independent investment decisions of licensees and the Crown. Although SIGY's strategic role is strictly advisory, this report also indicates where the Co-op could have a beneficial role in various aspects of delivery.

## 2. CHANGING BUSINESS ENVIRONMENT

Implications of recent government re-organization and the implementation of "New Era" forestry policies are among the main factors driving the re-rationalization of long-term G&Y data at this time. Government downsizing and the accompanying increase in licensee responsibilities have had a major effect on the management and delivery of G&Y in BC, long-term data in particular.

Government's long-term stewardship roles have historically included G&Y to support its Crown forest management responsibilities. Establishment of long-term G&Y data collection marked the beginning of the BC Forest Service G&Y program in 1912. The government's G&Y program grew to keep pace with the expansion of forest development in the province. Legislation of licensee reforestation responsibility during the 1980's initiated a shift in forest management responsibilities from government to licensees. The current "New Era" forest policies are advancing this shift even further, but G&Y has not been explicitly included. Government has down-sized its own G&Y program by nearly 50% since 2001.

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Beginning with Section 88 (BC Forest Act) in the 1980's, a string of funding programs supplemented both licensee and government G&Y investments. Long-term data programs expanded over the next 20 years with successive funding infusions from FRDA and FRBC. This encouraged government to eliminate long-term G&Y data funding from its base (Treasury Board) budgets. EPs logically fell within the FRBC Research envelope, but PSPs were relegated to the Landbase envelope. This artificial split began to have a disproportionate effect on the PSP Program once FRBC-Landbase investment decisions were shifted to licensees. Licensee G&Y investments accelerated under FRBC. But with few exceptions, these focused on short-return AAC enhancement projects (site index adjustments, etc) rather than long-term data collection or model building. FIA perpetuated the artificial funding split for PSPs (Landbase) and EPs (Research) with similar results. A growing PSP re-measurement backlog now threatens program recovery.

Interest in monitoring has increased over the last few years with the rise of two new issues. First, many recent AAC enhancements are attributed to increased expectations for future managed stand G&Y. The departure from older, more conservative yield estimates lead to an increased emphasis on monitoring actual yields within individual management units. At the same time, global markets and certification pressures also provide new incentives for monitoring in support of sustainability claims.

The future of long-term G&Y data appears to be at a crossroads. Government G&Y programs no longer have the staff or budgets to continue supporting the legacy programs or fund new long-term G&Y data programs such as monitoring. Licensees have not perceived enough incentives (economic, policy, etc) to embrace investments in long-term G&Y data. Reasons for this have now been mooted by shrinking FIA allocations. However, with respect to long-term G&Y data, SIGY's Board of Directors feel monitoring currently holds the most investment incentives for licensees.

### **3. BUSINESS CASE REVISITED**

#### **3.1 The need for G&Y models reaffirmed**

Public and private sector G&Y investments all support some aspect of the broad vision established by the Forest Productivity Council (FPC) of BC:

*"To be able to consistently and accurately predict the quality, quantity and dynamics of British Columbia's forests under any management regime."*

G&Y models are the main source of these predictions. They play a major role in timber supply analyses supporting the Chief Forester's determination of Allowable Annual Cut (AAC). In addition, G&Y models are used extensively in many other areas of forest management planning, silviculture investment analysis, and inventory projection. As decision support tools, G&Y models provide forest managers with a functional synthesis of current knowledge about forest dynamics and silvicultural treatment response.

G&Y's traditional focus on timber has expanded to include other forest values such as wildlife habitat, biodiversity, visual quality and watershed protection. Predictive models for these non-timber values rely on forest structure predictions provided by G&Y models. The increasing complexity of forest management places new demands on model predictions. G&Y models must continually incorporate new information and data to keep pace with these demands.

Forest management issues currently driving continued G&Y model improvement include:

1. Maintaining or enhancing timber supplies under increasing pressures
2. Improving managed stand yield expectations: G&Y information and silviculture
3. Timber supply impacts of large-scale natural disturbances (e.g., beetles, fire)
4. Enhancing information systems to support results-based management
5. Managing for more complex stand structures to maintain non-timber values
6. Predicting and actively managing the future supply of non-timber values
7. Improving mill supply forecasting: log profiles and wood quality
8. Market access through public trust in sustainable management practices

From the business perspective, G&Y models support the regulatory licensee-to-cut through their central role in AAC determinations. G&Y models and data also support social licensee-to-cut and world market access through land-use planning and sustainability initiatives including certification. Government and licensees both benefit from maximized harvest levels supported by defensible, scientifically sound models and data.

Past experience has shown investments in G&Y models and data often lead to higher yield expectations replacing more conservative estimates. G&Y refinements sometimes have a negative effect (e.g., forest health), but the net result is still a more balanced, realistic prediction for business planning purposes. Investments in better information tend to be less expensive and less risky than investments in more intensive silviculture. Making intensive silviculture investments with fuzzy G&Y expectations increases their risk.

BC's current suite of active models

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|-------|--|--|
| VDYP  | Variable Density Yield Prediction            | Primary source of natural stand yields for timber supply analysis and inventory (MSRM)   |
| TIPSY | Table Interpolation Program for Stand Yields | Primary source of managed stand yields for timber supply analysis, silviculture planning and investment analysis (MoF)                             |
| TASS  | Tree and Stand Simulator                     | Source of TIPSY yields. Also stand dynamics research, silviculture planning and investment analysis (MoF)  |
|       | Prognosis <sup>BC</sup>                      | Limited application as yet. Intended for timber supply analyses, inventory and silviculture planning for complex stands in southern interior (MoF) |
| MGM   | Mixedwood Growth Model                       | Limited application as yet. Intended for timber supply analyses, inventory and silviculture planning in boreal mixedwood (UofA)                    |
|       | FORCAST                                      | Long-term sustainability based on nutrient (nitrogen) cycling. Yields scaled to TASS. (UBC)  |
|       | SORTIE                                       | Research model for exploring dynamics of multi-species stands (MoF)  |

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## 3.2 The need for long-term data reaffirmed

Data from long-term G&Y plots continues to play a major role in the development of G&Y models for BC. Modellers continue to seek out long-term data on a regular basis. Application of this data in model building differs by model type.

Data from the Provincial PSP Program is used in all the major models to some extent. PSP-like data is especially important for certain types of models such as VDYP, Prognosis<sup>BC</sup> and MGM. TASS (TIPSY) also uses PSP data, but in a totally different way. All these modelling efforts have actively sought out PSP data in the last 5 years and are likely to continue doing so in the future.

EP data will undoubtedly remain the primary source of treatment response data for managed stand models. No other type of plot can provide comparable data. Response to silviculture treatments will only increase in importance and controversy as managed stand yields contribute more to AACs over time. Response estimates from EPs are especially important to models producing managed stand yield predictions. Currently, this only excludes VDYP.

Monitoring is a relative newcomer to BC that is rapidly gaining interest. Monitoring plots provide inventory-like G&Y snapshots over time for a specific landbase. The primary role of monitoring is to check the outcome of operational predictions, which are largely made with G&Y models. This feedback loop has long been missing in BC.

Data from temporary plots are sometimes used as a substitute, but modellers prefer long-term data when available. Temporary plots are expedient but they do not yield equivalent data. This is particularly true for height-growth, mortality and regeneration, which tend to be the weakest components of a G&Y model.

## 3.3 A re-rationalized mix of long-term data

Long-term G&Y data comes from plots re-measured over time. These plots may be subjectively located like those in the Provincial PSP Program or randomly (or systematically) located like monitoring plots. Plots following an experimental design are EPs. Each of these long-term data sources contributes to G&Y modelling in different ways.

The role of EPs is unique. Many of the G&Y issues facing forest management today require on-going G&Y model improvements to better predict complex forest dynamics and silviculture treatment response. A broad mix of EPs will always be needed.

The simultaneous decline in PSP investments and rise in monitoring interest are two of the main forces driving the current re-rationalization of long-term G&Y data strategies. Declining FIA budgets merely reinforce existing questions about the need for two separate systems of otherwise similar looking plots, one subjectively located and the other randomly located. This issue was a frequent topic in the discussions leading up to this strategy.

Clearly, only random sampling can produce defensible monitoring data. Monitoring is an important and neglected area of long-term data that is gaining momentum as forest management strives to meet increasing public accountability pressures. The primary role of monitoring is to check the actual outcome of model predictions. Since monitoring plots capture the same type of data as PSPs, some felt that monitoring might also provide better model calibration data than PSPs by virtue of its random nature. Some saw monitoring as a higher priority than model calibration at this point in time. Others expressed concern that

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the non-strategic, de facto abandonment of PSP investments had already taken place without first examining the alternatives and consequences.

There was greater agreement among G&Y experts about the growing importance of monitoring than the continued importance of PSPs. On the surface, there appear to be few reasons to think monitoring plots could not be used for model calibration since the data appear to be virtually identical. In fact, the original version of Prognosis (USFS) was calibrated with monitoring-like data in the form of random PSPs. However, there are reasons to suspect the BC situation could be different in some respects. Modellers have always tended to be more selective about data from managed stands, especially data confounded by multiple silvicultural treatments. To date, funding shortages and strategic priorities have limited most existing monitoring programs in BC to a light sampling of managed stands. Should this continue to be the case, monitoring would provide no new data for natural stands and possibly little of the data preferred for calibration of managed stand models.

Random sampling (monitoring) tends to concentrate samples in the most common forest conditions. Model behavior benefits from data at the extremes. Modelling and inventory rely on different forms of statistical inference. Unlike inventory, modelling does not require strict adherence to random sampling. It is impossible to sample future stand conditions that do not exist on today's landbase. Subjective sampling for model building is a scientifically accepted practice, so there is no reason to reject subjective PSP data as fundamentally unsound. However, the notion of monitoring plots doubling as model calibration (PSP) plots is certainly attractive from a cost efficiency perspective.

Continued uncertainty around broad-scale monitoring implementation makes immediate PSP abandonment questionable and risky. Interrupting the flow of long-term data will stall continued improvement of the PSP-dependent models (e.g., VDYP, Prognosis<sup>BC</sup>, etc), or force reliance on temporary plots with associated costs. If monitoring identifies problems with predictions, modellers will be looking for data to re-calibrate models. Older PSP plots provide invaluable long-term growth trajectories that would take years to replace with a new data program. These are some of the reasons why abrupt PSP abandonment at this time creates strategic risks. A more gradual transition would enable proactive management of these risks while monitoring practices become established. A long-term mix of PSPs and monitoring is also a possibility.

## **4. IMPLEMENTATION RECOMMENDATIONS**

### **4.1 Strengthen Strategic Management**

Planning and commitment are required to ensure continued long-term G&Y data availability in a cost effective manner. Long-term data programs around the world are normally managed independent of individual modelling projects. This facilitates coordination, standardization, quality control, data accessibility, economies of scale, championing of annual investment priorities and stakeholder acceptance. From a G&Y perspective, neighboring management units have more similarities than differences. Shared G&Y data and modelling generate economies of scale that produce robust models at a lower per hectare cost. This is why G&Y co-ops exist around the world. Here in BC, the Forest Productivity Council (FPC) and SIGY both evolved from these ideals.

Comparing recent G&Y experiences (FPC and SIGY) with those of genetics (Forest Genetics Council) indicates that central investment control is sometimes needed to keep

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strategic objectives on track. Prior to FRBC, PSP investments were centrally managed from Victoria by government. Under FRBC, and now FIA, PSP investment decisions by licensees have undergone extreme de-centralization under the respective Landbase programs. This de-centralization has placed the continued strategic viability of the PSP program in jeopardy. The individual investment priorities of licensees in each management unit have yet to collectively support a regional strategy despite the active influence of SIGY.

Biologically, regional boundaries vary with species and ecosystems. G&Y economies of scale do not stop at political boundaries. By their nature, the subjective location of PSPs and EPs should be driven by regional priorities. It is not important that each management unit have equal representation. On the other hand, the number and location of monitoring plots is unique to each management unit. However, regional efficiencies could still be gained by sharing monitoring data if it is compatible.

SIGY will continue to work with member licensees and ministry G&Y managers to help raise awareness among ministry and industry Executives regarding the business case for G&Y investments and the implementation strategies contained in this paper. SIGY would welcome re-vitalization of the Forest Productivity Council, or its equivalent, and an opportunity to provide regional input into provincial G&Y strategies.

## **4.2 Continue EP support**

Strategic management of EPs has tended to be less centralized than PSP in the past. This reflects the number of research organizations and funding mechanisms that exist at national, provincial and local levels. Investment strategies to be established by the new BC Forest Science Board for FIA's Forest Science Program are expected to reaffirm earlier research strategies (FRBC, FORREX, etc) which placed a high priority on G&Y.

SIGY would be willing to work with the Forest Science Board to establish G&Y-related EP priorities for the southern interior. SIGY recognizes the importance of continued investments in research to support advancements in G&Y. However, declining FIA allocations along with current policy and economic conditions mean that EPs can expect little direct financial support from licensees at the moment.

## **4.3 A Managed PSP-monitoring transition**

In discussions leading up to this strategy, licensees consistently identified greater investment incentives for monitoring than for PSPs. Consequently, licensees are more likely to direct dwindling FIA allocations toward monitoring under the current FIA-Landbase model. As a result, SIGY's Board of Directors encourages government to reconsider PSP funding before valuable assets are permanently lost. PSPs will still be important in the short-run until monitoring becomes established, which could take many years at the current pace. The long-term importance of PSPs cannot be fully evaluated until more practical experience is gained with monitoring.

Parts of the PSP Program can be salvaged with a more proactive transition strategy. The existing Forest Productivity Council PSP strategies provide a solid foundation. Additional prioritization work, including field verification, is needed to confirm plot priorities. Several outstanding issues were identified that still need to be resolved, including forest health. This strategic exercise needs to be funded at the provincial level to include all the plots. Initial results indicate only about half the existing PSPs may need to be maintained.