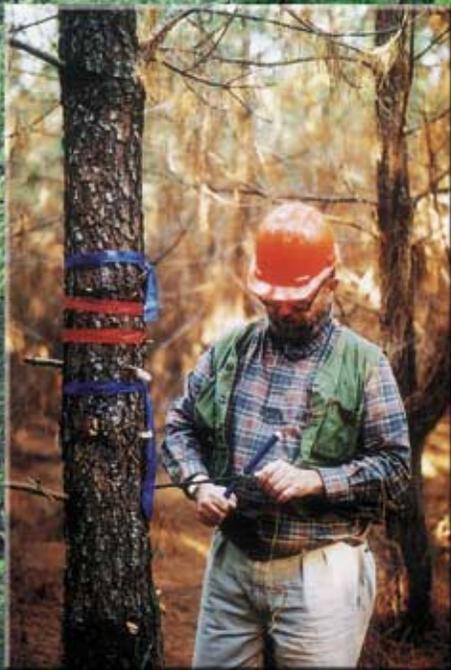


IMPROVING BC TIMBER CRUISING & VALUATION



Dr. Kim Iles

June 2003

**Published by:**

APPLIED SCIENCE TECHNOLOGISTS
& TECHNICIANS OF BRITISH COLUMBIA

in cooperation with...

TIMBER CRUISING CERTIFICATION BOARD
COASTAL CRUISING SUPERVISORS TASK FORCE
NORTHERN INTERIOR CRUISING COMMITTEE
SOUTHERN INTERIOR TIMBER CRUISERS ASSOCIATION

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June 2003
Printed in Canada

ISBN 0-9683728-9-9



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Nanaimo, BC

June 2003

Report commissioned by...



The TIMBER CRUISING CERTIFICATION BOARD, a special certification board within the
APPLIED SCIENCE TECHNOLOGISTS & TECHNICIANS OF BRITISH COLUMBIA

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COASTAL CRUISING SUPERVISORS TASK FORCE
NORTHERN INTERIOR CRUISING COMMITTEE
SOUTHERN INTERIOR TIMBER CRUISERS ASSOCIATION



REVIEW OF METHODS THAT WOULD IMPROVE BC TIMBER CRUISING & VALUATION

Executive Summary

- ⌞ BC timber cruising methods are less efficient and less accurate than they should be when timber is sold by a bid process.
- ⌞ With approximately a \$2,000,000,000 return to the Province, accuracy is worth attaining in the present system as well as any new stumpage systems.
- ⌞ Both the Government and industry need better methods, and it would be desirable to coordinate them, with the Ministry taking the lead.
- ⌞ The necessary changes are well known, widely used elsewhere, and many of them are already used by the BC coastal industry in parallel with currently Ministry methods.
- ⌞ There is no need for testing or evaluation of these methods, only for coordination and leadership.

Recommendations

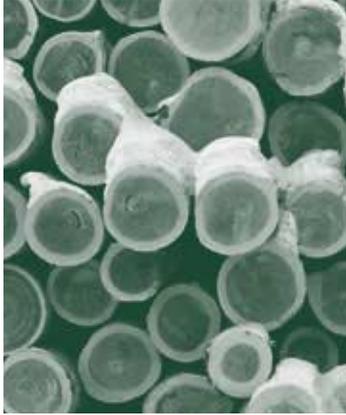
In order to improve the valuation of timber in BC...

1. Adopt a direct estimation of tree grades and defect using standard rules for deduction, rather than 'loss factors' having only a few class averages. This would be more correct, more efficient, and simpler than the current method.
2. Allow and encourage more efficient sampling designs for cruising timber such as 'Big BAF cruising', more count plots, and '3P sampling'.
3. Periodically compute differences between audit and original results based on a sample process to insure that the Provincial payments are within reasonable limits.
4. Minimize the number of requirements which do not affect volume or value – perhaps using these errors only as reported indicators of cruising skill rather than a basis for accepting or rejecting the work.
5. Retain the gross volume when log scaling is done, for comparison purposes.
6. Compute statistical parameters more correctly, and report them for every compilation.
7. Coordinate and encourage these changes by making them Provincial valuation standards.
8. Improve the standards for timber cruising using certification and establish formal training programs for cruising.



DETAILED DISCUSSION

The Need for Change



If the Province adopts a competitive bid system, methods of cruising used by the buyers **must** become more efficient. **It is important to both parties that they more accurately measure the value of timber in British Columbia.** It would benefit the Province if leadership was provided, and these changes were led by the Ministry group in charge of selling public timber. **The changes suggested here will provide an immediate improvement in sampling precision and value determination.** Final completion of all details will take about 2 – 3 years, due to a delay with adjusting compilation programs and the many necessary reviews of technical details.

In the process of doing this report I have attended all 3 annual BC timber cruising meetings, reviewed the process with various specialists in BC, and used my own experience with sampling and cruising methods common in the Pacific Northwest. None of these suggestions are contingent upon present or future appraisal methods. They would all be improved.

There are a number of techniques in North America that have excellent track records in accurately sampling, measuring, and evaluating the value of timber. Some of these have been adopted or tested in the recent BC timber inventory process, but have not yet migrated to the Provincial valuation procedures. We have an opportunity with recent legislation and the softwood lumber issue to initiate some much-needed changes. The existing BC techniques are not efficient or cost-effective, and some are heading in the wrong direction.

Anyone who can memorize the bewildering number of rules about tree classes, age groups, interpretations and exceptions in the current procedure can certainly master the simpler techniques needed to produce more precise answers.

Experience in the Pacific Northwest

In the United States, a great deal of timber is sold on the open market. Some of this is **sold outright**, based on a 'cruise-based' sale. This greatly minimizes the administrative details for the public agency. Other timber bidding is only on the **rate of payment**, with a log scale to establish the final payment amount. This means that both volume and log quality issues can be financially critical. **Any mistake in the results is paid for by one side or the other.** Some expensive and valuable lessons have been learned, and BC can profit from them. With both sides at financial risk (and therefore legal risk), as well as **individuals** at professional risk, there is every reason to produce better quality answers. **Control and consistency are not sufficient goals – more complete and more accurate answers are required.**

In addition, a great deal of timber must be cruised that will **not** be purchased, and this means that future cruises must be done at reasonable expense and efficiency. In BC we are accustomed to cruising only timber that will be cut, using cruising methods which are both inefficient and time consuming. The time when we can afford this might be coming to an end. The sampling methods proposed here have a reasonably long track record in the Pacific Northwest. British Columbia has been slow to adopt these techniques because of a single-owner, all-problems-have-one-solution approach to cruising timber. **Some of these methods have already been tested in BC, and are ready for adoption with relatively little effort.** All that is required for success is focus and leadership.

Many of the valuation methods currently used in BC are known to be inefficient and sometimes wrong. **Fortunately, recent initiatives within the Ministry Revenue group and the Ministry Forest Inventory groups have developed methods that are ready to implement and quite thoroughly worked out.** All they require is adoption after a review of the details. Industry, in some cases, is far ahead in applying these methods and has used them in parallel with any required Provincial methods for many years.



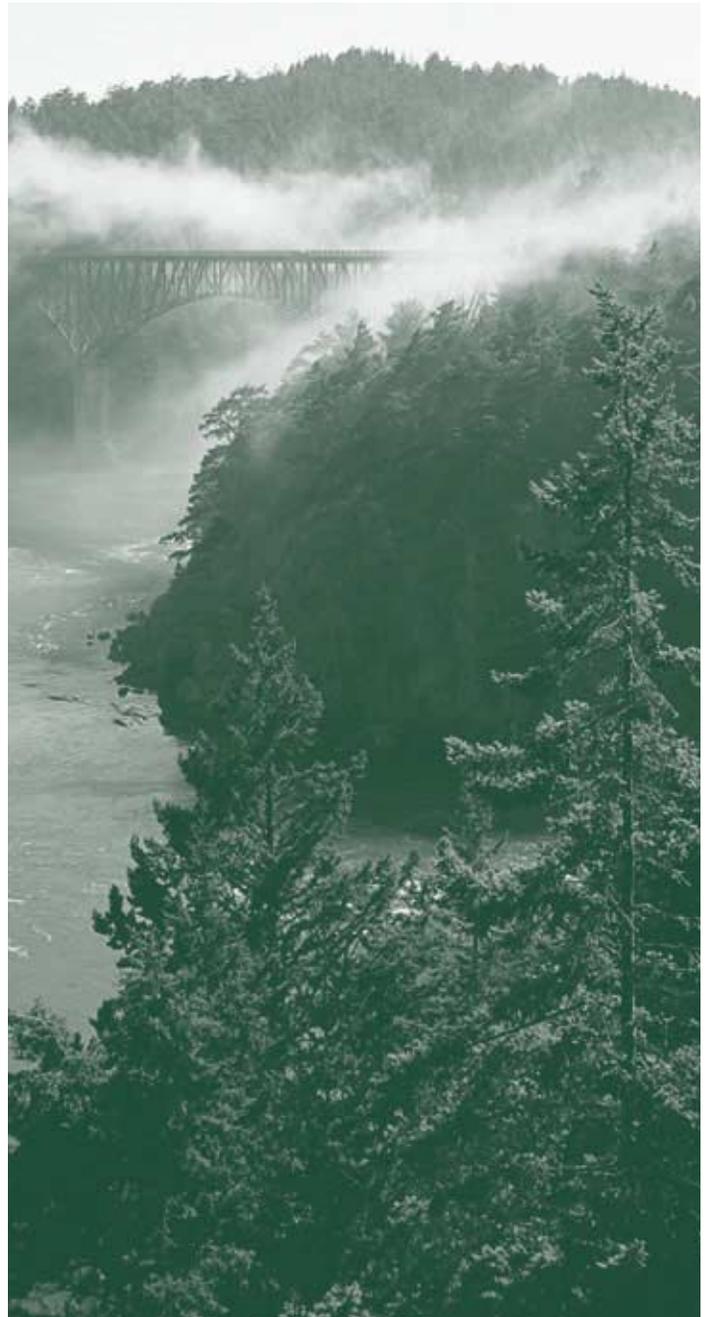
The BC Situation

Traditionally, the valuation of timber in BC did not use the experience or techniques developed by groups outside the Ministry. Ministry rules were used simply because they controlled the wood source and could see no organizational reason to change. The inefficiency of current methods is far less serious when a company only cruises for current logging. **In other parts of the world a company will cruise a great deal of timber which it will not buy, and therefore needs systems that are cost-effective. BC is entering this situation.** Certainly the government methods are due for a change. They are inflexible, not informative enough, and not cost-effective. They are certainly **not** in line with the government move away from rules to results-based systems backed by individual professional accountability. On the other hand, the necessary changes are not particularly difficult.

Some of the groups competing for timber (and at risk) may be small operators with little internal expertise in sampling. The Ministry should provide leadership and initiate methods which would provide better answers, and provide systems which bidders can modify based on their own needs.

In BC a single valuation number is calculated, and the timber company has little choice in the matter. Different cruising methods are not encouraged or even permitted. British Columbia is almost alone in this situation. The idea that a seller would compel the buyer to cruise the timber at their own expense and specify the method (often a very inefficient one) then set their own price for that stand of timber hardly qualifies as an open or competitive process.

The timber industry, when dealing with non-governmental timber, has developed along the lines of the rest of the Pacific Northwest. Better cruising systems have been adopted, direct methods of decay and grade specification have been developed, and systems that can be modified to the situation have been used. The government should follow this path if it is to improve their methods and if these processes are to be standardized within the province. **The current valuation methods do not, in my opinion, provide adequate evaluation of public timber for competitive bidding.**



US Government Timber Sales

In most of the Pacific Northwest the sellers do their own cruise. The US Forest Service or other agencies (the sellers) train their staff efficiently enough to do this work, and expect them to do it adequately. They do their own check cruising for their staff, and require a high degree of training and experience. **Training sessions are formal, involve testing and continuing education at intervals, and provide a means of tracking individual competency.** This training is usually internal, but also involves external training such as that provided by Oregon State University on forest inventory design and techniques. BC would do well to follow this model.

A public agency will normally cruise the timber in order to establish a **lower limit** or 'upset price', but companies certainly would not depend upon that number. They cruise the timber themselves. They are financially at risk. In a competitive market very few will trust the field work of an agency which has little, if anything, at risk themselves.



SUGGESTED CHANGES TO BC METHODS

The following discussions are about specific methods and techniques that should, in my opinion, be adopted by both the Province and industry alike. I think that most of the sampling experts in BC will readily agree that these changes are desirable. Industry will adopt these methods no matter what the Province does, and many of these suggestions are already used in the industry with great success. **They have been delayed in their development by the former Provincial valuation methods, which simply did not require correct answers.** Pressure is constantly building to drop some of the older and inefficient methods which dominated the former Provincial valuation process.

Cruise Design

'Variable Plot Cruising', also called 'Prism Cruising', dominates forest sampling for larger areas because of its efficiency. This is true in BC and throughout North America. In BC, however, some aspects of the method are not well applied. **The major error in BC cruising is not using 'count plots' effectively.** This is the process of simply counting trees in order to establish a good basal area for the tract. The Ministry goes as far as ignoring the well known and widely used equations for sampling error to discourage the use of count plots, and this needs to be corrected. The technique is well developed, and no research needs to be done here. It is a question of providing a compilation system that can accommodate processes that have been working well for almost 40 years. The newer 'Big BAF' method should be introduced, and restrictions on the rate of 'count plots' should be dropped. **Cruise adequacy should be based on the computed sampling error of the process.** Grid systems for the placement of plots should still be used, but should not be adjusted to produce exact sample sizes. The use of 'enhanced count plots' (where tree diameter is quickly measured or estimated) is useful in producing better stand tables and for computing different utilization limits. There is also the possibility of measuring a higher percentage of some particular trees such as higher value species, bug killed timber, etc.

Defect Deductions

I am not aware of anyone who has persisted in what BC refers to as the 'Risk Group' approach to quantifying defect. In this system trees are put into only a few broad classes, and fixed percentages of defect are removed. This method was not done for efficiency or quality control. It was originally done for simplicity. It persists out of habit. Most cruising systems in the world rely upon the judgement of timber cruisers actually viewing the tree to make defect deductions. **Any substantial improvement in BC methods requires this change.** Quality control is maintained by training and by the use of consistent rules based on research. We have sufficient rules available for timber cruising right now. They have been adapted from industry practice, tested, and well described during the development of the latest Provincial Inventory. They need to be adopted. **Every field comparison has shown that this method is far superior to the old Risk Group system, and this approach is used to evaluate most of the timber in North America.**

Scaling Issues

There is only one major scaling issue affecting timber valuation, in my opinion. **The province needs to retain both the net and gross volumes of logs that are scaled.** This would be a constant quality control check on defect determination and the change of grades as timber is processed. While this comparison is not a fully satisfactory check on defect percentages, it is a consistent and useful quality control process. It would require relatively little effort to make this change.

Log Grades & Value

The use of computerized grades is too inaccurate to continue, and should be eliminated. The use of historic grades is not particularly appropriate, and serves only to dull the effect of individual cruise results. **Timber cruisers need to assign the standard grades to standing timber as it is being evaluated.** The small differences because the cruiser cannot directly view decay or ring count are not a large issue. Processes developed for the latest BC Provincial Inventory, with minor operational changes, are adequate and should be adopted as soon as possible. Training courses and manuals are already available from that inventory process, and can be readily modified for valuation cruising. Although variable lengths must be allowed by the compilation systems to remove defect sections, the log lengths for sound sections might be standard lengths.



Cruising of Larger Areas

Variable Plot sampling continues to be the sampling system of choice for large areas. The main modifications here are the effective use of count plots, with defect and grades assigned by cruisers on individual trees as they are being viewed. **The main issues for cruising larger areas is the proper reporting of statistics and the assignment of monetary values to individual trees and logs.**

A minor problem with larger areas is with measurements near the edge of the tract of timber. The Ministry has quite rightly stated that plots near the stand borders should not be moved. In the last two years there have been developments that will improve measurements near these stand edges. Specifically, the 'walk-through' technique, described in more detail in the technical appendix would be helpful. This should be tested by the Ministry in the near future.

Cruising of Smaller Areas

Standard Variable Plot Sampling applied to small areas is not effective. The main **technical** problem is 'edge effect' which causes biases on small tracts. The main **efficiency** problem is the cost, and the past procedure was simply to use a small sample size that gave inadequate precision. Virtually all the trends in timber sales are for smaller areas, longer and more irregular borders, intentional clumps or openings, and greater difficulty with minor species. In addition, there are more instances of sales involving individually marked trees.

The clear favorite for use in small areas is '3P sampling', or one of several very similar methods. This will eliminate the 'edge effect' problem, and give very precise answers even for minor species. It provides excellent silvicultural information as a by-product. The Provincial government has done several studies on this method, and they have been quite successful. Industry has developed hand-held recorders to do the work, and has even processed the information for use with the current valuation system. **It is time to accept this process for future valuation use in the province.** A major advantage of this method is that it is cost-effective for a bidder to check a Ministry sample of the area.

Compilation & Statistical Issues

There are several errors in the provincial statistical calculations. These can be corrected, requiring only the coordination of the companies that provide computation services within the province. Flexibility is also required. The only reason that Provincial compilation products are still widely used in BC (rather than using more flexible programs from U.S. sources) is that the province uses metric measurements, unique log grades, and **requires** the use of Provincially controlled programs. These programming shortcomings are not hard to overcome, and at least one private company is working to supply a compilation program that includes appropriate alternatives. It is likely that others would welcome the opportunity of joining a coordinated effort. **It would be preferable if the province was to take a lead role with this endeavor.**

Data Reporting

At present, the Provincial compilations provide little information to guide future sampling design. Most of the necessary information is computed at some point in the process, but it is not reported for the benefit of the user and it is eliminated after the reporting is done. **Specifically, the reporting of value statistics is completely lacking.** In addition, for many cruise designs the stumpage rate itself should be described by a sampling error and other appropriate statistics. Individual tree volumes, values and other tree characteristics should be provided on computer printouts, and this can be done with relatively little effort. These are not overly complicated issues, but they have been ignored up to this point.

Bias Reduction

In general, field measurements are done well by sampling crews in BC. **A major improvement here would be the use of 'cruiser net factors' which would reduce the bias from applying overall defect averages (loss factors) to specific areas.** The correct approach is to apply local observations to local conditions (rather than regional averages). The current set of data used for both taper equation construction and loss factor determination is not actually a sample with known probabilities. It is a collection of trees which are thought to be useful. **Even with the use of a valid sample, loss factors cannot compete with the direct observation of defects.** The change to a 'BEC ecological strata' system based on the same data is not a solution to the problem of local accuracy lost through applying averages to specific areas.



As the Provincial inventory process gathers an actual sample of trees to check volume and decay estimates (currently called the 'net volume adjustment factor' or NVAF) it will provide an actual sample, and one which has a wide geographic base. This will allow checking the current taper equations and the decay estimation rules. This has been a well-run and productive part of the Provincial inventory effort. Trees from this source should be used to suggest and test better alternatives to the present rules for estimating defect. The NVAF method is not appropriate to **directly** check individual cutting permit areas, because it would require too many felled trees. **It is appropriate for checking deduction rules.**

Auditing & Check Cruising

Quality control is too important to do poorly. The check cruising process should be a major opportunity to test new methods and to teach the current process to field staff. Presently, check cruising data is not used effectively. The check cruising results should be computed, and differences in Gross Volume, Net Volume and Stand Value should be reported for each audited plot. Any standard set of monetary values for BC log grades will suffice for this relative comparison purpose. Three items (Gross and Net Volume, \$ Value) should be the main concern of quality control efforts. All other differences are training issues, and detract from the central issues of better measurement and valuation. Standards that do exist should be based on the demonstrated ability of check cruising staff to attain better than those standards. All check cruising should be on a probability sample basis, with known (but not necessarily equal) probabilities. This would allow Provincial compilations of differences in these three types of result on a yearly basis, which would be useful for all parties. At the moment, everyone is concerned about the accuracy of the field work, and this simple comparison should put the issue into perspective.

Training, Development & Certification

In virtually any other part of the Pacific Northwest you would expect a check cruiser to be experienced, well trained, and knowledgeable. This is not true in BC. Provincial check cruisers, unlike check scalers, are sometimes poorly experienced and trained. The theory is that they only need to know, defend and apply the provincial rules – and little else. They are not prepared to suggest or evaluate changes and improvements and are mainly defenders of the status quo. When the recent provincial inventory needed to develop cruising methods they relied almost entirely on the experience of industrial cruisers to do so. No provincial staff was well enough qualified to help improve the process. This must change. **The shift to professional reliance and professional accountability requires that cruisers understand objectives and can make educated decisions rather than simply enforce procedures.**

Peter Pearse, in his 1976 Royal Commission report, suggested that the Ministry begin a period of 'vigorous experimentation' with cruise-based sales, and stated the following...

*"The Forest Service has found it difficult to adopt cruise-based stumpage assessments because it has grown to rely on licensees for cruising and hence lacks sufficient cruising capability within itself. But as the 1974 Task Force emphasized, the Forest Service must expand its cruising expertise in any event."*¹

BC does not have an adequate training system for timber cruisers, and certainly nothing for the further step of appraising timber or designing sampling systems. The University system has no cruising or forest sampling extension courses. This is partly because educational institutions find it increasingly difficult to teach a series of rules which are often contradictory to principle. The only partial training system is the largely voluntary attendance at cruising seminars, which is one of the successful examples of Ministry and industrial cooperation. **Some group in the province needs to solve this problem, as well as develop people who can improve, evaluate and teach cruising methods.** While the US Forest Service and the US Bureau of Land Management have internal training courses for professional development they also encourage or even require attendance at courses outside of their agency. **Organizations do not develop by constantly looking inward.** The University of Northern BC in Prince George, the British Columbia Institute of Technology in Vancouver, and Malaspina University College in Nanaimo might have the staff and inclination for this sort of training. **Formal cruiser training courses should be available in several parts of the province, provided by experienced and knowledgeable teaching staff.**

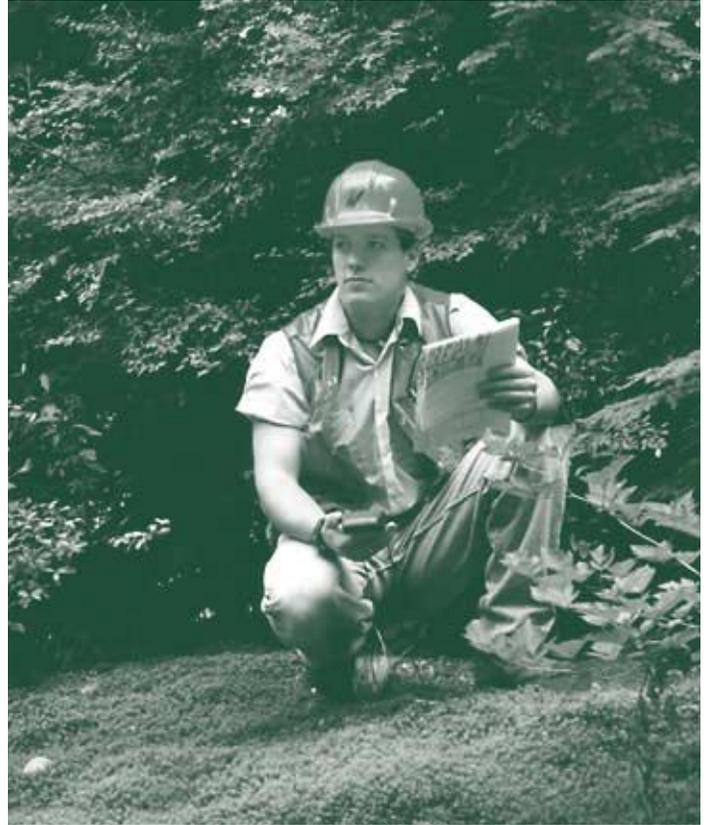
The recent initiatives to require registration and certification of cruisers in BC are encouraging. Log scalers have led the way in training and certification of this kind, and it has been to the advantage of the profession to extend it to forest sampling. Cruiser certification should require qualifications in line with professional accountability for field work of this kind. Provincial staff should be prepared to qualify in the same way if they wish to work in this field.



Implementation

All of these technical suggestions have a track record of success on the West Coast of North America. Virtually none of them are new, and certainly not controversial. **These methods are not a package, but can be individually adopted when the time is right – but there should be a clear commitment on the direction we are heading and constant progress in that direction.** As with any technical processes, they will have to be worked out in detail. This will not be trivial, but many resources exist for this process. **It will require the active involvement of experienced inventory specialists in BC.** Most of these are currently employed by industry or consulting groups. By 'experienced' I mean that they understand the principles and techniques used outside the narrow bounds of the Provincial manuals of past decades, as well as having extensive personal experience in forest sampling. There is also a clear need within such a group for Ministry staff who know the Provincial requirements for the sale of timber.

It would be very desirable to **successfully** test and implement these changes on a single District or Region before it is more widely used. Although we know what is to be done, we have proceeded a long way up a dead end with the method of 'loss factors', and must be thoughtful about how this is reversed. **The good news is that the methods we must adopt have a good track record and are already used inside the province with great success.**



Funding

In the United States, there is a timber tax which is specifically set aside for forest research. This provides money for a variety of research initiatives by the University community. Within the US Forest Service, they maintain a centralized group of forest biometricians that specialize in measurement technique research at Fort Collins, Colorado. Both the US Forest Service and the US Bureau of Land Management maintain regional specialists who are generally competent at the check cruiser level, can teach cruising design classes, and who suggest or initiate improvements and research. If they require technical and statistical guidance there is a permanent staff available for that purpose and local consultants are used on a retainer basis.

BC would benefit from a technical group with similar experience and credentials that could address these topics.

The Ministry might have a central role in funding such a group if their administration of it was light-handed. Such a group would have several potential partners in BC. The Log Scaling community affords a centralized group to deal with the few issues of change in that field. The Timber Cruising community, in its recently organized and legislative form, can provide guidance on the rest of the technical issues. As in all technical groups for this kind of work, membership should be by qualifications, not by position or authority.

Future Changes to Timber Valuation Methods

None of these changes depend strongly upon the exact nature of any new Provincial valuation process either now or in the future. In all cases, they are simply about better accuracy, better efficiency, and better flexibility in getting the correct answer to the question "*what amount of timber is here, and what are its characteristics?*"

The time, however, is appropriate to make these changes. **BC has the expertise, the techniques, and the need for more accurate timber valuation.** Some leadership is needed, but everything else is currently available.



TECHNICAL APPENDIX

Listed here are the main technical details for implementing the suggestions in the report. They are of interest to anyone who must write a manual, program the compilations, or review the suggestions in regard to the published literature.

Only a few topics need to be covered, since each of them provides a solution to several of the needs explained in the main report.

Cruise Design & Count Plots

The use of count plots is quite well developed in most other parts of the Pacific Northwest. It is the key to making current Variable Plots more efficient. A very complete history of the process and all the methods suggested here (with examples and spreadsheets for the compilations) is available.²

Some specific changes should be made to the current cruising rules (and of course tested, before widespread implementation).

1. There should be no limit on the ratio of count plots.

There is no statistical basis for this requirement. At most, it should be a suggestion. If there is a rule, I would suggest that no more than 5 count plots should be used for each measured plot.

2. There should be no limit on the average tree count when sampling error is used to evaluate the accuracy of the cruise.

The Ministry might require a *minimum overall number of trees* in the entire project (I would suggest 20), but *not* an average per plot. There are situations where quality control is degraded because trees cannot be accurately counted at the distances needed for 4 – 5 trees per plot. If there is any rule at all, it should limit the average count to less than 10, because quality control is so difficult to maintain at these higher counts.

3. The first tree for any new species should be measured, just in case the count plots record a species that might not be selected for measurement.

The current method of turning an entire plot into a 'measured plot' is also biased, and in my opinion contains a greater bias than selecting the first tree of a species. If a member of this species is eventually selected, this 'insurance tree' would be dropped. The only known unbiased alternative is to combine all 'minor species' into a single group, and this is far less desirable. Compilation programs must allow this process.

When the Sampling Error is waived for small areas, there are currently too many trees measured and too few counts. The Ministry is receiving poor data due to the lack of counts. I can provide a public domain spreadsheet for planning the ratio of count and measured plots in order to sample efficiently.

I would suggest that if a contractor has done a reasonable job of estimating the CV of the tree count and the VBAR of an area, the Ministry should approve the number of plots put in when the cruise plan is accepted, and both should live with the results. If the Ministry is not able to approve of the CV estimates, the contractor can be held to the Sampling Error accuracy standards. In most cases, the easiest way to improve a sampling error that is too large would be the addition of new count plots.

The Sampling Error calculations in the compilation should not just be computed based only on the 'measured plots'.

This is technically incorrect, as well as inefficient. The Sampling Error should be computed with 'Bruce's method' (details on page 514 of cited reference book). For compilation purposes, the program should compute the average VBAR independently of the plots where the trees were measured. This will simplify the process, particularly in regard to the method suggested next.

I would suggest that the 'Big BAF' method for Variable Plot Cruising be approved. This is explained on page 564 of the cited text. It involves measuring only a few trees (possibly zero) selected with a large prism, while a smaller prism is used at the same point to count trees. It is more efficient than taking all trees on a few plots, because it spreads the trees through the sample area. The measured tree selection is easy to audit.

The CV of the tree count, VBAR and \$BAR should be reported by the compilation program. '\$BAR' is the value of the tree divided by the tree basal area. The grade or sort values can be any set of reasonable values, since the SE% will be relatively stable when prices change. These CVs are necessary for future planning.



It is important to coordinate these issues with the compilation specialists in the province. They will require time to make and test these changes, as well as to modify any data storage issues. **These changes, although highly desirable, are not trivial issues to compilers and they should be included in the planning and testing from the outset.** I would suggest that the Ministry might want to contract some specialists to help resolve these issues to everyone's satisfaction, and perhaps to provide the programming code (at least as an example). When these changes are made, perhaps the use of 'sorts' might be added to the compilation process. These are often as useful as grades, are provided in several US compilation programs, and might be better correlated with log sales records.

When the cruise area is small, the Province has accepted a minimum sample size based on a grid, and has dispensed with the Sampling Error requirement. I believe that count plots could greatly improve the result, but the basic idea of a minimum cruising effort is sound. Sample grids should not be changed in size to accommodate an exact sample size. The approximate grid size should be determined and placed on the map. I would suggest that the Ministry should choose the starting point of the grid, perhaps on a faxed copy of the map that could quickly be returned to the cruise planner. At that point, if the sample size is not exact the process should proceed with an approximate sample size.

Defect Deductions: Call Grading & Net Factoring

This process is critical to accurate assessment, particularly for small sales, and it will greatly reduce the bias in using any past or future set of loss factors. Several tests in BC have shown it to produce superior results, as would be expected when actual observations are incorporated into the process. Valuation branch and Inventory branch can provide details about past tests. The BC Vegetation Inventory developed an entire section in their manual for this process as well as a formal training package to teach cruisers to use it. It has been successfully delivered several times, and experienced instructors are available to teach it.³ **Details are available on the Vegetation Inventory website, and the description is quite thorough.**

This method should be designed for variable-length compilation, although the valuation process might want to use it with standardized lengths (after irregular sections of **defect** are removed). **Inventory branch can directly provide computer code for this process.** When I viewed the discussions on sample trees at the annual cruising seminars in the interior, it was clear that this process would have greatly simplified current rules as well as providing more accurate results. The current system is based on rules which can be developed and tested based on sectioned trees which are an actual sample of inventory areas.

The current deduction and grading rules in the Vegetation Inventory should be reviewed, in light of differences between valuation needs and long-term inventory needs. The objective should be to keep the methods as similar as possible, but the valuation package might combine some grades. The same methods, if adopted by both groups, would simplify the process and give better standardization in the Provincial agencies. Individual companies might see fit to use their own variations, but if they are similar it would be to everyone's advantage.

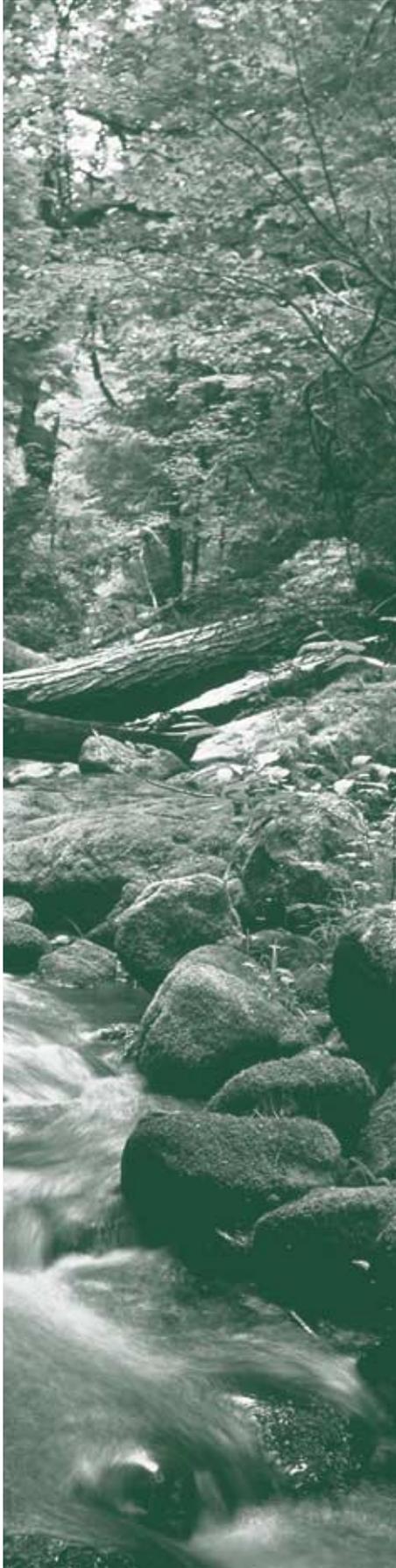
The structure of the process is quite similar to methods used everywhere in the US Pacific Northwest. Given the US orientation toward bid-based purchase of timber, and the diversity of ownership, the fact that it works well for them is pertinent to plans for changing BC valuation and bidding methods.

Auditing & Check Cruising

The check cruise plots should be chosen on a probability basis. The 'weight' that would be permanently assigned to each plot should be the hectares represented by the audited plot. This is necessary for comparison purposes. The concept of checking areas more frequently based on value or past performance by the cruiser is a good one, and should be continued.

The cruise should be rejected based only on errors that would affect the species identification, the volume, or the value of the cruise (and the stumpage price, if that can be done). Errors which have no affect should be treated as training issues, although some method of 'scoring' the samplers on this basis might be productive. It would stimulate a healthy tendency to do more precise work, and unofficially reward skillful work. Some of the US Forest Service regions do this kind of scoring, but I do not think that it should be used for accepting/rejecting cruises. Errors precluding compilation must, of course, be corrected.

³ Mr. Mike Fall (Brenton Forest Surveys) and Mr. Norm Shaw (instructor at BCIT) would be the most experienced people currently available to teach this process. Mr. Alex Orr-Ewing would be of great help in developing any changes, since his company is one of the most experienced at using this process in BC. All of these people also helped design the process for the Vegetation Inventory.



At the end of some period, such as 1 year, the computed audit plots should be compared to the originals. This will assure outsiders that the overall result was within reasonable bounds. The weight assigned to each plot must be used in this comparison. If the volume/value of each plot was recorded individually, this comparison could be done on a simple spreadsheet, and I believe that this would be the best way to do this. The individual plot results might be useful in identifying individuals, companies, or situations that would require more frequent examination in the future.

Edge Effects

The principle new ways to handle edge effect are described in detail within Chapter 14 of the text cited. Specifically, the 'walk-through' method is described on page 638. Only one other method offers the possibility of unbiased estimation, and that is the 'toss-back' method described in the same chapter. Both of these methods will also be described in the scientific literature within the next year. The Ministry should test the 'walk-through' method for immediate use in valuation cruising. While it is not completely unbiased, it certainly will greatly reduce any existing bias, and it is very practical for field work. A possible alternative, for small areas where the Ministry currently eliminates plots altogether, is to do a 3P sample in these areas while doing a Variable Plot sample on the rest of the tract.



PROCEDURES REQUIRING COORDINATION & ORGANIZATION BY SOME CENTRAL GROUP

A **working** (not oversight) group must be formed to specify and prioritize the changes.

Membership should be strictly by competence, experience, and willingness to change.

Visitors, for familiarization and information purposes, would be encouraged.

The group must have a considerable commitment of time to this process.

Funding must be available, but the cost would be moderate.

The group should include, at a minimum...

2 Cruisers who use Net Factoring on a regular basis and also use the current Ministry method. By this I mean people who spend a great deal of time actually doing the work. Consultants would be good, since they know the full span of data requirements, as would industrial cruisers.

2 Compilers (both coastal and interior) – this is critical. They will be the slowest link in the process, because of the time and testing needed for these programs.

1 Biometrician to sort out statistical issues.

1 Provincial Ministry staff who knows the requirements for selling timber.

2 Region/District level Ministry staff who are in charge of implementing these methods.

All of these people need to be experienced, and respected within the profession. They will be suggesting change that others must live with, and that requires trust. Given that this involves a revenue stream of about \$2,000,000,000 per year, it would be foolish to rely upon volunteer labour or people who are 'not busy enough right now'. This is critical work. It requires a strong Chairman with solid Provincial backing (I would suggest that the Chair should **not** be a Ministry person – someone academic might be a good choice, if they can spare the time). The problem will be to find really top-notch people who will agree to lend their time and reputation to this project.

The group needs access to...

Lawyers who can clarify actual vs. perceived 'needs'.

Regional/District specialists, who must apply these rules and methods.

Compilation testing and computer code.

This group must specify the way to approach the following needs...

Changes to field procedures.

Changes and additions to compilation programs or data storage.

Reporting and statistical changes.

Grade rules & methods for recording.

Suggested training needs within the province.

Timing and processes to test and introduce these changes.

The group must also be seen to consult both widely and deeply with the forest sampling community in BC – both private and governmental. It should be as small as possible in regard to **regular** members, with wider involvement of visitors and specialists.



Notes:

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**IMPROVING BC TIMBER
CRUISING & VALUATION**

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ISBN 0-9683728-9-9