Rebuilding Our Legacy Inventories: Identifying the Good and Fixing the Bad

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Abstract.—Several challenges faced the Province of British Columbia in the early 1990's as we undertook a major redesign of our inventory systems: a provincial legislated demand requiring the chief forester to develop and maintain an inventory of the land and forests in British Columbia; existing inventories of the 94.5 million ha of the province; the need to meet new information requirements to address criteria of sustainable forest management and their associated indicators; the need to link previously almost disparate systems in growth and yield and inventory through common sampling and monitoring protocols; and little possibility of significant new resources.

The three papers presented in this session provide a management perspective, the technical details of the design and its current implementation, and the significant issues in the development and delivery of the training program to deliver this inventory.

This paper presents the historical background of the current inventory design, its implementation over the last 30 years with its strengths and weaknesses, the audited state of the existing inventory, the drivers of the new design, and the associated constraints with any new design.

As always when implementing change, the change in corporate culture is the most significant issue. The notion of sampling to provide population statistics that in turn adjust initial estimates has been foreign to most practitioners in the province. A review of the reliability of the existing inventories as gleaned through audit procedures, along with an assessment of our ability to photo-interpret inventory strata, is also provided.

> "***Sadly, the state of renewable forest resources inventories in this province is inconsistent at best, and woefully inadequate at worst***" (Forest Resources Commission, April 1991).

What a rude awaking, almost 13 months to the date of being appointed as the Director of the Resources Inventory Program of the Ministry of Forests when an impartial commission, the Forest Resources Commission, reported April 1991, to the then Minister of Forests.

Several issues, one of which was the adequacy of the inventories of the natural resources of the province, were reviewed by the commission. On the subject of natural resource inventories, the commission recommended that:

> "***The government immediately examine and implement ways by which the full range of forest related inventories can be made standard and able to be used on compatible systems while, at the same time, retaining the values for which they were originally intended***" (Forest Resources Commission, April 1991).

As the new guy on the block, I could only hope that the Commission's report was a comment on the legacy that I had inherited and not the current Director!

The reality was accurately portrayed by the commission. The province possessed an inventory of its timber resources that was old and aging fast. The timber inventory had its origin in the 1960's when the prime motivation was timber volume to feed an expanding forest industry, and as a result, information on other forest values was non-existent. Further inventories of other values, fisheries, wildlife, and rare and endangered

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species were almost non-existent due to chronic underfunding.

This paper and the two following, by Dr. Kim Iles and Mr. Norm Shaw, will discuss the response of the province and industry to the challenge presented by the Forest Resources Commission.

This paper provides the framework by:

- outlining the size of the province, the state of ownership, and the scale and importance of the industry;
- outlining progress that has been made to develop compatible inventory standards and procedures for all resource inventories;
- describing the state of the existing inventories, their origin, and the ongoing management process for those inventories;
- presenting the results of the audit of the provincial timber inventories; and,
- describing the emerging issues that we are facing.

Dr. Iles will describe:

1. Development of the vegetation resources inventory.
2. Dynamics of the committee structure.
3. Education: the lessons learned.

Mr. Shaw will describe:

1. Development of the training program.
2. Delivery of training including certification of field staff.
3. Delivery of the program.

BC: Just Where Is That Foreign Country?

British Columbia, one of the 12 provinces and territories of Canada, spans 12 degrees of latitude from 48 degrees to 60 degrees and 25 degrees of longitude from 114 degrees to 139 degrees. The province covers 95 million ha. Placed in comparison, the province covers almost as much land area as the Pacific Northwest States of Washington, Oregon, Montana, and Idaho in the U.S. For our visitors from Europe, British Columbia is larger than the countries of France, Germany, and Belgium combined.

The Province of British Columbia manages as much forest land as the United States Forest Service.

The forest sector is the mainstay of our provincial economy. British Columbia derives 7 percent of its provincial gross economy from the forest industry. We are an export economy, exporting to Europe, Japan and Southeast Asia, and to our largest market, the United States.

Unlike the United States, 95 percent of British Columbia is owned by the Crown, and land use, in particular the forest sector, is regulated under law. The chief forester of the province, my boss, determines the Allowable Annual Cut (AAC) for each of the 71 management units in the province. The current AAC is set at 70.855 million m^3 per year.

Responding To The Recommendation Of The Forest Resources Commission

In response to the Forest Resources Commission recommendations, a multisectoral, multiagency Resources Inventory Committee (RIC) was established in 1992, to address the issues of standards and coordination of forest resource inventory information.

RIC is responsible for establishing standards for natural and cultural resources inventories, including collection, storage, analysis, interpretation, and reporting of inventory data. The range of standards required to deliver an inventory program goes beyond just field inventory, and includes discipline standards, field inventory standards, digital data standards, use or interpretation standards, and product standards.

From its inception, the committee attempted to answer questions in two critical areas:

1. **Land Management**. Vital information for effective land management, levels of detail, and for what purposes?
2. **Efficient information**. How can this information be most efficiently acquired in a manner that minimizes duplication, promotes cooperative data collection, and encourages broad application and long-term relevance?

The committee's objectives focus on standards for the collection and application of forest resources data. The approach was:

1. **Collection**. Determine who has been collecting what resource inventory information, to what standards, and using what procedures.
2. **Requirements**. Identify the information products that will be needed most by resource managers and the associated inventory needs.
3. **Standards and Procedures**. Develop, where appropriate, common standards and procedures in both the government and private data collection programs.
4. **Delivery**. Develop appropriate inventory-related training and extension programs and delivery mechanisms.

The approach developed by RIC to facilitate the development of common standards and procedures across a variety of private, provincial and federal jurisdiction was to establish eight task forces co-chaired by experts drawn from the appropriate agencies: Aquatic Ecosystems, Atmosphere & Air Quality, Coastal Ecosystems, Culture, Earth Sciences, Land Use, Terrestrial Ecosystems, and Infrastructure. Seven years after the establishment of this process, we can look back on the development of 97 standards and procedures. Appendix 1 provides a listing of the standards developed to date and the 17 standards still under development.

As the standards and procedures were developed, the realization dawned on the committee that a series of training programs was needed to effectively implement the program. The purpose of the RIC Training Program is to provide people involved in the collection of this information with the required skills and knowledge to properly conduct resources inventories.

The RIC Training Program is targeted at a broad range of people. Levels 1 to 3 focus on people who are new to the resources inventory field; this portion of the training program provides them with the required skills and knowledge to work as effective members of a field crew. Level 4 focuses on existing technicians and professionals. Training at this level deals with the specifics of each RIC Standard. Generally speaking, individuals taking this level of training will be the ones who will lead the various field crews in their inventory activities.

The following figure illustrates each of the levels in the training program and how they relate, and it provides a few examples of course content (fig. 1). Appendix 2 provides a complete listing of training courses developed to date.

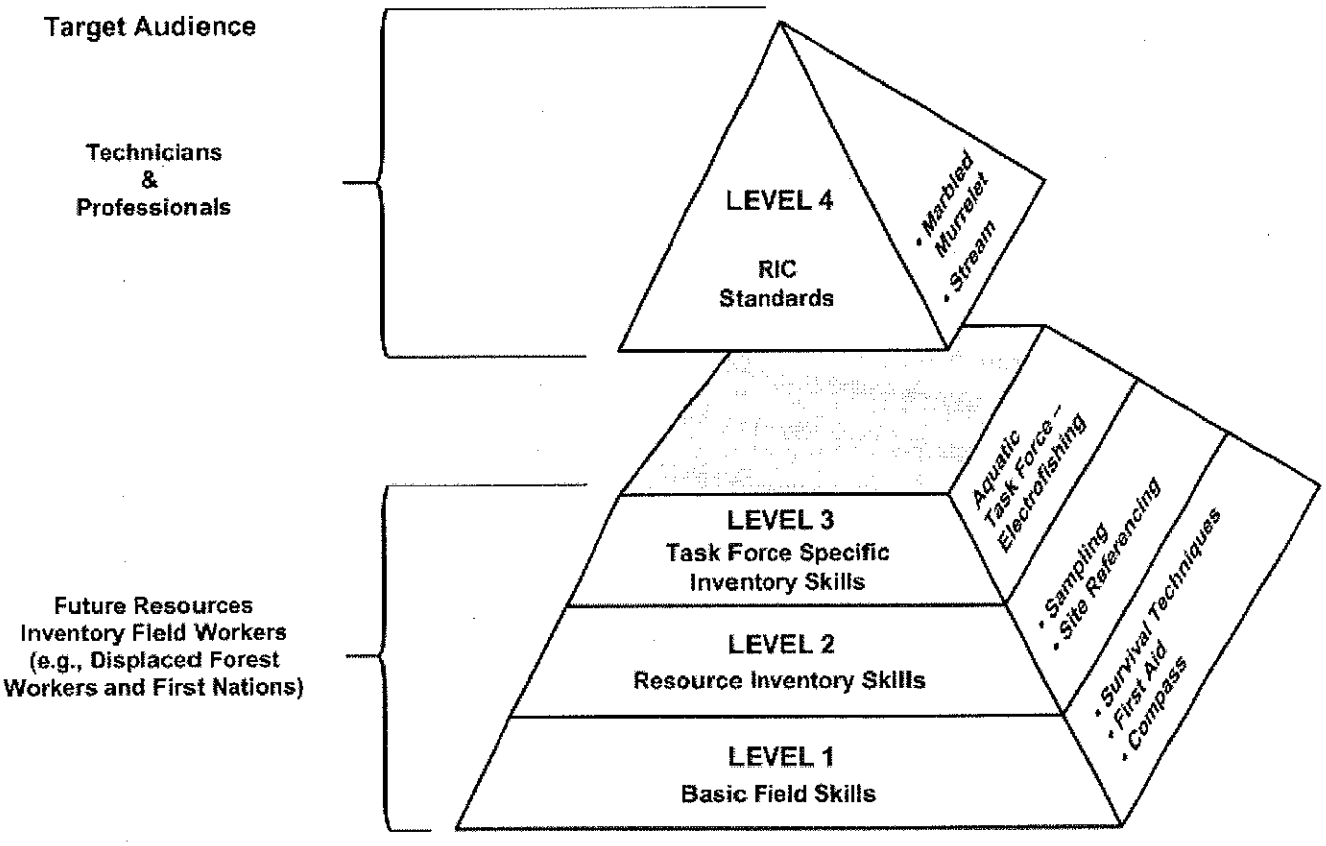

Figure 1.—*Resource Inventory Committee (RIC) training program.*

RIC continues to function. As the development of inventory standards and procedures draws to completion, the challenge of change management becomes more critical. Given the dependency that has been created with common inventory standards, the rigor of a change management is being visited on all data custodians. This requires sufficient notice of proposed changes and the adherence to a standard that prohibits changes in standards during field season.

SCOPE OF BC TIMBER INVENTORIES

The foundation of our current timber inventory was laid during the "Unit Surveys" of 1960-1977 (Thrower 1992). Unit surveys were conducted on discrete areas of 500,000 to 5 million ha. Using 1:15480 black and white air photography, timber polygons were delineated, and attributes of these timber types were interpreted from the photos. The inventory was a basic timber inventory characterizing the land base as productive or non-productive for timbered forests, and within the timbered forests as commercial or non-commercial. For volume estimation, similar timber types were grouped into strata, and a series of randomly located temporary ground samples was installed to establish average volume lines for each stratum. The design sampling error was +/- 15 percent 19 times out of 20. The inventory concluded in 1976 as did the money for further field work and sampling.

From 1978 to 1992, the existing timber inventory was loaded into a Computer Assisted Drafting environment, IGDS, developed by Intergraph along with special purpose software written by ministry staff. As the project progressed, so did the ambitions.

The eventual design was to create a complete coverage of the province, to update this coverage for change, and to project the inventory for growth. To accomplish this latter task, the temporary volume samples, along with selected samples from our Permanent Sample Data Base, were used to develop yield functions. As such, the yield functions perform reasonably well in a stable environment, but for those forest types characterized by rapid stand structure changes, this approach obviously is less than desirable.

In 1988, a modest reinventory program began. Inventories were re-estimated using air photos. Little field work was conducted, and no new ground samples were installed.

We are on a biannual cycle of update for changes and re-projection of the inventories on a periodic or annual bases depending on business needs.

Aside from the obvious problems with this approach, we lost statistical rigor. It was not possible to estimate the accuracy of our existing inventories. With a contracting timber supply, in some management units, the accuracy of the standing inventory is critical to the robustness of the long-run harvest levels. In response to our inability to determine the accuracy of our inventories, we developed a program to audit the state of each inventory.

BC INVENTORY AUDITS - IDENTIFYING THE GOOD, THE BAD, AND THE UGLY

Pilots of a process to audit the state of an inventory began in 1992, under the direction of Dr. A.Y. Omule[1], Ministry of Forests, and Dr. Kim Iles, then of MacMillian Bloedel, Ltd.

The process was to select 50 forested samples in a systematic fashion from a sorted polygon list of the population of interest, i.e., all stands greater than 60 years of age in a management unit. A random start in each polygon was established in the office before field work began. A series of four full measure variable-radius plots and five count plots was established in each of the selected polygons. Volumes compiled from the plots in each polygon were compared to the estimated volume from the provincial data set for that polygon. Descriptive statistics and a student 't' test were compiled for each of the audits.

For each management unit, it was then possible to define the accuracy associated with the attributes and yield models used in the inventory, to identify possible strata of interest that exhibited substantial trends, and in some cases to identify specific remedies to deal with the problem strata. The key to being able to develop such a picture was reasonable consistency during the initial interpretation of the air photographs.

So how are we doing?

Table 1 provides a summary for the 40 audits that we have conducted and compiled to date. These audits cover 65.8 million ha of the province or about 2/3 of the land area and 56 percent of the 71 management units.

The provincial inventory overestimates the total forested timber volume by 5.15 percent with confidence limits from 2.70 to 7.60 percent. Of the 40 management units audited to date, only 8 (20 percent) exhibit differences that are significant from the inventory estimate. In 16 cases, the difference between the audit volume and the estimated volume derived from the inventory is less than 5 percent.

[1] *Dr. Omule left the Forest Service to join J. S. Thrower and Associates as the Senior Biometrician.*

Table 1. *Timber Supply Area (TSA) and Tree Farm License (TFL) Mature Volumes and Species Composition Agreement Summary*

1		2	3	4	5	7	8	11	12	19
Region		Timber Supply Area	Total TSA area (ha)	*Total productive forest (ha)	Audit volume	Label volume	Percent difference	Label over or under estimated	Means ratio	Samp size
Cariboo		100 Mile House (94)	1,220,579	776,847	220	247	12.3	over est	0.89	50
		Williams Lake (95)	4,861,715	2,667,966	168	190	13.1	over est	0.88	50
Kamloops		Kamloops Dist (94)	1,241,731	792,991	183	179	-2.2	under est	1.02	50
		Clearwater Dist. (95)	852,080	450,578	287	300	4.5	over est	0.96	47
	=>	Lillooet (94)	1,123,819	540,266	218	178	-18.3	under est	1.22	50
		Merritt (96)	1,115,915	725,828	246	229	-6.9	under est	1.07	50
		Okanagan (96)	2,173,877	1,244,734	299	293	-2.0	under est	1.02	50
Nelson		Invermere (93)	1,018,357	416,884	238	231	-2.9	under est	1.03	78
		Golden (94)	920,167	212,141	340	308	-9.4	under est	1.10	50
		Kootenay Lake (94)	1,144,803	472,314	290	285	-1.7	under est	1.02	40
		Revelstoke (94)	503,984	168,608	353	363	2.8	over est	0.97	50
		Arrow (95)	753,948	353,053	263	265	0.8	over est	0.99	50
		Cranbrook (96)	1,391,619	560,872	189	200	5.8	over est	0.95	50
		Boundary (97)	580,109	342,135	179	163	-8.9	under est	1.10	50
Pr. George		Mackenzie (93)	6,130,617	2,474,317	187	207	10.7	over est	0.90	47
	=>	Dawson Creek (94)	2,277,753	1,233,978	191	155	-18.8	under est	1.23	50
	=>	Fort St.John (94)	4,553,553	1,548,285	162	194	19.8	over est	0.84	49
		Prince George (96)	7,512,981	4,451,602	234	258	10.3	over est	0.91	130
Pr. Rupert		Bulkley (94)	736,154	431,125	269	277	3.0	over est	0.97	50
		Cranberry (95)	76,751	44,436	403	378	-6.2	under est	1.07	40
		Cassiar (96)	13,413,228	3,073,088	96	101	5.2	over est	0.95	70
		Kalum (96)**	1,559,733	509,226	509	496	-2.6	under est	1.03	50
		Upper Nass (94/96)**	655,000	218,240	403	404	0.2	over est	1.00	49
		Lakes (97)	1,123,264	733,666	251	254	1.2	over est	0.99	50
		Morice (97)	1,498,698	864,629	240	237	-1.3	under est	1.01	50
Vancouver		Mid Coast (94)	2,214,984	744,819	494	526	6.5	over est	0.94	49
	=>	Fraser I (94)****	1,165,178	372,700	425	510	20.0	over est	0.83	46
	=>	Kingcome (95)	1,126,125	460,333	480	540	12.5	over est	0.89	50
		Soo (97)	719,503	233,546	460	516	12.2	over est	0.89	47
Cariboo		TFL 5 (94)	34,320	11,815	346	362	4.6	over est	0.96	50
		TFL 52 (95)	265,190	172,574	312	326	4.5	over est	0.96	50
Kamloops		TFL 33 (95)	8,354	4,448	318	314	-1.3	under est	1.01	40
		TFL 35 (94)	39,199	17,383	287	284	-1.0	under est	1.01	50
		TFL 18 (95)	74,571	30,528	283	311	9.9	over est	0.91	49
Nelson	=>	TFL 14 (93)	139,443	28,919	299	237	-20.7	under est	1.26	49
		TFL 23 (94)	554,981	173,005	339	362	6.8	over est	0.94	50
		TFL 3 (95)	79,250	22,611	255	292	14.5	over est	0.87	40
Pr. George	=>	TFL 30 (94)	180,766	84,757	249	298	19.7	over est	0.84	47
Pr. Rupert	=>	TFL 1 (95)	609,204	208,945	373	464	24.4	over est	0.80	50
Vancouver		TFL 37 (94)	189,851	77,861	722	788	9.1	over est	0.92	41
Total			65,841,354	27,952,053	301.5	313.1				

count 40

	Diff% ==>	5.15
	t*SEE% =>	2.45
Conf Int>	**Lower ==>**	2.70
	upper ==>	7.60

Note:

Percent Difference: The percent difference is calculated by (label volume - ground volume)/ground volume

* Total Productive Forest Area (does not include immature and NSR). Total Productive forest area is derived from area by leading species for all sites in age class range>4 (mature, greater than 60 yrs)

** Since productive area for Upper Nass was not available, the total productive area for Upper Nass was derived by using the ratio of the entire Kalum TSA.

**** Fraser does not include the additional 100 net operable

=> **Statistically Significant (95 percent level of probability)**

t= 2.02

A NOTE ON THE CONFIDENCE INTERVALS OF THE DIFFERENCE FOR THE COMPLETED TSAs

1. The area weighted difference is 5.15 percent, for the completed TSAs and TFLs, i.e., the mean volume/ha in the inventory may be larger than the actual mean vol/ha by 5.15 percent.
2. The confidence interval around this difference is (=/-) 2,45 percent, i.e., the over estimation could be as low as 2.71 percent, or as high as 7.60 percent, 19 times out of 20.
3. The confidence interval was computed by multiplying the SEE percent (1.21) by the t-value at the 95 percent level of confidence (2.02).
4. Use the above figures with caution. The numbers for total productive forest area has not been confirmed and is still considered draft. The

So overall, the total forested inventory is being overestimated by 5 percent. This result is not surprising given that most stands in the existing inventory are from the original forest. We have been harvesting that forests in general, from the best stands first. One would expect an audit of the remaining inventory to reflect a lower means than when the inventories were first developed. However, not everything is rosy; when we look in detail at specific inventories and strata within an inventory, we observe trends that are disturbing.

Our inventory is driven by the inventory label, the key elements of which are the leading species in the correct order and then the correct magnitude. We characterize the leading species into growth type groups (GTG). With a statistically unbiased data set, it is now possible to address questions that before, for the want of reliable data, were unanswerable. Reviewing GTG for each management unit, we created a list ordered from the best comparison to the worst. In one management unit, we identified the leading species correctly 88 percent of the time. In the worst unit, we identified the leading species correctly only 33 percent of the time. The median was 51 percent (slightly better than a coin toss). Further analysis suggests that our ability to determine leading species is related, not surprisingly, to the species themselves.

The prime driver of the volume, and thereby the accuracy of the inventory, is the height of the stand. In general, when we find an inventory that is significantly different from the audit, the most common error is a systematic bias in the estimate of the stand height.

In concluding this section, the development of an ability to audit an existing inventory has provided much needed insight to our commonly held conventional wisdom of our ability to photo-interpret. As coaches of elite athletes are fond of saying, *"You cannot expect improvement by doing the same thing that you have always done in the past."*

EMERGING ISSUES

Since the RIO conference, the world agenda has been greening.

First came the Criteria of Sustainable Forest Management and their associated Indicators, as codified in the Montreal Accord or the Helsinki Accord or the ITTO version. Following close behind is the international marketplace drive to certification of sustainable forest management for a landowner or industrial enterprise operating on a mix of crown and/or private lands.

In the last 8 months, we have seen the drafting of the Kyoto Accord to reduce greenhouse gas emissions by the developed nations.

Taken individually or collectively, all of these initiatives are placing incredible burdens on resource management agencies to develop, manage, and provide the relevant information that can satisfy all of these emerging issues.

Make no mistake, a company, a province (state), or a nation that fails to address these issues with the attention that they deserve will reap a whirlwind of economics effects that will not be easily overcome. At the heart of the new paradigm, the green agenda is driving market forces. Fail to present the appropriate green report card and you will no longer be allowed to play in the market game.

CONCLUDING REMARKS

At this point, it is appropriate to step aside and allow Dr. Kim Iles and Mr. Norm Shaw to describe our response to the stated needs and emerging issues that we have faced over the last 7 years.

But before I leave, I offer these lessons from our experience:

1. **Standards and Procedures**. It is possible, with considerable patience, to draw together disparate interests in resource inventories to develop common standards and procedures to the benefit of all.
2. **Planning**. Before you throw out that existing inventory to replace it with something better, invest a little upfront money to determine just what needs fixing and what can be left alone.
3. **Trust**. Do not accept the conventional wisdom in any field without asking them to provide objective evidence. Often, we have not been troubled by the facts in ascertaining our abilities.
4. **Sampling**. Most of our clients, and some of our colleagues, do not understand sampling and do not trust it. Expect to spend considerable time educating the educated.

LITERATURE CITED

Forest Resources Commission. The future of our forests, April 1991. ISBN 0-7726-1330-3.

Thrower and Associates. (1992) An historic summary of forest inventory sampling designs in British Columbia. Report to the BC Ministry of Forests, Inventory Branch, Timber Inventory Task Force. Prepared by J.S. Thrower. Victoria, BC: BC Forest Service.

Appendix 1 RIC—Standards

Name of Inventory Standard	Name of Inventory Standard
Aquatic Ecosystems	**Coastal Ecosystems**
Field Key to Freshwater Fishes of BC	Assessing Shellfish Culture Capability in Coastal BC
A Guide to Photodocumentation for Aquatic Inventory	BC Biological Shore-Zone Mapping System
Aerial Photopography & Videography Standards: Applications for Stream Inventory & Assessment	BC Physical Shore-Zone Mapping System
Bathymetric Standards for Lake Inventory -- Fish & Fish Habitat	BC Marine Ecological Classification: Marine Ecosections & Ecounits
Fish Collection Methods & Standards	Review of Aerial Video Survey Techniques & Recommendations of Survey Standards
User's Guide to the BC Watershed/Waterbody Identifier System	
Key to Cladocerans (Crustacea) of BC	**Culture (includes Recreation & Tourism)**
An Identification Guide to the Nymphal Mayflies of BC	
Key to the Species of Freshwater Calanoid Copepods of BC	Recreation Features Inventory
Reconnaissance 1:20,000 Fish & Fish Habitat Inventory Standards & Procedures (Version 1.1)	Recreation Opportunities Spectrum Inventory
Standards for Fish and Fish Habitat Maps (Version 2.0)	River Recreation
Ambient Freshwater & Effluent Sampling Manual	Visual Landscape Inventory Manual Procedures (Version 2.0)
Aquatic Biological Sampling Manual	Routes & Trails
Lake and Stream Bottom Sediment Sampling Manual	Caves
Standard Operating Procedures for Hydrometric Surveys	Wilderness Monitoring Sampling Plots
Guidelines for Designing & Implementing a Water Quality Monitoring Program in BC	Comprehensive Guidelines for Cultural Heritage Resource Inventories (Site Inventory Form & Recording Guide)
Guidelines for Interpreting Water Quality Data	Tourism Resource Inventory Standards & Procedures 1:250,000 Scale
Fisheries Information Summary System Data Compilation & Mapping Procedures	Traditional Use Site Database Technical Specifications
Automated Water Qulaity Monitoring	Culturally Modified Trees: (Handbook for ID & Recording of CMT's; Operational Procedures: Interim Permit Reporting & Recommended Report Format; Operational Criteria for Assessing Scientific & Cultural Significance of CMT's)
Atmosphere & Air Quality	**Earth Science**
Bibliography of Air Quality - British Columbia	
Bibliography of Meteorology & Climatology - British Columbia	Groundwater Mapping & Assessment in BC (Vol. I & Vol. II)
British Columbia Air Quality Monitoring Networks	Preliminary Seismic Microzonation Assessment for BC
Climatological, Meteorological & Air Quality Products Summary	BC Archaeological Impact Assessment Guidelines (includes Archaeological Site Inventory Form)
Description of British Columbia Meteorological Networks	Guidelines and Standards for Terrain Mapping in BC
	Specifications & Guidelines for Bedrock Mapping in BC
	Terrain Stability Mapping in BC: A Review & Suggested Methods for Landslide Hazard & Risk Mapping

Appendix 1 RIC—Standards

Land Use	
	Standards for Wildlife Radio Telemetry
Corporate Land Use Classification System for BC	Wolves & Cougars (Version 2.0)
Terrestrial Ecosystems -- Biodiversity	**Terrestrial Ecosystems -- Ecology**
Bats (Version 2.0)	Procedures for Environmental Monitoring in Range and Wildlife Habitat Management
Marbelled Murrelet	Soil Inventory Methods for BC
Plethodontid Salamanders	Standards for Terrestrial Ecosystems Mapping in BC (Ver 2)
Fast-stream Amphibians (Tailed Frogs & Pacific Giant Sal.)	BEC Subzone Variant Mapping
Forest & Grassland Songbirds	Field Manual for Describing Terrestrial Ecosystems in the Field
MacroFungi	BC Wildlife Habitat Rating Standards
Raptors	Standards for Broad Terrestrial Ecosystem Classification & Mapping for BC (Version 2.0)
Small Mammals (Shrews, Voles, Mice & Rats) Version 2.0	Terrain Classification System for BC (Manual 10 - Ver 2)
Aerial Based Inventory of Ungulates	Data Standards for Terrestrial Ecosystem Mapping in BC
Medium Territorial Carnivores (Coyote, Red Fox, Lynx, etc.)	
Pikas & Sciurids (Squirrels)	**Terrestrial Ecosystems -- Vegetation**
Woodpeckers	
Introduction to RIC Wildlife Inventory	VRI - BC Land Cover Classification Scheme (Version 2.0)
Pond-Breeding Amphibians & Painted Turtle (Version 2.0)	VRI - Photo Interpretation Procedures Phase 1 (Version 2.1)
Terrestrial Arthropods (Version 2.0)	VRI - Ground Sampling Procedures (Version 3.0)
Live Animal Capture & Handling Guidelines	VRI - Operational Field Procedures for Forest Resource Survey & Mapping Using GPS Technology
Shorebirds	VRI - Photo Estimation Retrofit Procedures
Upland Gamebirds	VRI - Quality Assurance Procedures for Photo Interpretation
Nighthawks & Poorwills (Goatsuckers)	VRI - Photo Interpretation Standards
Colonial-Nesting Freshwater Birds	Overview Aerial Survey Standards for BC & Yukon
Ground Based Census Techniques for Selected Cervids	
Riverine Birds (Dippers & Harlequins)	
Hares & Cottontails	
Snakes	
Swallows & Swifts	
Standard Taxonomy of BC Vertebrates	
Bears	
Other	**Standards under Development**
BC Standards, Specifications & Guidelines for Resource Surveys Using GPS Technology (Release 2.1)	Estuarine Mapping & Classification A20
LandData BC Corporate Data Model Framework	Nearshore Marine Habitat Inventory Manual
LandData BC Modelling Standards & Guidelines	Nearshore Marine Habitat Mapping Manual
RIC Map Projection Standards for Resource & Cultural Heritage Inventories in BC	General Biodiversity Inventory

Appendix 1 RIC—Standards

Standard for Developing Digital Data Specifications Standards Documents	Marten, Weasels & Fishers
	Standards for Voucher Collection and Preparation
	Wolverines
	Woodrat, Porcupine & Mountain Beaver
	Seabirds
	Waterfowl (Geese, Ducks & Sandhill Cranes)
	Beaver and Muskrat
	Moles & Pocket Gophers
	Bitterns & Rails
	Lizards & Skinks
	Rare Vascular & Non-vascular Plants
	River Otter & Mink
	Raccoons, Opossums & Skunks

Appendix 2 - RIC Training Courses

The following is a list of RIC Training courses that have either been completed or are currently under development.

Course Title	Duration
Level 2	
• Resources Inventory Skills	15 - 20 days
Level 3	
• Electrofishing – Crew Member	2 days
• Archaeological Inventory	10 days
• Culturally Modified Tree Inventory	7 days
Level 4	
• Fish Identification	2 days
• Introduction to RIC Wildlife Species Inventory	2 days
• Using GPS Technology	1 - 5 days
• Culturally Modified Tree Inventory	5 days
• Reconnaissance Level Field Stream Inventory	3 days
• Introduction 1:20,000 Fish & Fish Habitat	3 days
• Reconnaissance Level Stream Field Inventory	3 days
• Wildlife Habitat Capability & Suitability	4 days
• Terrestrial Ecosystem Mapping	5 days
• Vegetation Resources Inventory	13 days
• Marbled Murrelet Inventory	5 days
• Raptor Inventory	4 days
• Terrestrial Salamander Inventory	4 days
• Forest & Grassland Songbird Inventory	4 days
• Small Mammal Inventory	3 days
• Describing Ecosystems in the Field	5 days
• Visual Landscape Inventory	3 days
• Recreation Resource Features & ROS Inventory	3 days
• Net Volume Adjustment Factor Sampling	5 days
• Bat Inventory	5 days