KARST MANAGEMENT IN BRITISH COLUMBIA: THE TRANSITION TO A RESULTS-BASED FOREST PRACTICES FRAMEWORK AND THE LEGALLY SUPPORTED PRACTICE REQUIREMENTS FOR KARST RESOURCE FEATURES

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Abstract

The release of karst inventory standards and vulnerability assessment procedures in 2001, and best practice recommendations for forestry operations on karst in 2003, has laid the groundwork for more comprehensive management of karst resources in British Columbia's forests. In January 2004, the British Columbia Government introduced the Forest and Range Practices Act, a new results-based regulatory framework for forest practices. The act will have profound implications for karst management in British Columbia. Draft government orders made pursuant to regulations under the act have identified categories of karst features and karst terrain that would be legally subject to a practice requirement of not damaging or rendering the resource feature ineffective when conducting a primary forest activity. Under these proposed orders and the Forest and Range Practices Act, it is the responsibility of forest companies to recognize and assess the various categories of karst resource features, and to prescribe the appropriate forest practices for them, using professional advice when needed.

Introduction

In January 2004, the Forest and Range Practices Act was introduced in British Columbia to streamline regulatory forest management requirements and improve the competitiveness of the provincial forest and range sectors, while at the same time maintaining high environmental standards. The the Forest and Range Practices Act is a results-based legislative and regulatory framework whereby the government establishes objectives for resource values, and forest companies (licensees) prepare results and/or strategies that must be consistent with those objectives.[1] The development of appropriate results and strategies is left to the professional judgment and discretion of the licensee; however, the government retains the responsibility for reviewing and approving licensees' operational plans. The focus of the Forest and Range Practices Act is on "end results" rather than prescriptive forest practices. The act replaces the more prescriptive Forest Practices Code, which has guided forest management in British Columbia since 1995.

This paper presents an overview of British Columbia's new results-based approach to forest practices and how it relates to the management of karst resources in British Columbia. The recently proposed use of legally supported practice requirements, and other legal and non-legal options for karst management under the Forest and Range Practices Act, are discussed. The paper also addresses related issues such as professional reliance, the evaluation and monitoring of karst resources under the Forest and Range Practices Act, the role of the Forest Practices Board, certification and self-regulation, and the next steps for karst management in British Columbia.

Background to Karst Management in British Columbia

The westernmost of Canada's ten provinces, British Columbia borders the Pacific Ocean, and the states of Alaska and Washington. The province is nearly one million square kilometers (or 621,371 square miles) in area and is significantly larger than the state of Texas for comparison purposes.

British Columbia is Canada's most ecologically diverse province and home to some of the nation's finest karst resources. Approximately 10% of the province is underlain by soluble bedrock that has the potential to form karst. Extensive areas of carbonate bedrock and karst occur within the Rocky Mountains in alpine and sub-alpine settings. Karst is also known in many other areas of inland British Columbia: in the Northwest (Stikine, Nakina, and Taku Rivers), the Southeast (Nelson area and Glacier National Park), the Northeast (Chetwynd and Prince George areas) and in South Central British

1 A licensee for this purpose means a forest agreement holder; a holder of an agreement under the Forest Act.

Columbia (Marble Range).

Some of the best-developed and most significant karst areas in British Columbia occur along the Pacific Coast, particularly Vancouver Island and the Queen Charlotte Islands/Haida Gwaii. This karst is distinctive because of its unique association with the coastal temperate rainforest biome.[2] Large mature trees, diverse plant and animal communities, highly productive aquatic systems, well-developed subsurface drainage, and extensive surface karst often characterize these coastal karst ecosystems and underlying cave resources. Most of the issues related to karst management in British Columbia have focused on these coastal areas, since they tend to be highly productive forest sites.

More than 90% of karst resources in British Columbia are publicly owned.[3] This means that the vast majority of the forests and the karst are administered and regulated by government on behalf of all British Columbians.

Under the Canadian Constitution, the provinces are responsible for most aspects of natural resource management, which by default includes karst. However, karst is rarely, if ever, addressed explicitly in any provincial legislation. There is currently no specific law or regulation governing the protection and conservation of karst resources in British Columbia. The British Columbia *Park Act* can provide legal protection for karst, but this has effect only where karst resources occur in parks and other protected areas. The British Columbia *Heritage Conservation Act* can be applied wherever specific archeological and cultural heritage resource values are known to occur in relationship with karst. The British Columbia *Wildlife Act* has some limited application as well. Historically, British Columbia government agencies other than the Ministry of Forests and Range and its predecessors have not played a significant role in karst management. The Ministry of Forests and Range has primary responsibility for managing karst resources in British Columbia forests outside of protected areas. Managing karst in British Columbia has therefore been largely integrated with managing forest lands.

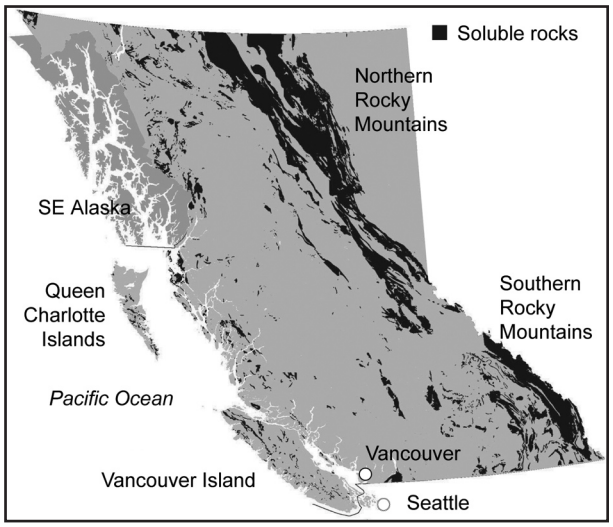


Figure 1: Distribution of Soluble Rocks in British Columbia.

Karst management in British Columbia forests was initially shaped by concerns for the protection and conservation of specific caves. In recent years, however, there was a significant policy shift to a management strategy that considered both the surface and subsurface elements of a karst system. The end result was that British Columbia adopted a non-legally supported ecosystem approach to the management of karst and cave resources. This approach to managing karst resources was embodied within a series of significant government initiatives. In 2000, the British Columbia Government released *A Preliminary Discussion of Karst Inventory Systems and Principles for British Columbia* (Stokes and Griffiths 2000), which proposed a scientific framework for developing a standardized inventory system for karst ecosystems in British Columbia. The Karst Inventory Systems and Principles report led to the development of provincial standards (Resources Information Standards Committee) for conducting karst inventories, which were initially released in 2001 and revised in 2003: *Karst Inventory Standards and Vulnerability Assessment Procedures for British Columbia* (RISC 2003). In 2003, the government also released the *Karst Management Handbook for British Columbia* (MOF 2003), which provides recommended best management practices for forestry operations on karst terrain. Finally, in 2004, the Ministry of

2 The major tree species here are western hemlock and amabilis fir, with some western red cedar, yellow cedar and Sitka spruce. This biome is essentially the coastal western hemlock biogeoclimatic zone.

3 There is a larger than average proportion of privately owned land on Vancouver Island, and to the extent that this land encompasses karst there is less regulation of the resource.

Forests initiated the development of monitoring and effectiveness evaluation indicators and protocols for karst resources under the Forest and Range Practices Act Resource Evaluation Program.

The management approach described above recognizes the four fundamental environmental components to be managed in a karst ecosystem — air, water, land and biota — and takes into account the fact that the three-dimensional nature of karst causes it to function quite differently from other landforms, presenting unique challenges to land management. In particular, the approach recognizes the potential for karst systems to transport air, water, nutrients, soil, and pollutants into and through underground environments. This potential is considered carefully when developing and implementing management strategies for karst landscapes. The overall management strategy subscribes to the following key principles:

- Focuses on protecting the integrity of karst systems, including individual surface karst features, caves and the broader karst landscape.
- Independence of scale (for example, micro-relief karst features, such as karren exposures, are managed along with larger scale components such as complex cave systems).
- Not all karst features need to be found or known in order to manage the karst system.
- Subsurface karst resources are to be managed through appropriate forest practices applied on the surface, utilizing a total karst catchment approach.
- Contributing non-karst portions of delineated karst catchment areas should also be considered.

The the Forest and Range Practices Act

To improve the competitiveness of the provincial forest and range sectors and reduce administrative requirements, the British Columbia Government introduced the Forest and Range Practices Act and associated regulations in January 2004. Over a three-year transition period (January 31, 2004–December 31, 2006), the Forest and Range Practices Act replaces the 1995 Forest Practices Code, which was viewed by many in industry and government as cumbersome, costly, and inflexible.

One of the primary goals of the act is to focus on the end results of forest practices rather than prescriptive requirements. Under this new approach to forest management, licensees are responsible for developing plans containing results and strategies consistent with government objectives for managing 11 resource values identified under the act: soils, visual quality, timber, forage and associated plant communities, water, fish (riparian), wildlife, biodiversity, recreation resources, resource features (including karst as a subset), and cultural heritage resources. Some resource values under the Forest and Range Practices Act already have objectives established by government, in which case licensees are required to address those resource values in their plans.

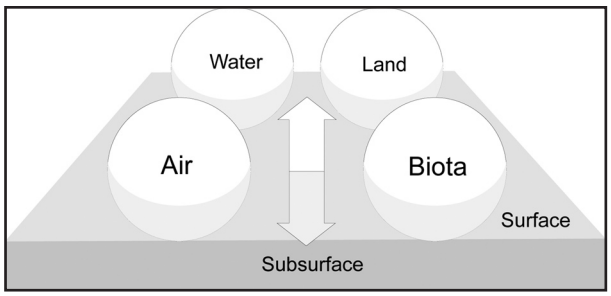


Figure 2: The Four Fundamental Environmental States and the Three-dimensional Nature of Karst.

This new results-based regime aims to reduce the complexity of the legislation and regulations, and lower costs to both industry and government. Maintaining environmental standards is an accompanying goal. The streamlined the Forest and Range Practices Act and regulations, and simplified legal policy framework, are to rely on a science-based approach to the management of natural resources, including karst.

The maximum fines that apply on conviction of an offence under the Forest and Range Practices Act range from $5,000 to $1,000,000 and imprisonment from six months to three years. For example, a person carrying out forest practices that result in damage to the environment can be fined up to $1 million. The maximum fine doubles for a person found liable on a second or subsequent conviction for the same offence.

Karst Management under the Forest and Range Practices Act and its Regulations

Practice Requirements for the Forest and Range Practices Act

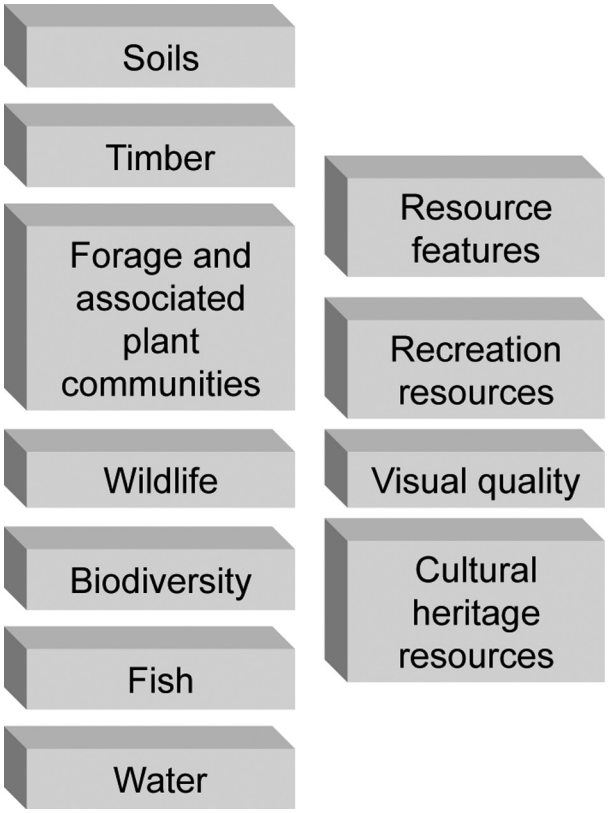


Figure 3: the Forest and Range Practices Act's 11 Resource Values to Manage and Protect.

Karst is not one of the 11 resource values identified under the Forest and Range Practices Act; it is a subset of resource features, which can also include range developments, public land used for research or experimental purposes, permanent snow sampling sites, Aboriginal traditional use sites, and recreation resources (for example, sites, trails, features).

There are two Forest and Range Practices Act regulations that can potentially impact the management of karst resources in British Columbia: the Government Actions Regulation and the Forest Planning and Practices Regulation. Section 5(1) of the Government Actions Regulation provides for identifying "a surface or subsurface element of a karst system" as a "resource feature." This specific recognition for karst resources as a resource feature in law is unprecedented in British Columbia, it is not found in any prior legislation.

Resource features are are "established" by a ministerial order. Resource features identified by such orders, including surface or subsurface elements of a karst system, must meet four tests before the order can proceed:

1. The order must be consistent with established objectives, such as existing land-use objectives, other objectives set by government, or objectives established under the Forest and Range Practices Act or the regulations.
2. The order must not unduly reduce timber supply.
3. The benefits of the order must outweigh any material adverse effects on a forest agreement holder, and any constraints on the ability of an agreement holder to exercise rights granted under the agreement.
4. The resource feature must require special management that is not otherwise provided for in provincial legislation.

Resource features and wildlife habitat features

70 (1) An authorized person who carries out a primary forest activity must ensure that the primary forest activity does not damage or render ineffective a resource feature.

Figure 4: Section 5(1) of the Government Actions Regulation.

Surface or subsurface elements of a karst system can be legally established as resource features by type or category, and may be restricted to a specified geographic location. All resource features previously established under the Forest Practices Code continue to be recognized as resource features under the Forest and Range Practices Act.

According to the Government Actions Regulation, an order must be sufficiently specific "to enable a person affected by it to identify the resource feature in the ordinary course of carrying out forest practices or range practices." Thus, a category or type of readily recognizable karst feature or karst terrain could be established by order as a resource feature. The precise outer boundaries of individual identified karst elements need not be specified in the order.

Opportunities for review and comment are provided to licensees that may be impacted by the establishment of resource features by order. There is also a legal provision not to disclose the precise location of a resource feature in an order if there is reason to believe that the resource feature could be subject to damage or disturbance if the location

Table 1: Milestones in Karst Management for British Columbia (1997-2005)

Year	Initiatives
1997	Karst inventory system and management practice projects initiated Karst poster and booklet
1998	Reconnaissance-scale karst potential mapping for British Columbia initiated
1999	Reconnaissance-scale karst potential mapping for British Columbia completed
2000	*A Preliminary Discussion of Karst Inventory Systems and Principles for British Columbia* published Field testing of karst inventory and vulnerability assessment procedures begins
2001	Version 1 of *Karst Inventory Standards and Vulnerability Assessment Procedures for British Columbia* released
2002	Training materials developed and Karst Field Assessment training course piloted Timber supply impact assessments completed
2003	Version 2 of *Karst Inventory Standards and Vulnerability Assessment Procedures* released *Karst Management Handbook for British Columbia* released *Note to the Field* released Web training course launched
2004	New results-based regulatory regime (the Forest and Range Practices Act) transition Karst indicators and monitoring protocols developed
2005	Field testing of karst indicators and monitoring protocols Draft the Government Actions Regulation orders under the Forest and Range Practices Act identifying karst resource features

of the resource feature is disclosed. Licensees may be prohibited from disclosing the location of the feature, or restricted as to whom they disclose the location of the feature to. This would have potential applications to sensitive caves or other karst features.

The legal practice requirement for resource features established by order is specified in Section 70(1) of the Forest Planning and Practices Regulation. Once established as a resource feature, the practice requirement specifies that primary forest activities (harvesting, road work and silviculture) must not damage the resource feature or render the feature ineffective.

The best management practices for karst as recommended in the *Karst Management Handbook for British Columbia* provide forest practices that can be used for both specific karst features and broad karst landscapes.[4] As the Forest and Range Practices Act approach is based on specifying outcomes as opposed to specific practices for karst, licensees can set out to meet the practice requirement for karst resource features established by an order (as outlined above) by utilizing recommendations from the Karst Management Handbook, or by em-

4 As an example, the Karst management Handbook recommends a two-tree-length reserve (to maintain microclimatic conditions) and a management zone (to protect the reserve from windthrow) for sinkholes with distinct microclimates.

ploying new alternative strategies. As licensees and operators gain more knowledge and experience, they are expected to become more innovative karst managers, and less likely to rely solely on the Karst Management Handbook.

Resource features

5 (1) Subject to subsection (2), the minister responsible for the *Forest Act* by order may identify one or more of the following as resource features in relation to a specified area:

(a) a surface or subsurface element of a karst system

Figure 5: Section 70(1) of the Forest Planning and Practices Regulation.

The Forest and Range Practices Act Objectives and Strategies

As noted earlier, some, but not all, the Forest and Range Practices Act resource values have objectives established by government. For those resource values with established government objectives, licensees must prepare Forest Stewardship Plans that identify results and/or strategies consistent with meeting those objectives. Objectives for the Forest and Range Practices Act resource values can include: land-use objectives (for example, objectives established under regional planning processes), objectives previously set by government (for example, objectives rolled over from the Forest Practices Code), and objectives set by government under the Forest and Range Practices Act and associated regulations. Examples of resource values with objectives set by government under the Forest and Range Practices Act and the regulations include soils, timber, water, fish, wildlife, biodiversity, and cultural heritage resources.

Resource features have no specific objectives set by government under the Forest and Range Practices Act and the regulations at the present time. Karst resources that might be established by order as resource features are not currently required to be included in Forest Stewardship Plans, as there are no existing land-use objectives or other legal objectives established by government for karst.[5] If resource features are established by order, they are managed instead by the legal practice requirements specified in the Forest Planning and Practices Regulation.

If land-use objectives for karst resources were to be legally established from approved land-use plans previously established under the Forest Practices Code, they can override any the Forest and Range Practices Act requirements for karst if the land-use objectives conflicted with the Forest and Range Practices Act requirements. In the land-use planning process, objectives can be set for resource values that are not listed under the Forest and Range Practices Act and the objectives are not subject to the Forest and Range Practices Act timber supply impact policy.

The Vancouver Island Land Use Plan has been established as a higher-level plan under the former *Forest Practices Code of British Columbia Act*. The summary of this plan offers the following karst management strategies for consideration:

- Paying particular attention to issues of forestry and cave/karst interaction, including karst geology, hydrology, soils, karst and cave biology, and cultural and recreational cave and karst features prior to forestry-related development within areas of high cave/karst occurrence or potential;
- Designing development activities in a manner which minimizes and/or mitigates impacts on sensitive cave/karst features and terrains;
- Managing cave/karst features and terrain in accordance with approved cave/karst guidelines. (Prov. of B.C. 2000)

The objectives for karst management described in the summary of the plan have not been legally established by a higher-level plan order. If established, however, the implementation of strategies and results to meet those objectives would become mandatory and form part of an approvable plan (that is, Forest Stewardship Plan).

Many regions of British Columbia where karst resources are known to occur have no approved higher-level plans and objectives.

There are important linkages between the Forest and Range Practices Act and land-use planning processes such as the new Sustainable Resource Management Plans. Sustainable Resource Management Planning is a provincial planning process for

5 The *Karst Management Handbook for British Columbia* outlines comprehensive management objectives for karst, but this provincial government document for karst is not legally supported.

public lands and natural resources in British Columbia. It incorporates various other planning processes, including those for landscape units, watersheds, local resource uses and coastal areas, all under one umbrella. The Sustainable Resource Management Plans can provide resource management direction (that is, objectives) needed for operational planning and Forest Stewardship Plans. If an Sustainable Resource Management Plans were to identify karst resources that required special management considerations (that is, additional protection), government may establish specific objectives for those karst resources that should be included in Forest Stewardship Plans (Prov. B.C. 2004). Sustainable Resource Management Plans also offer the possibility of implementing a total catchment approach to karst resource management and protection.

An option for the management of some karst resources under the Forest and Range Practices Act is to establish a feature or area as an interpretive forest site, recreation site, or recreation trail. This option is available only if the feature or area clearly has recreational value and is therefore not applicable to management of the majority of karst resources in British Columbia. Objectives for interpretive forest sites, recreation sites, and recreation trails can be established under Section 56 of the Forest and Range Practices Act. These objectives must be included in Forest Stewardship Plans, along with results and/or strategies for achieving the objectives.

Professional Reliance and the Forest and Range Practices Act

Professional reliance is heralded as one of the key components of the Forest and Range Practices Act, and is founded on the discretion and judgment of professional resource managers to design, prescribe, and assess appropriate measures to achieve specific forest resource objectives. A large part of professional reliance is the expectation that a professional will exercise due diligence — the same level of care that another professional would or ought to have exercised under the same circumstances.

No one professional body in British Columbia has sole jurisdiction over karst resources. Karst is a multidisciplinary field with a variety of professionals playing a potential role. Typically, two or more professionals representing different disciplines come together as a team (for example, a geoscientist, engineer, biologist, or a forester) with only one taking overall professional responsibility. the Forest and Range Practices Act is predicated on the principle that practitioners in their respective disciplines apply good judgment and act in the interest of the public and karst resources. It is therefore essential that these professionals have some level of karst competence, understand the limits of their competence, and know when to call in another professional to assist with a particular activity.

The conduct of professionals in British Columbia is governed by legislation, codes of ethics, and standards of practice applicable to each discipline. Professionals are accountable to their respective regulatory bodies in the fields of geoscience, engineering, forestry, biology, and agrology.

Holding professional foresters accountable for their actions under the Association of British Columbia Forest Professionals and the *Foresters Act* will be a key tool to curb any unprofessional practices including those affecting the protection of karst resources. However, as already noted, there is no single regulatory body dedicated to overseeing karst practices, and the existing regulatory bodies have yet to set standards for karst competence (for example, developing required skill sets). Since there is so much overlap in managing karst resources, it is expected that joint practice boards will eventually provide practice directives for karst.

The best management practices recommended in the Karst Management Handbook are an important professional reliance tool for professionals working in the karst field. Guidelines for personnel qualifications and training of personnel completing karst inventories in British Columbia are provided in the *Karst Inventory Standards and Vulnerability Assessment Procedures for British Columbia*.

Evaluating the Management of Karst Resources Under the Forest and Range Practices Act

The Forest and Range Practices Act and its regulations place a much greater emphasis on monitoring and evaluating the outcomes of forest management. Under the Forest and Range Practices Act Resource Evaluation Program, a series of effectiveness indicators and monitoring protocols have been developed for assessing whether or not forest practices have adequately protected karst features

and karst terrains.[6] These were refined in 2004 with the input of industry, government, and karst experts, and field tested in 2005. The questions and supporting indicators are based on definitions, assessment procedures and management objectives as outlined in the *Karst Inventory Standards and Vulnerability Assessment Procedures for British Columbia* and the *Karst Management Handbook for British Columbia*. Draft the Government Actions Regulation orders that are consistent with these provincial guidance documents for karst will further facilitate the application of the evaluation indicators and monitoring protocols.

The Forest and Range Practices Act Resource Evaluation Program will measure the success of the Forest and Range Practices Act in the sustainable management of resource values through ongoing monitoring and evaluation projects. The results of the program will be used to identify implementation issues regarding forest practices, policies and legislation, and promote the continuous improvement of forest practices in British Columbia.

As part of this program, the environmental indicators and monitoring protocols that were developed for karst resources will provide a means of determining if forest practices are successful in achieving the appropriate types and levels of karst management recommended in the Karst Management Handbook and any the Forest and Range Practices Act requirement for karst resource features identified by order.

The karst monitoring protocols will be used by the Ministry of Forests and Range, licensees, and other agencies (for example, the Forest Practices Board, compliance and enforcement agencies, and possibly even certification auditors) to assess the effectiveness of forest practices in the management of karst resources.

Since the evaluation of karst management practices is a new activity in British Columbia, the initial short-term goal will be to establish baseline information and general trends.

The Forest Practices Board of British Columbia

The Forest Practices Board is an independent forestry watchdog established by the British Columbia government. Its reports and findings are not subject to government approval prior to public release. Under the Forest Practices Code, the Board evaluated compliance with specific mandated forest practices, carried out special investigations, issued special reports, and responded to public complaints.

The Board has an important new role in the current results-based regime. Under the Forest and Range Practices Act, the Board will reduce the emphasis on assessing compliance and focus on the effectiveness of forest practices in achieving desired results. The Board will act as an independent auditor of the effectiveness of forest practices in the management of resource values, including karst resources that are legally established as resource features. It is also actively contributing to the transition to the results-based framework by working with all stakeholders to test monitoring and evaluation protocols. The Board is working cooperatively with the Ministry of Forests and Range Forest Practices Branch to develop the karst indicators, and is planning to test the karst monitoring protocols in a thematic audit.

Certification and Self-regulation

Some of the largest forest companies on the British Columbia coast have the capacity to voluntarily implement karst management strategies in the absence of any specific legal requirements. These voluntary efforts are often tied to corporate policies and objectives for environmental protection or sustainable forest management, or for obtaining market certification status.

Major licensees operating in karst currently employ a combination of certification schemes, and have developed both internal management and external auditing systems. Most have already achieved International Standards Organization (ISO) 14001 Environmental Management, Canadian Standards Association Sustainable Forest

6 The range of karst indicators covers the following four key categories: caves, surface karst features, sinking and losing streams, and broad karst landscape. Many of the indicators can be defined as routine indicators, which serve as a relatively quick and efficient assessment of the status of the karst resources with little or no analysis. Nevertheless, the indicators are considered to be responsive to karst management practices and measurable using scientifically and statistically based techniques.

Management, and/or the Sustainable Forestry Initiative certification for their operations.

While most large forest companies in British Columbia are certified under the ISO system, certification audits generally do not assess karst management performance specifically. If karst is managed as a resource feature that could be impacted by primary forest activities, and where those activities are deemed to be a significant environmental aspect of the licensee's operations, then the licensee's ISO 14001 environmental management system will normally have controls on the activities to prevent adverse impacts to the karst.

Development of the Government Actions Regulation Orders for Karst Resources: the Draft Order for the Campbell River Forest District

In May 2005, the Campbell River Forest District publicly announced the first proposed the Government Actions Regulation order identifying karst resource features.[7] This announcement was followed immediately by a 60-day public comment period and open houses. A final order was initially to have been made legally effective on or about August 15, 2005.

Pursuant to Section 5(1) of the Government Actions Regulation, the Campbell River Forest District draft order identified the following surface or subsurface elements of a karst system as categories of resource features wherever they are found within the forest district:

- Caves
- Surface karst features (including swallets and karst springs)
- Very high or high vulnerability karst terrain

To avoid a very lengthy order, the extensive roster of possible subcategories of "surface karst features," beyond the two specific examples, was purposely left out of the draft order.

The Campbell River Forest District draft order identified "very high or high vulnerability karst terrain" based on the *Karst Inventory Standards and Vulnerability Assessment Procedures for British Columbia*, which defines the vulnerability of broad karst landscapes based on a four-step field procedure.[8]

Other Draft the Government Actions Regulation Orders for Karst Resources

Another two of British Columbia's eight coastal forest districts have since prepared draft the Government Actions Regulation orders for karst resources. The Queen Charlotte Islands Forest District followed with an order founded on the Campbell River Forest District model, which had been formulated with the help of karst experts. The Campbell River Forest District and Queen Charlotte Islands Forest District draft orders were based on wording consistent with existing provincial guidance documents for managing karst resources in British Columbia. However, a third draft order prepared by the South Island Forest District differed from the Campbell River Forest District and Queen Charlotte Islands Forest District draft orders.

In the South Island Forest District draft order there was a discrepancy between the draft order and the Karst Inventory Standards and Vulnerability Assessment Procedures for British Columbia vulnerability classification conventions, the latter being developed over a number of years with input from government agencies, industry, and qualified karst professionals and experts. The proposed vulnerability definition for karst terrain in the South Island Forest District draft order was based solely on feature densities and the presence of caves, oversimplifying the Karst Inventory Standards and Vulnerability Assessment Procedures for British Columbia procedure into one based on only a few vulnerability attributes. The South Island Forest District draft order defined high and very high vulnerability karst terrain based on the presence of more than ten karst "types" per hectare and a high

7 The Campbell River Forest District consists of 20,000 square kilometers of land, of which 42% is productive forest land, 22% alpine, swamp, and rock, 20% inaccessible forest and 16% park land. Significant karst features in the Campbell River Forest District include many of Canada's longest, deepest, and best decorated cave systems.

8 The procedure evaluates three major criteria: epikarst sensitivity, surface karst sensitivity, and subsurface karst potential. Other factors considered in assessing karst vulnerability include soil texture, overall karst roughness, and unique or unusual flora/fauna or habitats.

likelihood for caves. By reducing the defining attributes of high and very high vulnerability karst terrain to a feature density threshold and a high likelihood for caves, the South Island Forest District draft order addressed a narrower set of karst resources susceptible to primary forest activities (see Figure 6).

In addition, by not identifying "surface karst features" as a subcategory, the South Island Forest District draft order did not cover many features that can occur at different density levels in all types of karst terrain (low, moderate, high, and very high vulnerability). These features, such as springs, sinkholes, karst canyons, swallets, and the like, can also be significantly damaged or rendered ineffective by inappropriate forest practices. By contrast, the Campbell River Forest District and Queen Charlotte Islands Forest District draft orders identified surface karst features as a subcategory of karst resource features without density limitations.

The South Island Forest District draft order did identify karst caves as a specific subcategory of karst resource features. Consequently, such caves would be covered by the order regardless of the vulnerability classification of the karst terrain in which they occur.

Unresolved Draft Order Issues

In September 2005, the British Columbia Coast Forest Region struck a sub-committee with government and licensee representatives to develop guidance for consistent draft the Government Actions Regulation orders. While the Region has no power over the the Government Actions Regulation order process, the districts have agreed to see what the Coast Region Implementation Team subcommittee develops by way of consistent wording for these orders. The districts can then take this under advisement when developing their local orders. The Region plans to have the draft wording for the Government Actions Regulation orders sent out to karst experts before finalizing them for discretional use by the districts. The Coast Region Implementation Team sub-committee is scheduled to report on their work by the end of January 2006. (Reveley *pers. comm*. 2005)

It is anticipated that the following issues are likely to be considered during the development of regional guidance for drafting karst orders:

1. Clarity and Precision in Defining Categories of Karst Resource Features

An important unresolved issue is the question of clarity and precision in defining the categories of karst resource features identified by the the Government Actions Regulation orders.

The approach taken by the Campbell River Forest District and Queen Charlotte Islands Forest District draft orders was to leave out definitions that already exist in the established and accepted provincial guidance documents for karst — these could be referenced, if necessary, outside the orders. The draft orders simply identified the broader karst resource feature categories, whereas the many subcategories could be located and identified in the supporting provincial documents. Definitions for caves and other karst features, including the many possible subcategories of surface karst features, as well as karst vulnerability categories, are explicitly described in the Karst Inventory Standards and Vulnerability Assessment Procedures for British Columbia.

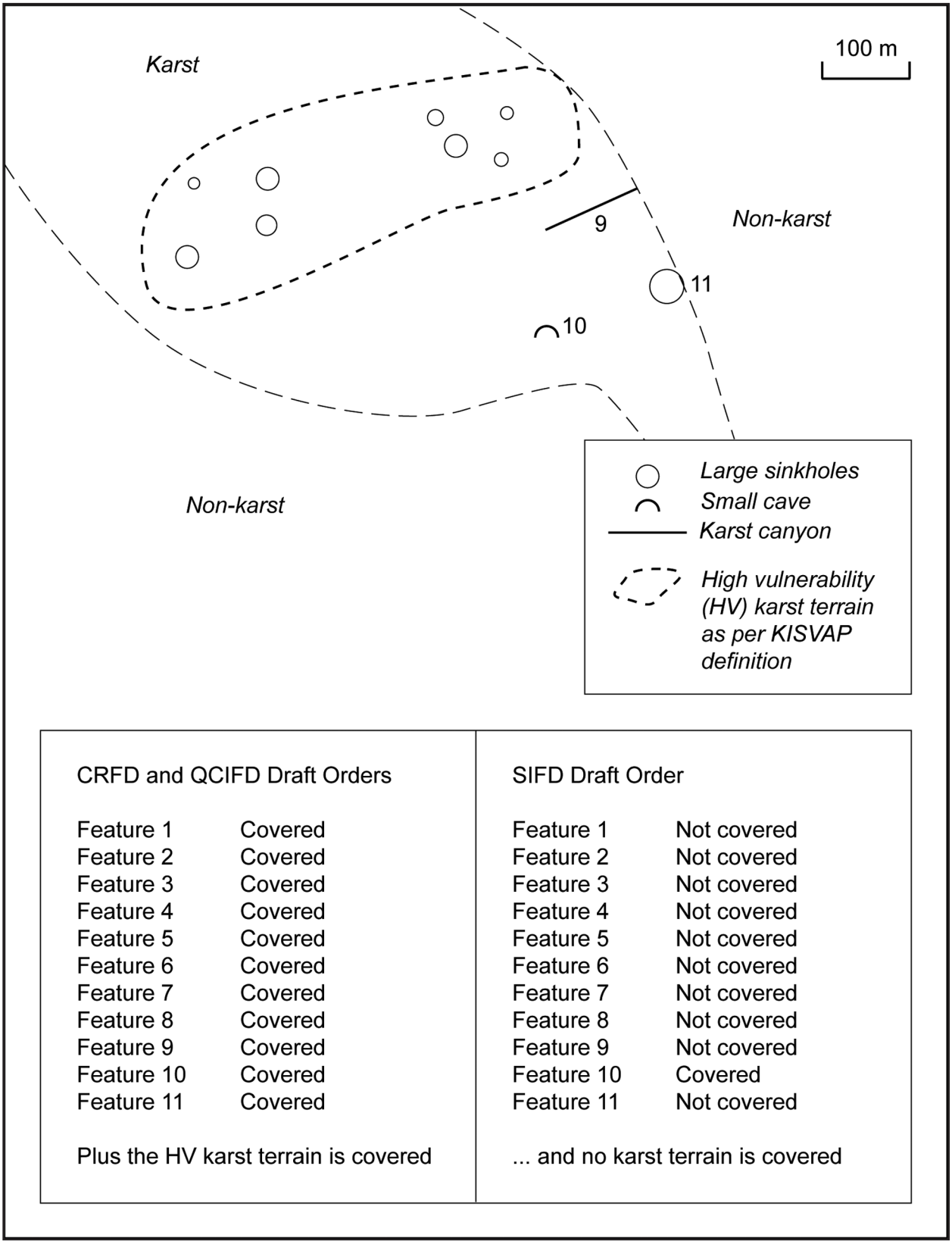
Another possible approach, provided there is no limit on how long a Government Actions Regulation order can be, would be to attempt to list and define all of the possible subcategories of karst resource features within the order itself. However, it is recognized that this could make for a very lengthy and cumbersome order with unintended legal restrictions (that is, there could be the risk of missing some of the important subcategories of karst resource features).

A third option would be to leave details on subcategory definitions to the realms of professional reliance and due diligence, which are cornerstones of the results-based the Forest and Range Practices Act.

2. Defining "Damaged or Rendered Ineffective"

As discussed earlier, Section 70(1) of the Forest Planning and Practices Regulation stipulates that an authorized person who carries out a primary forest activity must ensure that the activity "does not damage or render ineffective a resource feature."

At present, it is difficult to determine a government definition as to what "damaged or rendered ineffective" might mean for a specific karst



CRFD and QCIFD Draft Orders		SIFD Draft Order	
Feature 1	Covered	Feature 1	Not covered
Feature 2	Covered	Feature 2	Not covered
Feature 3	Covered	Feature 3	Not covered
Feature 4	Covered	Feature 4	Not covered
Feature 5	Covered	Feature 5	Not covered
Feature 6	Covered	Feature 6	Not covered
Feature 7	Covered	Feature 7	Not covered
Feature 8	Covered	Feature 8	Not covered
Feature 9	Covered	Feature 9	Not covered
Feature 10	Covered	Feature 10	Covered
Feature 11	Covered	Feature 11	Not covered
Plus the HV karst terrain is covered		... and no karst terrain is covered	

Figure 6: Example Map Showing Key Differences Between the South Island Forest District Draft Order and Campbell River Forest District and Queen Charlotte Islands Forest District Draft Orders for Karst.

resource feature. Ideally, there could be a threshold level above which a karst feature would be considered "damaged or rendered ineffective." Very simply, this threshold level could be judged to be exceeded for a feature when impacts resulting from the primary forest activity are found to be beyond the range expected when utilizing practices recommended in the Karst Management Handbook for British Columbia. The best management practices in the Karst Management Handbook are founded on the widely accepted principle that not all karst features are equally significant or susceptible to primary forest activity impacts. Accordingly, the recommended practices are varied and designed to meet a set of management objectives specific to each karst feature or karst terrain type. The Karst Management Handbook recognizes that a certain amount of disturbance is unavoidable whenever the soil-vegetation system components of a karst ecosystem are subjected to primary forest activities. The provincial karst management strategy as expressed in the Karst Management Handbook and other government karst guidance documents does not recommend full protection (that is, no harvesting) as an objective for every karst feature or karst terrain type.

Defining what is meant by "damaged or rendered ineffective" could eventually entail factoring in the degree of damage or ineffectiveness using indicators for karst such as those already developed and field tested under the Forest and Range Practices Act Resource Evaluation Program. Compliance and enforcement personnel would then be trained to use the karst indicators and monitoring protocols to recognize the results of inappropriate forest practices for karst resource features identified by the orders. Some concerns have been raised about possible contentious interpretations of the meaning of "damaged or rendered ineffective." However, it is felt that professional reliance and due diligence will assist in addressing these concerns.

In summary, the meaning of "damaged or rendered ineffective" could probably be determined based on the circumstances of each specific occurrence of alleged noncompliance. Ultimately, it may be decided by jurisprudence, in the same way that Courts in British Columbia have decided the meaning of "harmful alteration, damage or destruction" of fish or fish habitat.

3. Proposed Temporary Variance

An addendum could be added to the draft the Government Actions Regulation orders for karst that incorporates a Temporary Variance that would allow time for the development of an interpretation bulletin and other specific guidance for the Forest Planning and Practices Regulation Section 70(1) practice requirement. This would also allow time for instruction and training of government compliance and enforcement personnel. An example of a temporary variance is outlined as follows:

Draft of a Proposed Temporary Variance

The following practices are established as management requirements for the following subcategories of resources features identified by the karst order: surface karst features (including cave entrances not classified as significant enough to require full protection) and high vulnerability karst terrain.

1. Timber Harvesting – If, upon review, the quality of the karst feature or karst terrain will not be significantly affected in the opinion of a qualified karst professional.
2. Road Construction – In the case of high vulnerability karst terrain, if the road permits local access to timber or access beyond in non-karst areas or karst terrain of low or moderate vulnerability, and if, upon review, the quality of the high vulnerability karst terrain will not be significantly affected in the opinion of a qualified karst professional.
3. Road Maintenance and Deactivation, and Silviculture Treatments – If, upon review, the quality of the karst feature or karst terrain will not be significantly affected in the opinion of a qualified karst professional.

A "qualified karst professional" for the purpose of the proposed temporary variance would be defined based on the qualifications suggested in the *Karst Inventory Standards and Vulnerability Assessment Procedures for British Columbia*.

FAQ Web Site on Karst Orders

The issues surrounding legally supported practice requirements for karst under the Forest and Range Practices Act are complex and can be difficult for members of industry, stakeholder groups,

government, and the general public to sort out. In the interests of clarifying some of these issues, a FAQ Web site was developed by members of the professional karst community:

http://www.island.net/~subterra/FAQ.htm

This Web site is periodically updated as developments pertaining to the proposed the Government Actions Regulation orders for karst unfold. There have been over 5,000 hits on this Web site since its inception, which suggests that not only is there a need for clarification about the current state of karst management in British Columbia, but also that there is a high level of interest in the recent developments described in this paper.

Next Steps for Karst Management in British Columbia

The eventual passage of effective Government Actions Regulation orders for karst in British Columbia may prove to be highly significant because without such orders, and in the absence of any other the Forest and Range Practices Act provision that could be applicable to karst, there are presently no specific legal requirements to protect or manage karst resources under the new results-based forest practices regime.

The Forest Planning and Practices Regulation specifies a practice requirement to protect karst resources from the effects of primary forest activities by established legal orders, with significant penalties for noncompliance. However, as of this writing, the passage of the proposed the Government Actions Regulation orders for karst is in limbo, and it remains to be seen what form they will take or how effective they will be at protecting karst.

As with other resource values under the Forest and Range Practices Act, the responsibility for karst management in British Columbia is shifting from the government to licensees. The licensees are responsible for managing risk and ensuring sustainable forest practices are implemented. This responsibility would include determining whether karst field assessments are required prior to operating in a karst area. Licensees are also expected to ensure that staff or contractors consider recommended best management practices or otherwise provide a rationale for not doing so. This approach relies heavily on the participation of registered and/or qualified resource professionals who can be held accountable for their work, including geoscientists, biologists or foresters.

It is anticipated that the due diligence emphasis in the Forest and Range Practices Act will motivate the more consistent use of qualified karst professionals. There are but a few karst resource experts or specialists in British Columbia at the present time. Many resource professionals have no specific knowledge or experience related to karst. Despite the emphasis placed on professional reliance under the Forest and Range Practices Act, there continue to be cases where the assistance of qualified karst professionals is not sought. As well, resource professionals have occasionally rendered opinions for karst without adequate experience or knowledge.

Legally supported requirements for karst could actually enhance timber supply because the the

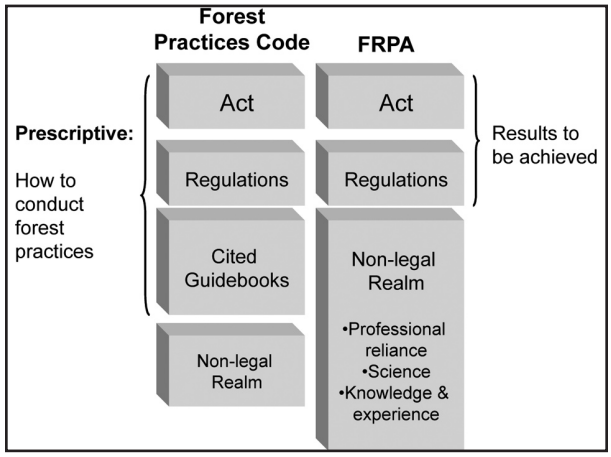


Figure 7: The Shifting Balance: From the Forest Practices Code to the Forest and Range Practices Act.

Government Actions Regulation orders under the Forest and Range Practices Act have the potential to facilitate more efficient harvesting operations in karst areas. Licensees who improve and expand their karst knowledge, or avail themselves of the appropriate professional advice, could conceivably gain better access to commercial timber in karst areas, while still achieving the desired management outcomes for karst.

The benefits of sustainably managed karst resources are without question important to shareholders and customers of forest companies worldwide, and of course to the public on whose behalf these resources are being managed. Raising the level of awareness of karst could lead to greater

public benefits from these resources. Commercial and non-commercial recreation and tourism, and scientific research activities, for example, are bound to become more prevalent as more people discover the myriad non-timber values of coastal British Columbia karst forests.

Conclusions

The Forest and Range Practices Act, a results-based regulatory framework, replaces the more prescriptive Forest Practices Code, which has guided forest management in British Columbia since 1995. Freedom to manage has been actively sought by industry; however, it comes with added responsibilities.

Karst is a subset of resource features, one of the 11 key resource values specified in the Forest and Range Practices Act. The British Columbia government presently sets no objectives for managing karst under the Forest and Range Practices Act or its associated regulations; however, objectives for karst may be provided in land-use plans or Sustainable Resource Management Plans, or if karst resources are established as an interpretive forest site, recreation site or recreation trail with objectives.

Under the Government Actions Regulation, the surface and subsurface elements of a karst system can be legally established by order as resource features. This is the first time that karst has been recognized in legislation in British Columbia. Karst resources can be established as resource features by type or category, and may be restricted to a specified geographic location. Specific karst features and categories of easily recognized, well-developed broad karst landscapes might meet this requirement.

With the establishment of the Government Actions Regulation orders for karst, implementation of a karst management system would in effect no longer be discretionary, it would be compulsory and results-driven. The Government Actions Regulation orders are therefore regarded as the "missing link" in the transition to a results-based forest practices framework (Griffiths *et al*. 2005).

The proposed karst orders represent a significant milestone for karst management in coastal British Columbia's temperate forests, enabling legally supported practice requirements based on documents such as the *Karst Management Handbook for British Columbia*. Once established, the karst orders will be looked upon as an important first step on the way to achieving parity with current world leaders in the protection and management of karst resources in coastal temperate forests (for example, federal forest lands in southeast Alaska).

British Columbia currently has a comprehensive framework for karst management, including a karst inventory system, best management practices for forestry operations on karst terrain, and is in the finishing stages of developing monitoring protocols for evaluating karst management under the Forest and Range Practices Act. The development and implementation of a karst-specific monitoring program is likely to facilitate the periodic updating of recommended best management practices. This indicates an ongoing commitment by the British Columbia Government to manage its karst resources.

As one of the few jurisdictions in the world to move toward a results-based regulatory regime, it is anticipated that experiences in British Columbia will be of value to karst management specialists in other forested karst regions, particularly in the coastal temperate rainforests of Alaska, New Zealand, Australia (Tasmania), and Chile.

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Forest and Range Practices Act: www.for.gov.bc.ca/tasb/legsregs/frpa/frpa/frpatoc.htm

Government Actions Regulation: www.for.gov.bc.ca/tasb/legsregs/frpa/frparegs/govact/gar.htm

Forest Planning and Practices Regulation: www.for.gov.bc.ca/tasb/legsregs/frpa/frparegs/forplanprac/fppr.htm

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