

## **The Next Step for Karst Management in British Columbia: Transition to a Results-based Forest Practices Framework**

**Paul Griffiths, Tim Stokes, Bill I'Anson, Carol Ramsey, Peter Bradford and Bob Craven**

### **Abstract**

The release of **Karst Inventory Standards and Vulnerability Assessment Procedures for British Columbia** in 2001, and the **Karst Management Handbook for British Columbia** in 2003, has given impetus to more comprehensive management of karst resources in British Columbia (BC) forests. In January 2004, the BC government introduced **the Forest and Range Practices Act**, heralding a new results-based legislative and regulatory framework for forest management. This new approach, based largely on professional reliance, and monitoring and effectiveness evaluations, will have profound implications for karst management in BC. Under this new system, the surface or subsurface elements of a karst system will most likely be managed as a "resource feature" that must first be established by legal order. Once established as a resource feature, practice requirements specify that primary forestry activities (harvesting, road work and silviculture) must not damage or render the resource feature ineffective. Monitoring and evaluation indicators and protocols for karst have recently been developed as part of a province-wide evaluation program. These protocols will be used to assess the effectiveness of karst management strategies and practices in BC forests under the new **Forest and Range Practices Act**.

### **Introduction**

In January 2004, the *Forest and Range Practices Act* (FRPA) was introduced in British Columbia (BC) to streamline regulatory forest management requirements and improve the competitiveness of

the provincial forest and range sectors, while maintaining environmental standards. FRPA is a results-based legislative and regulatory framework wherein the government establishes objectives for resource values and licensees prepare results and/or strategies that must be consistent with achieving those objectives. The development of appropriate results and strategies is left to professional judgment and discretion; however, government retains the responsibility for reviewing and approving licensees' operational plans.

The focus of FRPA is on end results rather than adherence to established rules and regulations. FRPA replaces the more prescriptive Forest Practices Code, which has guided forest management in BC since 1995. As one of the few jurisdictions in the world to move toward a results-based regulatory regime, it is anticipated that experiences in BC 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.

This paper presents an overview of BC's new results-based approach to forest management and how it relates to the management of karst. The paper also addresses related issues such as professional reliance, evaluating and monitoring karst management under FRPA, the role of the Forest Practices Board, voluntary compliance and certification, and the next steps for karst management in BC.

### **Contact Information**

*Paul Griffiths, Cave Management Services/KarstCare™, 544 Springbok Road, Campbell River, British Columbia, Canada, V9W 8A2 Email pgriff@island.net*

*Tim Stokes, Malaspina University-College/Terra Firma Geoscience, 1480 Sherwood Drive, Nanaimo, British Columbia, Canada, V9T 1G7 Email tstokes@island.net*

*Bill I'Anson, 2483 Wilcox Terrace, Victoria, British Columbia, Canada, V8Z 5R7 Email b.ianson@shaw.ca*

*Carol Ramsey, 206-1501 Richmond Avenue, Victoria, British Columbia, Canada, V8R 4P7 Email sciurus46@yahoo.ca*

*Peter Bradford, Resource Stewardship Evaluation Officer, Forest Practices Branch, British Columbia Ministry of Forests, PO Box 9513 Stn Prov Govt, Victoria, British Columbia, Canada, V8W 9C2 Email Peter.Bradford@gems1.gov.bc.ca*

*Bob Craven, Manager, Forestry Operations, International Forest Products Limited, #311-1180 Ironwood Road, Campbell River, British Columbia, Canada, V9W 5P7 Email Bob.Craven@Interfor.com*

## **Background to Karst Management in BC**

BC is Canada's most ecologically diverse province and home to some of Canada's finest karst resources. Approximately 10% of the province's 950,000 square kilometres 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 subalpine settings. Karst is also known in many other areas of inland BC - 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 BC (Marble Range). However, some of the best-developed and most significant karst areas occur within the temperate rainforests along the coast, particularly Vancouver Island and the Queen Charlotte Islands/Haida Gwaii. Most of the issues related to karst management in BC have focused on these coastal areas, since they tend to be highly productive forest sites. Much of this coastal karst forest land is publicly owned.

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 BC. The *BC Park Act* can provide legal protection for karst, but this has effect only where karst features occur in parks and other protected areas. The *BC Heritage Conservation Act* can be applied wherever specific archaeological and cultural heritage resources values are known to occur in relationship with karst, and the *BC Wildlife Act* has some limited application as well. Historically, BC government agencies other than the Ministry of Forests (MOF) have not played a significant role in karst management in BC.

The MOF has primary responsibility for managing karst resources in BC forests outside of protected areas. Karst management in BC forests was initially shaped by concerns for the protection and conservation of specific caves. Over the last several years, however, there has been a significant policy shift to a management strategy that considers both the surface and subsurface components of a karst system. The end result is that BC has adopted an ecosystem approach to the management of karst and cave resources.

A series of significant government initiatives have steadily improved the management of karst and cave resources in BC in recent years. In 2000, the Province released *A Preliminary Discussion of Karst Inventory Systems and Principles (KISP) for British Columbia* (Stokes and Griffiths 2000), which proposed a scientific framework for developing a standardised inventory system for karst ecosystems in BC<sup>1</sup>. The KISP 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)<sup>2</sup>. In 2003, the government also released the *Karst Management Handbook for British Columbia* (BC Min. For. 2003), which provides recommended best management practices for forest operations on karst terrain<sup>3</sup>. Finally, in 2004, the MOF initiated the development of indicators and evaluation and monitoring protocols for karst resources under the FRPA Resource Evaluation Program<sup>4</sup>. All of these initiatives indicate that BC is putting considerable effort into developing appropriate management practices for karst resources.

## **The Forest and Range Practices Act**

To improve the competitiveness of the provincial forest sector and reduce administrative requirements, the BC government introduced the *Forest and Range Practices Act* (FRPA) and associated regulations in January 2004. FRPA introduces the transition to a results-based forest practices framework in BC. Over a three-year transition period (January 31, 2004 – December 31, 2006), FRPA replaces the 1995 Forest Practices Code, which was viewed by many in industry and government as too cumbersome and inflexible.

One of the primary goals of FRPA is to focus on the end result of forest practices rather than the prescriptive methods by which results are achieved. Under this new approach to forest management, the forest industry is responsible for

---

<sup>1</sup> See: [www.for.gov.bc.ca/hfd/pubs/docs/wp/wp51.htm](http://www.for.gov.bc.ca/hfd/pubs/docs/wp/wp51.htm)

<sup>2</sup> See: [srmwww.gov.bc.ca/risc/pubs/earthsci/karst\\_v2/karst\\_risc.pdf](http://srmwww.gov.bc.ca/risc/pubs/earthsci/karst_v2/karst_risc.pdf)

<sup>3</sup> See: [www.for.gov.bc.ca/hfp/fordev/karst/karst-final-Aug1-web.pdf](http://www.for.gov.bc.ca/hfp/fordev/karst/karst-final-Aug1-web.pdf)

<sup>4</sup> See: [www.for.gov.bc.ca/hfp/frep/index.html](http://www.for.gov.bc.ca/hfp/frep/index.html)

developing plans containing results and strategies consistent with government objectives for managing the 11 resource values identified under FRPA – soils, visual quality, timber, forage and associated plant communities, water, fish (riparian), wildlife, biodiversity, recreation resources, resource features (including karst), and cultural heritage resources. Not all resource values under FRPA have objectives established by government, in which case, licensees are not required to address those resource values in their plans. Resource values without objectives established by government are managed by practice requirements specified in FRPA's regulations.

This results-based regime aims to maintain high environmental standards, while reducing the complexity of the legislation and regulations, and lowering costs to both industry and government. The streamlined FRPA and regulations, and simplified legal policy framework, relies on a science-based approach to environmental management.

The maximum fines that apply on conviction of an offence under FRPA 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 FRPA and its Regulations**

### **Practice Requirements**

Karst is not one of the 11 resource values identified under FRPA. It is a subset of resource features, which can also include range developments, Crown land used for research or experimental purposes, permanent snow sampling sites, Aboriginal traditional use sites, and recreation resources (e.g., sites, trails, features).

There are two FRPA regulations that directly impact the management of karst resources – the Government Actions Regulation and the Forest Planning and Practices Regulation.

Under the Government Actions Regulation, a surface or subsurface element of a karst system can be identified as a "resource feature". This

specific recognition for karst in law is unprecedented in BC – it is not found in any prior legislation.

Resource features are "established" by a ministerial order. The establishment of resource features, 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 FRPA 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.

Specific procedures and mechanisms for establishing karst resource features by legal order are somewhat unclear at this time. However, it is assumed that the process for legally establishing karst resources as resource features will be finalised prior to December 31, 2006 when FRPA comes fully into effect. All resource features previously established under the Forest Practices Code continue to be recognised as resource features under FRPA.

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. Theoretically, a category of recognisable karst features, such as sinkholes, could be established as a resource feature. Thereafter, all sinkholes contained within a specified geographical area would be managed and protected when and where encountered. The establishing order would not identify sinkholes individually; only the outer boundaries of the geographical area in which sinkholes could potentially occur would be identified. According to the Government Actions Regulation, the 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." A well-developed karst landscape may be recognisable enough on the ground to meet this test. Thus, a category or type of karst area could be established as a resource feature. The precise outer boundaries of the individual karst element(s) would not need to be specified in the order.

Opportunities for review and comment are provided to forest licensees that may be impacted by the establishment of resource features. There is a legal provision not to disclose the precise location of a resource feature in a legal order if there is reason to believe that the resource feature could be subject to damage or disturbance if the location of the resource feature is disclosed. Licensees may be prohibited from disclosing the location of the feature or restricted on the extent to which, or the persons to whom, they disclose the location of the feature. This will have potential application to sensitive caves or other karst features.

The legal practice requirements for resource features established by ministerial order are specified in the Forest Planning and Practices Regulation. The practice requirements specify that resource features must not be damaged or rendered ineffective by primary forest activities.

The best management practices for karst as recommended in the Karst Management Handbook for British Columbia (KMH) provide forest practices that can be used for both specific karst features and broad karst landscapes. As an example, the KMH 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. As the new results-based approach is based on specifying outcomes as opposed to specific practices for karst, licensees can set out to meet the legal practice requirements (as described above) for established karst resource features by utilising practice recommendations from the KMH, or by employing new alternative strategies. While the KMH is basically a prescriptive approach, both industry and government in BC acknowledge that initial guidance for specific karst management practices is required, and that this guidance will likely rely a great deal on the KMH. As operators gain more knowledge and experience, they are expected to become more innovative karst managers.

## **Objectives, Results and Strategies**

As noted earlier, some, but not all, FRPA 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 FRPA resource values can include: land-use objectives (e.g., objectives established under regional planning processes), objectives previously set by the BC government (e.g., objectives rolled over from the Forest Practices Code), and objectives set by government under FRPA and the regulations. Examples of resource values with objectives set by government under FRPA and the regulations include soils, timber, water, fish, wildlife, biodiversity, and cultural heritage resources.

Resource features have no specific objectives set by government under FRPA and the regulations at the present time, and are managed instead by the legal practice requirements specified in the *Forest Planning and Practices Regulation* as described above. Therefore, there is no requirement to include resource features in Forest Stewardship Plans unless they have existing land-use objectives or objectives previously set by the BC government. This means that karst resources established 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.

Land-use objectives for karst resources derived from approved land-use plans previously established under the Forest Practices Code can override any FRPA requirements for karst if the land-use objectives conflict with FRPA practice requirements for resource features. In the land-use planning process, objectives can be set for resource values that are not listed under FRPA and the objectives are not subject to the FRPA timber supply impact policy.

There are important linkages between FRPA and land-use planning processes such as the new Sustainable Resource Management Plans (SRMPs). Sustainable Resource Management Planning is a provincial planning process for Crown lands and natural resources in BC. It incorporates various other planning processes,

including planning for landscape units, watersheds, local resource uses and coastal areas, all under one umbrella. The SRMPs will provide resource management direction (i.e. objectives) needed for operational planning and Forest Stewardship Plans. If an SRMP identifies karst resources that require special management considerations (i.e. additional protection), government may establish specific objectives for those karst resources that must be included in Forest Stewardship Plans. SRMPs may also offer the possibility of implementing a total catchment approach to karst resource management and protection (Prov. B.C. 2004).

Another option for the management of some karst resources under FRPA is to establish the feature or area as an interpretive forest site, recreation site or recreation trail. This option is available if the karst resources clearly have recreational value. Objectives for interpretive forest sites, recreation sites and recreation trails can be established under section 56 of FRPA. These objectives must be included in Forest Stewardship Plans, along with results and/or strategies for achieving the objectives.

As with other resource values under FRPA, the responsibility for karst management is shifting from the government to licensees. The licensees are responsible for managing risk and ensuring sustainable forest practices are implemented. This responsibility includes determining whether professional karst inventories, such as karst field assessments, are required prior to operating in a karst area. Licensees are also expected to ensure that staff or contractors follow appropriate karst inventory standards and recommended best management practices, or otherwise provide a rationale for not doing so. This approach relies heavily on the participation of registered and qualified resource professionals who can be held accountable for their work, including geoscientists, biologists and foresters. Thus, resource professionals with specific karst knowledge and experience are expected to make a greater contribution to karst management strategies and practices in BC.

### **Professional Reliance**

Professional reliance is one of the key components of FRPA, 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 done under the same circumstances. In the case of karst in BC, licensees generally rely on the judgment of professionals who have demonstrated competence in achieving desired results. The best management practices recommended in the Karst Management Handbook are an important professional reliance tool for professionals working in the karst field.

The due diligence emphasis in FRPA will continue to motivate the use of qualified professionals. There are but a few karst resource experts or specialists in BC at the present time - most registered professionals have no specific knowledge or experience related to karst. There have been instances in BC where registered professionals have provided opinions on karst without adequate experience or knowledge.

No one professional body in BC 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 (e.g. a geoscientist, engineer, biologist and a forester) with only one taking overall professional responsibility. As FRPA is predicated on relying on appropriate practitioners in their respective disciplines to apply good judgment and act in the interest of the public and karst resources, it is 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 BC 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. 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 (e.g., 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.

### **Evaluating the Management of Karst Resources Under FRPA**

FRPA and its regulations place a much greater emphasis on monitoring and evaluating the outcomes of forest management. Along with increased accountability on the part of licensees, FRPA also provides more room for innovation and flexibility. As more knowledge is accumulated, new approaches to resource management can be suggested if there is a level of assurance that the alternative practices will meet government's objectives for resource values. New management approaches must be specified in FSPs and can be approved or rejected by the Ministry of Forests (MOF).

In view of this greater reliance on achieving results, the MOF initiated the FRPA Resource Evaluation Program in 2004.<sup>5</sup> The FRPA Resource Evaluation Program measures the success of FRPA 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 BC.

As part of this program, environmental indicators and monitoring protocols were developed for karst resources.<sup>6</sup> The karst indicators and monitoring protocols 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 the legal practice requirements for identified karst resource features. Since the evaluation of karst management practices is a new activity in BC, the initial short-term goal will be to establish baselines and general trends.

The karst monitoring protocol is based on the concept of a retrospective assessment. With few exceptions, it is anticipated that harvested cutblocks will be assessed to determine the effect of forest practices on karst features and the

broader karst landscape. Controlled research to assess the effects of alternative treatments, or to examine particular issues, will not be part of initial monitoring efforts. Past experience will be relied upon until applied karst research can be carried out in BC. At the present time, compliance and validation-type evaluations are outside the scope of current MOF monitoring and evaluation initiatives.

The karst indicators and monitoring protocols were developed in early 2004. Initially, a total of 45 evaluation questions were generated from an analysis of the karst management objectives specified in the KMH. The range of evaluation questions covered the following four key categories:

- Caves;
- Surface karst features;
- Sinking and losing streams; and
- Broad karst landscape.

The KMH management objectives for karst features and landscapes were translated into specific questions that needed to be answered in order to determine if the objective was being met. The evaluation questions were further refined following a stakeholder workshop into a more detailed suite of 21 evaluation questions, along with supporting indicators and rationales. 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 were considered to be responsive to karst management practices and measurable using scientifically and statistically based techniques.

Many of the karst indicators provide a range score. For example, the amount of windthrow within the first 10m of the rim of a significant sinkhole (measured from the slope break at the rim) is recorded in categories of: <5%, 5-15%, 15-30% and >30%. Amounts of windthrow greater than 5% within the first 10m of the sinkhole are considered undesirable, whereas graduated higher levels of windthrow are somewhat more acceptable at further distances from the rim of the sinkhole. Critical thresholds for the indicators were not always known conclusively, and it is recognised that detailed research is required to validate the underlying assumptions for many of

<sup>5</sup> See: [www.for.gov.bc.ca/hfp/frep/index.html](http://www.for.gov.bc.ca/hfp/frep/index.html)

<sup>6</sup> See: [www.for.gov.bc.ca/hfp/frep/repository/feat\\_karst\\_checklist.pdf](http://www.for.gov.bc.ca/hfp/frep/repository/feat_karst_checklist.pdf)

the indicators and to facilitate the development of additional or more reliable indicators.

The karst monitoring protocols will be used by the MOF, forest licensees, and other agencies (e.g., the Forest Practices Board, other compliance and enforcement entities, and possibly even certification auditors) to assess the effectiveness of forest practices in the management of karst resources.

### **The Forest Practices Board**

The Forest Practices Board is an independent forestry watchdog established by the BC 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 FRPA, 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 cooperatively with all stakeholders to test monitoring and evaluation protocols. The Board has contributed funding for the development of the karst indicators and field testing of the karst monitoring protocols, and is planning to test the karst monitoring protocol in a thematic audit to be conducted later in 2005.

### **Voluntary Compliance and Certification**

Some of the largest forest companies on the BC 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 ISO 14001 Environmental Management, Canadian Standards Association Sustainable Forest Management, and/or the Sustainable Forestry Initiative certification for their operations.

While most large forest companies in BC 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 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.

### **Next Steps for Karst Management**

One of the next steps for karst management in BC will be to continue to field-test the karst monitoring protocol. Preliminary field testing was completed earlier in 2005. The karst indicators and field protocols will undergo further refinement based on feedback from the preliminary field-testing. It is anticipated that basic implementation of the karst monitoring protocol by the Forest Practices Board later this year will result in further modifications and refinements to the procedures.

Initial monitoring and evaluation of karst management in BC will provide much needed baseline information in order to establish current management trends and facilitate comparisons with alternative approaches to managing karst. As significant trends and causal factors are identified, the information will be fed back into the karst management system. Multi-year monitoring will be required to determine the true effectiveness of karst management practices, especially in cases where the biological and geomorphological responses occur over prolonged periods. To be successful over the longer term, the karst monitoring program will need to establish priorities and secure a long-term commitment for the program from the government.

## Conclusions

Karst is currently not listed as one of the 11 key resource values identified under FRPA, but is recognised and managed as a component of resource features, which are one of the resource values specified in FRPA. The BC government presently sets no objectives for managing karst under FRPA or the regulations; however, objectives for karst may be provided in land-use plans or SRMPs, 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 as a resource feature. This is the first time that karst has been recognised in legislation in BC. Karst resources can be established as resource features by type or category, and may be restricted to a specified geographic location. A well-developed, easily recognised karst landscape may meet this requirement.

The *Forest Planning and Practices Regulation* specifies practice requirements to protect karst resources that are legally established as resource features from the effects of primary forestry activities. There can be significant penalties for non-compliance with the practice requirements.

BC currently has a comprehensive framework for karst management, including a karst inventory system, best management practices for forest operations on karst terrain, and is in the initial stages of developing monitoring protocols for evaluating karst management under FRPA. This indicates an ongoing commitment by the Province to manage its karst resources. In addition, the new results-based forest management framework places a greater reliance on the judgment and discretion of qualified resource professionals, which may benefit the management of karst resources.

For major licensees who have a prior commitment to voluntary compliance and/or certification schemes, the transition to a results-based approach to karst management is not expected to produce substantial changes to practices. Licensees who have not already implemented a comprehensive karst management system based on the principles of the Karst Management Handbook are likely to find the results-based shift much more challenging.

## Acknowledgement of Reviewers

The authors would like to thank the following people for acting as technical reviewers for this paper: Ian Miller, Bill Marshall and Brian Eccles, BC Ministry of Forests; Steve Chatwin and John Pennington, Forest Practices Board; and Mike Alexander, KPMG Performance Registrar Inc.

## References

- British Columbia Ministry of Forests. 2003. Karst Management Handbook for British Columbia. Province of British Columbia, Victoria, BC.
- Province of British Columbia. 2004. Resource Analysis Guide for Sustainable Resource Management Planning. Ministry of Sustainable Resource Management. Victoria, BC.
- Resources Inventory Standards Committee (RISC). 2003. Karst Inventory Standards and Vulnerability Assessment Procedures for British Columbia. Victoria, BC.
- Stokes, T.R. and P.A. Griffiths. 2000. A Preliminary Discussion of Karst Inventory Systems and Principles (KISP) for British Columbia. B.C. Min. For., Res. Br., Victoria, B.C. Work. Pap. 51/2000.
- Forest Practices Code of British Columbia Act:  
[www.for.gov.bc.ca/tasb/legsregs/fpc/fpcact/confp c.htm](http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcact/confp c.htm)
- Forest and Range Practices Act:  
[www.for.gov.bc.ca/tasb/legsregs/frpa/frpa/frpatoc .htm](http://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](http://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](http://www.for.gov.bc.ca/tasb/legsregs/frpa/frparegs/forplanprac/fppr.htm)
- BC Park Act:  
[www.qp.gov.bc.ca/statreg/stat/P/96344\\_01.htm](http://www.qp.gov.bc.ca/statreg/stat/P/96344_01.htm)
- BC Heritage Conservation Act:  
[www.qp.gov.bc.ca/statreg/stat/H/96187\\_01.htm](http://www.qp.gov.bc.ca/statreg/stat/H/96187_01.htm)
- BC Wildlife Act:  
[www.qp.gov.bc.ca/statreg/stat/W/96488\\_01.htm](http://www.qp.gov.bc.ca/statreg/stat/W/96488_01.htm)