Risk Listing and Setting Conservation Priorities for Species in British Columbia—A Review of Current Practices

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Abstract: Much work has been done on how to prioritize activities for species and ecosystems that are risk-listed. To date, British Columbia has been assigning priorities for conservation activities on an initiative by initiative basis. This paper outlines the way species are risk-listed, provides cautions regarding misuse of lists, and gives four examples of prioritization processes that are currently being used in the region. The paper concludes with some specific recommendations for implementation in British Columbia.

Key Words: conservation priorities, Red and Blue Lists, ranking, Identified Wildlife, Conservation Data Centre, species at risk, British Columbia

Risk Listing (Ranking)

Over the last twelve years in British Columbia (B.C.), there has been a growing use of conservation status lists, such as the Red and Blue Lists compiled by the B.C. Conservation Data Centre (CDC). Unfortunately, misunderstandings about these lists, how they are created, and how they should be used still exist. These lists are intended only to demonstrate the degree of at risk in British Columbia; they can, however, be used as inputs into other activities, such as setting conservation priorities. This priority exercise requires other factors to be considered.

There is widespread recognition that the number of species and ecosystems at risk is increasing, while the resources available for activities such as recovery are not keeping pace. In addition, there is growing support for activities directed at species conservation before the species become risk-listed, and similar growing support for multi-species, landscape, or ecosystem level recovery efforts.

How Species and Ecosystems are Ranked—the Red and Blue Lists

The Red and Blue Lists are produced by the CDC, Ministry of Sustainable Resource Management. The staff specialists at the CDC, in cooperation with scientists and specialists

throughout the province, identify those animals, plants, and plant communities in the province that are of immediate conservation concern. The Red List includes any indigenous species, subspecies, or plant community (referred to as an element) that is Extirpated, Endangered, or Threatened in British Columbia. Extirpated elements no longer exist in the wild in British Columbia, but do occur elsewhere. Endangered elements are facing imminent extirpation or extinction. Threatened elements are likely to become endangered if limiting factors are not reversed. The Blue List includes any indigenous species, subspecies, or plant community that is considered to be Vulnerable (Special Concern) in British Columbia. Vulnerable elements are of special concern because of characteristics that make them particularly sensitive to human activities or natural events. Blue-listed elements are at risk, but are not Extirpated, Endangered, or Threatened. The Red and Blue Lists are reviewed annually. The Yellow List, containing species and plant communities presently not at risk, is also reviewed.

Each of the species and plant communities on the Red, Blue, and Yellow Lists is first assigned a global (G) conservation status rank according to an objective set of criteria established by NatureServe. NatureServe is a nonprofit conservation organization that provides scientific information and tools to help guide effective conservation action. It is composed of both a central group and the network of Conservation Data Centres around the western hemisphere. The global rank is based on the status of the element throughout its entire range and is established by a biologist assigned to that element by NatureServe, in consultation with experts on that element. Each species and plant community is then assigned a provincial (S) conservation status rank. The provincial rank is based solely on the element's status within British Columbia and is established by the B.C. CDC.

How Are the S-ranks Assigned?

The status of each taxon or plant community (i.e., element) is indicated on a scale of one to five. The score is based on an analysis of the following factors:

1. estimated number of extant occurrences;
2. viability of these occurrences;
3. trend in population size (except for plant communities), number of occurrences, or geographic distribution;
4. overall estimated population size;
5. geographic distribution;
6. number of occurrences adequately protected *and* managed; and
7. actual or potential threats facing the population and habitat.

The ranking process begins with estimating the number of extant occurrences (an occurrence is roughly equivalent to a local population or metapopulation; they are defined at the element level by NatureServe to ensure continent-wide consistency). If there are 5 or fewer in the

province, the element is tentatively assigned a rank of S1; if there are an estimated 6–20 occurrences, a rank of S2 is tentatively assigned; for 21–100 occurrences, S3; and finally, > 100 occurrences, S4 or S5. For many animal species that are very mobile, the number of 'occurrences' is difficult to define, and this factor is not given much weight. The process begins with this factor because it is usually a good estimator of the vulnerability of a species. *But this is only the beginning of the ranking process*. Each additional factor is then examined sequentially, and ranked A–D (Table 1), and then consideration is given to raising or lowering the rank accordingly. A process similar to that outlined in Table 2 is employed.

Table 1. Scoring for various rank factors used by NatureServe for conservation ranks.

Estimated number of extant occurrences:	A = 0–5 B = 6–20 C = 21–100 D = 101+
Abundance:	A = fewer than 1000 individuals B = 1000–3000 individuals C = 3000–10,000 individuals D = over 10,000 individuals Note: areal extent is used for plant communities
Range:	A = global: narrow endemic (usually less than 100 square miles) provincial: very small range, less than 3% of territory B = global: regional endemic (100 to 10,000 square miles) provincial: narrow range, less than 10% of territory C = global: moderately widespread, or widespread with spotty distribution provincial: less than half of territory D = global: widespread (greater than 1,000,000 square miles) provincial: more than half of territory
Trend:	A = declining rapidly B = declining C = stable D = increasing Note: plant communities do not use the population trend factor
Protected occurrences:	A = believed to be none protected B = at least one protected C = several protected D = many protected U = unknown
Threats:	A = very threatened; species or plant community directly exploited or threatened B = moderately threatened; habitat lends itself to alternate use C = not very threatened; habitat is unsuitable for other uses D = unthreatened

A species that has many occurrences or is common in much of the province (normally ranked S5), but is declining or faces known threats might thus end up with a rank of S4 (e.g., olive-sided flycatcher [*Contopus cooperi*]), S3 (e.g., grizzly bear [*Ursus arctos*]), or even S2 (e.g., marbled murrelet [*Brachyramphus marmoratus*]). Conversely a species that has few breeding occurrences or a very narrow breeding range in the province (normally ranked S1 or S2), but is increasing, not threatened, or is securely protected might end up with a rank of S2S3 (e.g., Dall's sheep [*Ovis dalli dalli*], S3 (e.g., gray flycatcher [*Empidonax wrightii*]) or even S4 (e.g., ring-billed gull [*Larus delawarensis*]). The main point here is that this ranking process is NOT one that is based solely on 'rarity'.

Where there is uncertainty about any of the rank factors, the resulting rank might be a 'range' rank, e.g., S1S2 or S3S5 that indicates our relative ignorance of this species. Where the range spans more than two ranks (e.g., S1S4), a rank of SU is assigned, indicating that the deficiency of information is too great to assign a useful rank.

As a part of major modifications to the CDC database software and methodology, these rank factors and the scoring methodology are being updated. More factors are being examined (e.g., trends will be split into long-term and short-term), and each will have more detailed scoring associated with it. In general, the ranking factors and the ranking factor 'breaks' are being adjusted to be more comparable with those employed by the World Conservation Union (IUCN) and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). It must be said that, even using the 'old' system of ranking, very few species end up with different ranks than those employed by COSEWIC.

Global (G) ranks are assigned using the same methodology as S-ranks. They are assigned and reviewed periodically by scientists working for NatureServe, in consultation with species experts and zoologists working in the conservation data centre network. New information provided by field surveys, monitoring activities, consultation, and literature review continually improves accuracy and keeps ranks as current as possible. Each month, four to seven local data centres exchange data (including their S-ranks) with NatureServe to achieve a network-wide data exchange over the course of a year. Often, proposals to change the G-rank are initiated by network biologists who are most closely aware of such things as new inventory/monitoring information, and changes in threats.

The final responsibility of assigning the S-ranks for British Columbia is in the hands of the appropriate CDC specialist; however, a ranking meeting is held annually in the early autumn for each group (birds, mammals, dragonflies, plant communities, vascular plants, etc.), with provincial experts in each group invited to participate. Using CDC ranking procedures (Table 2), the rank of every species (not just those on the Red or Blue Lists) is reviewed. If a particular expert is unable to attend the meeting, he or she is encouraged to submit written comments for rank changes for species of interest. Additionally, specific information that will contribute to the most precise ranking possible is sought from experts.

Table 2. Sequential process for ranking animal species.

Consideration	*Ranking instruction*
Consider the estimated number of extant occurrences [defined as "an area of land and/or water on which a population or ecological community is present "]; often corresponds with a local population or metapopulation	Assign an initial, tentative rank based on that figure
Consider the rank (viability, based on size, condition, and landscape factors) of the occurrences	Consider raising (lower the number [= increase the priority] of) the rank by one if there are relatively few excellent/good (A- or B-ranked) occurrences
Consider trends in number of occurrences, overall population size, and range	Consider raising the rank by one if there is a significant, long-term (greater than 10 years) or noncyclic negative trend. Consider lowering the rank by one-half rank if there is a significant, noncyclic positive trend [Note that half-ranks or decimal ranks are not used, and so a whole number rank should be selected after a consideration of all the factors listed here]
Consider the overall population size (total abundance of the element) and demographic factors	Consider raising the rank by one-half to one if population size is relatively small or if reproductive potential is unusually low. Consider lowering the rank by one-half if population size is particularly large
Consider the geographic distribution	Consider raising the rank by one-half if the distribution is small and restricted such that the element is particularly vulnerable to extinction/extirpation from localized events. Consider lowering the rank by one-half if the element is widespread
Consider threats	Consider raising the rank by one-half to one if all/most possibly viable occurrences are threatened. Consider lowering the rank by one-half to one if there are no apparent threats to many or most possibly viable occurrences and/or if such occurrences are 'protected' (including adequate management) from foreseeable threats to their persistence for the foreseeable future

If there is disagreement over a particular rank, that species is reviewed once more by the committee of specialists, based on any new information that may have been sent by the reviewers. Consensus is strived for; however, if disagreement remains, the CDC specialist makes the final decision. Status reports, done to COSEWIC standards, are the ultimate source of information since they incorporate an intense inventory effort and detailed assessment of status factors. Status reports for some element groups, such as freshwater fish, are reasonably complete; other groups, like vascular plants, are lacking many status reports.

For every animal species tracked by the CDC, and for most plant species, electronic ranking forms have been created which document the ranking process and summarize the reasons for

assigning a particular provincial rank. A 'tracked' species is one that is considered to be at risk and for which the CDC compiles specific geographical occurrence information. The information sources upon which the ranking is based are also listed. The CDC is in the process of creating ranking forms for ALL species, regardless of whether or not they are tracked. These forms are available to the public upon request and will soon be posted to the endangered species and ecosystems web site (http://srmwww.gov.bc.ca/atrisk/toolintro.html). Table 3 summarizes the advantages of the CDC ranking system.

Table 3. Advantages of the CDC ranking methodology.

Principle	*Method to achieve*
Defensible	Established methods, principles or information were used.
Transparent	Method and decisions were documented and are available.
Consistent	Decisions were structured using risk assessment principles.
Biological focus	Economic impacts were not considered. (These will be addressed in a separate process)
Broad scope	The method had modest data requirements and enabled consideration of all species and plant communities.
Adaptable	Available information or expert opinion was used. Ranks can be updated with new information.

In 1999, ranking forms for vertebrates on the 1998 Red and Blue Lists were published in the form of two reports (Cannings et al. 1999; Fraser et al. 1999); comparable information for vascular plants was published in 2002 (Douglas et al. 2002). The ranking factors and ranking reasons for global ranks of all vertebrates, all vascular plants, and many invertebrates are available on the NatureServe web site (http://www.natureserve.org/).

Relationship of Red, Blue, and Yellow Lists to CDC Ranks

Plant communities and native species of plants and animals are assigned to the Red or Blue Lists based on the S-rank assigned by the CDC (Table 4). In the case of animals, only regularly occurring (i.e., not accidental or casual) breeding species are eligible; exceptions are those *regularly occurring* non-breeding species that are considered to be at risk globally (i.e., ranked G1 to G3).

Table 4. Relationship of Red and Blue Lists to S-ranks.

	Red list	*Blue list*
Animals	S1 S1S2 S2 S2? S1S3	S2S3 S2S4 S3 S3? S3S4
Plants	S1 S1S2 S2 S2? S1S3	S2S3 S2S4 S3 S3?
Plant Communities	S1 S1S2 S2 S2? S1S3	S2S3 S2S4 S3 S3?

Note: The Blue List does not currently include S3S4 ranks for plants or plant communities; these will be reviewed in 2004.

Species ranked S3S4 (vascular plants only), S4, S4S5, and S5 are placed on the Yellow List. This list is a grab-bag of uncommon, common, declining, and increasing species. Those species ranked S4, however, are considered to be of conservation concern. They have been ranked S4 either because they have a small range or low abundance in the province (e.g., American shrew mole [*Neurotrichus gibbsii*][1], black oystercatcher [*Haematopus bachmani*]), they have exhibited provincial declines (e.g., chinook salmon [*Oncorhynchus tshawytscha*], olive-sided flycatcher, blue grouse [*Dendragapus obscurus*]), or they are perceived to be susceptible to long-term threats (e.g., western toad [*Bufo boreas*]). Thus, the list of S4 species can be seen as a 'watch' list of species to be actively monitored and otherwise studied.

All credible sources of information regarding distribution, abundance, trends, and threats are considered in the ranking process. These include formal inventories and research projects; status reports; Breeding Bird Surveys, Christmas Bird Counts and other volunteer-based surveys; recorded ad hoc sightings; museum specimen records; and personal communications with species experts, regional biologists, and naturalists.

Relationship of S-ranks to General Status Ranks

In 1996, provincial, territorial, and federal Ministers responsible for wildlife established an agreement called the *National Accord for the Protection of Species at Risk*. The Accord commits parties to "monitor, assess and report regularly on the status of all wild species" with the intent of identifying those species that may be in trouble or those for which a formal status assessment (i.e., COSEWIC report) may be needed. A methodology was developed to create a general status rank for all biodiversity, "integrating information on population sizes, distributions, trends, and any known threats to species" for each jurisdiction and across a species' Canadian range (CESCC 2001). For most animals and all vascular plants in British Columbia, the S-ranks are directly translated into the provincial general status ranks used in the national assessment.

[1]Currently, the BC Species and Ecosystems Explorer (September 2004) lists this species as the shrew-mole.

The Use of Red and Blue Lists

Threatened species lists may be created to assess potentially adverse impacts on species; to help inform conservation priorities, including reserve system design; or as a component of a State of Environment report (Possingham et al. 2002). In British Columbia and Canada, there is legislation that ensures political and social considerations are taken into consideration before legal designations occur. Unfortunately, lists such as the Red and Blue Lists are used for purposes beyond their original intent, including being used to allocate scarce conservation resources. Possingham et al. (2002) provide a number of cautions around list utilization.

Lists of species at risk should not solely guide resource allocation for species recovery. Some of the most highly ranked species require huge recovery efforts but have a small chance of success, whereas less threatened taxa might be secured for relatively little cost. For other species, such as island colonies of seabirds, there may be very little that can be done to ameliorate the risk factors. Although it may be difficult, resources should be allocated to recovery actions such that marginal increase in viability is equalized across all threatened species.

Lists of species at risk should be used as one input into setting priorities for reserve selection. Evidence indicates that there is no justification for using only threatened species as umbrella species. The reserve selection system should maximize a specific objective, such as securing as many species as possible.

Species at risk lists should not be used to constrain development. Otherwise, developments with small impacts for a listed species may be constrained, but developments with a large impact on a lot of unlisted species may not. Lists should be objective, without the taint of consequence. Listing may lead to increased threats to species through deliberate harm, especially if there are no incentives for conservation (although there has been minimal evidence of this in British Columbia).

Threatened species lists should be used cautiously to indicate changes in the status of biodiversity. Theoretically, the lists may provide a benchmark for extent and severity of human impacts, and a basis for comparing impacts over time among places and taxa. This potential may have limited value because of uneven taxonomic treatment and variation in observational effort, and because changes in the lists often reflect changes in knowledge rather than a change in the status itself. An exception would be groups that are thoroughly evaluated so that relative differences in numbers among taxa actually reflect differences in threat, time, and space.

In conclusion, Possingham et al. (2002) provide some potential solutions for avoiding the misuse of species at risk lists, such as creating new tools for allocating resources and mandating constraints on development, using additional information for reserve design, and recording changes in knowledge and trends of populations and range separately in State of Environment reporting.

The message here is to make species at risk lists part of the contributing information for setting conservation priorities, not the sole source. The following example programs follow this direction.

Communication Challenges

The Red List is composed of species that are candidates for Endangered (high risk of extinction or extirpation) **and** Threatened status (high risk of becoming endangered). The Blue List corresponds to those species of Special Concern (formerly Vulnerable). As a communication tool, the Red and Blue Lists may be too powerful. There is an immediate intuitive (mis)understanding of what the lists mean. Despite consistent use of the 'colored lists' since the 1980s, there is widespread confusion about the significance of a species being on one list or the other. The commonest misunderstanding would translate the Red List as Endangered, and the Blue List as Threatened—this is incorrect. Red-listed species are species that are candidates for Endangered OR Threatened status.

Perhaps part of this confusion is due to the lack of progress on moving the red-listed species to the legal list of Threatened and Endangered species under the provincial *Wildlife Act*. Indeed, those lists so poorly represent the status of species at risk in British Columbia, that when the *Forest Practices Code Act of British Columbia* was created, it bypassed the 'legal lists' and used the Red and Blue Lists directly. The CDC may have contributed to the miscommunication over the years by touting the lists as a means of setting conservation priorities, although the CDC only meant that the lists should be used as *one factor* in setting priorities.

Legal Requirements

With the passing of the federal *Species at Risk Act* (SARA) and the adoption of the *National Accord for the Protection of Species at Risk*, there are now timelines associated with the production of recovery strategies. These will, in turn, outline schedules of activities and studies for action planning, including the identification of 'critical habitat' under the Act. These timelines represent legal obligations for the production of recovery strategies by the federal Minister of the Environment. The *Species at Risk Act* allows for the adoption of a recovery strategy and action plans developed by another party (usually a recovery team working under provincial authority). The legal timelines for the production of the recovery documents, protection of the species and its residence, and the protection of 'critical habitat' is another factor in the prioritization of some types of conservation activities.

Setting Conservation Action Priorities

There are a number of programs in place that attempt to set conservation priorities based on a number of objective criteria. The degree to which the species is in danger of disappearing is but one of these criteria.

Four different programs that use criteria for ranking conservation activities for species at risk are presented: two are used in British Columbia and two are used nationally (Canada). All systems use rankings and information from the NatureServe and CDC G- and S-ranks.

Species at the edge of their range are often considered to be unimportant in conservation and are often used as examples of species of low conservation priority. While there are a number of conservation considerations that need to be taken into account when dealing with 'peripheral species' (see Fraser 2000), it is generally agreed that a widespread and abundant species that is in danger of extirpation in B.C. is clearly a lower conservation priority than an endemic species at the same level of risk (everything else being equal). Each of the examples of conservation priority setting schemes that are presented here use combined G- and S-rankings to gauge relative conservation responsibility and set priorities. In Canada, with the recent passing of the federal *Species at Risk Act*, being assessed as a species at risk in Canada determines that some conservation work be completed (e.g., recovery plans), even if little subsequent investment occurs.

Conservation priorities are generally set to allocate funds and efforts to those elements most in need of, and most likely to benefit from, conservation actions. Methods to establish priorities often include criteria that are not directly related to the risk of extinction but rather emphasize management considerations such as management responsibility (Carter and Barker 1993; Thompson et al. 1993; Gross et al. 1995; Caldecott et al. 1996; Beazley 1997; Ceballos et al. 1998; Dunn et al. 1999), available information (Sparrowe and Wright 1975; Millsap et al. 1990; Beazley 1997), or economic importance (Landry et al. 1979; Myers 1983; Caldecott et al. 1996). Many methods are also limited to vertebrate species (Millsap et al. 1990; Carter and Barker 1993; Gross et al. 1995; Ceballos et al. 1998; Dunn et al. 1999). The criteria chosen to set priorities vary depending on the objectives and limitations of different processes.

Examples of Conservation Priority Setting in British Columbia

In the absence of an overall biodiversity plan for the province, priorities for activities on species at risk are currently being set on a project-by-project basis, and often without taking into account species that are not risk-listed. The following examples, each at a different scale, have been chosen to illustrate how current priority setting activities are being done.

Example 1. Setting Conservation Priorities at the Local Level: Garry Oak Ecosystems Recovery Strategy

Like several other teams, the Garry Oak Ecosystems Recovery Team (GOERT) has a difficult challenge in developing the species at risk portion of their recovery strategy. Priority setting for getting new information, setting research goals and garnering support for status reports could not be done all at once. The team set out to use a combination of the S-rank and the G-rank (as supplied by NatureServe).

This stepwise approach for these topics followed the following priority-setting rules. For the commissioning of status reports the following criteria were used:

a) First priority: G1 or G2 or T1 or T2[2]
b) Second priority: G3 or T3
c) Third priority: S1 or SH[3] or SX[4]
d) Fourth priority: other red-listed species
e) Fifth priority: the remaining blue-listed species

For recovery planning (for those species with COSEWIC listing), including inventory, research, threat abatement, habitat protection, habitat enhancement, propagation, reintroductions and other measures, an additional criterion was applied:

a) First priority: G1 or G2 or T1 or T2: 2 species
b) Second priority: G3 or T3 or COSEWIC Endangered or Extirpated species: 16 species
c) Third priority: S1 or SH or SX or COSEWIC Threatened Species or Species of Special Concern: 15 species
d) Fourth priority: other red-listed species: 7 species
e) Fifth priority: the remaining species: 7 species

Example 2. Setting Conservation Priorities at an Ecoregional Scale: Nature Conservancy of Canada Ecoregional Planning

In the ecoregional planning process developed by The Nature Conservancy (U.S.), a systematic approach to conserving biodiversity has been developed. The Nature Conservancy of Canada is continuing that approach in Canada, often cooperatively across our international border. This approach is "to be explicit about what features of biodiversity we are trying to conserve and where we are trying to conserve them" (Groves 2003). These special features of biodiversity are referred to as conservation targets. This explicitness provides a practical approach to focus on a smaller set of features with the hope that they will look after the broader array of biodiversity. The targets can be used to check how well the final plan is performing, and can also serve as the basis for designing strategies and conservation plans for each conservation area selected in the plan. Lastly, although some targets may be selected because of political legislation (e.g., SARA-listed species), political boundaries are largely ignored. These conservation targets include both the fine filter and coarse filter elements of biodiversity (Noss 1987). The conservation plans attempt to consider species that are classified as threatened, endangered, imperiled, and at-risk; endemic species; and keystone species (Groves 2003). Peripheral populations may be considered "under two sets of circumstances: (1) experts in the region have reason to believe that such populations are likely to be genetically distinct from core

[2]T plus a number are added to the global rank to indicate the rank for a subspecies.
[3]H indicates the species is historic, has not been seen for 20 years, but has not been researched enough to confirm extirpation.
[4]X indicates evidence exists to indicate extirpation.

populations, and (2) a species range has shrunk by at least 50% over historic times and remaining populations are primarily peripheral ones" (Groves 2003). Ecosystem targets are also set, using ecological systems (Groves et al. 2002), defined as "dynamic, spatial assemblages of ecological communities that occur together on a landscape, are tied together by similar ecological process, underlying features, or environmental gradients, and form a cohesive, distinguishable unit on the ground."

In practice, the global ranks are used for selecting the at-risk species subset, although national designation or rank may also be used to satisfy legislative needs of some jurisdictions.

Example 3. Setting Conservation Priorities at a Provincial Scale: Identified Wildlife

Identified Wildlife are species (includes subspecies and populations), and plant communities that receive special management of critical habitats under the *Forest Practices Code Act of British Columbia* and its successor the *Forest and Range Practices Act*. The Identified Wildlife Management Strategy is the mechanism to address the management of critical habitats of Identified Wildlife. In 1999, government initiated a process to develop a method to set priorities for the Identified Wildlife Management Strategy (Province of British Columbia 1999).

The objectives of the method were to identify species and plant communities most likely to benefit from designation as Identified Wildlife, and to rank these species and plant communities to enable efficient allocation of resources and timber supply impact allocations. Some important limitations of the Identified Wildlife Management Strategy include timber supply impact restrictions, and staff and resource limitations with respect to implementation. Additionally, the Forest Practices Code (and the present *Forest and Range Practices Act*) applies specifically to Crown lands managed for forestry or ranching.

For this reason, species and plant communities were ranked by their relative risk from forest and range management practices, and their relative conservation concern, indicated by their global and provincial status. For instance, species or plant communities with a high conservation concern (e.g., G1, S1) and a high level of risk from forest or range management practices were considered of high priority.

It was important that the method was defensible, transparent, consistent, and applicable across taxonomic groups, and that emphasis was placed on risk not social or economic impacts. The detailed steps in the process of determining Identified Wildlife are included in Appendix 1.

The method used the 2001 CDC Red and Blue Lists as the basis for species and plant community evaluations. Evaluations were initially completed in 2000 but were updated in October 2001 to reflect changes to CDC lists. In 2001, 1247 species and plant communities were included on the Red and Blue Lists, of which 889 (~70%) were eligible for inclusion in the Identified Wildlife Management Strategy. Eligible elements are red- and blue-listed animals and red-listed plants or plant communities

Approximately 10% of these eligible candidates were not evaluated because their global ranks had not yet been assigned, and this was a requirement of the method; however, these

species or plant communities may be reevaluated when global ranks are determined. Of the remaining species and plant communities (*n* = 801), another 26% (*n* = 231) could not be evaluated as there was no information to assess the threats from forest or range management practices. Another 7% (*n* = 58) of the species and plant communities were considered *extinct*, *extirpated*, or *historical* in British Columbia. Extirpated and historical elements may be considered once they have been addressed within a recovery plan. Approximately 26% (*n* = 233) were not considered to be threatened by forest or range management practices. Other species and plant communities (*n* = 26 or 3%) were only recorded within parks or protected areas, or were considered to be addressed by current habitat management, or were only known to occur on private land. In addition, several species and plant communities (*n* = 7) were delisted in 2001 (no longer included on Red or Blue Lists); thus they were no longer candidates for designation as Identified Wildlife. Table 5 summarizes these results.

Table 5. Summary of results from assessing at-risk species in B.C. for Identified Wildlife candidacy.

Results	*%*	*n*
No global rank*	10	88
Extinct, extirpated, historical in B.C.	7	58
Insufficient data or no data	26	231
Not at risk from forest or range management practices	26	233
Only known to occur in protected areas	3	26
At risk from forest and range management practices	27	246
Downlisted since evaluation (Oct. 2001)	1	7
Total	**100**	**889**

*not considered in evaluation

Approximately 31% (*n* = 246) of the eligible candidates were considered at risk from forest or range management practices, and therefore were candidates for designation as Identified Wildlife. These species and plant communities were grouped into high, intermediate, and low priorities (Table 6) based on the results of steps 1 to 5 outlined in Appendix 1.

Table 6. Results of Identified Wildlife evaluation process.

Species or plant communities	*High priority n*	*Intermediate priority n*	*Low priority n*	*Total n*
Invertebrates	3	5	31	39
Vertebrates	20	57	25	102
Plants	1	35	16	52
Plant communities	28	18	7	53
Total	**52**	**115**	**79**	**246**

The end product of the exercise was a preliminary ranked list of species and plant communities. This list directed development of species and plant community accounts for inclusion within the Identified Wildlife Management Strategy (Version 2004). These accounts summarize life history, distribution, threats, trends, habitat requirements, and current protection, and provide management recommendations. Ideally, these priority lists should be updated on an annual basis. The intent was to annually reevaluate priorities to reflect changes to provincial Red and Blue Lists and federal lists (e.g., *Species at Risk Act*).

Example 4. Setting Conservation Priorities at a National Scale— National Recovery Working Group Scheme for Setting Conservation Action Priorities.

The National Recovery Working Group is an advisory group of technical experts that works with the Recovery of Nationally Endangered Wildlife (RENEW) secretariat and reports to the Canadian Wildlife Directors Committee. The working group is tasked with assisting in drafting policy and program guidelines for recovery activities in Canada.

The National Recovery Working Group is in the process of developing the National Prioritisation Scheme for the purposes of

1. guiding decision making by the Canadian Endangered Species Conservation Council and the Canadian Wildlife Directors Committee;
2. providing advice to funding agencies; and
3. indicating to the public the priority level being assigned to the species by the responsible jurisdictions.

While the document is not finalized, the current model (2003) being proposed is outlined as follows. Criterion scores are developed in a coordinated fashion by the responsible jurisdiction(s), in consultation with species experts as necessary. The following are the ten draft criteria used for assigning conservation action priorities (November 2000) (Appendix 2 lists the details of the factors under each criterion and applies these criteria and factors to five species examples):

1. biological probability of recovery
2. Canadian status
3. global rank
4. percent of range in Canada
5. level of effective protection from primary threat
6. significance of ecological/ecosystem role where the species occurs in significant numbers
7. multi-species/community benefits
8. taxonomic level of the entity that is at risk
9. biological potential for recovery
10. socio-economic value of species recovery

Looking Forward

There are a number of proposals regarding setting conservation priorities in British Columbia that the authors of this paper suggest should be implemented:

1. A consistent approach should be used in setting provincial conservation priority rankings.
2. The Biodiversity Strategy for British Columbia, currently in development, should provide principles and procedures for managing for all aspects of biodiversity. Species not considered to be 'at risk' would then be dealt with outside the programs set up for threatened and endangered species recovery. With regards to the coarse filter/fine filter approach used by British Columbia for comprehensive biodiversity conservation, more effort must be directed towards the coarse filter information needs.
3. Conservation ranking schemes need to consider economies of scale that occur in conservation activities in habitats at risk that also have a large number of risk-listed species (e.g., Garry Oak Ecosystems Recovery Strategy, South Okanagan Spaces Conservation Plan).
4. The Red and Blue Lists should not be changed to reflect conservation priorities. Currently, they are a simplification of the 'risk listing', ignoring global responsibility and status elsewhere.
5. The current Yellow List should be divided into a Yellow List and a Green List, where the Green List would contain species/ecosystems that are considered secure, and the Yellow List would contain species/ecosystems that are widespread but declining and need to be watched (e.g., S4 elements)
6. It is proposed that we use a priority system such as that used for Washington State species (Washington Department of Natural Resources 2003). This system uses a matrix of global and provincial ranks to provide the first step in setting priorities, but then assesses additional factors to arrive at a High, Medium, or Low Conservation Priority (Fig. 1). The matrix is used as framework for assigning priorities, as indicated by color blocks in the matrix. Prior to final assignment of priority, a number of factors are considered for each species; these factors are used to elevate or lower the priority. Factors considered include the following:
    - Does distribution pattern (local endemic, peripheral, disjunct, isolated populations, etc.) convey more or less concern?
    - Are demographic issues (small populations, declining populations, poor reproduction, etc.) significant?
    - Are habitat issues (habitat declining, dependence on natural disturbance, habitat restricted but not threatened, etc.) significant?

	S1	S2	S3	S4	S5
G1	G1S1	-	-	-	-
G2	G2S1	G2S2	-	-	-
G3	G3S1	G3S2	G3S3	-	-
G4	G4S1	G4S2	G4S3	G4S4	-
G5	G5S1	G5S2	G5S3	G5S4	G5S5

	Priority high
	Priority high, medium or low
	Priority medium
	Priority medium or low
	Priority low
	Not of current conservation concern

Figure 1. Proposed matrix for setting conservation priorities (Washington Department of Natural Resources 2003).

Using the matrix and modifying factors, each rare species has been assigned one of the following rankings:

High priority: species in danger of extinction across their range; populations are critically low or their habitats are significantly degraded or reduced.

Medium priority: species may become endangered across their range if factors contributing to their decline or habitat loss continue.

Low priority: these species are vulnerable or declining and could become endangered or threatened throughout their range without active management or removal of threats to their existence.

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Appendix 1. Detailed Steps in Determining Identified Wildlife

Step 1. Determine all Legally Eligible Species and Plant Communities

Species and plant communities that can be designated as Identified Wildlife are determined by the definitions of *wildlife*, *species at risk*, and *regionally important wildlife* in the *Forest Practices Code Act of British Columbia* and its successor, the *Forest and Range Practices Act*. These definitions include red- and blue-listed animals, and red-listed plants and plant communities. Blue-listed plants and plant communities are not included, nor are common species and plant communities (yellow-listed), except those considered to be *regionally important.* However, regionally important wildlife were not considered in this exercise; instead, a separate evaluation may be made after the provincial red- and blue-listed candidates have been addressed. Until such time, it is expected that yellow-listed species will be addressed through other mechanisms in the Forest Practices Code or *Forest and Range Practices Act*.

Step 2. List Conservation Status

The NatureServe global and provincial ranks were compiled in an Excel database. These status ranks were used because the ranking system, as described by Master (1991), is an accepted and established method in all Canadian provinces and the Yukon, all U.S. states, and a number of Latin American countries. It is a scientifically-based, peer-reviewed system that is readily available, considers all taxonomic groups, and provides both a global and provincial perspective on the status of species and plant communities thus enabling a comparison of the status of all candidates (i.e., plants, animals, and plant communities).

Step 3. Determine Relative Conservation Concern

Using the NatureServe ranks, species and plant communities were categorized into one of 15 categories of conservation concern (where 1 is the greatest concern). Categories were determined by combining global and provincial ranks in a matrix shown in Table 7 (adapted from The Nature Conservancy 1996). This matrix enabled a comparison of the relative conservation concern of species and plant communities with different global and provincial ranks. For instance, an endemic and endangered species such as the Vancouver Island marmot (*Marmota vancouverensis*) was considered the highest concern (category 1), whereas a globally common and secure species at the periphery of its range in British Columbia, such as the sage thrasher (*Oreoscoptes montanus*), was considered of intermediate concern in British Columbia (category 8). The lowest category (category 15) included species considered both globally and provincially secure (e.g., American crow [*Corvus brachyrhynchos*]).

Table 7. Relative conservation concern matrix.

	Provincial rank				
Global rank	*S1*	*S2*	*S3*	*S4*	*S5*
G1	1				
G2	2	3			
G3	4	5	6		
G4	7	9	11	13	
G5	8	10	12	14	15

Step 4. Determine Relative Risk from Forest or Range Management Practices

Because the Identified Wildlife Management Strategy is mandated to manage the threats from forest and range management practices, the risk from these practices was evaluated. Determining the risk from forest or range management practices can be subjective due to the lack of information and the difficulty in determining and measuring threats and risks from these practices. To reduce subjectivity and increase consistency in this exercise, the principles of risk assessment (B.C. Ministry of Forests 1998) were applied to determine the risk from forest or range management practices. Experts used these risk assessment procedures and the structure they provided to achieve consistency while maintaining the flexibility to deal with complex and variable information. Published and unpublished articles, ranking summaries, and expert opinion were used to evaluate species and plant communities.

The evaluation of the relative risk from forest or range management involved four considerations.

i. Potential threat from forest or range management practices

Each species or plant community was evaluated to determine whether it was considered to be negatively affected by forest or range management practices. Those not negatively affected were not considered candidates for designation as Identified Wildlife. Examples of negative effects include habitat loss or alteration, disturbance or displacement, trampling, and introduction and spread of invasive species.

ii. Magnitude

Species and plant communities negatively affected by forest or range management practices were further evaluated to determine whether the potential magnitude of the effects was high, moderate, or low. The main consideration in this evaluation was the relative threat from forest or range management practices; however, other factors, such as a species' life history traits that may increase sensitivity to disturbance, were considered (Table 8).

Table 8. Guidelines for estimating magnitude of risk from forest and range management practices.

Magnitude	*Guidelines for assessment*
High	Primary threat was forest or range management practices. Element characteristics included habitat specialist, very restricted range (endemic), individuals aggregate or concentrate, low reproductive ability, low dispersal ability, permanent or long-term effects, possible extinction or extirpation from effects, and high dependency on forest or grassland habitats.
Moderate	Threats included forest or range management practices. Element characteristics included medium- to short-term effects, restricted range, habitat preferences, semi-colonial, moderate reproductive ability, moderate dispersal ability, possible range reduction from effects, fragmented distribution, and somewhat dependent on forest or grassland habitats.
Low	Threats other than forest or range management were likely more significant such as urban development or exotic species. Element characteristics included habitat generalist, wide range, high dispersal ability, high reproductive ability, solitary, possible short-term displacement from effects, and not dependent on forest or grassland habitats.
Nil	Not considered to be negatively affected by forest or range management practices.

iii. Likelihood

Likelihood was determined through an assessment of existing habitat protection. The level of habitat protection indicated whether forest or range management activities were likely to occur, or to occur in a manner that could negatively affect candidates. The number of protected occurrences and the Forest Practices Code management recommendations were evaluated to determine whether the need for species-specific habitat management was high, moderate, low, or nil. Guidelines for these evaluations are described in Table 9. Other factors, such as whether known occurrences were on private land, were also considered.

Table 9. Guidelines for estimating likelihood of risk from forest and range management practices.

Likelihood	*Guidelines for assessment*
High	High probability that existing habitat protection mechanisms do not adequately address an element's habitat conservation needs (i.e., no or very few protected sites, no legal designations, no planning mechanisms, or planning mechanisms may only partially address a candidate's habitat requirements).
Moderate	Moderate probability that existing habitat protection mechanisms adequately address the habitat conservation needs of a particular element (i.e., legal designations and planning mechanisms address some habitat requirements).
Low	Low probability that existing habitat protection mechanisms do not address the habitat conservation needs of a particular element (i.e., some to many protected sites and adequate legal designations).
Nil	Habitat conservation needs are addressed (i.e., all known sites protected) or element occurs on private land.

iv. Risk

Risk from forest or range management practices was determined by considering both magnitude and likelihood of effects, as shown in Table 10 (adapted from B.C. Ministry of Forests 1998).

Table 10. Risk assessment matrix for Identified Wildlife.

Magnitude	*x*	*Likelihood*	*Risk*
High	x	High	Very high
Moderate	x	High	High
High	x	Moderate	High
Low	x	High	Moderate
Moderate	x	Moderate	Moderate
High	x	Low	Moderate
Low	x	Moderate	Low
Moderate	x	Low	Low
Low	x	Low	Very low
Low	x	Nil	Nil

Step 5. Establish Preliminary Priorities

Species and plant communities determined to be at risk from forest and range management practices were grouped into three priorities: high, intermediate, and low (Table 11) using the combination of the relative conservation concern (Step 3) and the relative risk from forest and range management practices (Step 4). Since the information used in the evaluations was cursory, a finer distinction was deemed inappropriate. High priority candidates were globally and provincially at risk (G1, G2, G3/S1, S2, S3) with a very high to moderate risk from forest or range management practices. Intermediate priority candidates were those elements at risk in the province (e.g., S1, S2, and S3) but globally secure (G4, G5). Low priority elements were those with a low to very low risk from forest or range management practices.

Table 11. Description of priority categories for Identified Wildlife.

Priority	*Relative conservation concern*	*Relative risk from forest or range management practices*
High	Very high, high, moderate	1–6
Intermediate	Very high, high, moderate	7–12
Low	Low, very low	1–12

Accounts were developed according to priority. The information in the accounts was used to confirm preliminary ranks. The accounts were peer-reviewed and technically reviewed by

individuals with operational expertise to ensure the information and recommendations were clear, defensible, and feasible.

Once complete, the accounts were reviewed by a stakeholder and government technical advisory committee to determine whether species or plant communities were still appropriate candidates for designation as Identified Wildlife. Candidates were not put forward for designation if the account was considered to be data deficient, the species or plant community did not occur on Crown land (or private-managed forest land), or all known occurrences were currently protected. Candidates are officially designated as Identified Wildlife when signed off by the Deputy Minister of the B.C. Ministry of Water, Land and Air Protection.

Appendix 2. The Criteria Used for Assigning Conservation Action Priorities for Recovery

Criterion 1. Biological probability of recovery

- Recovery is biological feasible: include species for consideration
- Recovery is not biologically feasible (use precautionary approach): remove species from consideration

Criterion 2. Canadian status (based on COSEWIC assessment criteria)
(sum of a, b, and c)

a) Total population size:
   - < 250: 5
   - 250–2500 or unknown: 3
   - 2500–10,000: 1
   - 10,000: 0

b) Total population (or habitat loss; use trends in habitat loss as a surrogate measure if population trend data are unavailable) trend:
   - population (or habitat) decline of ≥ 50% in 10 years or 3 generations, whichever is longer: 5
   - population (or habitat) decline of ≥ 20% in 10 years or 3 generations, whichever is longer: 3
   - population (or habitat) decline of > 0% in 10 years or 3 generations, whichever is longer, or trends are unknown: 2
   - population (or habitat) is not declining or species is extirpated: 1

c) Geographic range in Canada:
   - small (extent of occurrence < 5000 km^2 or area of occupancy < 500 km^2): 5
   - large (extent of occurrence > 5000 km^2 or area of occupancy > 500 km^2): 2
   - species is extirpated: 1

Criterion 3. Global rank (Global conservation status as assigned by NatureServe)

- G1, G2, GX, or endemic to Canada: 10
- G3: 7; Unknown status and trends: 5
- G4 or G5: 0

Criterion 4. Percent of range in Canada (This calculation could be performed by using the present range distribution of the species, or, if extirpated, its historical range. For species, such as several whales, that are not breeding in Canada but feed or stage in Canadian territory, the breeding or staging areas will be used for the present criterion)

- 75–100% of the range in Canada: 10
- 50–74% of the range in Canada: 7
- 25–49% of the range in Canada: 5
- percent range unknown: 4
- 1–24% of the range in Canada: 2
- 0–0.99% of the range in Canada: 0

Criterion 5. Level of effective protection from primary threat (The types of activities permitted in a protected area will determine its level of protection. For example, an ecological reserve will be weighted higher than a wildlife reserve. A marine reserve in which use of fishing vessels and nets are permitted, causing increased mortality for a given species, would be considered less effective protection than a marine reserve in which those activities were not permitted or controlled)

a) If habitat destruction/fragmentation is considered a primary threat:
   - 0–24% protected: 10
   - 25–49% protected: 7
   - 50–79% protected: 4
   - 80–100% protected: 2

Habitat is not a limiting factor: mean score for this criterion

b) If primary threat is something other than habitat destruction/fragmentation:
   - few or no effective activities are underway to address threat: 10
   - threat is being partially addressed by action: 7
   - threat is being mitigated or mostly mitigated by action: 2

Criterion 6. Significance of ecological/ecosystem role where the species occurs in significant numbers

- the species is (was) a *keystone species* (species which has a profound effect on the structure or function of its ecosystem. Its absence would have a cascading effect on many species which depend on its activities or presence) or an ecologically dominant species: 10
- the species has (had) a significant role (e.g., the species is essential in one or more physical-chemical processes) in the ecosystem: 7

- at least one other species depends mainly on the listed species and/or the species plays a minor role in the ecosystem: 4
- Unknown: 4

Criterion 7. Multi-species/community benefits (sum of a and b)

a) Number of endangered, threatened or special concern species which share the same threats and/or would benefit from recovery activities for the species in question:
   - 11 or more additional species will benefit: 5
   - 5–10 additional species will benefit: 4
   - 1–5 additional species will benefit or benefits are unknown: 2
   - 0 additional species will benefit: 0

b) Status, at the continental scale, of community or native assemblage of which the population/species is a member (e.g., Garry oak communities, alvar communities):
   - rare or unusual: 5
   - moderately common: 3
   - extremely common: 1

Criterion 8. Taxonomic level of the entity that is at risk (as defined by COSEWIC)

- species is at risk: 10
- subspecies is at risk: 7
- distinct population is at risk: 4

Criterion 9. Biological potential for recovery (Consider severity of the limiting factor among such parameters as habitat and feeding specificity, fecundity, survival rate, inbreeding depression, population size, age and spatial structure, sex ratio, capacity for dispersal, etc.)

- high: 10
- medium: 7
- unknown: 5
- low: 3

Criterion 10: Socio-economic value of species recovery (reflect the value of the species as a resource [food, clothing, medicine, cultural use or revenue], the extent of the area where the species is important for people, the possibility of replacing the species with another species or resource, and possible conflicts with land users)

- Highly valued: 10
- Moderate: 7
- Low: 4

Tables 12–16 utilize this rating system for five examples.

Table 12. An example of a species at risk that is endemic to B.C.

Vancouver Island marmot (Marmota vancouverensis)		
Criterion		*Score*
1. Biological probability of recovery	Recovery is feasible	-
2. Canadian status		
a. Total population size	< 250	5
b. Total population (or habitat) trend	≥ 50% in 3 generations	5
c. Geographic range in Canada	Small (< 5000 km^2)	5
3. Global rank	G1	10
4. Percent of range in Canada	100%	10
5. Level of effective protection from primary threat	0–24% protected	10
6. Significance of ecological/ecosystem role	Plays a minor role	4
7. Multi-species/community benefits		
a. Number of other species that will benefit	11 or more	5
b. Status of the community at continental scale	Moderately common	3
8. Taxonomic level of the entity	Species	10
9. Biological potential for recovery	Medium	7
10. Socio-economic value of species recovery	Moderate	7
	Overall score	**9.00**

Table 13. An example of a species that is extremely rare globally and has a small percent of its range in Canada.

Golden paintbrush (Castilleja levisecta)		
Criterion		*Score*
1. Biological probability of recovery	Recovery is feasible	-
2. Canadian status		
a. Total population size	> 10,000	1
b. Total population (or habitat) trend	> 0% in 3 generations or trends unknown	2
c. Geographic range in Canada	Small (< 5000 km^2)	5
3. Global rank	G1	10
4. Percent of range in Canada	1–24%	2
5. Level of effective protection from primary threat	0–24% protected	10
6. Significance of ecological/ecosystem role	Plays a minor role	4
7. Multi-species/community benefits		
a. Number of other species that will benefit	1–5 or unknown	2
b. Status of the community at continental scale	Rare	5
8. Taxonomic level of the entity	Species	10
9. Biological potential for recovery	Unknown	5
10. Socio-economic value of species recovery	Low	4
	Overall score	**6.67**

Table 14. An example of a species that is globally frequent to common, apparently secure, and has a small percent of its range in Canada.

White-headed woodpecker (Picoides albolarvatus)		
Criterion		*Score*
1. Biological probability of recovery	Recovery is feasible	-
2. Canadian status		
a. Total population size	< 250	5
b. Total population (or habitat) trend	> 20% in 3 generations	3
c. Geographic range in Canada	Small (< 5000 km^2)	5
3. Global rank	G4	0
4. Percent of range in Canada	1–24%	2
5. Level of effective protection from primary threat	0–24% protected	10
6. Significance of ecological/ecosystem role	Plays a minor role	4
7. Multi-species/community benefits		
a. Number of other species that will benefit	1–5 or unknown	2
b. Status of the community at continental scale	Rare or unusual	5
8. Taxonomic level of the entity	Species	10
9. Biological potential for recovery	Low	3
10. Socio-economic value of species recovery	Low	4
	Overall score	**5.89**

Table 15. An example of a species that is globally common to very common, demonstrably secure, and has a small percent of its range in Canada.

*American badger (Taxidea taxus), jeffersonii subspecies**		
Criterion		*Score*
1. Biological probability of recovery	Recovery is feasible	-
2. Canadian status		
a. Total population size	250–2500	3
b. Total population (or habitat) trend	> 0% in 3 generations or trends unknown	2
c. Geographic range in Canada	Large (> 5000 km^2)	5
3. Global rank	G5	0
4. Percent of range in Canada	1–24%	2
5. Level of effective protection from primary threat	0–24% protected	10
6. Significance of ecological/ecosystem role	Plays a minor role	4
7. Multi-species/community benefits		
a. Number of other species that will benefit	5–10	4
b. Status of the community at continental scale	Extremely common	1
8. Taxonomic level of the entity	Subspecies	7
9. Biological potential for recovery	Medium	7
10. Socio-economic value of species recovery	Low	4
	Overall score	**5.11**

*Currently, the BC Species and Ecosystems Explorer (September 2004) refers to *Taxidea taxus* as the badger, but does not list the *jeffersonii* subspecies.

Table 16. An example of a species that is globally common to very common, demonstrably secure, and has a large percent of its range in Canada.

Barrow's goldeneye (Bucephala islandica)		
Criterion		*Score*
1. Biological probability of recovery	Recovery is feasible	-
2. Canadian status		
a. Total population size	> 10,000	0
b. Total population (or habitat) trend	not declining	0
c. Geographic range in Canada	> 5000 km^2	2
3. Global rank	G5	0
4. Percent of range in Canada	75–100%	10
5. Level of effective protection from primary threat	Habitat not limiting	5
6. Significance of ecological/ecosystem role	Unknown	4
7. Multi-species/community benefits		
d. Number of other species that will benefit	0	0
e. Status of the community at continental scale	Extremely common	1
8. Taxonomic level of the entity	Species	10
9. Biological potential for recovery	High	10
10. Socio-economic value of species recovery	High	10
	Overall score	**5.56**