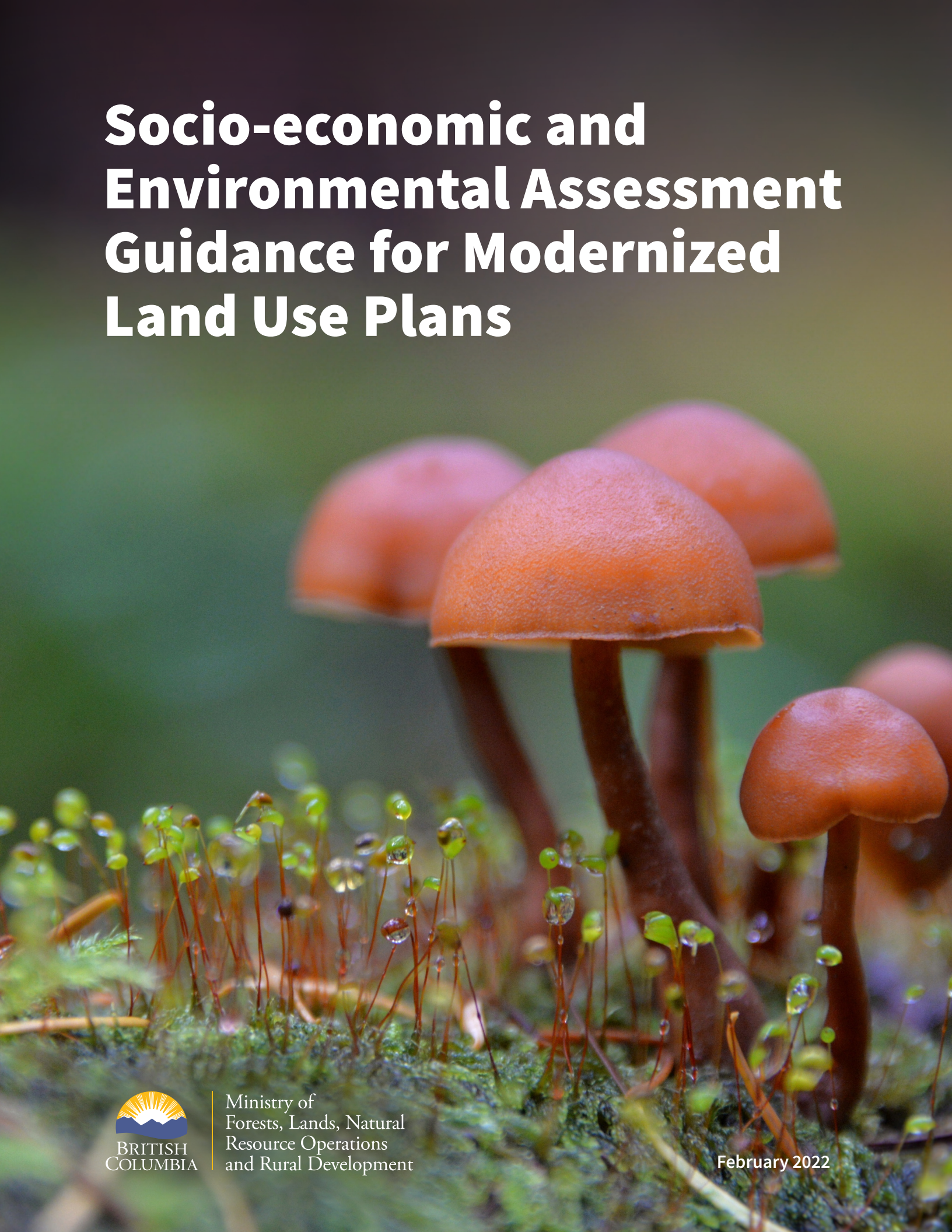
Socio-economic and Environmental Assessment Guidance for Modernized Land Use Plans



BRITISH COLUMBIA

Ministry of
Forests, Lands, Natural
Resource Operations
and Rural Development

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Executive Summary

This guidance describes a consistent method for conducting socio-economic and environmental assessments (SEEA) in the context of modernized land use planning in B.C. The goal of modernized land use planning is to address reconciliation with Indigenous Peoples in B.C. through a partnered, government-to-government approach that has been updated to address planning objectives. The planning process is led by a planning group, consisting of provincial and Indigenous government planning partners in collaboration with local governments, communities, industry, non-government organizations and other stakeholders.

The objective of a SEEA is to estimate incremental changes to socio-economic and environmental conditions that would occur due to implementing a land use plan by comparing at least one alternative planning scenario to a base case scenario. An alternative scenario refers to a proposed change in land use and management practices in the plan area. The base case scenario refers to the status quo scenario. The base case scenario is a prediction from the baseline (i.e., existing) conditions in the plan area.

The planning group provides several inputs to the SEEA, including:

- Management objectives that define the desired future state of land, water and resources relevant to the modernized land use planning initiative
- The results of ongoing engagement activities to highlight key issues, concerns and interests associated with the plan area
- The alternative scenario or scenarios developed by the planning group to meet the management objectives

The identified planning issues, interests and concerns relevant to the plan area help inform the selection of indicators for use in the SEEA, which are used to determine how socio-economic and environmental conditions may change as a result of the change in management direction. In general, a SEEA is a three-phase process: (1) identification of indicators, (2) data collection and analysis and (3) assessment.

A SEEA uses a multiple accounts analysis approach to assess socio-economic and environmental effects associated with changes in land use. A multiple accounts analysis separates potential effects into different accounts or categories so that comparisons can be made among effects on different indicators within alternative scenarios and against the base case scenario. In this guidance, a SEEA account is defined as a category of the human or natural environment that has social, cultural, economic, health, environmental or other implications to the planning area. The multiple accounts analysis process follows five basic steps for each account:

1. Selecting and confirming indicators
2. Selecting appropriate method(s) of analysis
3. Collecting data
4. Analyzing the effects of the base case scenario and alternative scenarios on indicators
5. Comparing the results of the analysis between scenarios

The planning group will determine the scope of the SEEA based on the number and complexity of planning issues and challenges to be addressed and the time frame and budget for the plan. The three broad levels of scope for a SEEA are:

- comprehensive (in the case of multiple complex planning issues),
- focused (for issues of moderate complexity) and
- condensed (for a small number of issues or a single issue).

The assessment accounts are identified from planning group discussions and informed by engagement activities. The draft accounts and indicators are analyzed to confirm that they align with management objectives and planning scenarios.

Land and resource management decisions may lead to complex and interrelated effects on communities and the environment, so the SEEA must be sufficiently comprehensive, use a clear and consistent framework to facilitate comparisons, and include both immediate and future implications. This guidance recommends considering accounts for climate change, environmental risk, Indigenous governance and law, economy, social, health, and archaeological, paleontological and heritage resources. In practice, not all accounts may be needed for the SEEA, depending on the range and diversity of planning issues relevant to the planning initiative. In the context of a SEEA, alternative scenarios may affect specific communities, groups and individuals differently. The consideration of differential effects, also referred to as Gender-based Analysis Plus (GBA+), refers to understanding how some communities, groups and individuals – such as Indigenous Peoples, women, seniors, youth and many others – may be more vulnerable to effects from management decisions. Differential effects are influenced by demographic factors (e.g., age, sex and household structure), economic factors (e.g., employment, income level and skills) and socio-cultural factors (e.g., ethnicity, gender and many others). Differential effects should be considered as a key part of the analysis for all socio-economic accounts.

By comparing results of the SEEA for alternative scenarios, the planning group can better identify or confirm a preferred planning scenario that aligns with the management objectives. The SEEA may also identify possible changes to plan design that may be needed to better address planning issues and concerns.

The guidance in this document is intended to provide a consistent framework for a SEEA that is comprehensive yet sufficiently flexible to be modified for the issues and existing conditions in the plan area. It reflects current knowledge and analysis approaches for the accounts that may be adapted and updated as knowledge is gained through ongoing land use planning and government and Indigenous initiatives. SEEA guidance will continue to evolve to align with new understandings and experience, address emerging issues and reflect the evolving relationship between Indigenous and provincial governments.

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1.0 Introduction

Socio-economic and environmental assessments (SEEA) are a critical step in the land use planning process to evaluate the implications of changes to the management of land, water and resources on communities and the environment. This guidance describes a consistent approach for conducting a SEEA in the context of modernized land use planning in B.C.

1.1 Background

Provincial public lands overlap with the traditional territories of Indigenous Peoples that are unceded but have not been claimed under title rights. Approximately 94 per cent of the total land area of B.C. is provincial public land. Provincial public lands, formerly referred to as Crown lands, are lands that are managed by the Province of B.C. on behalf of the public.

Existing land use plans cover more than 90 per cent of provincial public lands, and marine plans cover a large portion of coastal marine areas (Province of B.C. 2021a). Provincial government-led land use planning initiatives took place in B.C. from the 1990s through the mid-2000s, with the goal of providing strategic, high-level management direction on the use of public lands. The planning process was consensus based, and all parties with interests or stakes in the planning area were invited to participate (Province of B.C. 1993). Indigenous nations were invited to participate in planning processes without prejudice to treaty negotiations; however, some Indigenous nations found that they could not meaningfully participate in the provincial government-led initiatives, preferring government-to-government negotiations on land use issues (BC Treaty Commission 2021).

Although large-scale, provincial government-led land use planning has paused in many areas of the province since the mid-2000s, coastal and marine planning has continued for the north and central coasts through key planning initiatives led by Indigenous and provincial government partnerships, including the Gitanyow Lax'yip Land Use Plan, the Wóoshtin wudidaa Atlin Taku Land Use Plan, the Great Bear Rainforest Land Use Decision and marine and coastal planning under the Marine Plan Partnership.

In 2017, the Minister of Forests, Lands, Natural Resource Operations and Rural Development was directed to "…work with the Minister of Indigenous Relations, First Nations and communities to modernize land use planning and sustainably manage B.C.'s ecosystems, rivers, lakes, **watersheds**, forests and **old growth**." As part of the government's commitment to true and lasting reconciliation with Indigenous Peoples, the Minister was further directed to move forward on the Calls to Action of the Truth and Reconciliation Commission and to review policies, programs and legislation to incorporate the principles of the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) (Office of the Premier of B.C. 2017).

Specific articles of UNDRIP are directly relevant to land use planning initiatives, including but not exclusive to Article 3

> Indigenous peoples have the right to self-determination. By virtue of that right they freely determine their political status and freely pursue their economic, social and cultural development (UNDRIP, 2007 Article 3).

and Article 32(2):

> States shall consult and cooperate in good faith with the Indigenous peoples concerned through their own representative institutions in order to obtain their free and informed consent prior to the approval of any project affecting their lands or territories and other resources, particularly in connection with the development, utilization or exploitation of mineral, water or other resources (UNDRIP, 2007 Article 32(2)).

Other UNDRIP articles associated with land use planning are listed in Appendix B of Kehm et al. (2019). In 2019, B.C. formally committed to implementing UNDRIP with the B.C. *Declaration on the Rights of Indigenous Peoples Act* (Declaration Act) (Province of B.C. 2019b).

1.2 Modernized Land Use Planning: A Collaborative Approach

Modernized land use planning will advance the B.C. government's commitment towards reconciliation with Indigenous Peoples in B.C. through a partnered, government-to-government approach that has been updated to address modern land use planning challenges. The key drivers for this approach are:

- Reconciliation with Indigenous Peoples and the B.C. government's commitment to implement UNDRIP
- Ensuring communities and stakeholders[1] are engaged in land and resource planning
- A growing economy and increased demand on natural resources, and the need to balance economic, environmental, social and cultural objectives
- Increasing complexity as a result of climate change and factors that affect the land base, including managing **species at risk** and managing the impacts of wildfires, flooding and drought
- Addressing cumulative effects on natural resource values (Province of B.C. 2021a)

The modernized land use planning process is led by a **planning group**, consisting of provincial and Indigenous government planning partners in a government-to-government approach, in collaboration with local municipal governments, regional districts, communities, industry, non-government organizations and other **stakeholders** (**Figure 1.1**). The process is intended to maintain and strengthen collaboration

[1] In a land use planning process, stakeholders may include, but are not limited to, the following: local and regional government; communities; forestry, mining and oil and gas interests; conservation and environmental protection advocates; individual tourism operators and tourism associations; commercial fishing industry and aquaculture interests; hunters and trappers; farmers and ranchers; recreational groups and associations; and other special interest groups (Province of BC 2021b).

between governments, to allow for effective and meaningful input to the process from all partners and stakeholders with interests in the planning initiative, and to improve predictability, effectiveness and certainty in land use decisions.

Box 1 How to Use This Guidance Document

- This document summarizes methods for preparing a SEEA (**Section 3.0**) and a recommended structure and approach for analyzing socio-economic and environmental topics, or accounts, for the SEEA (**Section 3.0**). Appendices present additional technical guidance on specific topics.
- The first mention of each term defined in **Appendix H: Glossary** appears in **bold, blue text**.
- Blue underlined text is linked to online information sources. British Columbia government websites are subject to change due to ministry reorganizations. If a link does not work, we suggest that you conduct an Internet search for the document title or contact the relevant agency for a current reference.
- Text boxes throughout the guidance suggest recommended sources of further reading and other information that may be of use for conducting a SEEA.

Planning partners have been engaging with communities and stakeholders on an ongoing basis to identify critical areas around the province for updated planning. As of 2021, a number of active projects to update regional and sub-regional plans are in progress (Province of B.C. 2021b). General information on modernized land use planning in B.C. is available online and includes a list of active land use planning projects, policies and guidance, as well as archives of older plans and previously completed SEEAs (Province of B.C. 2021a).

Figure 1.1 A collaborative approach to modernized land use planning

1.3 Guidance Purpose

This guidance is a reference document for those involved directly with SEEAs and for those seeking greater understanding of SEEA reports. This guidance is not intended to be prescriptive or definitive; rather, the intention is to recommend practical methods that can be used to obtain clear and reliable SEEA information with the time, funding and technical resources that are typically available. SEEA guidance will continue to evolve to align with new understandings and experience, address emerging issues, and reflect the evolving relationship between the provincial and Indigenous governments.

This guidance document builds from past versions, including the most recent guidance from 2007: Guidelines for Socio-economic and Environmental Assessment (SEEA): Land Use Planning and Resource Management Planning (B.C. Ministry of Agriculture and Lands 2007).

This document is aligned, where appropriate, with the approach to environmental assessments set out in the B.C. *Environmental Assessment Act* (2018) and with the B.C. Environmental Assessment Office's guidance entitled Human and Community Well-being: Guidelines for Assessing Social, Economic, Cultural and Health Effects in Environmental Assessments in B.C. (B.C. Environmental Assessment Office 2020a). However, in the context of land use planning, a SEEA differs in purpose from environmental assessment under the B.C. Environmental Assessment Office review process. While both types of assessment examine the potential effects of a change on communities and the environment, an environmental assessment evaluates the potential socio-economic and environmental effects of a proposed major resource project (i.e., a single alternative go or no-go scenario), while a SEEA is a strategic, high-level assessment that evaluates the implications of changes in the management direction of public lands (i.e., multiple alternative management scenarios).

1.4 How a SEEA Fits into the Land Use Planning Process

The objective of a SEEA is to estimate incremental changes to socio-economic and environmental conditions that would occur as a result of implementing a land use plan by comparing at least one alternative planning scenario to a base case scenario. An **alternative scenario** refers to a proposed change in land use and **management practices** in the **plan area**. The **base case scenario**[2] refers to the status quo scenario. The base case scenario is a prediction from baseline (i.e., existing) conditions in the plan area. The base case scenario consists of existing and expected resource management strategies and land use designations, as well as the existing and expected socio-economic and environmental trends in the area (**Section 2.5** provides further detail).

[2] The base case scenario should reflect known or reasonably foreseeable changes in **value drivers**, such as commodity prices and changes in climate variables, taking into account the **range of natural variability**. As such, the base case scenario is not static but is what is anticipated to occur from the present into the foreseeable future if current management activities and external trends continue as expected.

The SEEA is typically completed by contractors who receive relevant information and support from the planning group. The planning group provides several inputs to the SEEA, including:

- **Management objectives** that define the desired future state of land, water and resources relevant to the modernized land use planning initiative. These objectives are defined by the planning group early in the planning process and guide plan development.
- The results of ongoing engagement activities to highlight key issues, concerns and interests from local and regional government, communities, industry, non-government organizations and other stakeholders.
- The alternative scenario or scenarios developed by the planning group to meet the management objectives and informed by results of engagement activities.

1. **Pre-planning**: Conduct initial discussions between Indigenous and provincial government partners and with other levels of government, communities, industry, non-government organizations and key regional stakeholders on land use and management issues. The planning group agrees in principle to undertake the land use planning process, develop a business case and seek mandates to proceed.
2. **Plan Initiation**: Formalize partnership agreements for the planning group to proceed with the planning project. Finalize scope, including a governance structure to oversee the process and provide support at key project milestones. Develop a project budget, workplan and engagement strategy.
3. **Plan Development**: Apply information and planning tools to produce scenario analyses that address planning issues. Evaluate the implications of various management scenarios with the SEEA. Select a preferred planning scenario and prepare a draft plan.
4. **Plan Evaluation and Approval**: Evaluate the recommended scenario and adjust the plan as needed to meet the overall management objectives. Submit the land use plan for review and approval by the planning group.
5. **Implementation and Monitoring**: Develop an implementation plan that includes associated agreements, and secure an implementation committee and budget. Monitor planning outcomes to assess the plan's effectiveness and develop a review and feedback process for applying new information to the plan.

(Adapted from: Steps for Completing a Land Use Plan (Province of BC 2021c)

Figure 1.2 Modernized land use planning process

A SEEA is typically initiated and completed during the plan development phase of a land use planning initiative after the planning group has developed management objectives and identified one or more alternative management scenarios to meet the objectives[3] (**Figure 1.2**). A SEEA considers the potential economic, social, cultural and environmental implications of the alternative scenarios against the base case scenario. The results of the SEEA are then evaluated for alignment with the management objectives. The scenario that is most aligned with the management objectives can be highlighted.

A SEEA incorporates the key elements of sustainability and sustainable development. Sustainable development is broadly defined as "development which meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland 1987). A SEEA focuses on balancing present and future social, cultural, economic, health and environmental needs to provide the best possible benefits to all communities across the province.

1.5 Incorporating Indigenous Knowledge into the SEEA

In the context of a modernized approach to land use planning, a SEEA must be informed by Indigenous knowledge and Western knowledge in a complementary manner. These should be equally recognized and respected. For the purpose of this document, **Indigenous knowledge** refers to

> "…the understandings, skills and philosophies developed by societies with long histories of interaction with their natural surroundings[.]
>
> "This knowledge is integral to a cultural complex that also encompasses language, systems of classification, resource use practices, social interactions, ritual and spirituality[.]
>
> "These unique ways of knowing are important facets of the world's cultural diversity, and provide a foundation for locally-appropriate sustainable development" (UNESCO 2017).

Western knowledge is the system of knowledge based on a European worldview, which is the basis for current Canadian and provincial legislation and policies (B.C. Environmental Assessment Office 2020b).

Different Indigenous groups, organizations or individuals may define Indigenous knowledge differently, in consideration of their unique culture and worldview. Reflecting Indigenous knowledge in a SEEA is subject to the discretion of the knowledge holder and their respective Indigenous community.

[3] In some cases, a SEEA base case scenario may be developed earlier in the planning process while management objectives are being determined; however, initiating a SEEA earlier in the planning process increases the risk of the base case scenario becoming outdated.

In a SEEA context, guiding principles for the use of Indigenous knowledge are:

- Respect for Indigenous knowledge as a distinct, valid and legitimate way of knowing
- Recognition that Indigenous knowledge is specific to Indigenous nations and knowledge holders and specific to the context in which it was given
- Reflection of Indigenous knowledge throughout the SEEA process (i.e., Indigenous knowledge should not be restricted to any one phase or section of an assessment)
- Recognition that the process for engagement and relationship building takes time before Indigenous knowledge can be shared
- Permission for use of Indigenous knowledge, meaning that the terms of use are defined by the knowledge holders, on a case-by-case basis

Interpretation of Indigenous knowledge should be led (or verified) by the specific Indigenous nation or knowledge holders.

See **Box 2** for a selection of further reading on Indigenous knowledge.

Box 2 **Indigenous Knowledge: Further Reading**

- An Updated Effective Practices Guide: Land Use Planning by First Nations in British Columbia. New Relationship Trust (Kehm et al. 2019)
- Best Practices for First Nation Involvement in Environmental Assessment Reviews of Development Projects in British Columbia (Report to New Relationship Trust) (Plate et al. 2009)
- Guidelines for Incorporating Traditional Knowledge in Environmental Impact Assessment (Mackenzie Valley Environmental Impact Review Board 2005)
- Guide to Indigenous Knowledge in Environmental Assessments (B.C. Environmental Assessment Office 2020b)
- Living Proof: The Essential Data-Collection Guide for Indigenous Use-and-Occupancy Map Surveys (Tobias 2000)
- Rediscovery of Traditional Ecological Knowledge as Adaptive Management (Berkes 2000)
- Resource Analysis Guide for Sustainable Resource Management Planning (B.C. Ministry of Sustainable Resource Management 2004)
- Respecting Indigenous Peoples and Traditional Knowledge (International Association for Impact Assessment) (Croal et al. 2012)
- Sacred Ecology: Traditional Ecological Knowledge and Resource Management (4th edition) (Berkes 2017)
- Summary of Best Practices for Applying Traditional Knowledge in Government of the Northwest Territories Programming and Services (Government of Northwest Territories nd)
- Traditional Knowledge Governance Challenges in Canada (de Beer and Dylan 2015)

2.0 Methods

This section provides an overview of the methods used when conducting a SEEA, with subsequent sections providing more detailed information and guidance. The appropriate scope and scale of the SEEA depends on the number and complexity of planning issues covered by the plan. The identified planning issues, interests and concerns relevant to the plan area help inform the selection of **indicators**, which are used to determine how socio-economic and environmental conditions may change as a result of the change in management direction. **Section 2.2** provides details on choosing the appropriate scope and scale for the SEEA.

In general, a SEEA incorporates three phases: (1) identification of indicators, (2) data collection and analysis and (3) assessment (**Figure 2.1**). For some land use planning initiatives, it may be preferred to conduct preliminary tasks, such as identifying baseline conditions, before the plan development phase of the planning process. This is not considered to be best practice, since conditions in the plan area may change by the time the SEEA is initiated, leading to potential duplication of efforts.

The planning group should co-ordinate engagement activities early in the planning process (i.e., the pre-planning phase described in **Figure 1.2**) to identify economic, social, cultural and environmental issues and concerns of importance to the plan area. Information from these early and ongoing engagement activities is critical for all phases of a SEEA: for identifying and confirming the range of interests, issues and concerns relevant to the planning area; for identifying baseline conditions in the plan area to describe the base case scenario; for informing the assessment of the effects of alternative scenarios; and for comparing SEEA results across scenarios.

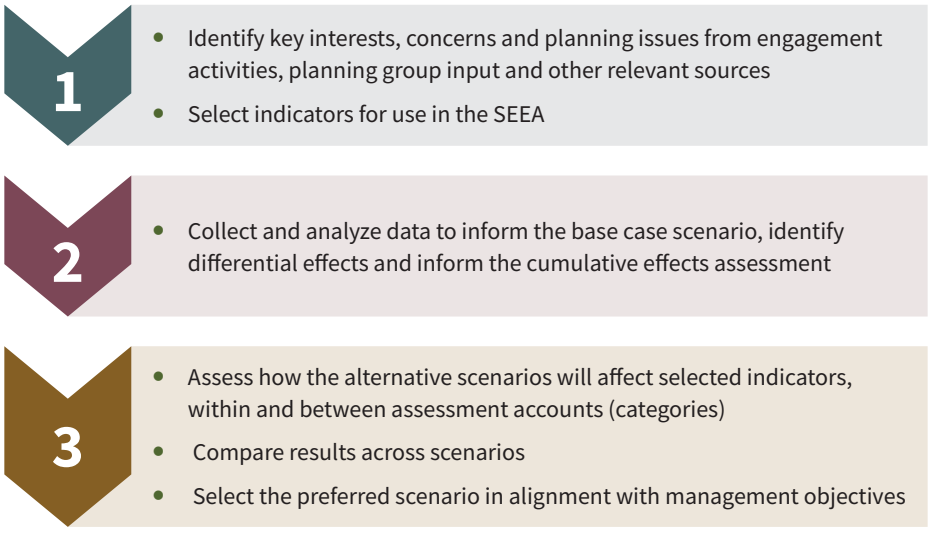


Figure 2.1 Phases of socio-economic and environmental assessment

2.1 Analyze Multiple Accounts

SEEA uses a **multiple accounts analysis** approach to assess the socio-economic and environmental effects associated with changes in land use. A multiple accounts analysis separates potential effects into different accounts or categories so that comparisons can be made among effects on different indicators within alternative scenarios and against the base case scenario.

In this guidance, a SEEA **account** is defined as a category of the human or natural environment that has social, cultural, economic, health, environmental or other implications that are inclusive and flexible to the values of partners and stakeholders within the planning area. Accounts may be further divided into **sub-accounts** if that is useful for the analysis. Indicators are used to evaluate specific effects for each account or sub-account. A multiple accounts analysis is a flexible approach because the specific accounts, sub-accounts and indicators can be tailored to the SEEA based on the management objectives and the characteristics of the planning area. The process includes the following basic steps for each account:

1. Selection and confirmation of indicators
2. Selection of appropriate method of analysis
3. Data collection
4. Analysis of the effects of base case and alternative scenarios on indicators
5. Comparison of the results of the analysis between scenarios

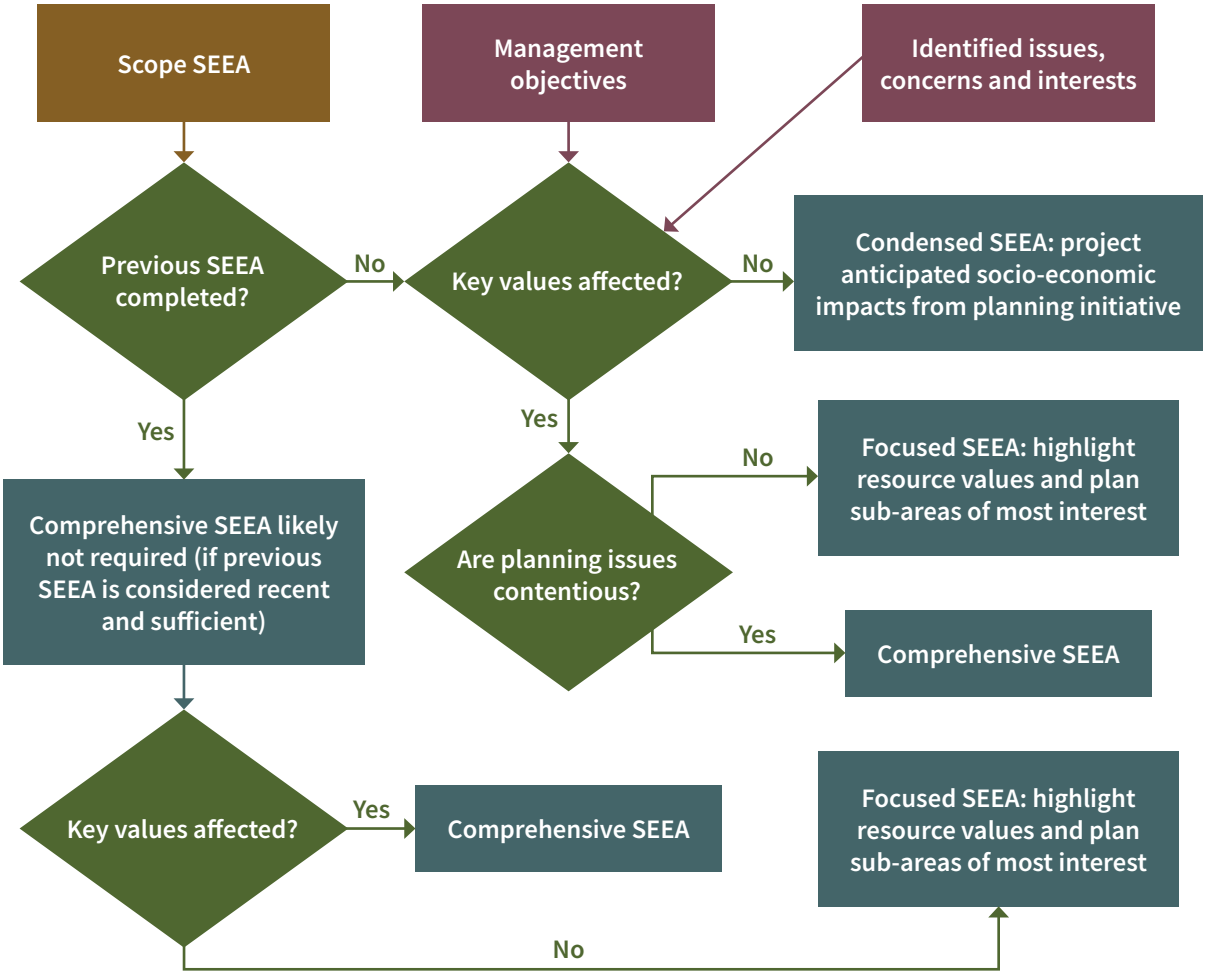
The multiple accounts analysis approach recognizes that a SEEA must consider a range of different issues that cannot be properly captured with a single impact indicator or measure. It's a flexible approach because the specific accounts, sub-accounts and indicators can be tailored to the SEEA based on the management objectives and characteristics of the planning area. Using this approach ensures that a complete range of effects are considered. In addition, it allows for the inclusion and evaluation of both **quantitative** (measurable and comparable) and **qualitative** (non-measurable and descriptive) outcomes, allowing for a systematic and consistent analysis that incorporates specific issues and concerns identified by engagement activities. The multiple accounts analysis approach is grounded in many planning and impact assessment experiences in B.C. and is proven to be effective in informing land use decision-making (e.g., Province of B.C. 2000, Shaffer 2010).

2.2 Determine Scope

The planning group determines the scope of the SEEA based on the number and complexity of planning issues and challenges to be addressed and the time frame and budget for the plan. The three broad levels of scope for a SEEA are described below:

- **Comprehensive SEEA**: Addresses a number of complex environmental, cultural, resource management and/or economic development issues where there is the potential for significant effects on key indicators, such as large employment impacts or alternative scenarios that contribute substantially to cumulative effects. The SEEA likely includes a socio-economic profile of the plan area and adjacent areas that the plan directly affects, a detailed review of environmental resources in the plan area and surrounding region, and an assessment of the alternative scenarios. The assessment follows SEEA guidance and carries out primary research and sophisticated and in-depth studies across accounts and sub-accounts. Example plan: Land and Resource Management Plan (LRMP): e.g., Fort St. John Land and Resource Management Plan Update.
- **Focused SEEA**: Addresses planning issues of moderate complexity or contentiousness, such as a limited set of issues across a large area, or a larger number of issues across a smaller area. The base case scenario is compared with a limited number of alternative scenarios. The assessment follows SEEA guidance, but potentially in an abbreviated form so that only resource uses that are proving difficult to reconcile in the planning process are analyzed. Primary research may be minimal. Example plan: Natural disturbance recovery plan: e.g., Ecosystem Restoration Program: Rocky Mountain Trench Natural Disturbance Type 4 Draft Five Year Plan (2010–2015).
- **Condensed SEEA**: Addresses a small number of land use planning issues of low complexity or contentiousness. Analysis is limited to a comparison of a base case and a single alternative scenario. The SEEA includes a brief description of current socio-economic conditions in the study area, highlighting the main drivers of resource-based economic activity. The planning initiative is not expected to contribute to cumulative effects and primary research is not required. The assessment follows SEEA guidance, but in an abbreviated form. Example plan: Nicola Watershed Planning Project.

When using a focused or condensed SEEA, include a rationale for why certain accounts have been omitted. A land use plan that addresses a small set of cultural or environmental issues may still result in effects on other important indicators. Use the decision tree presented as **Figure 2.2** to determine the appropriate scope of a SEEA.



Source: Updated from B.C. Ministry of Agriculture and Lands 2007

Figure 2.2 Decision tree for determining scope

2.3 Select Accounts

Guidance for scoping the SEEA to the local context follows from the management objectives of the planning initiative and consultation and engagement activities conducted by the planning group. The planning group should begin by identifying planning issues and concerns. For example, local issues may include legal objectives for a plan area, species at risk present in the plan area, protection of traditional use areas and more. Local issues may also be identified by reviewing past plans, relevant background studies and available datasets.

During the initial scoping process, the planning group will identify a draft set of accounts and sub-accounts based on their discussions and informed by ongoing identification of planning issues through engagement activities (**Table 2.1**). From these accounts and sub-accounts a set of indicators can be developed.

Table 2.1 Sample Accounts and Sub-accounts

Planning Issue	Account	Sub-account	Rationale for Use
Protection of old-growth forests	Environment	Old-growth forest	Yes – issues and concerns heard in engagement, limited areas remaining, priority of 2019 Old Growth Strategic Review…

Draft accounts and indicators can be analyzed using an **interaction matrix** (**Table 2.2**), which helps to identify the degree of overlap between selected indicators and plan scenarios. Use the scoping tools provided in the B.C. Environmental Assessment Office's Human and Community Well-being: Guidelines to help identify relevant topics for assessment (B.C. Environmental Assessment Office 2020a).

The interaction matrix is used to assess the potential for an interaction between the proposed changes to management (i.e., in the alternative scenarios) and the selected indicators (**Table 2.2**). When an indicator is not needed to address a plan action, it is not carried forward. The interaction matrix can indicate that an interaction between a management change and an indicator is expected or not expected (e.g., Yes/No), or that the interaction has a high, moderate or low likelihood of occurring. A rationale should be provided for the decisions.

Table 2.2 A Sample Interaction Matrix for Account or Sub-account, by Indicator

Management Change	Account or Sub-account		
	Indicator 1	Indicator 2	Indicator 3
Changes to forestry activities	High	High	Moderate
Changes to mining activities	Moderate	Moderate	High
Changes to infrastructure	Low	High	Low
Changes to protected areas	High	Low	Low

High potential for interaction expected: Include for further detailed analysis.
Moderate potential interaction expected: Include for further analysis.
Low potential interaction expected: No further analysis is warranted.
(Adapted from B.C. Environmental Assessment Office 2020c).

When selecting a draft set of accounts, sub-accounts and indicators, you may require extra time to properly identify key **values** and decide which indicators can be eliminated because they are considered unlikely to be affected by plan scenarios. Once the draft accounts and indicators have been fine-tuned through this iterative scoping process, the draft SEEA framework can be presented to the planning group for review and approval.

Review the accounts to ensure that the management objectives will be addressed and adapted to reflect local issues. If an identified account is no longer considered to be applicable to the planning initiative, it is not carried forward. Provide a rationale if accounts are removed or added.

See **Section 3.0** for a recommended structure for the accounts, sub-accounts and indicators. The SEEA should provide a rationale for the accounts included within it, describing the additions or deletions that have been made to best reflect the scoping process.

2.4 Select Indicators

Indicators are used to understand the potential effects of implementing alternative scenarios. Potential indicators are informed by planning issues and concerns identified by the planning group, as well as the economic, social, cultural and environmental values relevant to the planning area. Indicators should be:

- Clear: The indicators must be clear and understandable to the planning group.
- Relevant: The indicators must be appropriate for the region and study area and must relate to the selected account or sub-account.
- Practical: There must be a practical way to evaluate each indicator, using existing or achievable data, predictive models or other means.
- Measurable: The indicators must be measurable and rely on information reasonably gathered, and they must generate useful data that inform an understanding of the potential consequence to the account.
- Accurate: Within a reasonable margin of error, indicators must accurately reflect changes to the account.
- Predictable: Indicators must be able to predict the consequences of management changes on the account.

Quantitative indicators can be counted or measured as a quantity (e.g., total population), while qualitative indicators are descriptive and based on observation (e.g., factors affecting population changes). Although indicators may be quantitative or qualitative and will vary between accounts, they must be consistent to allow for comparison across scenarios. Selected indicators are used to identify baseline conditions for the base case scenario and to estimate how conditions will change under one or more alternative scenarios. The performance of indicators is then assessed in consideration of the modernized land use planning management objectives to help identify the preferred alternative scenario.

With respect to applying Indigenous knowledge to the selection of indicators, multiple indicators could be included to help assess socio-economic and environmental effects from different perspectives. For example, an indicator based on Western knowledge can be identified to support the assessment of an identified issue in the planning area, and a parallel indicator based on Indigenous knowledge can be identified to support the same assessment on that same issue. In these cases, both types of indicators would be included and evaluated. This dual approach to the assessment will provide a more holistic analysis of the potential effects of the alternative scenario, and it highlights the application of Indigenous and Western knowledge as complementary methods for a SEEA.

Consider the following factors with respect to indicators:

- Are they quantitative or qualitative?
  - **a.** Quantitative indicators can be analyzed directly with statistics, and results may be expressed in terms of ranges with confidence intervals. For example, the range of values related to a change of lands accessible for resource development may be 400 to 600 hectares, with a most likely outcome of 550 hectares and a 90 per cent confidence interval of 500 to 600 hectares.
  - **b.** Qualitative indicators cannot be measured numerically and are usually categories or observations that supply valuable context and meaning to the analysis. Examples are the quality of the recreational experience, or the sensory disturbance from changes to air, noise or visual aesthetics.

- Have the indicators been clearly defined?
- How are they evaluated?
  - **a.** Against a known **threshold** (also referred to as benchmarks or management triggers), which is a limit beyond which change becomes a concern, such as disturbance to a **habitat** that negatively affects a fish population, or soil contamination that affects potable water supplies. A threshold can be a goal, target, standard or guideline, carrying capacity, or limits of acceptable change, with each term reflecting different combinations of scientific data and societal values (Government of Canada 2016).
  - **b.** Against thresholds identified in the scientific literature or by Indigenous knowledge holders (e.g., on the minimum viable population of wildlife species in a watershed).
  - **c.** Against broader geographical or jurisdictional averages (e.g., a comparison of unemployment rates in the plan area to provincial or national averages).
  - **d.** Against standards identified by subject matter experts and authorities (e.g., environmental quality and pollution standards, and minimum housing standards used by the Canada Mortgage and Housing Corporation).

- Are there relevant statements from governments, communities or representative bodies, such as the Gitxaala Nation's (2018) statement, that further degradation of the health of Indigenous people is unacceptable?
- Can the effects characteristics used in environmental assessment be applied? These characteristics are magnitude, extent, duration, frequency, reversibility, likelihood, significance and confidence (B.C. Environmental Assessment Office 2020c).
- How is uncertainty addressed? For example, is there an estimate of likelihood and confidence? (**Section 2.8**).

2.5 Describe the Base Case Scenario

The base case scenario describes existing socio-economic and environmental conditions relevant to the accounts and sub-accounts selected for the multiple accounts analysis. In most cases, socio-economic baseline conditions are the status quo, or the current and predicted conditions in the plan area without any changes to management direction. The base case scenario is informed by baseline conditions and current legislation and regulations that apply to land and resource use in the plan area. External factors such as commodity prices and regulatory policies are assumed to follow existing trends or remain the same. The base case scenario includes a future path and therefore incorporates a consideration of climate change and cumulative effects; that is, the base case scenario includes both existing and anticipated resource management strategies and land use designations, and existing and anticipated biophysical, environmental, ecological, economic and social trends in the area.

The planning group determines the time frame of analysis for baseline conditions (i.e., to what extent future trends and projections are included) during the initial SEEA scoping (**Section 2.2**). The base case scenario is also informed by planning issues and concerns identified during engagement activities.

For the environmental assessment, the base case scenario is defined with reference to the range of natural variability (**Section 3.2**).

For the socio-economic assessment, baseline conditions for the plan area are informed by, for example:

- Existing demographic and socio-economic conditions for communities and Indigenous nations (e.g., population size and distribution, gender ratio, median age, income and income distribution, labour force statistics)
- Overlapping plans (e.g., access management plans, plans developed by Indigenous nations for their traditional territories)
- Land and marine use designations (e.g., wildlife management areas)
- Current timber supply reviews and annual allowable cut decisions
- Identification of vulnerable groups to support differential effects analysis, or GBA+ (see **Box 3**)
- Indigenous knowledge, to provide a detailed understanding of historic or past conditions, since Indigenous knowledge can incorporate oral history that covers long periods of time. Indigenous knowledge is a highly relevant measure of **ecosystem** health because it can provide detailed knowledge of local conditions before modern development (Eckert et al. 2020, Diver 2017)
- Current climate trends to provide a baseline for the socio-economic and environmental impacts of ecological shifts due to climate effects (e.g., changes in temperature, precipitation and primary productivity; invasive species; extreme weather events and other climate factors)
- Future, reasonably foreseeable trends or activities that are likely to occur in the planning area, to support cumulative effects assessment

The base case scenario should be developed and approved collaboratively with the planning group and stakeholders before evaluating alternative scenarios. Additional engagement with technical, scientific, Indigenous knowledge and other experts will likely be required to supplement and verify information used to develop the base case scenario. The SEEA should identify assumptions used in describing the base case scenario.

2.5.1 Conduct a Spatial Analysis

Once the plan area has been defined and mapped during the planning process, conduct a spatial analysis to compare spatial information on land and resource use in an alternative plan scenario(s) to the base case scenario. Spatial analysis uses Geographic Information Systems (GIS) to represent data on the natural environment (e.g., topography, watercourses and **biogeoclimatic zones**), built environment (e.g., roads, rail lines and utilities) and administrative data (e.g., land use zoning, regional and municipal boundaries). Each dataset is managed as a layer that can be overlaid and manipulated to compare datasets and identify planning issues.

An **area analysis** uses GIS to break down the entire plan area by management zone (e.g., area in hectares in a protected zone or in an integrated management zone). The area analysis generates area-based statistics to show a detailed breakdown of mapped resource values by management zone (e.g., percentage of **timber harvesting land base**), energy reserves/potential, critical fish and wildlife habitat and known mineral potential in various zones).

A **resource impact analysis** uses the area analysis and a plan scenario's management strategies to assess short-term and long-term consequences for natural resource activity (e.g., timber harvest levels, energy production, fish/wildlife populations). The resource impact analysis shows the effects on the physical units of a resource (e.g., m^3/year of timber, tonnes of mineral production, number of wildlife populations) resulting from changes in land use.

The results of the spatial analysis may show, for example, the amount of "high mineral potential" land that a **protected area** would make unavailable for exploration and development. The spatial analysis may be linked to accounts with non-spatial indicators. For example, a relative change in the timber harvesting land base may be linked indirectly to indicators of employment or community health.

The overlaying of zones on resource values is particularly useful when the plan scenarios are using zones to differentiate management strategies across the plan area. If zones are not used, more emphasis may be required to interpret management objectives and strategies in a plan scenario and their implications for the various resource values. At a landscape unit scale, different management objectives and strategies apply to individual or groups of landscape units, and GIS data can help show the extent of potentially affected resource values in each landscape unit.

One way to present area statistics for base case and alternative plan scenarios is shown in **Table 2.3**. The table includes only a small sample of the resource indicators that may be appropriate for any particular

plan; the indicators chosen should reflect the resource values being managed or affected by the plan, as determined for each of the accounts, as well as their relative significance in the plan area. Similar approaches can be used to illustrate the differences between plan scenarios.

Table 2.3 Sample Summary Area Statistics by Zone Category for a Base Case Scenario

Key Mapped Resource Indicators for Plan Area (in hectares unless noted)	Total	Percent (%) Overlap			
		Protected Areas	Lower Development Intensity Zones	General Management Zones	Resource Development Emphasis Zones
Plan area gross land base	100	12	25	26	37
Forestry (e.g., timber harvesting land base and mature volume in it (m^3))	…	…	…	…	…
Recreation and tourism (e.g., primitive recreation areas, high value recreation features (#), high tourism capability area, visually sensitive area)	…	…	…	…	…
Access (e.g., motorized access, non-motorized access)	…	…	…	…	…
Minerals and petroleum resources (e.g., occurrences/developed prospects (#), high mineral potential lands, mineral tenured area, proven petroleum reserves, potential petroleum reserves)	…	…	…	…	…
Agriculture (e.g., high capability lands, range tenured area)	…	…	…	…	…
Environment (e.g., wildlife habitat **suitability/capability**, maps for key species, high value **riparian** areas (km), biogeoclimatic units, **site series** or site series surrogates)	…	…	…	…	…
Archaeological or paleontological resources	…	…	…	…	…

In summary, the spatial analyses include:

- Management zone areas (i.e., area in a protected zone)
- Tenured or permitted land and resource uses within management zones (i.e., area of timber harvesting land base in each management zone)
- Spatial cumulative effects assessment for resource uses that are active or proposed in the study area

2.5.2 Data Sources and Limitations

Three general categories of data are required to inform baseline conditions and conduct the SEEA: biophysical and natural resource data, human environment data and Indigenous knowledge. This section provides a brief overview of these data categories, data sources, general limitations of data and assumptions. Detailed information on data sources and references is provided in **Appendix G**.

Biophysical and natural resource data are available as spatial datasets through government agencies and ministries, including the B.C. Conservation Data Centre, GeoBC, the BC Data Catalogue and other sources. Participating Indigenous nations and agencies may also have internal biophysical and natural resource data that may be requested for use in a SEEA. Other potential sources of biophysical information include:

- Existing land use plans and associated studies
- Recent environmental assessments in the same region
- B.C. cumulative effects framework reports on current conditions and cumulative effects assessment
- B.C. government Integrated Monitoring Reports (Province of B.C. 2021d)
- Indigenous knowledge and current use studies, subject to confidentiality considerations and permission from the respective Indigenous nation(s)

Human environment data sources include **secondary sources** (i.e., publicly available information sources identified through desktop research methods) and **primary sources** (i.e., information that is collected directly, through observations, interviews, workshops, surveys and ethnographic research). Typically, secondary data is collected from public sources, and then verified through primary research and ground truthing. Using a variety of data sources is recommended, as it will provide for a more robust analysis. B.C. Environmental Assessment Office's Human and Community Well-being Guidelines provides detailed information on the types of questions that may be asked to inform a SEEA (B.C. Environmental Assessment Office 2020a). Examples of data and information sources are provided in **Appendix G**.

Data for smaller communities may not be accurately reflected in statistical data due to sampling errors, rounding, suppression and differences in how spatial or other boundaries are defined. As statistical data may be inaccurate for Indigenous nations, the respective Indigenous nation should verify publicly available data where discrepancies exist. Statistics Canada datasets may show characteristics for larger communities at a finer scale (e.g., by age, gender, occupation, income), but a similar level of information will likely be unavailable for smaller communities due to data confidentiality. The potential for differential effects across population groups should be considered throughout the SEEA process, starting with the selection of secondary data sources. To identify potential differential effects, the data collection program must include direct engagement with population subgroups such as (but not exclusive to) Indigenous people, women, Elders, youth, minorities and people with disabilities.

Indigenous knowledge is multi-faceted and may be formulated and modified by personal experiences, may constitute beliefs and may be shared through oral history. Indigenous knowledge is often not written, as many Indigenous Peoples share and transfer Indigenous knowledge through such lived experiences as stories, histories and activities (including, but not limited to, ceremony, dance, song, etc.) and engaging in traditional practices while out on the land and waters. To inform the SEEA, Indigenous knowledge may be provided in many different ways, including discrete project-specific studies (such as part of a traditional use study or as traditional ecological knowledge), through focused primary research (e.g., interviews with knowledge holders) or through a use and occupancy map survey (Tobias 2000). All sources of Indigenous knowledge are subject to permission of use, in recognition that the knowledge belongs to the individual

knowledge holder and the community, and in accordance with the informed consent parameters identified by the contributor when they shared their Indigenous knowledge (B.C. Environmental Assessment Office 2020b).

A **traditional use study** (also known as a current use study) can help to identify and provide critical information, oral history, Indigenous knowledge and current use information about important and potentially affected traditional use and cultural sites and respective associated activities, through such means as narrative, oral histories, photographs, spatial mapping and drawings. A traditional use study and other types of studies presenting Indigenous knowledge may be carried out by or on behalf of individual Indigenous nations and may focus on a specific context (for example, the traditional use study may focus on a proposed resource project's footprint).

A **use and occupancy map survey** is a method that combines interviews with knowledge holders with documenting place-based activities on a map to document oral histories and current uses of lands and waters by Elders and other knowledge holders in the community. Use and occupancy map surveys and similar methods are often employed as part of traditional use study research. The map is converted to GIS format, and when added to other Indigenous knowledge maps, the use and occupancy map survey can provide an overview of the community's combined uses and occupancy values in map form (Kehm et al. 2019). These unique surveys can also inform the base case scenario to guide plan development about places in the plan area that will need special designation and management (Tobias 2000).

Traditional ecological knowledge as a form of Indigenous knowledge generally refers to local, long-term observations about the environment that are held by individual knowledge holders. Traditional ecological knowledge can be used to validate scientific data, each potentially providing insight to the other. It can also reveal long-term trends for applications such as fisheries and wildlife surveys and understanding the effects of climate change (Berkes 2017). Within the current policy and legal context of reconciliation, traditional ecological knowledge is increasingly being recognized as a distinct but parallel empirical process and a legitimate basis for resource governance (e.g., de Beer and Dylan 2015).

See **Box 2** (in **Section 1.5**) for more sources on applying Indigenous knowledge.

2.6 Assess Cumulative Effects

Cumulative effects are changes to important societal, socio-economic and environmental values caused by the combined effect of past, present and potential future activities and natural processes. By definition, a SEEA assesses cumulative effects because all of the land and resource uses within the plan area are considered in the analysis of both the base case scenario and alternative scenarios. Cumulative socio-economic or environmental effects result from the incremental effects of multiple activities and land uses, which may have minor direct and indirect impacts that can add up to a major impact when combined.

Cumulative effects can interact in different ways, including additively, synergistically and antagonistically.[4] A well-used example of cumulative effects is the combined effects of human activities that add up to cause global climate change.

A cumulative effects assessment for a SEEA must consider the effects of the planning scenarios in combination with future reasonably foreseeable land and resource use trends and activities. Land use planning itself is a tool for cumulative effects management. The base case scenario represents the cumulative effects of past and present human and natural influences on the accounts and their indicators. The predictions for each of the accounts in the base case and alternative plan scenarios will consider changes imposed by the existing trends for future uses and the changes in management in the scenario.

Apply the following principles in a SEEA to help ensure a focus on cumulative effects:

1. Consider past and current trends in land and resource uses and how these trends may affect future conditions for each account, as well as other linked accounts.
2. Use available analytical tools to guide the assessment and interpretation of results, such as assessment protocols developed through the B.C. cumulative effects framework (Province of B.C. 2021e). Of particular use are the indicators, benchmarks and management triggers used for assessing current conditions.
3. Use available data and reports developed through the B.C. cumulative effects framework to inform baseline condition assessments for values.
4. Document key evidence, assumptions and uncertainties to do the best assessment possible given available cumulative effects assessment theory and information.
5. A selection of further reading on cumulative effects assessment is provided in **Box 3**.

Box 3 Cumulative Effects Assessment: Further Reading

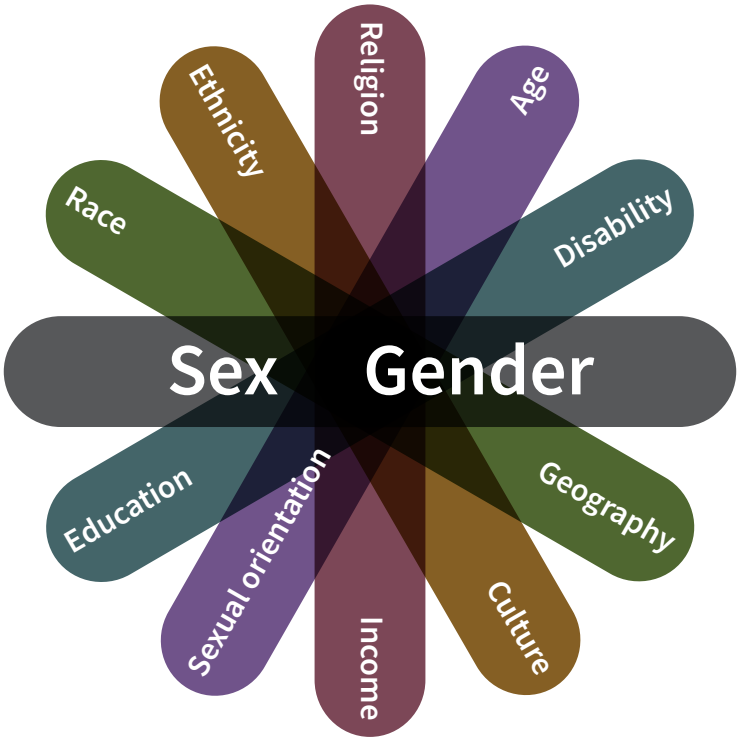
- Cumulative Effects Assessment Practitioners Guide (Hegmann et al. 1999)
- Cumulative Effects Framework Interim Policy for the Natural Resource Sector (Province of B.C. 2016)
- Cumulative Effects in Marine Ecosystems: Scientific Perspectives on Its Challenges and Solutions (Clarke Murray et al. 2014)
- Use of Significance Thresholds to Integrate Cumulative Effects into Project-level Socio-economic Impact Assessment in Canada (Joseph et al. 2017)
- Looking Up, Down, and Sideways: Reconceiving Cumulative Effects Assessment as a Mindset (Sinclair et al. 2017)

[4] An **additive effect** refers to a combined effect being the same as the sum of each individual effect, a **synergistic effect** refers to a combined effect being greater than the sum of each individual effect, and an antagonistic effect refers to a situation where one effect reduces the magnitude or extent of another effect.

2.7 Consider Differential Effects

In the context of a SEEA, alternative scenarios may affect different communities, groups and individuals differently. For example, recent research in northern Canada has found that resource development activities have disproportionately negative effects on local women, Indigenous people, seniors, people with disabilities and other marginalized or vulnerable groups (Stinson and Levac 2016). In addition, positive effects of development, such as increased employment opportunities, may be less available for local and/or unskilled workers, while the costs for housing, food and services may increase in communities where the workforce has increased due to increased resource activities (Stinson and Levac 2016). You should consider these and many other interrelated factors that may result in differential effects when conducting a SEEA.

A consideration of **differential effects** identifies how some communities, groups and individuals may be more vulnerable to effects from management decisions. Factors that influence differential effects include demographic factors (e.g., age, sex, household structure), economic factors (e.g., employment, income level and skills), socio-cultural factors (e.g., ethnicity, gender and many others) (Status of Women Canada 2020a). See **Box 4** for a list of groups to consider. As shown in **Figure 2.3**, multiple and often interdependent factors intersect to define individual identities.



Source: Status of Women Canada 2020a

Figure 2.3 Factors that can influence differential effects

The consideration of differential effects is often termed **gender-based analysis plus** (GBA+), referring to how gender and many other factors intersect to influence how different people or groups may experience differential effects of policies, programs and initiatives. In 2018, the Province of B.C. adopted the application of GBA+ as a key component of policy-making. The Government of Canada provides detailed information on GBA+ and consideration of differential effects, including an introductory online course and additional resources (**Box 5**).

Box 4 Groups to Consider when Examining Differential Effects

(Note: list is non-exclusive)

- Indigenous Peoples (as a whole or by Nation, as appropriate)
- Ethnic groups defined by culture
- Groups defined by gender and sexuality (e.g., women, transgendered people)
- Groups defined by age (e.g., seniors, youth)
- Groups defined by place of residence (i.e., rural vs. urban residents)
- Groups defined by economic activity (e.g., forest sector households, industrial sector)
- Groups defined by other factors, such as health status or other socio-economic or environmental constraints that contribute to vulnerability

Differential effects should be considered as part of the analysis for all socio-economic accounts. In a SEEA, two types of differential effects should be considered:

- Differential effects on an indicator that are common across groups in a region. For example, some groups may benefit from employment in a particular plan scenario, while other groups may lose employment in the scenario.
- Differential effects resulting from different perspectives and values. For example, an increase to the timber harvesting land base in a plan scenario may benefit those in a region working in forestry but may negatively affect Indigenous interests, values and practices associated with the affected land.

Differential effects of either type may be presented in specific accounts and sub-accounts, unless the differential effects relate to a specific Indigenous community or value, in which case it may be preferable to present the differential effects as part of the Indigenous law and governance account.

Understanding differential effects when conducting a SEEA requires considering the local context, which requires direct engagement with potentially vulnerable groups. Different population groups will have different perspectives on how a change in management direction may affect them. Data collection and analytical approaches should be disaggregated to ensure that the perspectives of different subgroups are represented and considered throughout the SEEA and the planning process.

Box 5 Differential Effects: Further Reading

- What is Gender-Based Analysis Plus (Status of Women Canada 2020b)
- Gender-based Analysis Plus in Impact Assessment (Government of Canada 2020b)
- Human and Community Well-being: Guidelines for Assessing Social, Economic, Cultural and Health Effects in Environmental Assessments in B.C. (B.C. Environmental Assessment Office 2020a)
- Requiring GBA+ and Participatory Research Principles in Environmental Assessments (Stinson and Levac 2016)
- Strengthening Impact Assessments for Indigenous Women (Manning et al. 2018)

2.8 Address Uncertainty and Risk

Uncertainty refers to a situation where the future is not known because of a partial or total lack of understanding about an event or result. In a SEEA, uncertainty could be associated with a lack of knowledge about the consequences and likelihood of planning scenarios. Uncertainty may also result from outdated knowledge. A key source of uncertainty is incomplete information, such as lack of survey effort (spatial or temporal), inappropriate data collection techniques or incomplete datasets. Other sources of uncertainty include an incomplete understanding of cause-and-effect relationships, natural randomness or human error. **Risk** describes a situation where there is a chance of loss or danger, such as the risk of increased wildfires from climate change effects. Unlike uncertainty, which cannot be reduced, risk can be quantified and managed. In a SEEA, risk can be characterized as the effects of uncertainty on management objectives.

You can think of a SEEA as a method for reducing uncertainty in how management decisions may affect communities and the environment in a plan area over time, although sources of uncertainty will always exist because uncertainty cannot be eliminated. A SEEA must consider and communicate uncertainty and risk in base case scenarios and alternative scenarios so that planning groups can understand the risks and decide on their acceptability.

The following recommendations can help you identify uncertainty and address risk in a SEEA:

1. Identify key uncertainties when choosing indicators. Be sure to consider the sources of these uncertainties, the assumptions used, the consequences of assumptions being wrong and key risks stemming from uncertainties.
2. Rely on strong evidence, substantiated inputs and data, and credible methods. Data, the method of analysis used and assumptions can all be chosen with caution in mind. Clearly identify data sources and use only credible sources.
3. During the assessment phase, when the consequences of alternative plan scenarios are less certain, the SEEA should consider a broader rather than narrower scope of analysis. Draw users' attention to uncertainties and risks when presenting results. Use statements of confidence to capture limitations in the assessment. A lack of caution can lead planning groups and decision makers to choose plans that lead to unintended and adverse consequences.

When communicating quantitative results, such as the results of an area analysis, the SEEA should include data ranges or confidence intervals if possible. For example, the range of a change of lands accessible for resource development may be 400 to 600 hectares, with a most likely outcome of 550 hectares and a 90 per cent confidence interval of 500 to 600 hectares.

A **sensitivity analysis** is a method of analysis used to identify the range of possible results. The method identifies the amount of variation in the input parameters for a given value that will affect the results. For example, economic impact analyses using input-output models can be run using a range of capital expenditures as inputs, associated with a range of future commodity price scenarios. A sensitivity analysis should be a standard part of quantitative analyses, but the technique can also be applied to qualitative assessment (such as a qualitative estimate of the likelihood of an outcome).

In land use planning, uncertainty may be addressed by implementing monitoring or other follow-up programs. **Monitoring programs** are used to track the performance of identified indicators after the land use planning initiative has been implemented to confirm that the effects predicted by the SEEA are as predicted and that mitigation measures are implemented and effective. The SEEA addresses the conditions in the plan scenarios provided by the planning group but does not include recommendations of **mitigation** measures. Mitigation may be considered part of the conditions in the provided scenarios, as management strategies may be prescribed that reduce negative effects (e.g., guidelines for access).

An **adaptive management** approach can be used to take action when unforeseen effects occur or the need for new or modified mitigation is identified. Adaptive management is a systematic approach for improving resource management policies and practices by learning from management outcomes (e.g., Adaptive Resource Management 2009, Province of B.C. 2021f). The SEEA may describe the need for – and scope of – monitoring or other follow-up programs, including adaptive management programs, to address any identified sources of uncertainty. During the scoping phase for the SEEA, identifying existing adaptive management programs may be important for establishing accounts and indicators.

In certain situations, it may be appropriate to conduct additional risk analysis to more fully characterize the potential risk associated with uncertain outcomes, particularly if there is a low level of confidence coupled with the possibility of a significant effect on a key indicator, and follow-up programs are not considered sufficient to manage the potential risk. **Box 6** provides further reading on considering uncertainty and risk.

Box 6 Uncertainty and Risk: Further Reading

- Adaptive Management Framework for the Central and North Coast of British Columbia: Overview (Final report prepared for the Ecosystem Based Management Working Group). (Adaptive Resource Management 2009)
- Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties. (Intergovernmental Panel on Climate Change 2010)
- Reducing Uncertainty and Risk though Forest Management Planning in British Columbia (Day and Perez 2013)
- Structured Decision Making: A Practical Guide to Environmental Management Choices (Gregory et al. 2012)

2.9 Compare Assessment Results

The planning group can compare results of the SEEA for alternative scenarios to identify or confirm a preferred planning scenario that aligns with the management objectives. The SEEA may also identify possible changes to the plan design to better address planning issues and concerns. For example, when several plan scenarios have been examined, the presentation of results could show how scenarios could be adjusted to mitigate their disadvantages relative to other scenarios, to support the development of a single, more acceptable option.

Three types of comparisons across accounts are useful for identifying key **trade-offs** (e.g., the relationship between economic output and environmental effects) and uncertainties. Some ways of reviewing these comparisons include:

1. A consequence matrix to compare accounts and criteria results across plan scenarios (e.g., which indicators will show a change relative to the base case scenario? How does the change compare between scenarios?).
2. Results within a plan scenario across accounts (e.g., how does a scenario affect indicators across all accounts? Which accounts are negatively affected, and which ones are positively affected?).
3. Comparison of how the scenarios align with the management objectives. The comparisons should focus on the relative performance of the different scenarios rather than performance in absolute terms.

The SEEA should highlight key results from the comparisons made across and between plan scenarios, as well as key areas of uncertainty in the analysis.

Some accounts and sub-accounts are more appropriately captured in qualitative terms. Qualitative results can be presented in consequence matrices in bullet form or through the use of defined terms with accompanying in-depth discussion. For example, the analysis of data from informant interviews could include an output of common themes, which would be the issues, concerns and values identified from multiple interviewees. These common themes could be supplemented with explanations or quotes from interviewees to provide more detail and represent key qualitative information.

2.9.1 Compare Results Across Plan Scenarios

Use matrix tables to summarize comparisons of assessment results across plan scenarios. In the simplified example presented in **Table 2.4** below, conditions in the two sub-accounts shown in the base case scenario are not expected to change from current conditions to 2030. However, under the alternative plan scenario, there may be a reduction in employment and an improvement with respect to **extirpation risk**, which may be a key trade-off. The consequence matrix would capture key results that would then be presented in executive summaries and the main body of assessment reports alongside more in-depth presentations of results and qualifications of the results (i.e., key uncertainties, assumptions).

Table 2.4 A Sample Consequence Matrix

Account	Sub-account	Indicator	Current Conditions	Future Conditions	
				Base Case scenario	Alternative Plan Scenario
Economic	Employment	Number of forestry jobs (full-time equivalents	250	250	200
Environment	Species at risk	Risk of extirpation of species at risk	high	high	low
…	…	…		…	…

2.9.2 Summarize Results by Scenario

Trade-offs can be made clearer by focusing on the particular values that conflict. A stereotypical trade-off is that between economic and environmental values, and trade-offs can be made explicit by highlighting the accounts and sub-accounts involved rather than presenting results by account and sub-account separately as if there were no interaction or connection between them. Highlight trade-offs by presenting them in reference to particular management strategies in plan scenarios. For example, the following table includes fictitious results for the environment and economy accounts, allowing for a direct comparison (**Table 2.5**).

Table 2.5 A Sample Summary of Assessment Results by Plan Scenario

Management Strategy	Risk to Mountain Goats	Risk to Forestry Operations
Maintain 70% basal area within 50 m of mapped mountain goat winter range	Low: Some risk associated with logging in and around goat habitat	Moderate: Potential loss of 15,000 m^3 of the annual allowable cut as a result of goat management guidelines
Unless no economically or operationally feasible alternative exists, do not construct roads within 500 m of mapped goat habitat	Low: Some risk to goats from poaching due to not completely eliminating roads	Low: Assessment indicates little impact on access to timber as a result of road restrictions

Figure 2.4 shows an example of a summary table that provides more detail (Pierce Lefebvre Consulting 2004). This example compares the alternative plan scenarios to the base case scenario by management plan directions (policies) and the accounts used for this plan.

Morice LRMP Socio-Economic and Environmental Impact Assessment (relative to Base Case or 'status quo' management scenario)		Forestry	Mining	Agriculture	Energy	Guiding/Trapping	Botanicals	Tourism	Recreation	Communities	First Nations	Ecosystem Representation	Coarse Filter Biodiversity	Focal Wildlife Species	Special and Rare Ecosystems	Aquatic Ecosystems and Fish
General Plan and Planning Process Products	land use certainty, resource inventory data and maps, community capacity building, stakeholder consensus	b	b	b		b	b	b	b	b	b	b	b	b	b	b
General Management Direction	Management Objectives															
General	noxious weeds, fertilizer use, point source pollution	b/c		b/c			b	b/c	b/c							
Consultation	consistency of operational decisions with LRMP direction	b/c	b/c	b	b/c	b	b	b	b	b	b/c					
Community	air quality, community stability, heritage, recreation, visual	c	c			b		b	b	b	b	b	b	b		
Economy	access management, specific sectoral objectives	c	b/c	b		b	b	b	b	b/c	b		b			
Ecosystem	biodiversity, fish and wildlife, aquatic resources	C	c	b/c	c	b	b	b/c	b/c		b	b	B	B	B	B
	Management Objectives															
Protected Areas	recreation, ecological, tourism, cultural heritage values	c	c			b	b	b/c	b/c		b	B	b	b	b	b
Area Specific Management	Management Objectives															
No Timber Harvest Areas	recreation, ecological, tourism, cultural heritage, water resources	c	c			b	b	b	b		b	B	b	b	B	B
Other Area Specific	recreation, ecological, tourism, cultural heritage, water resources	C	c	c		b	b	b	b		b	b	b	b	b	b

Legend: c = modest costs, C = significant costs, b = modest benefits, B = significant benefits, b/c = a mix of costs and benefits, * = not modelled in SELES simulation

Source: Pierce Lefebvre Consulting 2004.

Note: Colours shown in the table refer only to the ratings of cost or benefit as shown in the legend.

Figure 2.4 A sample summary table for socio-economic and environmental assessment results

2.9.3 Align Scenarios with Management Objectives

The assessment results can also be summarized by how well the scenarios meet the management objectives defined by the planning group. Use comparative ratings (such as neutral, low, moderate and high) to indicate the degree of alignment. The planning group is responsible for establishing the criteria for each rating or their evaluation.

Table 2.6 A Sample Comparison of Scenarios to Management Objectives

Management Objective	Degree of Alignment		
	Base Case	Scenario 1	Scenario 2
Diverse cultural values are respected, and shared values are recognized			
Harmonious and integrated use of the landscape among different users	Neutral	Moderate	High
Issues relating to Indigenous nation processes pertaining to identified Indigenous rights and title are respected			
Healthy air, water and soils			
A full range of ecosystems with natural processes, function and pattern			
Native species and ecosystems within the range of natural variation (including old growth dependent species)			
Stable access to a sustainable supply of natural resources			
Profitable investment opportunities			
A diverse economy supporting an increase in value-added processing			
Resource management and manufacturing that maximizes local benefits			
Opportunities for diverse jobs and lifestyles			
Development that honours and respects the land, ecosystems and communities			
Safe communities where citizens can live, work and recreate			

3.0 Assessment Accounts

Given that land and resource management decisions may lead to complex and interrelated effects on communities and the environment, the SEEA must be sufficiently comprehensive, use a clear and consistent framework to facilitate comparisons, and include both immediate and future implications. This section presents recommended accounts (categories), sub-accounts and indicators for assessing the potential impacts on the human or natural environment, and describes the assessment methodology for each account. See the appendices for additional technical information and tools for assessing impacts on the forest, recreation and tourism, minerals and petroleum sectors, as well as conducting an economic impact analysis and environmental risk assessment.

This guidance recommends considering multiple accounts, which could include climate change, environmental risk, Indigenous governance and law, economy, social, health, and archaeological, paleontological and heritage resources. In practice, not all accounts may be needed for the SEEA, depending on the range and diversity of planning issues relevant to the planning initiative.

Table 3.1 shows the recommended accounts, sub-accounts and sample indicators applicable for a SEEA for modernized land use planning. The accounts, sub-accounts and indicators listed in **Table 3.1** are intended as examples only. The indicators selected for the SEEA should be aligned with the management objectives of the specific planning initiative and the planning issues, interests and resource values for the plan area and reflect established legal commitments.

Table 3.1 Recommended SEEA Accounts and Sample Sub-accounts and Indicators

Account	Sample Sub-account[5]	Sample Indicators
Climate change		Net greenhouse gas flux Climate risk (e.g., flooding, wildfire, coastal erosion)
Environmental risk	Ecosystem representation	Ecosystem types in each planning zone
	Risk to environmental values	Coarse filter biodiversity Grizzly bear population Northern goshawk population
Indigenous governance and law		Governance and stewardship systems Occupation and use of lands and waters Customs, beliefs and values Language and intergenerational knowledge transfer Community and cultural cohesion
Economy	Employment and income	Number of direct, indirect and induced jobs Income and income distribution
	Economic efficiency	Net economic value by resource sector
	Government revenues	Net government revenue
Social	Infrastructure and services	Transportation, housing, utilities, health and emergency services, water supply and waste management
	Land and resource and marine use	Public land and resources, private lands, provincial land tenures, legally protected parks and protected areas
	Visual resources	Visual quality objectives
Health	Social determinants of health	Housing, employment, education, income, food security
	Environmental determinants of health	Air quality, water quality, soil and sediment quality, country foods quality
Archaeological, paleontological and heritage resources		Archaeological, paleontological and heritage sites Culturally modified trees

To ensure consistency of information across plan scenarios, the SEEA should assess the same indicators on all selected accounts and sub-accounts. Because the accounts are linked, it may be most effective to begin with a climate change assessment (which affects all accounts), followed by an environmental risk assessment. Socio-economic, environmental and the Indigenous governance and law accounts are interrelated and could be completed at the same time or sequentially as appropriate.

3.1 Climate Change Account

The anticipated extreme and rapid changes in climate are a key factor influencing all SEEA accounts. A current planning initiative may no longer be relevant if the effects of climate change on socio-economic and environmental indicators are not accounted for (Kehm et al. 2019). To address inherent uncertainty in the analysis due to climate change, the implementation of the selected planning scenario should include monitoring and periodic updates to review the SEEA's predictions (**Figure 1.2**).

[5] Possible sub-accounts and indicators are provided as examples only. Refer to **Section 3.0** for specific accounts.

Climate forecasts predict changes in temperature, precipitation and plant productivity, as well changes in plant and animal distributions. Climate change across B.C. is expected to include more frequent, severe and extreme weather (Government of Canada 2020a). Climate change may also provide some advantages, such as longer growing seasons and the possibility of expanded agriculture in northern regions. These projected changes will have important environmental implications for SEEAs and implications across all assessment accounts.

Climate change has been observed to disproportionately affect Indigenous Peoples by negatively affecting availability and quality of resources that are critically important to their cultural rights and practices (e.g., declining salmon populations and increased wildfires and flooding that limit the availability of resources for food and cultural purposes) (Teegee 2020). Climate change effects may also be disproportionately experienced in rural and remote Indigenous (and non-Indigenous) communities.

Climate change is linked with land use and marine planning because of the effects of climate change on B.C.'s lands, waters, natural resources and economic activities. Alternative planning scenarios that change land and resource use may in turn affect B.C. **emission sources** (e.g., industrial emissions, vehicle emissions and smoke from wildfires and human uses) and **carbon sinks**[6] (e.g., see carbon sequestration in forests). Climate change contributes to cumulative effects, not only by direct effects on ecosystems and species, but by interactions with human uses. For example, recently harvested forest land is more likely to be subject to erosion in areas where climate change is causing increased precipitation. Species that are already affected by human changes to the landscape may experience range shifts and population decline from the combined effects of climate change and landscape change (e.g., Heim et al. 2017).

Land use practices and management shape B.C.'s ability to adapt to future climate change. A changing climate poses serious risks to communities and ecosystems, such as flooding, drought and wildfire. Planning groups can design alternative plan scenarios that reduce climate change risk and vulnerabilities by:

- Reducing and diversifying exposure to climate risk
- Proposing **no-regrets strategies**[7] that generate robust outcomes across a range of uncertain conditions
- Strengthening resiliency across the biophysical and human environment to absorb and recover from climate stresses and shocks

3.1.1 Scoping Sub-accounts and Indicators

Determine the appropriate level of analysis for the climate change account based on the availability of regional and provincial data for climate change parameters. Available resources to guide the evaluations in the account are provided in **Box 7**.

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[6] A carbon sink is any natural system that accumulates and stores carbon-containing compounds, lowering the concentration of carbon dioxide in the atmosphere. Vegetation (including forests) and the ocean are key carbon sinks.

[7] A no-regrets strategy refers to a strategy that can be enacted now without complete information (i.e., with uncertainty) about the effects of climate change. Precautionary measures can be taken to respond to the negative effects of climate change before they intensify and are justifiable whether expected effects occur or not. Such measures increase resilience, such as investing in green technologies and infrastructure, or changing management practices to reduce air and water pollution (e.g., Dillingham 2020, Overpeck and Udall 2010).

Box 7 Climate Change: Further Reading

- Canada's Changing Climate Report (Bush and Lemmen (editors) 2019)
- Climate Action Toolkit (Green Communities Committee 2021)
- Climate Data and Models (UBC Faculty of Forestry: Centre for Forest Conservation Genetics. nd)
- Climate Change Tools – Comprehensive List (Province of B.C. 2021h)
- Climate Mitigation Potential of British Columbian Forests: Growing Carbon Sinks (B.C. Ministry of Forests, Land and Natural Resource Operations 2013)
- Climate Resilience Data Explorer (Conservation Biology Institute 2021)
- Cultural Rights of First Nations and Climate Change (Teegee 2020)
- Data Portal (Pacific Climate Impacts Consortium 2021)
- Managing Climate Change Risks: An Independent Audit (Office of the Auditor General of B.C. 2018)
- Modelling Future Climate Change; Chapter 3 in Canada's Changing Climate Report (Flato et al. 2019)
- Preliminary Strategic Climate Risk Assessment for British Columbia (B.C. Ministry of Environment and Climate Change Strategy 2019)
- Provincial Greenhouse Gas Emissions Inventory (Province of B.C. 2021i)

The climate change assessment should be informed by engaging with Indigenous knowledge holders, local government, communities and stakeholders in the plan area, and technical experts in both the provincial and federal governments (e.g., the Ministry of Forests, Lands, Natural Resource Operations and Rural Development; Ministry of Agriculture and Lands; Ministry of Environment and Climate Change Strategy; Canadian Forest Service; Agriculture and Agri-Food Canada). Guidance is also available from specific professional associations such as the British Columbia Institute of Agrologists, and Engineers and Geoscientists BC. Membership may be required to access guidance from professional associations.

3.1.2 Baseline and Trends in Indicators

Current and future projected climate trends are an important component of the base case scenario since climate conditions will affect all assessment accounts. The reverse is also true, as planning scenarios will influence climate effects in the plan area. This section focuses on the effects of planning scenarios on baseline climate conditions, which are cumulative across the accounts. The influence of climate change effects on individual accounts is considered in the sections for each account.

3.1.3 Analytical Methods and Evaluation

Potential methods for analyzing and evaluating the climate change consequences of plan scenarios for the calculation of net greenhouse gas (GHG) flux and climate risk are presented below. The methodology for the analysis of climate forecasts will be informed by available Indigenous knowledge and current scientific data and determined in consultation with subject matter experts in Indigenous, provincial and other levels of government (Hiwasaki et al. 2014).

Indigenous nations in B.C. are designing and leading climate change surveys and other initiatives, including a 2019 province-wide survey that revealed that survey respondents were unable to access certain sacred and cultural sites due to climate change effects such as erosion, flooding, landslides and droughts (Teegee 2020). In addition, many Indigenous nations have been actively assessing impacts of climate change on culture, ceremonial sites and rights through risk assessments that are part of community climate adaptation plans (Ghorbani et al. 2021).

3.1.3.1 Net Greenhouse Gas Flux

Determine net GHG change by establishing the base case scenario, estimating GHG flux and comparing the change in net GHG flux in the plan area to B.C.'s emission targets for the scenarios. **Net GHG flux** refers to net levels of GHGs resulting from both GHG emissions and carbon storage.

Land and marine activities can be a substantial source of emissions:

- Oil and gas exploration and production can release GHGs through leakage, natural gas flaring and gas processing facilities
- Agricultural activity can emit GHGs through fossil fuel combustion, release of methane produced by livestock, release of nitrous oxide from fertilizers and manure, and release of carbon stored in soils
- Forestry activity can emit GHGs through fossil fuel combustion during logging and milling, nitrous oxide emissions from fertilizers, and release of carbon stored in logged timber and forest soil
- The conversion of forests to agricultural or other uses can create a source of GHGs
- Fires and pests can also lead to the release of stored carbon

Other land and marine activities can contribute to carbon storage and the enhancement of carbon sinks:

- Forestry management can change the amount of carbon sequestered in trees by changing practices with respect to forest growth rates, rate of tree mortality, soil disturbance, fire suppression and nutrient management
- Establishing protected areas where no logging or land disturbance can occur would preserve lands, leading to increased carbon sequestration
- Restoring **wetlands** and other areas can contribute to carbon storage

The SEEA must first establish the base case scenario (**Section 3.5**) with respect to the effects of climate change on environmental and other values in the plan area, including expected future emissions and carbon storage capacity. Determine baseline GHG emissions and carbon storage by identifying the main sources of emissions and storage and estimating the appropriate volumes.

Your analysis should identify and estimate ways in which alternative plan scenarios will alter GHG emission sources and carbon storage from the base case scenario. Changes in sources may stem from changes in land cover and in the amount and pace of land and marine activities, both of which may be affected by changes in market conditions (e.g., changes in the price of natural resource commodities), technological

change, as well as changes in how the plan area is managed. Changes in carbon storage may similarly stem from changes in land cover, activities, market factors, technology and management. This step will rely substantially on an assessment of changes in lands and natural resource sectors and areas in other SEEA accounts. Changes in both emissions and storage should be quantitative to calculate the net change in emissions and storage and enable an estimate of net GHG flux.

Finally, for all scenarios, the SEEA should compare the estimated change in net GHG flux to B.C.'s emission targets. A change in net GHG flux from baseline conditions under alternative scenarios may have little quantitative significance with respect to B.C.'s emission targets. However, the evaluation should note the directionality of the scenarios' effects in relation to the targets and whether plan scenarios' effects on net GHG flux will shift emissions or storage to other parts of the province. Keep in mind that changes to emissions or carbon storage outside the plan area may compound or offset changes inside the plan area.

3.1.3.2 Climate Risks

Many GHGs remain in the atmosphere for tens to hundreds of years after being released, producing warming effects on the climate that persist over the long term and that affect both present and future generations (Flato et al. 2019). While adaptation measures may lessen the effects of climate change, uncertainty regarding the nature of climate change effects and the effectiveness of adaptation measures means that climate risks remain. However, planning can shape these risks and the capacity to adapt to them by influencing how natural resources are developed and managed. For example, a strategy of designating protected areas can help conserve ecological values, provide connections across landscapes for species and increase resilience to catastrophic events (e.g., International Union for Conservation of Nature 2021).

A climate risk assessment methodology is available in the Strategic Climate Risk Assessment Framework for British Columbia (Province of B.C. 2019a). The document provides a framework for assessing risk, as well as guidance for likelihood, consequence and risk evaluations. The B.C. Ministry of Environment and Climate Change Strategy steps are shown in **Figure 3.1.** Step 1 is covered in **Section 3.1.1** and Steps 2 to 4 are described in more detail below. In addition to these steps, the SEEA must also document the results and use them to inform analysis across the other accounts.

Source: Adapted from Province of B.C. 2019a.

Figure 3.1 B.C. Ministry of Environment and Climate Change Strategy steps for a climate risk assessment

The SEEA must identify risk events that could occur in the plan area. For example, possible risk events that could occur in B.C. include wildfires, severe storms, insect infestations, coastal flooding and shoreline erosion; however, not all of these risk events may be applicable to the plan area. Climate risk assessment should primarily focus on serious, high-priority risk events.

Identify risk events by engaging with government and local and Indigenous knowledge experts, as well as reviewing risk causes, such as changes in average temperatures, changes in seasonal precipitation patterns and sea level rise, and their effects on accounts (**Table 3.2**). Risk events should be described in terms of plausible scenarios that consider the accounts affected, risk causes, location, timing and consequences to accounts. For example, wildfire might be described in terms of the threat it poses to the communities, natural resources, economic activities and other values of the plan area. The potential effects of a changing climate on the plan area should be described using the best available climate change information, equally considering Western scientific information and Indigenous knowledge, which may be highly informative with respect to local changes in a plan area as observed over long time periods.

Table 3.2 Sample Risk Causes and Risk Events Related to Climate Change

Risk Cause	Example of Associated Risk Event	Example of Potentially Affected Account
Increased air temperature	Shift in climate envelope for invasive species, affecting native species	Environmental and Social
Changed precipitation	Drought, affecting agriculture	Economy
Changed hydrology	Low flow, affecting recreational opportunities	Social
Sea level rise	Loss of foreshore	Social

Source: Adapted from Price and Daust (2019).

Evaluate climate risks by developing estimates of likelihood and the consequence of a risk event and using these estimates as inputs to a risk matrix. Provincial guidance for definitions of likelihood, consequence and risk is provided in **Table 3.3** (Province of B.C. 2019a) and can be adapted to the plan area. While the guidance provides a numerical evaluation, it can also be adapted for a qualitative approach. Likelihood judgements should consider the probability of both the risk cause and risk event. For example, when assessing wildfire risk, examine the likelihood of both a change in wildfire patterns in the plan area and of wildfires interacting with accounts in the plan area.

Table 3.3 Descriptors of Level of Likelihood for Describing Climate Risks

Likelihood Descriptor	Likelihood Rating	Criteria for Discrete Climate-related Risk Events	Criteria for Ongoing Climate-related Risk Events
Almost certain	5	Once every two years or more frequently (i.e., annual chance ≥ 50%)	Certain to cross critical threshold
Likely	4	Once every 3–10 years (i.e., 10% ≤ annual chance < 50%)	Expected to cross critical threshold
Possible	3	Once every 11–50 years (i.e., 2% ≤ annual chance < 10%)	May or may not cross critical threshold
Unlikely	2	Once every 51–100 years (i.e., 1% ≤ annual chance < 2%)	Not anticipated to cross critical threshold
Almost certain not to happen	1	Once every 100 years (i.e., annual chance < 1%)	Certain not to cross critical threshold

Source: Province of B.C. 2019a

Climate change effects are the impact of risk events, captured in terms of expected changes to key indicators in a plan area (**Table 3.4**; additional information available in Province of B.C. 2019a). For example, a wildfire risk event in a plan area might reasonably be expected to have consequences for economic (forestry), environmental (at-risk ecosystems), Indigenous values (traditional territory) and social (community infrastructure) values. Descriptors of levels of consequence (insignificant, minor, moderate, major and catastrophic) are characterized in terms of specific consequences to cultural, natural resources, economic, health, social and provincial government values.

Indigenous knowledge that reflects long time periods and the insights of Indigenous communities is likely to be helpful in characterizing climate change risks and effects. In addition, Indigenous communities may have intensive decision-making processes and experience in addressing climate change risks and other environmental risks and effects.

Table 3.4 Descriptors of Level of Consequence for Describing Climate Risks

Consequence Descriptor	Consequence Rating
Catastrophic	5
Major	4
Moderate	3
Minor	2
Insignificant	1

Source: Province of B.C. 2019a

Conceptually, risk is the product of likelihood and consequence, and climate risk assessment entails taking the product of likelihood and consequence ratings to derive a risk score (**Figure 3.2**).

Risk Rating Matrix					
5	LOW	MED	HIGH	EXT	EXT
4	LOW	MED	HIGH	HIGH	EXT
3	LOW	MED	MED	HIGH	HIGH
2	LOW	LOW	MED	MED	MED
1	LOW	LOW	LOW	LOW	LOW
LIKELIHOOD	1	2	3	4	5

CONSEQUENCE

Likelihood x Consequence
Score 0–5 = Low
Score 6–10 = Medium
Score 12–16 = High
Score 20–25 = Extreme

Source: Province of B.C. 2019a

Figure 3.2 A Sample Matrix for Climate Risk Assessment

Determine likelihood and consequence by relying on available evidence from peer-reviewed and other authoritative studies, the insight of scientific experts and a review of relevant climate model data. When tasked with determining likelihood and consequence using Indigenous knowledge, follow best practices and culturally appropriate research methods when characterizing results to provide assurance to partners and stakeholders. Use clear definitions and unambiguous terminology. The objective of SEEA is not to predict outcomes in precise terms but in relative terms, and to understand how future climate risks in the base case and alternative scenarios may be reasonably expected to change.

Identify climate risks by:

- Documenting the steps above and using a tabular format to summarize the likelihood, consequence and confidence ratings, and the resulting risk score
- Documenting key evidence leading to these ratings and score
- Identifying the highest-scoring risks in the future base case and alternative plan scenarios as well as how climate risks are expected to change in the base case scenario from present to future
- Linking the results of the climate risk assessment back into the assessments of the other accounts and sub-accounts

3.2 Environmental Risk Account

Environmental risk assessment (ERA) is a process for estimating the likelihood or probability of an adverse outcome or event due to pressures or changes in environmental conditions resulting from human activities. An ERA is complementary to methods used in State of Environment Reporting (Province of B.C. 2021jf), environmental assessment and risk management. The ERA approach involves identifying, analyzing and presenting information in terms of risk to environmental values to inform planning and decision-making processes. In this guidance, an ERA does not presume to provide all social and economic information relevant to making decisions; nor is the approach intended to supplant planning and management processes (B.C. Ministry of Environment, Lands and Parks 2000).

The ERA should consider the potential environmental consequences of future plan scenarios. Environmental risk is a function of the probability of an adverse event occurring, such as a low-likelihood but high-consequence event like extirpation (i.e., loss) of a species at risk from the plan area. The ERA should cover consequences of alternative plan scenarios on terrestrial, aquatic and marine ecosystems as appropriate for the plan area. ERAs are typically undertaken by registered professional biologists, Indigenous knowledge experts and other qualified professionals.

An ERA should proceed through the following steps:

1. Scope the sub-accounts and indicators of environmental risk appropriate to the plan area
    a. Consider cause and effect linkages (e.g., road access as an indicator for wildlife mortality)
    b. Identify critical thresholds and define risk classes (e.g., range of natural variability)
2. Describe baseline conditions and trends in indicators over time
3. Assess environmental risk for the reasonably foreseeable future in the base case and alternative plan scenarios. This includes identifying the magnitude and likelihood of potential effects from plan scenarios
4. Assess the results with respect to:
    a. Effects of climate change
    b. Differential effects to vulnerable populations
5. Provide the results of the ERA to other linked accounts in the SEEA framework

3.2.1 Scoping Sub-accounts and Indicators

Identify indicators of ecological integrity using both **coarse filter** and **fine filter** approaches, supported by a literature review and engagement with technical experts and Indigenous knowledge experts.

Coarse filters focus on ecosystem elements that provide for the vast majority of species and can include:

- Indicators that represent ecosystems across the landscape and marine areas
- Umbrella or wide-ranging species whose habitat potentially also provides habitat for a wide array of other species
- Species that have a disproportionately higher ecological role than is suggested by their biomass (often described as "keystone" species)
- Indicator species that are sensitive and require a broad set of ecosystem elements

Fine filters focus on special ecosystem elements that are likely to not be maintained when solely relying on coarse filters, such as key ecosystem processes, particularly species at risk or rare habitat.

Values being monitored and reported through the B.C. cumulative effects framework (e.g., forest **biodiversity**, old growth forest, aquatic ecosystems, grizzly bear and moose populations, as well as species at risk present in the plan area) should be considered for use as coarse and fine filter indicators of environmental risk (Province of B.C. 2021e). The framework also establishes regional values for cumulative effects monitoring and reporting, and these values may also suit assessment.

To evaluate risks to environmental indicators, start by identifying appropriate ecological "low-risk" benchmarks, thresholds or other standards. Past SEEAs have relied on an approach that uses a low-risk benchmark defined as "conditions with a high probability of sustaining environmental values over the long term," but new SEEAs may use thresholds identified in the cumulative effects framework if these are available to interpret risk. The B.C. cumulative effects framework includes benchmarks and management triggers for a limited set of environmental values (Province of B.C. 2021e). In general, tools for risk interpretation should be based on scientifically and biologically sound principles, traditional ecological knowledge and other forms of Indigenous knowledge that may be applied when developing thresholds, standards and benchmarks. If possible, critical thresholds should also be identified to help determine the levels at which the probability of maintaining specific environmental values and services significantly diminishes.

You will need to establish a risk level scale. Past ERAs conducted for SEEAs have used five risk classes: very low, low, moderate, high and very high (e.g., Holt 2004). Ideally, each risk class is defined to reflect not only a certain probability or likelihood of an undesirable outcome, but also to reflect the relative magnitude of an impact (B.C. Ministry of Finance 2019). Examples of definitions include:

- Very high risk: A high likelihood that an undesirable outcome will result (e.g., greater than 70 per cent probability that a population will be extirpated from the study area within the next 100 years).
- High risk: A high likelihood that a species habitat/population will decline by 50 per cent over the next 25 years.
- Very low risk: A high likelihood that a species habitat/population can be sustained at historic, natural or desired levels over the next 20 years (given the ERA's methodological assumptions and limitations).

3.2.2 Baseline and Trends in Indicators

Characterize the current conditions for the selected indicators by drawing on information from the area analysis (refer to **Section 3.5.1**), the data sources listed in **Appendix G** and from **Appendix A: Forest Sector Assessment Techniques**.

Describe past, current and future trends in key indicators over time. Cause-effect linkages between management activities, **external value drivers** (i.e., contributors to cumulative effects that cannot be controlled by planning, such as climate change) and ecosystem components can be applied to estimate future indicator values. In general, assumptions should be drawn from the scientific literature and Indigenous knowledge in various disciplines, in particular conservation biology as it relates to changes in management. Ideally, these assumptions would be continuously assessed through monitoring and further scientific and Indigenous knowledge investigation within an adaptive management framework.

The following high-level assumptions have been used in past SEEAs:

- Biodiversity can be more effectively retained by managing ecosystems than it can by trying to manage all individual species, and the likelihood that biodiversity will be retained will be greater if managed forests resemble those produced by natural disturbances such as fire, wind, insects and disease (Edie and Associates 2004).
- A broad range of species will respond to managed landscapes that approximate natural landscapes in composition and structure (Province of B.C. 2007).
- Biodiversity conservation is more likely to be achieved if forest harvesting and timber land base management are applied at similar spatial and temporal scales to natural disturbance regimes. Conversely, biodiversity conservation is more at risk as divergence from those regimes increases (Province of B.C. 2012).

3.2.3 Analytical Methods and Evaluation of Environmental Risk

An assessment of the consequences of alternative plan scenarios on environmental risk should forecast future risk to the selected environmental indicators by considering the following factors:

- Amount of the resource value that will be directly and indirectly affected spatially
- Duration of potential effects
- Likelihood that an adverse event could occur
- Ability of the resource value to resist or recover from human disturbance (i.e., **resilience**)
- Management strategies of plan scenarios, including what is known of their effectiveness
- Potential cumulative effects in the plan area as well as from larger-scale phenomena (e.g., predator-prey relationships that extend across plan area boundaries) on environmental indicators

Some of the analytical tools available to assess environmental risk include:

- A GIS area analysis, which illustrates how various mapped environmental indicators (e.g., wildlife habitat) are distributed across resource management zone categories. Although the data for this approach is readily available, the availability of habitat over time can only be inferred, reducing its utility for risk assessment. Habitat supply models, particularly those that are spatially explicit, can project habitat availability over time and are therefore very useful for evaluating the relative risks of plan scenarios that potentially have long-term impacts.
- Modelling programs such as Spatially Explicit Landscape Event Simulator tools, which track potential resource development impacts on key landscape attributes over time and drive habitat supply models for key focal species used as environmental indicators (**Appendix A**).
- GIS area analysis and Spatially Explicit Landscape Event Simulators can also be used together. For example, while habitat supply models are explicitly linked to forest development planning, GIS area analysis can identify potential conflicts with **non-timber resource** development activities (e.g., mining, tourism) and the extent to which key environmental values occur in supportive management zones such as protected areas. Hence, a combination of both approaches may provide the best information for risk assessment.
- The Environmental Mitigation Policy for B.C. (Province of B.C. 2021k) provides resources and methods for assessing risk, in which consequences are described using effects characteristics (similarly to B.C. Environmental Assessment Office 2020c), probability is estimated and risk is based on the consequence and probability.

See **Appendix F: Tools for Environmental Risk Assessment** for more details about ERA techniques.

3.2.4 Other Considerations

Environmental risks have potential consequences on the cultural, economic, social, health and Indigenous governance and law accounts. For example, a high risk of extirpation of a keystone species (such as caribou) in a plan area would have wide-ranging effects on Indigenous nations and non-Indigenous communities in and outside the plan area. Scoping for the SEEA should consider the links between environmental risk and other accounts. In particular, the environmental risk assessment should consider:

- Potential effects on climate change (or reference to where ecological changes would be addressed)
- Potential effects on vulnerable populations

3.3 Indigenous Governance and Law Account

The Indigenous governance and law account provides a prominent place for assessing the effects of plan scenarios on Indigenous governance, laws, knowledge, values, practices and interests, consistent with B.C.'s commitment to implement the *Declaration on the Rights of Indigenous Peoples Act* and reconciliation in legislation, policies and programs. It is important to note that the naming and values associated with this account are meant to be adaptable and flexible to the needs of individual communities and that the name and description provided here is meant to act as a guide. As explained in **Section 2.7**, differential effects may be presented in specific accounts and sub-accounts, unless the differential effects relate to a specific Indigenous community or value, in which case it may be preferable to present the differential effects as part of the Indigenous governance and law account. Differential effects may be associated with commonly held values, such as employment and environmental quality, as well as with different perspectives and values, such as traditional harvesting activities and the natural resources upon which these activities depend. Effects related to Indigenous Peoples may be best addressed with individual consideration for each nation, depending on the scope and scale of the SEEA and the complexity of planning issues.

Indigenous communities may also have developed or be developing assessment processes of their own that more accurately reflect their values and interests, as well as the unique needs and characteristics of the community and territory. This type of Indigenous-led assessment is defined in Gibson et al. (2018) as:

> "A process that is completed prior to any approvals or consent being provided for a proposed project, which is designed and conducted with meaningful input and an adequate degree of control by Indigenous parties – on their own terms and with their approval. The Indigenous parties are involved in the scoping, data collection, assessment, management planning, and decision-making about a project."

Due to increased capacity needs and the lack of legislation in support of independent assessment process in many jurisdictions, Indigenous-led assessment is often restricted to major projects that have a high potential impact on communities. These processes, however, allow Indigenous communities to independently assess development opportunities and cumulative effects using data collection and methodology that adheres to their individual Indigenous governance and law structures.

3.3.1 Scoping Indicators

To ensure that indicators used in the SEEA are properly aligned with Indigenous values, interests and practices, the planning group should identify key values and indicators across all assessment accounts during the pre-planning and plan initiation phases of the planning process (**Figure 1.2**). These should be confirmed through engagement activities with Indigenous nation members, knowledge holders and technical staff. Indigenous communities should be directly involved throughout the development of the related assessment, through such key steps as confirming candidate indicators, conducting related primary research activities and reviewing the draft assessment (**Section 2.5.2**). Indigenous nation

members must be given the opportunity to discuss studies that may be occurring such as a traditional use study, cultural impact analysis (**Section 3.3.3**) or other related studies.

Potential indicators to define differential effects should also be collaboratively determined with each respective Indigenous planning partner. Indicators could include governance and stewardship systems; customs, beliefs and values; language and intergenerational knowledge transfer; access and quality of traditional resources; and community and cultural cohesion (e.g., see B.C. Environmental Assessment Office 2020b).

3.3.2 Baseline and Trends in Indicators

Primary research activities for the base case scenario should seek to identify potentially affected values and/or issues of concern, using best available Indigenous knowledge and data (e.g., GIS or other spatial data on Indigenous occupation and use; see **Section 2.5.2**). Partnering and engaging with Indigenous nations through the assessment process will not only contribute to community understanding and support but also enhance confidence in assessment determinations and any subsequent identified mitigations. When engaging Indigenous nations in assessments, the planning group should be mindful of appropriate protocols and considerations pertaining to Indigenous knowledge and socio-cultural information and openly invite participating nations to identify any established processes that should be followed or demonstrated (**Sections 1.5 and 2.5.2**). Planning groups, as well as B.C. and Indigenous nation representatives, may be useful in helping co-ordinate engagement activities. These activities should respect Indigenous knowledge, Indigenous law and Indigenous perspectives, with communities ultimately deciding how or whether they would like to be engaged and how collected information can and should be used.

3.3.3 Analytical Methods and Evaluation

Cultural impact analysis is a method of analysis that evaluates the implications for cultural values, practices and laws of Indigenous Peoples associated with management changes in the plan area, identified through scoping, community engagement (e.g., meetings, interviews, land-based engagement, focus groups, workshops), ethnographic interviews, oral histories and studies. This type of analysis may be approached through **community-based participatory research**, which is a partnered approach to research that includes the community in primary research activities, with community-based researchers helping guide and co-ordinate research activities. In this approach, participating community members share their expertise in designing, carrying out and analyzing the results of research (Fletcher 2003). Participatory research methods create increased opportunities for vulnerable members of communities to be heard, so that differential effects of alternative scenarios may be accurately identified (Stinson and Levac 2016). Scoping activities and data collection led by the community-based researcher(s) can use a variety of approaches tailored to the community and that incorporate Indigenous research methodologies and protocols, thus helping ensure that methods are culturally appropriate and locally relevant. Community researchers are typically Indigenous community members identified by the community as qualified to identify potential linkages between Indigenous values and plan scenarios.

For a focused or condensed SEEA where primary research is minimal or only secondary methods are used, secondary information sources such as traditional use studies must be approved for use by the Indigenous nation and used in accordance with any permissions identified on how the research may be collected, stored and used.

A key challenge associated with conducting a SEEA focused on Indigenous values and interests is recognizing the differences between Western and Indigenous perspectives of knowledge, sometimes identified as an "ethical space" or virtual area that exists between two worldviews where meaningful engagement and safe dialogue can take place (Alberta Energy Regulator 2017, Ermine 2007). Each worldview has been formed by separate and unique histories, belief systems and ways of knowing (Arsenault et al. 2019, Ermine 2007). Other challenges to evaluating effects on the values and interests of Indigenous Peoples may include time and budget constraints and a lack of community capacity for participation (Udofia et al. 2017). The SEEA framework should be established to accommodate the consideration and application of Indigenous knowledge.

These challenges can at least be partly addressed through the modernized government-to-government approach to land use planning where the planning process is co-led by provincial and Indigenous government representatives and guided by a mutually developed terms of reference or similar formal agreement. Specific to the SEEA, early engagement activities with a focus on vulnerable sub-populations, use of community-based participatory research methods, adherence to data protocols and respectful collaboration should also help address challenges.

The SEEA should be conducted with the best information that is available. Information gaps should not be identified as knowledge gaps, since a lack of available information does not necessarily imply a lack of knowledge. The SEEA can capture and communicate the potential implications of these gaps in the assessment report and identify them as future cultural research areas.

For differential effects concerning values common to all people in a plan area, not just Indigenous people, assessors should use the techniques and key indicators described in the other accounts and associated appendices as appropriate to the values being assessed, including techniques to highlight differential effects described in **Section 2.7**.

For differential effects concerning values that are uniquely Indigenous, the SEEA should specifically focus on those values identified and confirmed by potentially affected Indigenous nations, which may include such components as changes to lands and waters and how they are managed. Techniques such as area analysis and resource impact analysis may be useful (**Section 2.5.1**). Other assessment techniques may need to be adapted to suit the unique values in question but should be done mindful of known best practices in applying Indigenous knowledge to a SEEA (**Section 1.5**) and existing guidance for planning and impact assessment of Indigenous issues (**Box 8**). Key indicators will need to be developed to suit the particular values under assessment.

Cultural Indigenous knowledge and information shared by Indigenous Peoples may include histories, Indigenous knowledge, values, practices and interests, as well as personal information, as these bodies of knowledge are all intrinsically linked. Indigenous knowledge and personal information must be used respectfully and appropriately, and decisions for use are made with the knowledge holder.

Box 8 lists some further reading relevant to assessment for the Indigenous governance and law account.

Box 8 **Indigenous Governance and Law account: Further Reading**

- Including Indigenous Knowledge Systems in Environmental Assessments: Restructuring the Process (Arsenault et al. 2019)
- Guide to Indigenous Knowledge in Environmental Assessments (B.C. Environmental Assessment Office 2020b)
- The Ethical Space of Engagement (Ermine 2007)
- First Nations Environmental Assessment Toolkit (First Nations Environmental Assessment Technical Working Group 2004)
- An Updated Effective Practices Guide: Land Use Planning by First Nations in British Columbia (Kehm et al. 2019)
- Best Practices for First Nation Involvement in Environmental Assessment Reviews of Development Projects in British Columbia: Report to New Relationship Trust (Plate and Krehbiel 2009)
- Meaningful and Efficient? Enduring Challenges to Aboriginal Participation in Environmental Assessment (Udofia et al. 2017)
- Strengthening Impact Assessments for Indigenous Women (Manning et al. 2018)

3.4 Economy Account

Alternative planning scenarios may affect economic development in the plan area by changing key economic sectors, which can affect employment and income, government finances and **economic efficiency**. These three types of impacts have been grouped into three sub-accounts. Use the initial scoping process described in **Section 2.2** to scope for which sub-accounts should be completed. The sub-accounts for employment and income, government finances and economic efficiency are described separately below. Differential economic effects should be considered for each sub-account (**Section 2.7**).

3.4.1 Employment and Income Sub-account

The assessment of impacts on employment and income identifies the jobs, income and other appropriate labour force indicators for each major current and future economic sector that depends on the resources of the plan area. An **economic impact analysis** is used to examine employment and income impacts of alternative scenarios on the economic sectors that operate in the plan area. Employment and income are key components of economic well-being and are the key indicators for this sub-account.

The focus is on the basic resource sectors in the plan area and how alternative plan scenarios will affect employment and income in these sectors. **Basic sectors** such as forestry and tourism provide **direct employment and income** in a region, whereas **non-basic sectors**, such as retail services and accommodation, rely on basic sectors and spending by the employed labour force.

The economic base case scenario should describe the current and reasonably foreseeable future sectors that depend on the resources in the plan area, such as forestry, agriculture, aquaculture, guiding, mining, energy production and tourism. To ensure that the SEEA captures differential effects (i.e., a GBA+ approach) for vulnerable subgroups of the population, employment and income information should capture relevant subgroups such as women, youth, Indigenous Peoples and others as applicable and where available. The base case scenario should include information on direct and indirect employment and income associated with Indigenous community-led economic development projects in the plan area.

Assess alternative scenarios by estimating the incremental changes from the base case scenario in terms of the selected key indicators. Methods for assessing employment and income involve:

- Estimating direct employment and income for current basic economic sectors
- Estimating indirect and induced employment and income effects by sector
- Forecasting future uses of resources and associated employment and income

These steps are described below and in more detail in the appendices referenced in each section. Recommended indicators and parameters are included in the discussion; however, these will need to be reviewed for the specific resource sectors selected for review as an economic activity.

3.4.1.1 Direct Employment and Income

The first step of the economic impact analysis is to describe the current basic economic sectors that depend on the plan area resources, including estimates of direct employment and income. Current employment and income in the plan area reflect the current economic base of the plan area. You will need to collect data on the direct jobs and income associated with each economic sector that depends on the natural resources in the plan area. To help assess the impacts expected from the plan and each scenario, estimate the current jobs and income per unit of output (e.g., per cubic metre of wood harvested) for those sectors that are likely to be affected by a plan.

To estimate direct employment and income, first identify the extent to which local industries or economic activities are linked to the resources in the plan area. The nature and strength of the cause-effect linkage between industry activities and the resources on which they depend will vary from sector to sector.

1. **Forestry:** The management prescriptions in each scenario can directly influence timber supply available over time for harvesting.[8] Other factors to be considered include the extent to which local processing facilities rely on imported fibre or on secondary products such as dimension lumber or chips for which alternative supplies might exist; the proportion of the affected workforce living in the plan area; implications of adjustments such as periodic mill closures; and the possibility that cost and supply impacts can result in threshold effects on timber harvesting and processing operations. See **Appendix A: Forest Sector** for further details.
2. **Tourism:** The extent to which tourist activity is affected will depend on the importance of the affected resources to the amount and type of tourism in the area. A management scenario may directly affect tourism businesses that depend on backcountry recreational opportunities in relatively pristine environments but may not affect front-country facilities depending primarily on highway traffic, such as hotels and restaurants in communities. Also, tourism operations may be able to adjust to changes in land use by changing the timing and/or areas of operation or changing the type of product or activity offered. See **Appendix B: Recreation and Tourism Sector** for further details.
3. **Minerals and petroleum resources**: For hidden subsurface resources, the extent to which existing and potential activities may be affected is particularly difficult to assess. GIS data and analysis can help quantify the extent to which various mapped resource values and activities (e.g., mineral potential, mineral occurrences or mineral tenures) are overlain by and therefore possibly affected by different types of resource management zones or management strategies that plan scenarios may impose. See **Appendix C: Minerals Sector** and **Appendix D: Petroleum Sector** for further details.

Estimates of income and employment levels generated per unit of production (or dollar of output) in each industry or activity will facilitate the assessment of impacts, particularly if existing activities are affected. These estimates are often referred to as **employment coefficients** and are based on the average extent to which employment or income varies with the level of output in each industry or activity (e.g., the number of forest harvesting jobs per cubic metre of harvest or throughput, or the number of full-time equivalent tourist jobs per dollar of tourist spending). Data may be available from local operators, the provincial government or industry associations. Alternative ways in which industry could adjust to throughput changes, and other adjustments, should also be taken into account.

When assessing impacts on current economic activities you should, if possible, differentiate between effects on the local area (usually the plan area) and the province as a whole by accounting for people who work in the plan area but live in other regions (e.g., in logging, mining exploration and tourism lodges). BC Stats has previously produced reports on local area economic dependencies; for example, Horne (2009) provides useful information on methodology and concepts. It is recommended that the economic impact analysis only use analyses that incorporate updated multipliers.

[8] When possible, scenario analysis should use timber supply projections from the Ministry of Forests, Lands, Natural Resource Operations and Rural Development. These are prepared to determine annual allowable cut levels as part of the base case forecasts in an area of timber supply review. In projecting changes to timber supply, the transition from current levels to long-term levels should incorporate reasonable decade-to-decade changes.

3.4.1.2 Indirect and Induced Employment and Income

The second step in the economic impact analysis is estimating indirect and induced employment and income effects. **Indirect employment and income** are generated by other industries that supply goods and services to the basic sector (e.g., trucking companies, legal firms, equipment suppliers),[9] while **induced employment and income** is generated by the spending of workers' wages in industries that sell goods and services to consumers (e.g., food, gas, accommodation). Indirect and induced employment and income effects provide additional information for planning groups because they highlight the broader economic implications of changes to basic sectors.

Indirect and induced employment and income may be assessed through surveys to gather primary data on economic linkages, but this can be costly. As an alternative, indirect and induced impacts can be estimated using published multipliers. A **multiplier** summarizes the total impact of a given change in an economic activity, referring to the concept that money can be re-spent, so that every dollar spent can generate more than a dollar of economic activity. Multipliers increase with increased local economic activity, such as increased spending on equipment and supplies in the region. For example, an employment multiplier is the ratio of the size of the indirect and induced workforce to the direct workforce, so that a ratio larger than 1.0 means that the total workforce (direct, indirect and induced) is larger than the direct workforce. Updated multipliers may be found in the **B.C. Input-Output Model** and Statistic Canada's Supply, Use and Input-Output Tables. However, caution must be exercised when using published multipliers because:

- The ability of communities to adjust to changes in the economic base is not reflected.
- The mobility of the labour force in the region may affect the use of regional multipliers (i.e., the extent to which labour is supplied from outside the region).
- Multipliers are linear and, as a result, do not recognize threshold effects (e.g., a small change in timber harvest level may result in a mill closure or may have very little economic impact).
- Assumptions regarding which sectors are basic and non-basic may not always be valid.
- Employment or income in remote or rural communities may not be accurately represented. Multipliers cannot identify fine-grained differential employment and income effects on vulnerable groups.
- Changes in a plan area may sometimes represent only the redistribution of base activity between plan areas, with little or no change for the province as a whole.

In summary, using published multipliers is a cost-effective, albeit flawed, technique for estimating indirect and induced economic impacts on basic sectors in a plan area. The more accurate but costly alternative entails surveying firms that supply goods and services at the local and regional level and estimating the linkages to direct economic activity as well as any threshold effects. Local knowledge identified through engagement can inform the analysis by illustrating the linkages between economic sectors. Estimates of

[9] Indirect impacts are cumulative and include transactions going all the way back to the beginning of the supply chain (i.e., the purchase of goods or services increases the economic activity of the supplying firms) and, in turn, the supplying firms themselves must purchase their own goods and services, which generates further economic activity in those supplying firms.

indirect and induced effects should be considered approximate and should be subjected to appropriate techniques for dealing with uncertainty as presented in **Section 2.8**.

See **Appendix D** for further information on economic analysis methods.

3.4.1.3 Future Jobs and Income

Estimating future potential uses of resources and associated employment and income requires predicting how economic activities and key indicators may change. You can use baseline information on past and current economic trends in the region to inform predictions of future economic conditions. Many factors could affect future economic activities, including market and technological factors. Markets may emerge in the future for natural resources not currently being developed, and technological development may make some resources economical for development.

Climate change effects should be considered as critical factors that influence future economic trends. Warmer temperatures, coastal erosion, extreme weather events and the effects of drought and wildfire are likely to cause changes to basic sectors and increase uncertainty in predicting future trends. GIS or other techniques and tools may help illuminate the differences between current and potential future economic activity.

The SEEA should attempt to explicitly address, either quantitatively or qualitatively, the extent to which alternative plan scenarios affect the probability and timing of possible future development relative to the base case scenario. Ranges, scenarios or other tools to address uncertainty discussed in **Section 2.8** may be appropriate. Notably, difficulties in predicting and estimating future resource uses may bias the SEEA in favour of current economic activity. Where possible, the SEEA should quantify potential economic activity that may reasonably be expected.

3.4.2 Government Finances Sub-account

The government finances sub-account is used to evaluate how planning scenarios may affect government finances. Effects on government finances might occur at different levels of government (provincial, regional and municipal, and Indigenous nations):

- At the provincial level, planning scenarios might affect government revenues, such as revenues from stumpage, taxes and royalties from mining operations, and fees for recreational use. Government expenditures may also be affected, such as remediation costs for abandoned mines, social services costs for expanding community services or infrastructure costs for new highways.
- At the local level, planning scenarios might affect local government revenues from property taxes and expenditures on municipal service provision (e.g., waste, water and other utilities).
- Indigenous governments use instruments such as Impact and Benefit (Participation) Agreements with industry and Economic and Community Development Agreements with government to access revenues from natural resources development.

The SEEA can be used to assess the net effect on government revenues by estimating changes to revenues after expenditures. In the past, a SEEA for land use planning typically only assessed effects on provincial government finances; however, the planning group may wish to apply similar methods to estimate effects on partner government finances or other levels of government as needed.

There are three key steps for evaluating the effects of plan scenarios on the government finances sub-account. The key indicator for this sub-account is net government revenue. Assessing the effects of alternative scenarios on government finances involves:

1. Estimating the effects of plan scenarios on government revenue for current basic economic sectors
2. Estimating the effects of plan scenarios on government expenditures
3. Estimating the effects of plan scenarios on net government revenue

These steps are described below along with recommended indicators and parameters.

3.4.2.1 Government Revenue

Government revenue[10] associated with natural resource development may be directly affected by any changes in resource use brought about by alternative plan scenarios. For example, a plan scenario may change how forestry or agriculture is practised. The change in resource activity going forward from the current activity into the future should be accounted for when estimating resource revenues generated per unit of activity. Government revenues vary from sector to sector and from plan area to plan area. Historical sector- and plan area-specific information, as well as forward-looking trends, should be considered when estimating changes in government revenues. Examples of sector-specific considerations are described below for forestry, minerals and oil and gas, recreation and tourism.

Forestry

The B.C. government collects stumpage from timber logged on public lands. The effects on stumpage should be estimated per cubic metre of timber and multiplied by the effects of the alternative scenario on timber harvest volumes over time. This will require a forecast of stumpage rates that corresponds to the period of timber harvest changes (e.g., the next decade). A forecast stumpage rate may be arrived at by averaging historical stumpage rates over a representative time period, such as a forest sector business cycle (usually between five and seven years); however, various factors affecting the stumpage rate outlook may also be considered.

Policy changes or changing species and grade composition may make it inappropriate to use historical stumpage rates. Average stumpage for the plan area over a representative period should be used, unless better information is available on the timber values that might be affected. For example, if current data show that a proposed protected area contains mostly pulp wood that would have a stumpage rate of $\$0.25/m^3$, it would be inaccurate to use a plan area average rate that is largely based on higher-quality timber.

[10] These revenue impacts are not exclusive to just the B.C. government and may impact other governments as well.

Minerals and Oil and Gas

In the case of subsurface resources, resource taxes, royalties and/or bonus bids are paid to the provincial government for production or use of land, and potential effects on government revenues are calculated by multiplying the estimated impact on subsurface resource activity by the applicable rates. Taxes and royalties over at least one business cycle should be taken into account, provided that provincial government policies have remained relatively unchanged.

Recreation

User fees such as park use fees and fishing licences are charged for certain recreation activities. The estimated effects of plan scenarios on such activities should be multiplied by the relevant charges to calculate changes in recreation-related revenues.

Tourism

Provincial revenues related to tourism include lease charges and fees for use of public lands or other resources by tourism operators, commercial angling and hunting fees, and, potentially, revenues from the sale of lands for a tourism project. To estimate effects on government revenues, the resource tax or lease component should be estimated and multiplied by the estimated effect of the plan or management scenario on tourism spending and/or tourism revenues in the plan area. If a tourism operator offering accommodation is dependent on access to a resource, then the hotel tax paid may be considered a tax related to access to that resource.

Sales Tax

Management scenarios may also affect corporate and personal income and sales tax. However, estimating effects on these revenue streams may be difficult, and the effects may not be incremental. For example, a change in management direction may cause a resource activity to shift to another location in the province, which would cause a regional loss of the associated capital and labour. In this case, the regional economic loss due to the relocated resource activity would be redistributed at the provincial level, with no net change. Alternatively, government expenditures may also be influenced by the plan scenario, such as reduced costs of government service provision if reduced resource activity leads to economic migration out of a region, potentially offsetting the consequence on revenues.

Uncertainties in the above estimation techniques should be explicitly addressed, at least in qualitative terms, and discounted if quantified (**Section 3.4.3** provides further details on discounting).

3.4.2.2 Government Expenditures

Government expenditures can be directly affected by changes in resource management expenditures or obligations (e.g., compensation requirements, tenure expropriation, or restoration and remediation costs), or indirectly by changes in infrastructure and service provision (e.g., highways, health services, emergency services or social services). The magnitude of these effects will depend on how resource activity in the

plan area is affected under alternative plan scenarios (e.g., the location and area of land base excluded from resource extraction, the nature of the management strategies or increased social services costs related to employment losses). You may need to consult with government specialists to estimate these effects on expenditures.

3.4.2.3 Net Government Revenues

Estimating net effects on government finances requires comparing estimated effects on government revenue against government expenditures. For example, suppose the reduced logging that is expected under an alternative plan means that the provincial government would obtain an estimated $5 million/year less in stumpage revenue than under the base case. In addition, the associated unemployment of forest workers might result in $500,000 more in annual social assistance paid by the provincial government. For government, the net financial effect would then be an annual loss of $5.5 million. However, there may be offsetting increases in tourism activity and employment as a result of the alternative plan scenario that should be considered.

Net government revenues should be reported both in terms of average annual effects and net present value (see **Section 3.4.3**). **Net present value** is a "lump sum" measure of the value of all future net government revenue impacts (positive and negative) over the entire time frame of analysis discounted to the present. Using net present value makes it easier to compare scenarios when different durations of net revenue impacts are anticipated. The discounted net revenue impact could also be presented as annualized or levelized values, the sum of which would be equivalent to the net present value. Per capita estimates could also be reported to support comparison. Net present value calculations are not required if all effects are presented as a constant stream of annual revenues or costs.

3.4.3 Economic Efficiency in Allocation

Economic efficiency in the context of a SEEA is concerned with maximizing the **net economic value** of resources in a plan area. Economic efficiency is achieved by allocating resources to uses such as forestry, recreation or carbon storage that generate the greatest economic value. For the purposes of this guidance document, the measure of economic efficiency is net economic value, which may be calculated as the present value of revenues minus the present value of costs, accounting for returns to labour, capital and resources.

If economic efficiency is not considered, the result might focus solely on economic activity and not overall economic welfare. For example, logging uneconomic timber generates employment for forest sector workers but results in minimal or no net economic value paid in the form of stumpage to the Province. Logging uneconomic timber is typically unjustifiable on economic efficiency grounds, particularly if it also involves negative externalities. **Negative externalities** refer to any costs that are caused by a resource activity and are not financially incurred by those directly involved in the activity, but rather imposed on third parties. Examples of externalities include noise and pollution created by a resource activity, or the impacts of timber harvesting on old growth forest, cultural and amenity values and recreation activities.

Estimating net economic value requires assessing the economic value generated by the commercial sectors active in a plan area as well as the economic value generated by non-commercial goods and services in the plan area resources (such as recreational uses and ecosystem services). The net economic value remains after all the costs of undertaking an activity have been accounted for. Net profits would be generated in timber production, for example, if the revenue from timber exceeds all the costs of production. Net economic value is the key indicator of the economic efficiency sub-account and is a monetary value, at least to the extent possible (see more on this later in this section).

Follow these four steps to estimate net economic value:

1. Scope the assessment of economic efficiency by determining which commercial and non-commercial activities to include.
2. Develop or compile estimates of net economic value generated by each resource sector included in the analysis.
3. Apply the net economic value estimates to the corresponding resource impacts and sum them to determine the total annual effects.
4. Sum the annual effects and discount to determine the average annual effects and net present value, respectively.

Techniques for undertaking these four steps are presented in the following discussion See **Appendix E** for sector-specific methods to assess net economic value.

3.4.3.1 Step 1: Scope Sub-accounts and Indicators

Begin by identifying commercial and non-commercial activities in the plan area that contribute to net economic value based on a review of previous plans for the plan area, engagement with the planning group, engagement with local knowledge holders, and a review of GIS and other resource development data housed by the provincial and partner governments. The SEEA should focus on both commercial and non-commercial activities. To assess effects on non-commercial activities and uses, it may be useful to first develop an understanding of the order of magnitude of the associated values in the plan area.

3.4.3.2 Step 2: Estimate Net Economic Value

For commercial sectors, net economic value is defined as the above-normal financial returns from a commercial activity that occur because the supply of the product or service generated by the activity is relatively fixed compared to demand. Net economic value can accrue to the entrepreneur, be captured by the land and/or resource owner (i.e., government) or be in the form of a wage premium accruing to labour. It can be estimated as total revenues (generally pre-tax) of an activity, plus any portion of costs that are over and above the minimum payment required to attract and employ any of the factors of production (e.g., wage premiums), but minus the sum of private and public costs of production, including any

externalities imposed upon third parties (such as environmental impacts). When estimating net economic value from commercial activities, consider the following additional guidance.

1. **Private sector net economic value (e.g., net profits) captured by owners of capital**: Net economic value may accrue to entrepreneurs who own or employ factors of production that are in relatively fixed supply, such as timber resources or access to key recreational or tourism features. These net profits are difficult to estimate. One suggestion is to estimate net profits using a percentage of sales revenues, at least for sectors where profitability is unknown.
2. **Public sector net economic value (e.g., tax revenues)**: Provincial government resource tax revenues are designed to capture net economic value, and as a result, they can be used to reflect the net economic value for the commercial use of natural resources. This includes, for example, stumpage revenues from the forest industry, and oil and gas royalties and bonus bids from the petroleum industry. Provincial government resource tax revenues are assumed to reflect product market prices less production costs (including a reasonable return on capital).
3. **Net economic value captured by labour**: Net profits may accrue to labour due to various labour market rigidities and "imperfections" that result in higher wages than would otherwise occur in competitive labour markets. This could occur in unionized sectors or in times of labour shortfalls. Because the net economic value accruing to labour may be difficult to estimate, assessors might approximate it with some fixed percentage of total direct labour costs for each sector, such as five per cent of total labour costs.

The assessment of the net economic value of commercial sectors should also include some recognition of the potential revenues that may accrue from commercial activities that are not currently occurring in the plan area but that might reasonably be expected to take place in the future. For example, a SEEA of an area with significant oil and gas potential might recognize the potential oil and gas royalties that could be expected from developing those resources, and the potential loss or gain in future royalties that may result from reducing or increasing access to the resources. Uncertainties in potential future development should be discussed using methods presented in **Section 2.8.**

The net economic value associated with **non-commercial values**, such as recreation values and ecosystem services, can be further divided into two categories: use values and non-use values.

- Use values are associated with the direct consumption or use of the resource, such as the use of backpacking trails or the consumption of ecosystem goods and services such as a community's reliance on hydrological resources in a plan area for clean water.
- Non-use values, sometimes referred to as "preservation" or "passive use" values, consist of three types: **option values** (i.e., the benefits of maintaining the possibility of future use), **existence values** (i.e., the benefits from simply knowing that an environmental attribute exists) and **bequest values** (i.e., the benefits from knowing that an environmental attribute can be available to future generations). When evaluating different planning scenarios, potential trade-offs between non-commercial and commercial activities and uses should be a key focus of the analysis, since land use planning conflicts are often between commercial and non-commercial land uses. The task of the SEEA is to compare advantages and disadvantages to different values and uses associated with different plan scenarios.

Possible methods for estimating the net economic value associated with non-commercial activities and uses (such as valuation of ecosystem services) include:

- Revealed preference techniques, such as **hedonic pricing**, are commonly used to estimate the economic value of ecosystem services (e.g., Ma 2010). The method uses statistical techniques to estimate the economic costs or benefits associated with environmental quality (e.g., air pollution, noise) or environmental amenities (e.g., recreational quality, viewscapes) (Alcamo et al. 2003). These types of techniques estimate economic values by observation, such as by analyzing the effects of environmental amenities like natural areas on property values.
- Stated preference methods (e.g., contingent valuation surveys), through which non-use values are estimated by asking people how much they would be willing to pay for ecosystem services in a hypothetical scenario (Alcamo et al. 2003).
- Value transfer approaches, which use results from original studies that have been conducted in a similar setting. Value transfer approaches may be useful for estimating non-commercial values when there are insufficient resources available to conduct primary research. For example, assessments of socio-economic effects pertaining to changes in GHG sources and sinks in the plan area might use available estimates of the social cost of carbon.
- Techniques are also being developed in the literature associated with natural capital and ecosystem goods and services (**Box 9**).

Box 9 Guidance on Evaluation of Ecosystem Services and Resource Economics

- An Introductory Guide to Valuing Ecosystem Services (UK Department for Environment, Food and Rural Affairs 2007)
- Ecosystems and Human Well-being: A Framework for Assessment (Alcamo et al. 2003)
- Ecosystem Service Evaluation to Support Land-Use Policy (Viglizzo et al. 2011)
- Guidance Manual for the Value of Regulating Services (UN Environment Programme 2004)
- Integrating Ecosystem Services in Land Use Planning: Concepts and Applications (Geneletti 2012)

Given the challenges of the above techniques, the SEEA might rely on the **critical value approach**, which compares economic values stemming from alternative uses of lands and marine areas. For example, while the environmental benefits of land protection may not be readily quantifiable, the estimated net economic value associated with resource development may be considered to outweigh a qualifiable environmental loss. This comparison might be aided by estimating critical values on a per capita or per household basis. At a minimum, the SEEA should estimate what can be monetized, describe in quantitative and qualitative terms any non-monetizable effects, and consider the net economic value of each planning scenario.

Regardless of how the net economic value of non-commercial activities and uses are estimated, care must be taken to avoid double-counting across the various kinds of values within this sub-account, given that the environmental effects of plan scenarios are covered in the economic efficiency sub-account.

3.4.3.3 Step 3: Estimate Effects on Net Economic Value

Net economic value is the present value of revenues minus the present value of costs, accounting for returns to labour, capital and resources. Two techniques should be used in this third step:

1. Sum the annual effects to generate annual net economic value and calculate the average net economic value of a plan scenario.
2. Discount the annual net values to determine the net present value of the plan scenario.

Net present value is generated by a discounting technique that recognizes the timing of benefits and costs and how these progressively diminish in value with time. Discounting is needed because of two factors: (1) the **opportunity cost** of capital, which refers to the cost of choosing one option over another (or the ability one has to earn interest from savings), and (2) the social rate of time preference, which signifies peoples' natural tendency to prefer benefits sooner rather than later and to defer costs to the future.

There are differences of opinion regarding which discount rates are appropriate, and the SEEA should consequently rely on government guidelines where possible while also considering the applicability of other available guidance to the given analytical context. The SEEA should include a sensitivity analysis on net present value to demonstrate the effect of alternative discount rates on results. The discount rate is most likely to affect the valuation of different scenarios.

3.4.3.4 Step 4: Sum to Determine Average Annual Effects and Net Present Value

Discount and sum the annual effects to determine the total net present value effect and average annual effects on net present value.

3.5 Social Account

The social account considers the effects of planning scenarios on how people live, work, play and interact with one another. Social values are influenced by culture (e.g., shared beliefs, values, customs and language or dialect); community cohesion, stability, character, infrastructure and services; health and well-being, in terms of physical, mental, social and spiritual well-being (addressed in **Section 3.6** Health account); environmental values, including environmental quality (air, water and food), access to and control of resources, and public health and safety; personal and property rights (referring to whether people are economically affected by change); and perceptions by people about their well-being and aspirations for the future (B.C. Environmental Assessment Office 2020a, Vanclay 2003).

Assessing social impacts is a critical component of a SEEA, and the consideration of differential effects is essential for assessing the social effects of planning scenarios (**Section 2.7**). The social assessment requires considering the concerns and objectives of Indigenous nations and non-Indigenous communities, and considering how different populations and groups may be differently affected by planning scenarios.

In the context of a SEEA, typical social values that are relevant to planning scenarios include:

- Land, resource and marine use (e.g., public land and resources, private lands, and tenures; parks and protected areas; and visual resources)
- Community and regional infrastructure and services (e.g., transportation, housing, utilities, health and emergency services, water supply and waste management)

The social account is informed by results of the climate change and environmental risk accounts. Social sub-accounts and indicators are interlinked with all other accounts, and particular cross-over is expected with the economy and Indigenous governance and law accounts. You will need to identify the social sub-accounts and indicators that are most relevant to the plan area and ensure that the key identified planning issues and concerns are not duplicated in other accounts.

Each selected account and sub-account should include a consideration of the baseline data, analytical methods, assumptions/biases, limitations of the analyses, and the results of the analyses and their evaluation. The following sections discuss how to conduct the scoping for the social account and potential sub-accounts, including consideration of the drivers of change and indicators; baseline and trends in indicators; and analytical methods and evaluation.

3.5.1 Scoping Sub-accounts and Indicators for Social Assessment

Engagement with communities in the plan area is critical to scoping issues and identifying social sub-accounts and indicators. Desktop research of secondary sources can identify key issues, such as concerns related to infrastructure and resources, important recreation resources, particular goals of the community with respect to stability and vitality, or other values that should be focused on in the social assessment.

3.5.1.1 Identify Drivers of Change

Research in social assessment should typically examine common drivers of social change, respective of the social issues identified in scoping. The economic and environmental effects of plan scenarios will often be the most influential drivers of social effects, and these should be examined in terms of findings in these accounts and including clear linkages to social values.

Changes in population, migration and demographics drive many of the potential social sub-accounts. Demographic changes are often influenced by economic factors. For example, a reduction in economic activity may lead to increased economic migration out of a region, while an aging population is likely to have economic effects as a result of a declining labour force. The findings of the economic assessment may be used to forecast consequences on migration, population and demographics. However, the actual population change in a region as a response to a change in economic activity will depend on multiple interrelated factors such as alternative employment opportunities in the same industry, other industries or other regions; quality of life in the plan area and peoples' attachment to the area; and other demographic factors such as age structure and family characteristics.

Economic drivers tend to underlie government-provided services and infrastructure that are critical to quality of life in communities. Changes in economic activity extend to changes in taxes and other government revenues. Changes to local industrial property taxes are a key issue and can be estimated when planning scenarios affect economic sectors that have in-community presences, such as sawmills within municipal boundaries. Changes to the residential tax base are usually only expected if planning scenarios are expected to lead to substantial out-migration.

Plan scenarios that affect economic activity on the land base, or environmental characteristics such as changes to land cover, can also often be linked to social values. When assessing impacts on recreational and other uses of land by communities and residents (e.g., domestic water supply, navigation), you should identify how resources are currently used for non-commercial purposes (e.g., recreation, food, domestic water) and the anticipated trends for such uses in the future.

3.5.1.2 Indicators for Social Account and Sub-accounts

Key indicators for the social account may include:

- Population size and distribution, migration rate and direction, demographics (gender and age) and dependency ratio (i.e., the proportion of the population of working age relative to youth and seniors)
- Capacity and supply of services and infrastructure (i.e., transportation, utilities)[11]
- Community resilience (i.e., the ability of communities to adapt to change)[12]
- Land use indicators, including area analyses of management zones and tenured land and water uses, indicators related to access, changes in harvested resources and changes in environmental quality (e.g., ambient sound). They can also include quantified indicators in such terms as recreational days by type of activity and number of persons or households directly dependent on plan areas and natural resources
- Indigenous (traditional) land and marine use, with specific indicators to be developed through consultation and engagement. Indigenous land and marine use may also be assessed under the Indigenous governance and law account

3.5.2 Baseline and Trends in Indicators

Use primary and secondary data collection methods to identify appropriate indicators for the social account. The use of primary research methods will depend on the scope of the SEEA and the complexity of the planning initiative. Sources of secondary data include desktop research of publicly available sources,

[11] Note that population and demographics are drivers of demand on services and infrastructure.

[12] Community resilience is a function of many factors, including human capital (e.g., education, schools), economic capital (e.g., employment, taxes), social capital (e.g., community volunteers), ecological integrity and economic vitality (e.g., economic diversity, income leakages, unemployment, entrepreneurship), and civic vitality (e.g., local governance, physical and mental health and recreational opportunities).

including previous land use plans and baseline reports, government and community reports and other sources. Primary data collection activities in the form of semi-structured interviews, community meetings, workshops and focus groups are used to verify and ground-truth secondary data and may also reveal new planning issues and concerns, as well as further sources of information.

When characterizing current conditions for the selected indicators, consider the context for the account and sub-account as this will help inform the assessment of the plan scenarios. Consideration should be given to:

- Applicable legislation, standards, plans and policies
- Existing condition of the account and the impact of natural and human-caused trends on the condition of the account, including cumulative effects
- Ecological or social limits and thresholds
- Vulnerability and resiliency of social and/or ecological systems and components
- Climate change projections relevant to the geographic scope and the account
- Community and cultural context
- Indigenous interests and rights (B.C. Environmental Assessment Office 2020b)

Information can be drawn from the area analyses (**Section 2.5.1**) and the data sources listed in **Section 2.5.2** and **Appendix G**. Baseline information compiled to support all accounts (**Section 2.5**), in particular for demographics and distinct populations, will also help identify indicators. See **Section 2.4** for general information for indicator selection.

3.5.3 Analytical Methods and Evaluation

The analytical methods used in the social assessment depend on the particular consequences under examination. For consequences related to population, economic activity and effects on public lands (such as those that might affect recreation), quantitative techniques may be available. For other social values, such as effects on community goals, qualitative assessments based on relevant indicators for the sub-accounts will be required. Social implications of land use planning initiatives can be assessed from a number of complementary and interlinked perspectives, including, but not limited to:

- **Social impact analysis**: Refers broadly to the collection of techniques for assessing the social, economic and cultural effects of planning scenarios, but may more specifically refer to effects on demographics, local government and community concerns.
- **Cost of living analysis**: Helps identify whether local inflation effects (due to increased demand for goods and services relative to supply) may differentially affect economically vulnerable population groups. This analysis is often used as a socio-economic determinant of health (**Section 3.6.1**) and it may also be assessed for the employment and income economic sub-account (**Section 3.4.1**).

- **Gender based analysis plus (GBA+)**: Identifies and evaluates how gender and many other factors intersect to influence how different people or groups may experience the differential effects of policies, programs and initiatives.
- **Cultural impact analysis**: Evaluates the implications for cultural values and practices of Indigenous Peoples associated with management changes in the plan area, typically identified through scoping, community meetings, ethnographic interviews, oral histories and studies.

The assessment of social implications will often require using multiple techniques to corroborate findings. Social assessment methods may also include quantitative and spatial techniques:

- Population modelling (or the use of others' models, such as those of BC Stats)
- GIS techniques that link area analysis to resource impacts (**Section 2.5.1**)

Determine the significance of social effects based on the characteristics of the effects and an interpretation of their meaning for affected people and communities. While there are some quantitative thresholds available that could be used to evaluate consequences (e.g., Canada Mortgage and Housing Corporation minimum housing standards, or comparisons of plan area indicator values to provincial or national averages) the social assessment should reflect the affected communities' view of the expected effects. Draft results can be shared with communities for validation and/or adjustment.

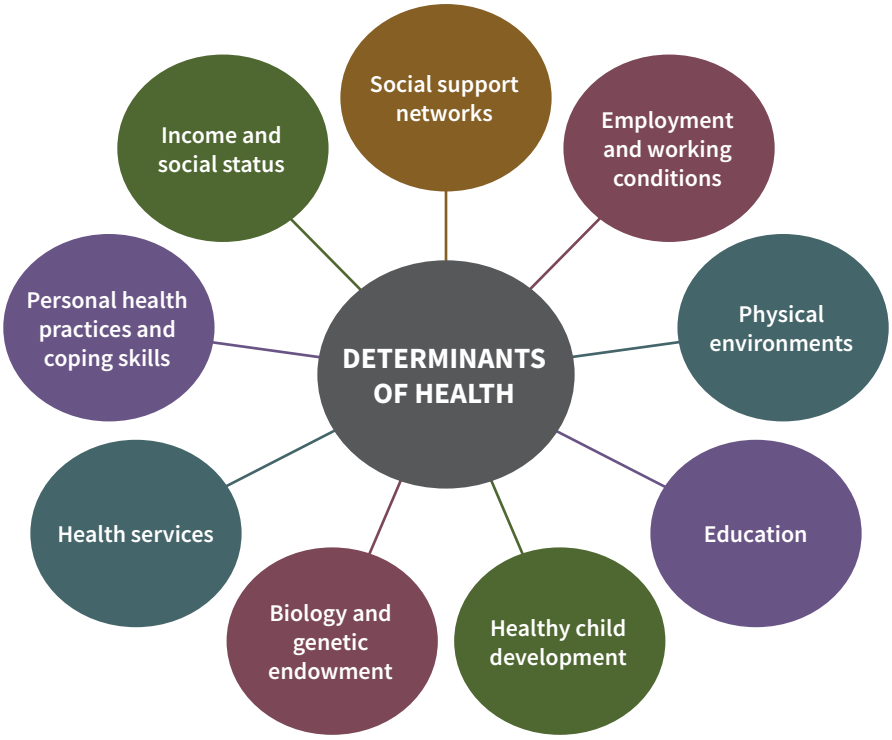
The standard evaluation methods for an environmental assessment can be used to help evaluate both qualitative and quantitative results for the effects of plan scenarios on social indicators, in which the "significance" of the effect is evaluated. Effects can be characterized using a defined set of effect characteristics, based on B.C. Environmental Assessment Office guidance (B.C. Environmental Assessment Office 2020c): magnitude, extent, duration, reversibility and frequency. Likelihood, significance and confidence can also be used in the assessment (B.C. Environmental Assessment Office 2020c). B.C. Environmental Assessment Office guidance to evaluate effects on human and community well-being includes a new effects characteristic, affected populations, and related considerations for importance and risk and uncertainty (B.C. Environmental Assessment Office 2020a).

3.5.4 Other Considerations

The social accounts rely on other accounts for their evaluation (climate change, environmental risk and economic) and may support (and be supported by) other accounts, such as the cultural, health and Indigenous governance and law accounts. For example, a high risk of extirpation of a keystone species (such as caribou) in a plan area may have cultural, social and environmental consequences. Scoping for the document should consider the links in co-ordination with other accounts where information should be provided. The results of the climate risk assessment should be linked back into the social assessment to address the potential effects of climate risk on social values. The evaluation should also consider the differential effects of the assessment on vulnerable communities.

3.6 Health Account

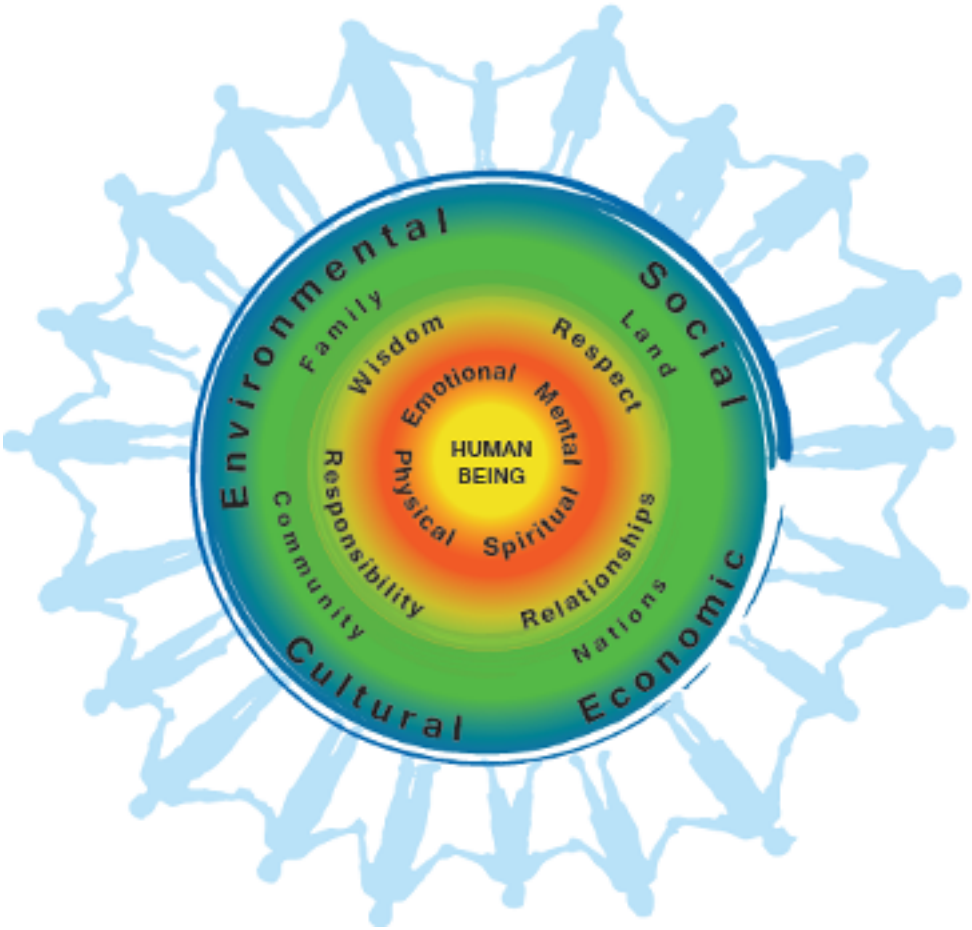
The health account assesses the potential risks and positive and negative effects of plan scenarios on the health and well-being of residents associated with a plan area. Health is a function of many individual and community determinants (**Figure 3.3**). **Determinants of health** are the full suite of socio-economic and environmental factors that influence the physical and mental health of people and communities. Determinants of health range from economic factors (e.g., income and employment) to social (e.g., social networks and access to health services) and environmental (e.g., air and water quality).



Sources: Health Canada (2004)

Figure 3.3 Health Canada determinants of health

Determinants of health or perspectives of health and wellness for Indigenous people may vary substantially from those of non-Indigenous people due to cultural, historical and ensuing social, economic and environmental factors (e.g., **Figure 3.4**). Indigenous perspectives of health and wellness are holistic. In **Figure 3.4**, the centre circle represents the individual person, the second circle shows the importance of mental, emotional, spiritual and physical health as nurturing well-being, and the third circle (i.e., respect, wisdom, responsibility and relationships) represents the overarching values that support wellness. The fourth and fifth circles are the people and places that surround a person, and the social, environmental, cultural and economic determinants of health (First Nations Health Authority 2021). The health assessment requires a consideration of the concerns and objectives of Indigenous nations and non-Indigenous communities and how different populations and groups may be differently affected by planning scenarios.



Source: First Nations Health Authority (2021)

Figure 3.4 First Nations Perspective on Health and Wellness

3.6.1 Scoping Sub-accounts and Indicators

Scoping sub-accounts and indicators for the health account will require engagement with communities in the plan area. Desktop research of secondary sources can identify key issues related to social and environmental determinants of health for Indigenous nations and non-Indigenous communities in and associated with the plan area. In addition to the general research methods described in **Section 2.0**, the Valued Component Scoping Tool in the Human and Community Well-being Guidelines (B.C. Environmental Assessment Office 2020a) may assist in identifying relevant sub-accounts for the SEEA. The baseline information collected to support the social, economic and Indigenous governance and law accounts will also support the selection of health indicators (**Section 2.4**).

General social determinants of health that are considered to be broadly applicable for health assessment may include, but are not exclusive to, changes in the following: economic stability (e.g., income, cost of living and socio-economic status), access to and quality of education and health-care services, social and community context (e.g., civic participation, community cohesion) and characteristics of the environment in which people live (air and water quality, housing quality, crime) (Centres for Disease Control and

Prevention 2020). Potential environmental indicators for the determinants of health include changes in air quality, ambient noise, drinking and recreational water quality, soil and sediment quality and the quality of traditional foods. Climate change effects on environmental determinants of health may have cumulative effects on risks to human health (World Health Organization 2017).

Indigenous perspectives on health and wellness indicate the need to consider the interconnectedness between social and environmental determinants of health from a holistic perspective. General Indigenous determinants of health that may require consideration and determination in the health account include:

- Access to and stewardship of traditional territory and traditional food
- Engagement in traditional and cultural practices (e.g., hunting, fishing, gathering berries or other plants and medicines)
- Cultural continuity and spiritual practices
- Gender
- Food security
- Community infrastructure
- Access to health and social services
- Health behaviours and health awareness
- Housing, living in urban versus rural areas
- Education, employment and income
- Economic resources that Indigenous nations have a responsibility to manage, share and sustain for future generations
- Colonial practices and policies (Tsimshian Environmental Stewardship Authority 2018)

3.6.2 Analytical Methods and Evaluation

The SEEA should examine the anticipated consequences of alternative plan scenarios across all other accounts to assess their effects on health. The health assessment will consider the cumulative effects of exogenous value drivers (such as climate change, demographic trends and financial markets) on key health indicators. Note that the key indicators in other accounts and associated sub-accounts may be suitable for coverage of the relevant determinants of health of a given SEEA, although local factors may require other indicators to ensure that all relevant indicators are considered. The assessment of health naturally follows assessment of the other accounts and synthesizes the findings in those other accounts.

The summary presented in **Table 3.5**, supported by appropriate description and associated evidence, is one way to undertake and capture the health assessment.

Table 3.5 Sample Summary of Key Findings in Determinants of Health Sub-account

Determinant of Health	Associated Account and/or Sub-account	Expected Directionality of Consequence	Key Supporting Findings
…	…	…	…
Employment and income	Economic activity	Decrease of unemployment rate	Forestry anticipated to remain a key industry in plan area Market conditions for forestry products from plan area expected to remain stable Forestry management under plan scenario expected to support industry growth
…	…	…	…
…	…	…	…

3.6.3 Health Outcomes

The more substantial analytical challenge in health assessment is assessing the consequences of alternative plan scenarios on health outcomes. Ultimately, health is a function of the effects on the determinants of health, and the SEEA must undertake a cumulative effects exercise. As with the rest of the SEEA, it is more important to determine the relative change associated with alternative plan scenarios than absolute measures of change.

A **health impact assessment** can estimate the effects of planning scenarios on selected health indicators for people living in or associated with the plan area. The Tsimshian Environmental Stewardship Authority has developed guidance for conducting health impact assessments for Indigenous nations in B.C., which may be informative for the health assessment process in a SEEA (Tsimshian Environmental Stewardship Authority 2018). A comprehensive SEEA may include a health impact assessment to consider the direct physical effects on human health (i.e., related to environmental determinants of health), as well as effects on selected social determinants of health.

3.7 Archaeological, Paleontological and Heritage Resources Account

The archaeological, paleontological and heritage resources account addresses the risks to sites of archaeological, paleontological, historical or heritage importance, including culturally modified trees. Inclusion of this account is aligned with the provincial guidance for human and community well-being assessment (B.C. Environmental Assessment Office 2020a). Archaeological components of the account may support the evaluation of Indigenous values, interests and practices in the Indigenous governance and law account.

3.7.1 Scoping Sub-accounts and Indicators

Determine the appropriate level of analysis for the archaeological, paleontological and heritage resources account based on the availability of regional and provincial data for the resources, such as the known number and distribution of resources. Include sites protected through the *Heritage Conservation Act*, the Fossil Definition Regulation pursuant to the *Land Act* or local government bylaws.

To ensure that the indicators used in the SEEA are properly aligned with Indigenous values and interests in the plan area, the planning group can identify key values and indicators during the pre-planning and plan initiation phases of the planning process and confirm these through engagement activities with Indigenous nation members, knowledge holders and technical staff. Indicators may be scoped to consider regional values or individual sites, depending on the level of available information, input from the regional planning group and consultation and engagement. Examples of indicators can include:

- Area analyses (e.g., area of high archaeological potential by management zone)
- Known protected sites and unknown resources (both known and unknown archaeological resources are protected in the *Heritage Conservation Act*) (e.g., change in presence, type, number of sites affected, significance of the site)
- Paleontological resources
- Sites identified through Indigenous and/or local knowledge

Obtaining data on specific archaeological sites may require information-sharing agreements with Indigenous nations, and there may be requirements for confidentiality of information.

3.7.2 Baseline and Trends in Indicators

The base case scenario should:

- Describe current conditions for archaeological, paleontological and heritage sites, including those sites designated under provincial legislation, such as the *Heritage Conservation Act*, or local government bylaws
- Include known sites from archaeological studies, as well as the archaeological potential in the planning area
- Describe known heritage or historical sites and paleontological potential
- Present Indigenous or local knowledge related to archaeological and heritage resources, subject to the discretion of the knowledge holder and/or their respective Indigenous nation
- Present any additional regional or site-specific information identified through consultation in the base case scenario
- Identify trends regarding the preservation and use of the sites

3.7.3 Analytical Methods and Evaluation

Analytical methods are available at several scales, focusing on the identification and management of specific sites or an overview assessment, as described below.

- **Heritage impact analyses** are used to assess the potential impacts of a project on protected heritage sites and develop appropriate mitigation measures. The approach may also be applied to the SEEA for a planning initiative. The objectives of the heritage impact assessment for a land use plan would be to evaluate and understand the heritage values and significance of designated sites, identify and evaluate heritage resources within the project area, and identify and assess all impacts on heritage resources that might result from the plan (Heritage BC nd). Evaluation of the significance of a site addresses historic, scientific, public, ethnographic and economic values. The guidance recommends that assessment should consider the magnitude, severity, duration, range, frequency, diversity, cumulative effects and rate of change for the site. If the plan scenario would adversely affect specific sites, it may be necessary to engage with users of the site.
- **Archaeological overview assessments** compile existing knowledge about recorded archaeological site locations, historical Indigenous land use, and cultural and environmental constants and changes in the area likely to affect site location. This information is used to build a model of where archaeological sites are expected to be located. They can be used to support planning initiatives (Province of B.C. 2021l). The Province has established guidelines for conducting archaeological overview assessments. It is recommended that you engage with the Archaeology Branch at the Ministry of Forests, Lands, Natural Resource Operations and Rural Development.
- **Archaeological impact analyses** are more detailed than archaeological overview assessments. An archaeological impact analysis mainly applies to development projects that are subject to B.C.'s environmental impact assessment and review processes. However, the same principles can also apply to other developments to focus on potential impacts to known sites and to include field investigation under permit to identify sites (Province of B.C. 2021m).
- A **fossil impact assessment** is an analysis to describe fossil resource potential that is provided in provincial guidelines for industry (Province of B.C. 2020). A fossil impact assessment process for a project includes a review of resources inventory, a systematic pedestrian field study, an evaluation of the resources and management recommendations.

For the SEEA, the evaluation of the impacts should be addressed in terms of their magnitude and importance to Indigenous nations and non-Indigenous communities. It may be useful to apply the standard environmental assessment method with effects characteristics.

The results of the climate risk assessment should be linked back into this assessment to address the potential effects of climate risk on the archaeological, paleontological and heritage resources. The evaluation should also consider differential effects of the assessment on vulnerable communities.

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Appendix A: Forest Sector Assessment Techniques

In a SEEA, effects on forest sector employment and revenue are driven largely by changes in timber harvest volumes and costs that stem from alternative management strategies. Assess forest sector effects by starting with a focus on the effects to harvest levels and then on the subsequent effects to employment and businesses.

Begin by assessing current economic activity in terms of harvest levels and determine if the alternative planning scenarios will affect the availability of timber resources that support the annual allowable cut (AAC). Employment, income and revenue effects can be estimated and expressed per cubic metre of timber harvested. An additional consideration is the possibility that cost and supply impacts can result in threshold effects on forestry processing and timber harvesting operations (such as an industry adjustment like the closure of a mill or logging camp). These factors are illustrated in **Figure A-1** and discussed below.

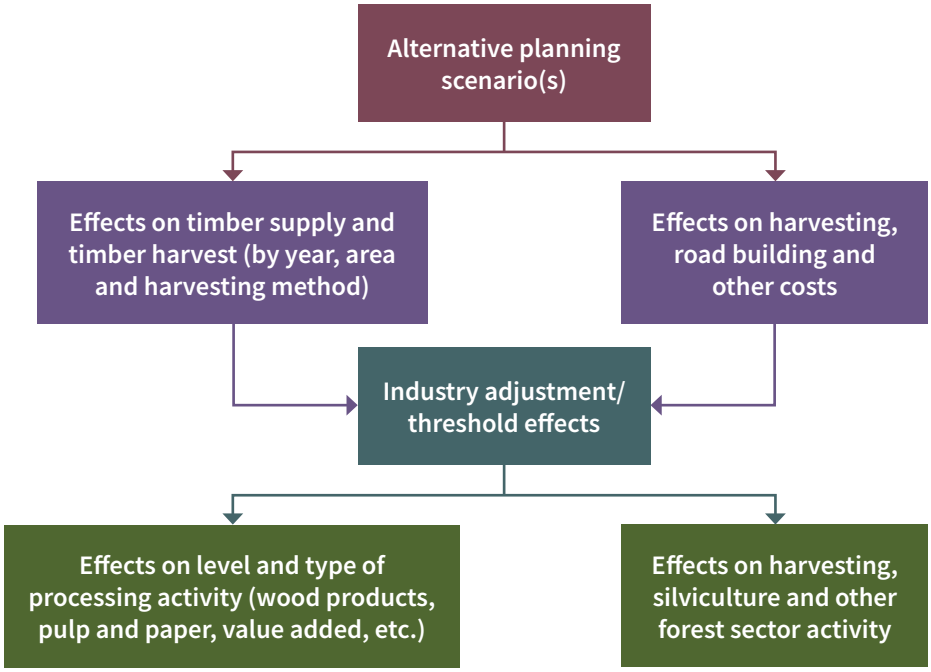

Figure A-1 Forest sector linkages to planning scenarios

A.1 Assess Current and Future Economic Activity

To assess the economic activity associated with the forest sector, you will need to consider historical and current timber supply analyses, actual harvest levels, harvesting and operability costs, relocation costs, availability of timber resources and the dependence of industry within the plan area on outside resources. A list of potentially relevant timber management planning issues, and associated indicators, is provided in the 2004 Resource Analysis Guide for Sustainable Resource Management Planning (B.C. Ministry of Sustainable Resource Management 2004).[13]

A First Nations Forest Strategy has been developed to support the modernization of the government-to-government relationship between the Province and Indigenous communities. The strategy describes a collaborative approach to forest governance and stewardship. This work is part of the Province's commitment to reconciliation and the mandate of fully adopting and implementing UNDRIP and the Truth and Reconciliation Calls to Action. The commitment also includes the review and development of forest policies, programs and legislation to support the strategy's implementation (BC First Nations Forestry Council and Government of B.C. 2019).

Indigenous and Indigenous-affiliate participation in forest economic activity has been increasing, in particular through tenures for community forest agreements and First Nations woodland licences. The volume making up the 11.6 per cent allocation to Indigenous groups in 2018 comes from well over 100 agreements with Indigenous communities, both direct awards and competitive bids (National Aboriginal Forestry Association 2018). The direct awards are based on the benefits that are received and/or returning to the community for harvest activities that take place in traditional territories (B.C. Ministry of Forests, Lands, Natural Resource Operations and Rural Development 2021).

There are two types of impacts associated with planning scenarios that can affect economic activity:

- Timber harvesting land base exclusions (for example, protected areas and no timber harvest zones)
- Impacts from other management initiatives that may change the intensity of harvesting

A.1.1 Timber Supply Analysis

The available timber supply depends on the conditions of the existing forest, the rate of growth of the existing and harvested forest, how the forest is managed for timber and other resource values, and choices around the rate of harvest. Management for other SEEA indicators such as visual resources, wildlife, watersheds and others may reduce the rate at which timber can be harvested and affect the overall timber supply (Province of B.C. 2017). The management prescriptions in each scenario can directly influence the current and future timber supply available for harvesting. These impacts can be estimated

[13] As with all older sources of information, readers should check for newer versions and note that information in the source may be superseded by more recent versions or updates.

with **timber supply models** and/or other landscape event simulation tools that explicitly address the impacts on the timber harvesting land base, the impacts on timber volumes, the length of time that the current timber supply can be maintained, and when any decline in timber supply might occur in the future (i.e., "fall-down").

When possible, use timber supply projections from the B.C. Ministry of Forests, Lands, Natural Resource Operations and Rural Development in the scenario analysis. These projections are prepared to determine the AAC as part of the base case forecasts in a timber supply review. To predict changes to timber supply, the transition from current levels to **long-term harvest levels** should incorporate reasonable decade-to-decade changes.

Box A1 Historical Harvest Volumes and Stumpage Rates

Data for historical harvest levels and associated provincial stumpage revenues can be obtained from the B.C. Ministry of Forests, Lands, Natural Resource Operations and Rural Development Harvest Billing System (Province of B.C. 2021n). However, many plan areas require more detailed reporting, sometimes to the resolution of portions of several districts. B.C. government technical staff may be able to assist in querying the Harvest Billing System and interpreting the resulting output.

A.1.2 When Timber Harvest is Less than Timber Supply

A timber supply analysis assesses the impacts of a planning scenario on timber harvesting opportunities. However, in some cases, actual harvest levels may be substantially below the AAC or the **short-term harvest level** shown in a timber supply analysis. In such cases, because impacts on revenue and employment are linked to harvest levels rather than to the AAC, the base case harvest forecast should be based on an average of actual harvest levels and/or on expert opinion about likely future harvest levels.[14] Timber supply forecast comparisons would still be important for assessing the impacts of planning scenarios on timber harvesting potential or opportunities. While it may be unlikely that the full timber supply would be harvested, increases or reductions in timber supply do represent changes in the "upside potential" harvest level that might be possible if, for example, operational conditions were to permit and markets for forest products were sufficiently strong. In these cases, it would also be useful to note the reasons why the full timber supply has not been harvested.

A.1.3 Impacts Relative to Current Conditions

Communities and other stakeholders are often interested in changes that may occur in the future relative to current conditions, such as the number of current jobs that may be at risk if timber harvest levels fall due to change in management practices as a result of land use planning. To address this concern, the SEEA could report on both the differences between the future forecasts (the base case and alternative plan scenarios) and how conditions under the new plan would differ from current conditions.

[14] In such cases, the base case harvest forecast will differ from the "base case" timber supply scenario used in the Ministry of Forests, Lands, Natural Resource Operations and Rural Development timber supply review.

A.1.4 Harvesting Costs and Operability Effects

The management prescriptions in each plan scenario can directly affect timber harvesting and silviculture costs. These additional costs may arise from reduced operating efficiencies (due to lower volumes being extracted from harvest areas) and increased harvest planning effort, as well as alternate harvest methods, access routes, harvest scheduling or silviculture treatments. It is very difficult to assess the potential magnitude of these costs and how incremental they might be relative to what would have occurred under base case management. Discussions with forest licensees and with representatives from the B.C. Ministry of Forests, Lands, Natural Resource Operations and Rural Development could help in this regard.

Increases in harvesting costs can lead to **operability effects** that occur when timber that was previously marginally economic to harvest becomes uneconomic due to the increase in costs (e.g., B.C. Ministry of Agriculture and Lands 2007). Higher costs may also reduce provincial government stumpage revenues by reducing harvest volumes and by reducing the stumpage rates applicable to that volume (due to the recognition of higher costs in the market pricing stumpage system).

A.1.5 Relocation Opportunities

Another issue to consider is whether currently unused or underutilized sites or timber resources are available. The most significant effect of an alternative plan scenario, even one that precludes such uses at certain sites, may be the costs incurred by operators to relocate the activity to alternative sites and, potentially, the higher operating costs and/or lower revenues at those sites if they are less suitable.

A.1.6 Dependence on Plan Area Timber

Consider the extent to which local processing facilities rely on imported fibre or on secondary products, such as dimension lumber or chips, for which alternative supplies might exist. Other factors that could be considered include the proportion of the affected workforce living in the plan area, and the implications of adjustments such as periodic mill closures (i.e., resulting in income rather than job loss) and normal turnover in the workforce.

A.2 Assess Forest Sector Employment

There are direct, indirect and induced economic effects from forest sector employment, as discussed in **Appendix E**. As shown in **Table A-1** below, direct forest sector employment includes the primary manufacturing sector, the forest management sector, secondary manufacturing, fibre supply and wholesale, and silviculture (MNP LLP 2015). These categories are linked to the most recent North American Industry Classification System (NAICS) (Statistics Canada 2017).

Table A-1 Forest Sector Employment Categories

General category	Subcategories
Primary manufacturing sector	Sawmills and wood preservation
	Veneer, plywood and engineered wood
	Pulp, paper and paperboard manufacturing
Forest management sector	Logging (except contract logging)
	Contract logging
	Support activities for forestry
Secondary manufacturing	Other wood product manufacturing
	Converted paper product manufacturing
	Wood kitchen cabinet and countertop manufacturing
	Other wood household furniture manufacturing
Fibre supply and wholesale	Lumber, plywood and millwork wholesalers
	Log and wood chip wholesalers and brokers
Silviculture	Forest orchards and nurseries
	Tree planters
	Silviculture contractors

Source: MNP LLP 2015

A.2.1 Woodlands and Harvesting

The forest management sector includes harvesting and other woodlands-related employment such as log salvage, log scaling and harvest planning. Log hauling and road building and maintenance are counted as indirect activities and are included in the multiplier-derived estimates discussed below. In recent years, there has been an increase in pre-harvest planning and the volume of timber harvested by innovative means such as helicopter logging, to address environmental concerns and regulations and the need to harvest in less accessible areas. Timber harvesting (by licensee employees and by contract loggers) is the component of the forest industry most strongly linked to harvest level changes. Harvesting employment levels are directly connected to changes in harvest levels.

A.2.2 Silviculture

In timber supply areas, licensees are responsible for basic silviculture, such as planting and surveying. In tree farm licences, licensees may also undertake enhanced or intensive silviculture, such as spacing, fertilizing and pruning. Silviculture employment is less strongly linked to harvest-level changes because of the time lag between when harvesting takes place and replanting begins, and because enhanced silviculture activities are concentrated on areas previously harvested.

A.2.3 Primary and Secondary Timber Processing

Primary timber processing includes milling for lumber, veneer and plywood, log homes, poles and posts, shakes and shingles, and pulp and paper. Secondary or value-added processing includes products such as remanufactured wood products, engineered building products, millwork, cabinets and furniture. Historically, technological change, consolidation of regional processing capacity, and the increase in value-added processing have been important factors affecting timber-processing employment coefficients. When timber harvest levels change, related employment changes in the processing sector depend on factors such as availability of alternative supplies, adjustments in capacity utilization and minimum economic production levels. The linkage with harvest levels is weaker still in the case of value-added products, which use lumber as an input, and pulp and paper products, which use sawmill waste.

A.2.4 Employment Coefficients

An employment coefficient for the forest sector is a measure of the number of **person-years** of employment associated with the harvesting of a thousand cubic metres of timber. For example, a coefficient of 1.0 indicates that every 1,000 cubic metres harvested supports one person-year and every 500,000 cubic metres supports 500 person-years.

- A person-year represents about 1,800 hours of work. Seasonal employment can be adjusted to person-year employment to allow meaningful comparisons between forest industry sub-sectors. Harvesting and silviculture work is usually seasonal, so the number of jobs in these activities supported by the timber harvest is greater than the person-years. On the other hand, timber processing is generally a year-round activity, and the number of processing jobs is roughly equivalent to the person-years.
- Data for deriving employment coefficients can be collected from local operators, the provincial government, industry associations and from timber supply reviews. In some cases, the employment and income coefficients prepared for the most recent timber supply review will be sufficient for the purposes of a SEEA. However, when there are no recent timber supply reviews, new surveys may be required to obtain current information.
- It may also be important to consider trends in employment. For example, the overall number of forest sector jobs in B.C. declined by about 30 per cent between 1995 and 2004 even as harvest volumes increased, with the decline attributed to increasing efficiencies and industry consolidation (McMorland and Clark 2007). Employment trends can be considered when estimating income and employment effects in future years.

In addition to estimating the direct forest sector employment associated with the timber harvest, indirect and induced employment may also be estimated. Indirect employment is associated with businesses that supply goods and services to forest sector companies, such as machine shops and road building and maintenance operations. Induced employment is associated with businesses that are supported by workers spending direct and indirect employment in the local economy, such as in local retail outlets. Indirect and induced employment may be estimated using multipliers from the BC Input-Output Model (Province of B.C. 2021p). See **Section 3.4.1.2** for further discussion on the use of employment multipliers.

- Indirect and induced effects have a relatively weak linkage to harvest changes of all the categories of impacts because activity levels in affected sectors depend on spending by businesses and workers in industries other than forestry. Forest sector indirect and induced impacts are discussed in more detail in **Appendix E: Tools for Economic Impact Analysis**.

There are several important qualifications to consider when assessing the effects on forest sector employment. Estimates indicate the general magnitude of change but should not be considered as accurate.

- Employment impacts calculated using coefficients are shown to occur immediately and in direct proportion to the change in the harvest level. While likely accurate for the harvesting sub-sector, this may not be the case for the milling sub-sector, which has weaker links to harvest levels and where impacts are more likely to occur at threshold levels at which shifts may be dropped or mills closed. Indirect and induced impacts would likely occur over a longer period of time, as business and consumer spending levels adjust.
- Direct employment coefficients are derived from surveys of companies operating in the area and reflect prevailing productivity, harvest practices and forest management. The coefficients may not reflect future industry operating conditions. In the short to medium term, trends in harvesting and processing may not result in major changes in the employment coefficients, in part because such trends can be mutually offsetting. For example, increased requirements for pre-harvest planning and more ecologically sensitive harvesting methods can partly offset the trend to mechanization and second growth harvesting methods. Also, the trend to labour-saving timber processing technology could be partially offset by growth in the value-added sector. There is likely to be considerable uncertainty attached to projections made beyond the first decade.

To assess employment income, the SEEA may differentiate between different measures of income, such as gross payroll (which includes wages and benefits), before-tax income net of benefits and after-tax income available for spending in local communities. Gross payroll is most relevant when assessing provincial impacts, whereas after-tax income is most relevant when assessing local impacts. Gross payroll includes all wages and benefits paid by employers. Before-tax income net of benefits is most representative of what people normally consider to be related to their wage or salary.

A.3 Summary

To assess effects on the forest sector:

- Understand that employment and revenue impacts are driven by the difference in timber harvest levels and harvest costs that are expected to occur with the alternative planning scenario, compared with those expected to occur under the base case scenario
- Calculate direct employment impacts by multiplying employment coefficients (jobs per cubic metre harvested) by forecasted timber harvest volumes. Indirect employment impacts may be calculated by applying multipliers to the direct employment figures
- Calculate provincial government stumpage revenue implications by applying forecast stumpage rates to the forecast harvest levels
- Keep in mind that for periods more than a decade in the future, forecasts based on current economic and technical conditions are subject to increasing uncertainty

Further resources on forest sector assessment techniques are listed in **Box A2**.

A.4 Additional References: Forest Sector

BC First Nations Forestry Council and Government of B.C. 2019. BC First Nations Forest Strategy. Available at: https://www.forestrycouncil.ca/cpages/forest-strategy-public#Download.

B.C. Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2021. First Nations Forestry Agreements. Available at: https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/consulting-with-first-nations/first-nations-negotiations/forestry-agreements.

Gorley, A. and G. Merkel. 2020. A New Future for Old Forests: A Strategic Review of How British Columbia Manages for Old Forests Within its Ancient Ecosystems. Prepared for the Ministry of Forests, Lands, Natural Resource Operations and Rural Development. Available at: https://engage.gov.bc.ca/app/uploads/sites/563/2020/09/STRATEGIC-REVIEW-20200430.pdf.

Box A2 Further reading and suggested resources

Note that older resources may have content that is no longer accurate but may be useful sources of background information and methods of analysis.

- 2018 Economic State of the B.C. Forest Sector (B.C. Ministry of Forests, Lands, Natural Resource Operations and Rural Development 2019)
- BC Forest Industry Economic Impact Study (MNP LLP 2015)
- BC Forest Sector Overview (Forestry Innovation Investment 2021)
- British Columbia Local Area Economic Dependencies: 2006. Prepared for BC Stats (Horne 2009)
- British Columbia's Forest Industry and the B.C. Economy in 2016. Prepared for COFI (PwC 2017)
- First Nations Forest Strategy, Draft. (BC First Nations Forestry Council and Government of BC 2019)
- First Nations Forestry Agreements (B.C. Ministry of Forests, Lands, Natural Resource Operations and Rural Development website)
- Forest Legislation and Policy Reference Guide 2015 (Association of BC Forest Professionals 2015)
- Fourth Report on Indigenous-Held Forest Tenures in Canada 2018 (National Aboriginal Forestry Association 2018)
- A New Future for Old Forests: A Strategic Review of How British Columbia Manages for Old Forests Within its Ancient Ecosystems (Gorley and Merkel 2020)
- Resource Analysis Guide for Sustainable Resource Management Planning. (B.C. Ministry of Sustainable Resource Management 2004)
- Timber Supply Review Backgrounder (Province of B.C. 2017)

Provincial Data Sources:

- BC Bioenergy Network
- BC First Nations Forestry Council
- BC Lumber Trade Council
- Coast Forest Products Association
- Council of Forest Industries
- Forestry Innovation Investment
- Naturally Wood
- Western Silvicultural Contractors' Association

National and International Data Sources:

- Canadian Forest Service
- Foreign Affairs and International Trade
- FP Innovations
- Industry Canada
- Madison's Lumber Reporter
- National Aboriginal Forestry Association
- National Forestry Database
- Natural Resources Canada
- Random Lengths
- RISI
- Statistics Canada
- Wood Pellet Association of Canada

Appendix B: Recreation and Tourism Sector Assessment Techniques

Outdoor recreation and tourism are overlapping concepts. For SEEA, a useful distinction is that outdoor recreation generally refers to non-commercial outdoor activities that take place on land or water for leisure purposes in the plan area. Recreational activities on public lands and waters include nature viewing, wildlife viewing, mountaineering, backpacking, caving, horseback riding, mountain biking, snowshoeing, off-road vehicle touring such as snowmobiling, kayaking and canoeing, sailing, marine cruising, diving, whitewater rafting and heli-skiing (Province of B.C. 2021o).

Tourism is defined as activity related to visitors to the plan area spending money on such activities as accommodation and food, recreation activities, and transportation. Tourism includes the activities of business travellers, which is consistent with international definitions of tourism (e.g., UN World Tourism Organization 2021). Tourism activities can be categorized as front-country and backcountry tourism.

Front-country tourism facilities are easily accessible by vehicle and depend primarily on highway traffic, such as hotels and restaurants in communities, while backcountry tourism opportunities depend on relatively pristine environments, with an abundance of natural features and views, and are therefore more likely to be affected by changes in land use planning. Effects are particularly related to protected areas, scenic viewscapes and access (motorized and non-motorized).

Backcountry tourism activities can be grouped as follows.

- Guided outfitting and hunting: In B.C., out-of-province hunters are required by regulation to use a B.C. licensed hunting guide. While guided hunting is the primary product offered by hunting guide operations, many also offer wilderness adventure and wildlife viewing tours outside prime hunting seasons.
- Guided sport fishing: B.C. offers world-class ocean salmon fishing and freshwater angling opportunities. Fishing lodges and guided angling are important sub-sectors of the backcountry and mid-country tourism sector.
- Adventure tourism and ecotourism: B.C. is increasingly popular as a destination for adventure tourism and ecotourism, including wildlife viewing, whitewater rafting, scuba diving, mountaineering and other activities that have an element of risk and challenge for the participant (Destination BC 2014).
- Indigenous-owned or operated tourism businesses that provide authentic cultural experiences to visitors are an important, unique and fast-growing sector within the provincial tourism industry (Indigenous Tourism BC 2019 Province of BC 2021o). Effects on the recreation and tourism sectors should consider the differential effects on Indigenous-owned or operated tourism businesses.

When assessing impacts on tourism and recreation, keep in mind that these two sectors are linked. However, even though the indicators for the two sectors may be the same, the interpretation of the results may be different. Your assessment should be tailored to the activities and the available information within the plan area. While spatial analysis and economic indicators are noted in the examples below, these analyses are evolving, and guidance for more recent analyses and indicators may be available.

B.1 Assessing Effects

Figure B-1 outlines the following approach for assessing effects on recreation and tourism activities:

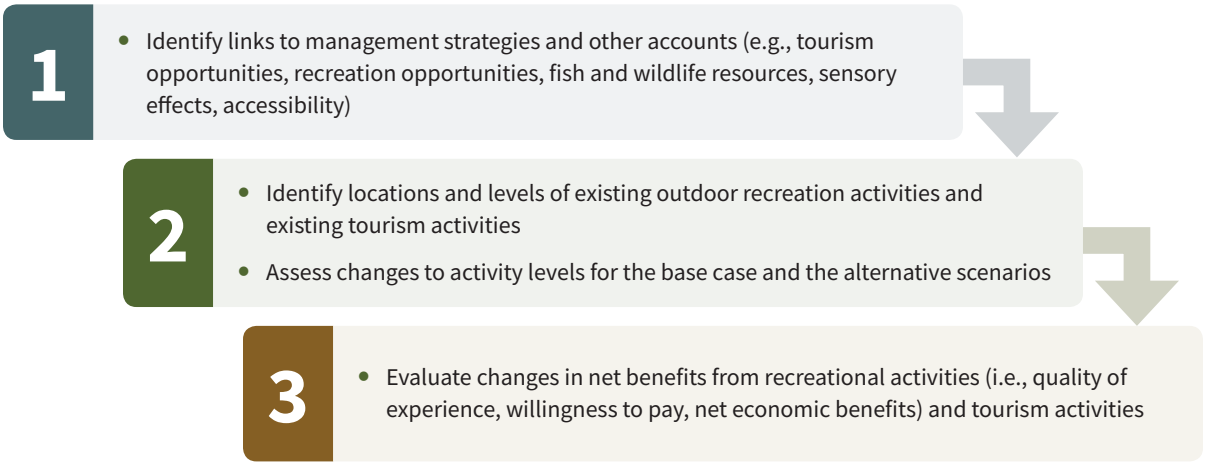

Figure B-1 Recreation activity and tourism assessment

B.2 Outdoor Recreation

Outdoor recreation resources are linked to the accessibility to the recreation area, the availability of fish and wildlife resources, and the management strategies in the scenarios. The recreation experience is also influenced by visual quality and other sensory conditions. For example, recreation in a specific area may be primarily focused on front-country activities such as swimming, water skiing and boating, and therefore not likely to be affected by a management plan that restricts access to the backcountry.

The level of recreation activity can be measured by the days associated with a specific area and type of recreation. Determine estimates by activity type through discussions with communities, recreational organizations, and tourism industry and other stakeholders, along with a review of available provincial government data. A comparison with other regions of British Columbia for which there is information may also provide some insight. Activities that may be affected include hunting, angling, snowmobiling, backcountry skiing and other winter activities, motorized summer activities (e.g., ATVs), bicycling, hiking, trail riding, and boating (including kayaking, canoeing, and power cruising). Recreational activities will be particularly affected by the access management provisions of a land use plan.

Restrictions on motorized access would reduce opportunities for some users (e.g., snowmobilers, motorcyclists, ATV operators) but could enhance the backcountry experience for other users (e.g., Indigenous communities and hikers) and reduce stress on the land base. Access management provisions of a plan are usually intended to allow the area to offer a variety of high-quality recreation experiences. An analysis of the level of activity can be developed by land use plan designations (adjusted to be relevant to recreation) as shown in the example in **Table B-1.**

Table B-1 A Sample Scenario Comparison of Management Unit Area Statistics for Recreation

Plan Area Tourism and Recreation Values	**Total Plan Area** *(ha)*	**Base Case**		**Land Use Scenario**	
		Protected	**General**	**Protected**	**General**
Total land base	…	…	…	…	…
Access restrictions:					
Non-motorized all seasons	…	…	…	…	…
Non-motorized summer only					
Summer: restricted motorized	…	…	…	…	…
Winter: non-motorized only	…	…	…	…	…
Recreation opportunity spectrum*	…	…	…	…	…
Roaded modified	…	…	…	…	…
Roaded natural	…	…	…	…	…
Primitive	…	…	…	…	…
Rural	…	…	…	…	…
Semi-primitive motorized	…	…	…	…	…
Semi-primitive non-motorized	…	…	…	…	…
Urban	…	…	…	…	…

*Definition provided in **Appendix H: Glossary**.

The net economic value from recreation activities may include estimates of recreationists' willingness to pay for activities and the extent to which this exceeds their actual level of expenditures (see **Box B1**). Time and budget constraints may preclude undertaking original survey research on the value of recreation activities for a specific region, and the analysis may therefore rely primarily on publicly available estimates of willingness to pay by activity.

Table B-2 shows examples of recreation activities and presents data on level of activity, direct expenditures and net economic value. This information could be provided for baseline conditions, and the SEEA can address changes that might occur due to a land use scenario.

Table B-2 Economic Significance of Recreation in a Plan Area

Activity Type	Annual Level of Activity in Plan Area	Expenditures per Day	Net Economic Value per Day
Resident hunting	# of hunter days	…	…
Resident angling	# of angling days	…	…
Wildlife viewing	# recreation/visitor days	…	…
Camping	# of camping visits	…	…
Other activities (e.g., snowmobiling, ATVing, horseback riding, cross-country skiing, hiking and bicycling)	# of recreation days	…	…
Total	Total # of recreation days	…	…

Note: Data for expenditures per day and estimates of net economic value can be obtained from Environment Canada and from the B.C. Ministry of Environment (see **Appendix G: Data and Information Sources**).

B.3 Tourism

Tourism activities may be affected by changes in opportunity, changes to fish and wildlife resources, effects to natural features and views, and changes in access to recreational areas. For example, a plan scenario may directly affect tourism businesses that depend on backcountry tourism opportunities but may not affect front-country tourism facilities. The extent to which tourist activity is affected will depend on the importance of the affected resources to the amount and type of tourism in the area. Recreational and tourism activities will be particularly affected by the access management provisions of a land use plan.

Tourism operations may be able to adjust to changes in management strategies, for example by changing the timing and areas of operation, or even the nature of the activities offered. Also, tourism operations (and recreation enthusiasts) may be able to relocate activities to sites that are currently unused or underused. In such cases, the most significant effect of a management scenario, even one that precludes such tourism or recreational uses at certain sites, may be the costs incurred by operators and users to relocate the activity to alternative sites and, potentially, the higher operating costs/lower revenues at those sites if they are inferior.

The analysis should determine the extent and type of base case tourism activities and the potential changes to the activities with the base case and alternative scenarios. For guide outfitting, for example, this may involve obtaining data on hunting days for non-resident hunters for the wildlife management units that overlap the area and estimating the associated socio-economic impacts from industry averages or an industry survey of individual guide outfitters in the region under study.

Table B-3 shows how land use plan designations (adjusted to be relevant to tourism) can be used to analyze activity levels. The information presented in the table can help you assess the impact of a plan scenario and determine the extent to which:

- Scenic areas gain increased protection through the plan
- Tourism and recreation facilities and features are insulated from extractive resource development incursion
- Fish and wildlife habitat are protected from resource development activities
- Specific tourism and recreation management initiatives encourage or discourage tourism and recreation activities
- The land use plan provides greater land use and operational certainty for tourism service providers, as well as positive international perception (e.g., of a locally endorsed, environmentally supportive and socially responsible tourism industry)

Table B-3 A Sample Scenario Comparison of Management Unit Area Statistics for Tourism Indicators

Plan Area Tourism and Recreation Values and Indicators	Total Plan Area *(ha)*	Base Case		Alternative Scenario	
		Protected	General	Protected	General
Total land base	…	…	…	…	…
Scenic areas (timber supply review):	…	…	…	…	…
R – Retention	…	…	…	…	…
PR – Partial retention	…	…	…	…	…
M – Modification	…	…	…	…	…
Total scenic areas	…	…	…	…	…
Existing tourism facilities:	…	…	…	…	…
Fishing lodges	…	…	…	…	…
Other lodges	…	…	…	…	…
Other facilities	…	…	…	…	…
Existing tourism features:	…	…	…	…	…
Anchorages	…	…	…	…	…
Recreation trails (km)	…	…	…	…	…

The socio-economic impacts from guide outfitting, guided angling and adventure tourism can then be assessed in terms of days of activity, number of operators, direct employment (person-year or full-time equivalents), income levels, provincial government revenues and net economic value. The consequences on provincial government revenues include only direct corporate taxes and payments (and not income taxes from employment). This is discussed in more detail in the context of techniques that pertain to assessing government revenues (**Appendix E**).

Box B1 Further information on assessing recreation and tourism effects in B.C.

Outdoor Adventure Tourism Sector Profile (Destination BC 2014)

- Recreation Manual 2000. Chapter 7 Recreation Analysis. (B.C. Ministry of Forests 2000)
- The Social and Economic Impacts of BC Recreation Sites and Trails (B.C. Ministry of Forests, Lands and Natural Resource Operations 2011)
- Welcoming Visitors – Benefiting Locals – Working Together: A Strategic Framework for Tourism in British Columbia, 2019-2021 (Province of B.C. 2019c)
- Forest Legislation and Policy Guide 2015. Section 8: Recreation Resources (Association of BC Forest Professionals 2015)

Appendix C: Minerals Sector Assessment Techniques

The minerals sector includes metallic, coal and aggregate resources. British Columbia is Canada's largest exporter of coal, a leading producer of copper and the only producer of molybdenum. The province also produces significant amounts of gold, silver, lead and zinc, and more than 30 industrial minerals, including gypsum, magnesite, limestone and dimension stone. Numerous quarries produce sand and gravel or crushed aggregate (Clarke et al. 2021). Subsurface resources such as these present unique challenges for land and marine use planning and resource management, and projections regarding future development are highly uncertain.

A plan may affect existing operations and future prospects by establishing:

- Protected areas in which exploration and mining are not permitted
- Guidelines for development activities in areas that have special values (e.g., wildlife habitat areas)
- Consultation protocols with Indigenous nations and local communities regarding exploration and mining activities

The result of a plan may be a smaller area in which to explore for and develop resources, but increased certainty on which activities are appropriate for a given area.

C.1 Factors Influencing Mining Activities

Consider the following factors and information when assessing and comparing plan scenarios:

- Available statistics for production, employment and earnings and exploration spending (see government websites for mineral exploration and mining (B.C. Ministry of Energy, Mines and Low Carbon Innovation 2021)
- Current employment and income dependency on the mineral exploration and mining sectors (data from BC Stats)
- Existing operating mines and producers (metallic, industrial, coal and aggregate[15]) and the associated employment, gross revenues, capital expenditures and mine lives
- Active exploration projects
- Known reserves/resources in the region

[15] For Ministry of Energy, Mines and Low Carbon Innovation definitions of these materials, please see: https://www2.gov.bc.ca/gov/content/taxes/natural-resource-taxes/mining/mineral-tax

- Exploration expenditures (data on exploration expenditures by region can be gathered from the Assessment Report Indexing System and Coal Assessment Reports (from the Ministry of Energy, Mines and Low Carbon Innovation). Data can be averaged over a selected period and compared with the British Columbia average; for example, a 20-year period would show longer-term trends, while a five-year average would show short-term trends)
- Provincial data (e.g., from iMapBC, MINFILE, MapPlace) regarding **mineral potential** (known **mineral occurrences**, including showings, prospects, developed prospects and past producers), aggregate and industrial mineral existing and potential resources (e.g., sand, gravel and crushed stone), known coal fields and placer and coal tenures (including Crown grants)
- The significance of the region to British Columbia in terms of mineral potential
- The Annual Provincial Overview of Exploration and Mining in British Columbia (e.g., B.C. Ministry of Energy, Mines and Low Carbon Innovation 2021)

The SEEA should also attempt to explicitly address, either quantitatively or qualitatively, the extent to which the probability and timing of possible developments are affected by a plan scenario compared with the base case.

The British Columbia Mineral Potential Project 1992-1997 provides information on the mineral potential data and its limitations.[16] This project was initiated in 1992 by the Geological Survey Branch of the B.C. Ministry of Energy and Mines to support land use planning by ranking the provincial land base according to its assessed ability to support mineral exploration and extraction. Since then, analysis techniques and technologies have improved, exploration activity has increased, and some areas of the province have been covered by more up-to-date geophysical, geochemical or geological surveys. Planners and practitioners should work with B.C. Geological Survey staff to access available data and determine if there is a more recent mineral potential assessment in the area of interest.

Additionally, knowledge of deposit models is constantly undergoing refinements that provide a better understanding of their geological settings and controls of mineralization. Note that:

- The mineral potential data has not been updated to accommodate such advances.
- The mineral potential analysis was conducted at a 1:250,000 scale, and therefore using this data at smaller scales may be inappropriate.
- Areas ranked as having “low” potential do not necessarily mean that the area actually has low mineral potential; instead, the ranking may reflect limited information.

[16] See “Limitations of Mineral Resource Assessments” at https://www.for.gov.bc.ca/tasb/slrp/citbc/b-MinResAsse-MacInt-etal.pdf

While it is important to appreciate these limitations, the mineral potential dataset remains an important tool for socio-economic and environmental assessment of land use plans and resource management initiatives. B.C. Geological Survey is currently working to incrementally update the mineral potential of the province using new machine-based approaches and planners and practitioners should contact B.C. Geological Survey early in the process to explore opportunities to co-ordinate. In some cases, there may be an opportunity to collaborate in new areas.

A land use plan may affect future potential activities, as well as existing activities. However, there is no widely accepted methodology for estimating the socio-economic consequences associated with changes in access to areas or regions with mineral potential under a plan relative to the base case.

The likelihood and timing of exploration and development are already subject to considerable uncertainty due to factors such as world market prices, technology changes, new information and new discoveries. Given the hidden nature of the resources and other unknowns regarding future mineral values and mining technologies, methodologies that are broadly applied to the land base are highly speculative. Very few mineral occurrences are ever developed into mines, and conversely, there are cases of mines being developed in areas that were previously considered to have low mineral potential.

One approach to assess the consequences of future mining activities entails applying probabilities of discovery and development to arrive at discounted net present value per hectare (see BriMar Consultants Ltd. 2004).[17] However, there is uncertainty about the appropriate probability values to use and the validity of using mineral potential information to create development and production scenarios.[18]

These issues are highly pertinent because when minerals are explored for and developed, they often produce high levels of employment, incomes and government revenues. Such values could far outweigh the values associated much more certainly with other economic sectors and lead to an inappropriately skewed presentation of combined impacts. On the other hand, to say nothing about mineral values would also be inaccurate.

[17] An example of this approach is the work of BriMar Consultants and Finisterre Holdings (2004) which estimated the value of various mineral tracts for the Coast Information Team. The report, "Economic Gains Spatial Analysis Minerals, Oil and Gas Sector Study", can be found at: https://www.for.gov.bc.ca/tasb/slrp/citbc/w-EGSA-MOGs-fin-05Apr04.pdf.

[18] For discussion of these issues, see https://www.for.gov.bc.ca/tasb/slrp/citbc/EGSA-MOGs-Hodge.pdf, https://www.for.gov.bc.ca/tasb/slrp/citbc/EGSA-MOGs-Power.pdf and https://www.for.gov.bc.ca/tasb/slrp/citbc/EGSA-MOGs-AuthResp.pdf.

C.2 Analysis Approaches

The SEEA should include two sets of information: GIS statistics and, if useful, an "illustrative example" of an appropriately representative mine development.

C.2.1 Mineral Potential and GIS Data Table

Mineral potential data and GIS data can be used to construct a table that shows useful indicators for assessing consequences of plan scenarios. Some examples include:

- Percentage of the land base accessible to mining (including already staked and what can be staked)
- Percentage of very high mineral potential area accessible to mining
- Percentage of very high industrial mineral potential area accessible to mining
- Number and status of mineral occurrences in new protected areas
- Crown grants and mineral, placer and coal tenures (hectares), multi-year area-based exploration permitting areas in new protected areas

An example of this type of presentation is shown in **Table C-1**. Note that not all of the categories would apply in every case; the analysis could use the indicator categories applicable to the specific situation being examined (for an example, see Pierce Lefebvre Consulting 2004). This type of table could be used to show the following:

- The proportion of the plan area land base managed as protected areas before the land use plan and the percentages of those areas that involve very high metallic mineral potential areas, mineral occurrences (producers, past producers, developed prospects, prospects and showings), aggregate resources and coal fields
- The impacts of increasing the proportion of the plan area that is protected, with incremental impacts on areas of mineral potential, mineral occurrences (producers, past producers, developed prospects, prospects and showings) aggregate resources, coal fields and mineral tenures (including Crown grants)

Table C-1 Scenario Comparison of Land-Based Area Statistics for Mining

Plan Area Mineral Values/ Indicators	Total Area *(ha or level)*	Base Case		Land Use Scenario	
		Protected	General Management	Protected	General Management
Total land base	…	…	…	…	…
Metallic mineral potential (ha)					
Very high	…	…	…	…	…
High	…	…	…	…	…
Moderate	…	…	…	…	…
Low	…	…	…	…	…
Very low	…	…	…	…	…
Industrial mineral potential (ha)					
Very high	…	…	…	…	…
High	…	…	…	…	…
Moderate	…	…	…	…	…
Low	…	…	…	…	…
Very low	…	…	…	…	…
Aggregate potential (ha)					
Primary	…	…	…	…	…
Secondary	…	…	…	…	…
Crown grants (ha)	…	…	…	…	…
Mineral and placer tenures (ha)	…	…	…	…	…
Coal fields area (ha)	…	…	…	…	…
Coal tenures (ha)	…	…	…	…	…
Metallic mineral occurrences					
Producer	…	…	…	…	…
Past producer	…	…	…	…	…
Developed prospect	…	…	…	…	…
Prospect	…	…	…	…	…
Showing	…	…	…	…	…
Total	…	…	…	…	…
Mineral exploration expenditures					
Number of sites	…	…	…	…	…
Amount of expenditures ($ mil.)	…	…	…	…	…

C.2.2 "Illustrative Example" Approach

This approach considers the values that could be associated with the development of an area of highest mineral potential, if such development were to occur. An "illustrative example" can be constructed by:

- Determining the most likely deposit type to be found in the region (at 90th percentile) using the predicted probabilities in the mineral potential data.
- Describing the economics of a particular type of mine using available and technically defensible information on employment, capital investment, operating costs, annual revenues, annual cash flow and profit, and taxes and royalties paid to the provincial government.

There are several considerations to keep in mind:

- With respect to employment levels and the proportion of jobs that might be held by local residents should a mine be developed in the area, it is increasingly common for mines to work closely with local communities and Indigenous nations in an attempt to maximize the proportion of local mining jobs held by local residents.
- Employment related to exploration expenditures and how that might change as a result of the land use plan, could also be included in any analysis.
- For protected areas, based on how much of a mineral tract is recommended for protection, it could be noted that the probability of discovery of the deposit may decrease – in fact, the deposit may end up in the protected area.
- Regarding the operating land base, it could be noted that the probability of discoveries may increase due to greater land use certainty.

Typical information for three types of illustrative examples for a metal mine[19] is presented in **Table C-2.** Data in the table dates from 2003 (B.C. Ministry of Sustainable Resource Management 2003); however, there may be existing operating mines that could be used as the basis for an illustrative example. In other cases, a theoretical example could be constructed from assumptions.

[19] The building blocks for minerals are at: www.al.gov.bc.ca/clad/strategic_land/econ_analysis/data_sources.

Table C-2 Illustration of Comparison of Consequences of Scenarios on Mining

Development Phase	CASE A Underground Mine (Small)	CASE B Underground Mine (Large)	CASE C Open Pit Mine (Large)
Commodity	Gold-Silver	Lead-Zinc-Silver	Copper-Gold
Processing capacity (tonnes/day)	500	3,000	60,000
Operating employment	110	335	405
Exploration and development ($ mil.)	9.0	27.0	18.0
Design and construction ($ mil.)	42.0	296.0	440.0
Operating costs ($/tonne)	76.0	$57.00/tonne milled	$4.41/ tonne milled
Offsite handling and shipping costs		$75.00/ tonne shipped	$75.00/ tonne shipped
Ongoing capital costs ($ mil., life of capital asset)	2 (5 years)	16 (15 years)	69 (20 years)
Closure costs ($ mil.)	4.0	15.0	20.0
Rehabilitation costs ($ mil.)	2.0	5.0	5 + 1/year in perpetuity

Using technically defensible data and assumptions, the SEEA could also estimate the employment, provincial government tax revenues and revenue-sharing impacts to partners associated with the example.

Selected information generated following the approaches suggested here could be presented in the summary matrix, along with information related to other accounts.

C.3 Additional Mining References

B.C. Farming, Natural Resources and Industry. 2021. Statistics, Mineral Exploration and Mining, Available at: https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/further-information/statistics.

B.C. Geological Survey. 2021. Assessment Report Indexing System (ARIS) Available at: https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/british-columbia-geological-survey/assessmentreports.

B.C. Geological Survey. 2021. Coal Assessment Reports (COALFILE). Available at: https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/british-columbia-geological-survey/assessmentreports.

B.C. Ministry of Energy and Mines. 2004. The British Columbia Mineral Potential Project 1992-1997 Methodology and Results. Geofile 2004. Available at: http://cmscontent.nrs.gov.bc.ca/geoscience/PublicationCatalogue/GeoFile/BCGS_GF2004-02.pdf.

B.C. Ministry of Sustainable Resource Management. 2003. Economic Building Blocks: Profiles of British Columbia Land and Resource Based Businesses. Available at: http://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=EPD&documentId=7513.

Clarke, G., Northcote, B., Katay, F., and Tombe, S.P. 2021. Exploration and Mining in British Columbia, 2020: A summary. In: Provincial Overview of Exploration and Mining in British Columbia, 2020, British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey Information Circular 2021-01, pp. 1-45.

Energy Mines and Low Carbon Innovation. British Columbia Mine Information. Available at: https://mines.nrs.gov.bc.ca/.

Appendix D: Petroleum Sector Assessment Techniques

Petroleum resources in British Columbia include oil, natural gas and coalbed methane. Similarly to the mineral sector, subsurface resources such as these present unique challenges for land and marine use planning, and resource management and projections regarding future development are highly uncertain.

Land and marine use planning usually involves identifying resource values through inventories, providing management direction through a series of objectives and strategies, and possibly creating protected areas or management zones. A land use plan may affect known mineral resources and existing operations as well as unknown resources and future prospects by establishing:

- Protected areas or zones where minimal surface disturbance is allowed (although in some cases directional drilling can be used to access petroleum resources while meeting the goals of these areas)
- Management objectives and strict guidelines for development activities in areas (e.g., the Muskwa-Kechika Management Area)
- Areas where the conservation of one or more resource values, such as wildlife habitat, recreation or community watersheds, are recognized as priorities for resource management (e.g., the Muskwa-Kechika Management Area)
- Consultation protocols with Indigenous nations and local communities
- Access to the land base outside protected areas

The result of a plan may be a smaller area in which to explore for and develop resources, but increased certainty on which activities are appropriate for a given area.

D.1 Factors Influencing Petroleum Sector Activities

Factors and information that should be considered when assessing and comparing plan scenarios include:

- Employment and income dependencies on the oil and gas sector (available from BC Stats)
- Number of wells drilled during both exploration and development
- Existing production facilities and the associated employment, gross revenues, and development/capital expenditures
- Proved reserves/resources in the region and production trends (see resources classification system BC Oil & Gas Commission 2021)[20]
- Exploration expenditures (B.C. Ministry of Energy, Mines and Low Carbon Innovation provides data on petroleum exploration expenditures and land sales, from which short-term and long-term trends can be identified)
- Provincial government revenues from royalties and land sales

Current sources for provincial information are listed below:

- Royalties: *www2.gov.bc.ca/gov/content/industry/natural-gas-oil/oil-gas-royalties*
- Oil and gas production in B.C.: *www2.gov.bc.ca/gov/content/industry/natural-gas-oil/statistics*
- BC Oil and Gas Commission (an independent, single-window regulatory agency with responsibilities for overseeing oil and gas operations in British Columbia, including exploration, development, pipeline transportation and reclamation):
  - Oil and gas reserves: *www.bcogc.ca/data-reports/reservoir-management/reserves/*
  - Petroleum sector activities: *www.bcogc.ca/data-reports/data-centre/?category=4398/*
  - Area-based analysis (cumulative effects analysis) (Peace Region): *www.bcogc.ca/how-we-regulate/safeguard-the-environment/cumulative-effects/*

D.2 Analysis Approaches

The SEEA should compare the oil and natural gas production and potential likely to occur in the base case with those likely to occur under the plan (acknowledging the uncertainty associated with subsurface resources). Two sets of information should be provided: GIS statistical analysis and economic values based on production forecasts.

[20] "Proved reserves" are quantities of petroleum that can be estimated with reasonable certainty to be commercially recoverable from known reservoirs under current economic, operating and regulatory conditions. Proved reserves can be categorized as developed or undeveloped. Unproved reserves may be classified as "probable reserves" and "possible reserves." Probable reserves are unproved reserves that are considered likely to be recoverable. Possible reserves are unproved reserves that are considered less likely to be recoverable than probable reserves.

D.2.1 Petroleum Potential and GIS Data Table

GIS analysis of petroleum data can be used to construct a table that shows useful indicators for the base case and alternative plan scenarios. Some examples of the analysis results may include:

- Percentage of the land base accessible to exploration and development
- Amount of reserves and percentage of the area with proved reserves accessible
- Amount of resources and percentage of area accessible with "high" and "very high" oil and gas potential
- Number of wells and kilometres of pipelines that are located in proposed protected areas and the operating land base

An example of a GIS data table is presented in **Table D-1**.

Table D-1 Indicators of Petroleum Sector Useful for Plan Assessment

Plan Area Mineral Values	Total Area *(ha)*	Base Case		Land Use Plan	
		Protected	General Management	Protected	General Management
Total land base	…	…	…	…	…
Proved oil (ha and cubic metres)	…	…	…	…	…
• Very high	…	…	…	…	…
• High	…	…	…	…	…
Proved natural gas (ha and cubic feet)	…	…	…	…	…
• Very high	…	…	…	…	…
• High	…	…	…	…	…
Oil potential (ha and cubic metres)	…	…	…	…	…
• Very high	…	…	…	…	…
• High	…	…	…	…	…
Natural gas potential (ha and cubic feet)	…	…	…	…	…
• Very high	…	…	…	…	…
• High	…	…	…	…	…
Oil and gas tenures (ha)	…	…	…	…	…
Number of wells (#)	…	…	…	…	…
Pipelines (km)	…	…	…	…	…

D.2.2 Petroleum and Natural Gas Production Forecasts

The SEEA should compare potential oil and natural gas reserves accessible in the planning area under the base case scenario with those estimated to be accessible under alternative plan scenarios, and then use this information to estimate future oil and natural gas production levels. Developing a model to project future production based on proved/potential reserves and anticipated markets involves significant work and consultation, and this level of analysis may not be appropriate in all circumstances. For example, the establishment of new protected areas would reduce the land area available for exploration (unless directional drilling was permitted), likely meaning fewer available reserves and lower production over time. Similarly, if lands outside protected areas were subject to stricter controls under a land use plan (for example, zones in the Muskwa-Kechika Management Area), the increased costs may mean that fewer reserves would be developed in future. The production estimates can then be used to estimate implications of the land use plan for employment (area residents and non-residents) and provincial government revenues (annual production royalties and land bonus bid revenues). An example of the presentation of the effects to production is provided in **Table 2**.

Table 2 Scenario Effects on Petroleum Sector

Indicator	Base Case Scenario	Alternative Plan Scenario	Difference
Total estimated potential oil production volume (million m^3)			
Total estimated potential natural gas production volume (billion cubic feet or trillion cubic feet)			
20-year average exploration/production jobs (person-years)			
• Area residents			
• Other B.C. residents			
Average annual B.C. government revenue ($ millions)			

The information gathered can also contribute to the discussion in other sections of an assessment (i.e., with respect to economic activity, B.C. government finances, environmental risk and social values in communities (see **Appendix E**).

Appendix E: Tools for Economic Impact Analysis

Indirect employment and income (from spending on supplies and services) and induced employment and income (from spending by direct and indirect employees) play an important economic development role in plan areas and the province as a whole. For example, the spending of forest sector companies and their workers supports much economic activity locally and elsewhere in the province. When conducting a SEEA, it is important to have a practical, reasonably accurate and technically valid way to estimate the extent of the indirect and induced activity.

E.1 Assessing Local Area Effects

Multiplier estimates developed by BC Stats are based on an economic base method. At the local area level, economic base multipliers are derived from assumptions that define certain sectors as basic for a region (e.g., forestry, tourism and mining) and that drive the local economy by bringing income into the local area from outside the local area. The basic sectors are distinguished from non-basic sectors (e.g., service and retail sectors) that depend on the local spending of businesses and workers in basic industries.[21]

The BC Stats Local Area Economic Dependencies is based largely on Census Labour Force Survey data and produces multipliers for local areas and broader regions (land and resource management plan areas, forest districts, health service delivery areas and health authorities).[22] **Table E-1** presents examples of multipliers for the forestry sector.

[21] Note that the concept of the non-basic sector is associated with induced effects: the non-basic sector relies on induced economic impacts.

[22] Other data sources used by BC Stats to construct the local area dependencies (in addition to census data) include Tourism BC's Visitor Survey, the BC Input-Output Model, Statistics Canada's Survey of Household Spending, and Canada Revenue Agency tax filer information.

Table E-1 Sample Forestry Employment Multipliers for Selected Communities, 1996 and 2001*

Community	1996			2001		
	Logging	Wood Products Manufacturing	Pulp & Paper	Logging	Wood Products Manufacturing	Pulp & Paper
Fort St. John	1.30	1.33	1.66	1.21	1.48	1.97
Prince George	1.40	1.40	1.81	1.34	1.56	2.10
Prince Rupert	1.41	1.35	1.67	1.28	1.44	1.90
Williams Lake	1.34	1.37	n/a	1.24	1.43	1.83
Campbell River	1.39	1.32	1.60	1.38	1.41	1.88
Squamish	1.40	1.32	1.72	1.32	1.47	1.94
Kamloops	1.39	1.35	1.79	1.36	1.46	2.17
Kelowna	1.42	1.34	1.69	1.38	1.41	1.97
Nelson	1.35	1.37	1.82	1.27	1.44	1.95

Note: *Multipliers are calculated as (direct+indirect+induced) / direct. Sources: Horne (1999; 2004).

The above "no-migration" multipliers assume that incomes of unemployed workers are supported by Employment Insurance and other social assistance, and they also assume that changes in direct employment do not result in migration into or out of the plan area.

BC Stats also estimates "migration" multipliers that are appropriate to use when it seems clear that migration out of (in the case of direct job loss) and into (in the case of direct job gains) the plan area is likely to occur. It is appropriate to use "migration" multipliers when the size of the impact is proportionately large compared to the size of the community affected. "Migration" multipliers are typically higher than "no-migration" multipliers.

Apply the estimated multiplier to the direct effects to calculate total income and employment effects. For example, **Table E-1** indicates that the local area multiplier for logging jobs in Fort St. John is 1.21 (2001 estimate). This means that each logging job is associated with an estimated 0.21 indirect and induced jobs in the Fort St. John area.

As indirect and induced effects can change over time, impacts in the short and long term should be separately identified, along with an indication and explanation of the range and nature of uncertainty in the estimates. The significance of such impacts may be more clearly understood if presented in both absolute terms and as a proportion of the industry and community workforce.

Finally, note that there are uncertainties associated with the census statistics on which the multipliers are based, especially when small numbers of survey respondents are involved. This reinforces the need to view the multiplier estimates as rough indications only.

E.2 Provincial Economic Development Implications

Evaluating provincial direct, indirect and induced employment and income impacts uses evaluation principles similar to those for local economic effects, with the added consideration of direct and indirect/induced impacts that occur outside the plan area. Three steps are involved:

1. Identify industries or activities outside the plan area that are directly dependent on resources in the area due to inter-regional flows of resources (e.g., log trading, downstream processing).
2. Estimate the impact of the plan scenarios on production, income and employment of these directly dependent industries or activities outside the area.
3. Apply estimates of provincial income and/or employment multipliers to the direct income and employment impacts both within and outside the area to obtain an estimate of the total provincial impacts.

Note that the above three steps generate estimates of "gross" economic income and employment impacts that assume that factors of production such as labour do not have alternative uses in the provincial economy. The SEEA should estimate incremental impacts, or qualify the estimates of gross impacts, after considering alternative employment opportunities for labour within the province.

Identifying Linked Provincial Activities

Resource-dependent industries or activities outside the plan area generally consist of industrial downstream activities (e.g., wood manufacturing, natural gas processing, mineral smelting), complementary activities (e.g., multi-destination tourism) or resource migration (e.g., ocean fisheries). For harvesting-related industries like forestry or fisheries, resource flows must be traced to identify the direct dependence on resources in the plan area. For the tourism industry, identifying direct dependence outside the plan area requires considering the type of tourism that takes place within the plan area and its relationship to tourism in other areas.

The assessment for all sectors must also consider the extent to which total provincial activity is affected or is simply being diverted or redistributed within the province. For example, a resource management scenario may not affect the number and spending of visitors from outside the province, at least in the short to medium term, but may affect where they visit in B.C. Consultation with industry and government specialists will likely be the main source of this information.

Provincial Direct Impacts

To estimate the impacts on direct employment and income outside the plan area, start by considering the nature and extent of the linkage between the affected industries and the resources in the area (e.g., plan area exports of resources for further processing in B.C.). The estimated impacts of the alternative plan scenarios on the relevant resources can then be used to estimate production impacts. Resource utilization or migration models may be available to assist in this estimation.

For example, salmonid enhancement production models can be used to estimate the extent and location of fish harvesting and processing impacts. If such models are not available, consult with industry or resource specialists.

To estimate income and employment impacts, multiply production impacts by estimates of the provincial-level income and employment generated per unit of production (see **Section 3.2.1**). This analysis should also take into account any affected workers who reside outside the plan area but work in the plan area (e.g., in log harvesting, mining exploration and tourism lodges).

Provincial Indirect and Induced Impacts

Sum the estimated direct income and employment impacts outside the plan area with the direct impacts within the plan area to estimate the total provincial direct impacts of each plan scenario. Multiplying these direct impacts by provincial-level income and/or employment multipliers will then indicate total income and employment impacts in the province (i.e., direct plus indirect and induced; **Table E-2**). Use the provincial multipliers generated by the B.C. Input-Output Model to estimate provincial indirect and induced impacts.

Table E-2 Calculating Total Provincial Economic Impacts

	Direct Impacts Within Plan Area
+	Direct impacts outside plan area
=	TOTAL direct impacts (i.e., impacts in all industries directly dependent on the area's resources)
x	Multiplier estimate (Total Direct + Indirect + Induced) Direct impacts
=	TOTAL PROVINCIAL IMPACTS

In 2020, the Ministry of Forests, Lands, Natural Resource Operations and Rural Development presented revised provincial forest economic multipliers with combined impacts from forestry and logging, wood product manufacturing and paper manufacturing.[23] The ratios presented in the tables below are from the ministry.

Table E-3 Impact per Million m^3 of Harvest (Excludes Waste and Reject) – Dollar Values in Millions (2015 basis)

	Output	GDP	Household Income	Employment	Provincial Tax Revenue
Direct	$315	$100	$68	749	$7.8
Total (Direct +Indirect + Induced)	$423	$160	$106	1288	$11.9

[23] See Forest Economic Multipliers developed by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development available at https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/forest-industry-economics/economic-state/bc_forest_economic_multipliers.pdf

E.3 Techniques to Assess Net Economic Value

Approaches for estimating net economic value (discussed in **Section 3.4.3.2)** for the forestry, mining, agriculture, tourism, and recreation sectors are illustrated in **Table E-4** and **Table E-5**. The tables also briefly describe the rationale for the estimates. Data sources for net economic value are discussed in **Appendix G: Data and Information Sources**.

Table E-4 Example of Net Economic Value for Key Industrial Sectors

Sector	Example of Public Sector Rent	Example of Labour Rent	Example of Industry Rent
Forestry	Average stumpage over one business cycle after inflation	5% for total direct payroll in logging and manufacturing activities mainly to reflect the relatively high wages in that sector	Assumed to be minimal; between 1995 and 1999, the B.C. forest industry reported earnings that might be considered to be below a "reasonable average return"
Mining	Mining and mineral taxes	5% for direct payroll in mining sector mainly to reflect the relatively high wages in that sector	Assumed to be minimal; between 1991 and 2000, the B.C. mining industry reported losses in six of the prior 10 years, therefore below what might be considered a "reasonable return on capital"
Agriculture/ Ranching	Range fees	5% for direct payroll; while wages are relatively low there may be additional social benefits associated with local employment	Assumed to be minimal
Tourism – guide outfitting guided angling adventure tourism	Various licensing and other fees	5% for direct payroll; although wages are relatively low, there may be additional social benefits associated with local employment	Assumed to equal 5% of total industry revenues, to reflect the fact that the backcountry tourism sector may be extracting economic rents from the exceptional natural setting of B.C.

Table E-5 Example of Net Economic Value for the Recreation Sector

Recreation Activity	Recreation Days	Approximate Expenditures per Day
Resident hunting	Hunter days	$91
Resident sport fishing	Sport fishing days	$355
Snowmobile activities	Recreation/visitor days	Locals: $556 Non-locals: $342
Camping	Camping days, resident and non-resident	$152
Hiking, trail running	Recreation days, resident and non-resident	$83
Total recreation days	Total days	3,545,112
Recreation	Net economic value=additional willingness-to-pay* minus actual user costs*	
Willingness to pay for recreation activity	Depends on activity and source of data	

Note: *See 2019-2023 Oregon Statewide Comprehensive Outdoor Recreation Plan Supporting Documentation Part B: Total Net Economic Value from Residents' Outdoor Recreation Participation in Oregon for a comprehensive report. Available at: https://recvaluation.forestry.oregonstate.edu/sites/default/files/Total_Net_Economic_Value_FINAL.pdf

Appendix F: Tools for Environmental Risk Assessment

F.1 Habitat Supply Modelling

Habitat supply models may provide useful data for risk assessment, offering a way to forecast habitat availability over time similar to timber supply models. Habitat supply models provide an output that can depict the spatial distribution and total amount of suitable habitat available at discrete time periods and various planning scales (B.C. Ministry of Sustainable Resource Management 2004, R. Keith Jones and Associates 2002). Habitat supply models typically estimate how much habitat or seral stage will be present at discrete time periods (e.g., 0, 20, 50 or 100 years) and compare that amount to a predefined benchmark with established thresholds.

Landscape-level habitat supply models, such as SELES (Spatially Explicit Landscape Event Simulators), and TELSA (Tool for Exploratory Landscape Scenario Analysis), can provide useful insights into potential consequences of forest development planning at sub-regional planning scales.

In the absence of these types of habitat supply models, surrogate models can be developed using existing databases and timber supply models. As an example, the availability of mature and old forests over time can be extracted from the timber supply runs using, for example, the Spatial Timber Supply Model that runs on SELES. This may be most helpful for mature and **old-growth** dependent species (e.g., marten). The availability of mature and old forests over time could be further broken down by biogeoclimatic subzone/variant and contributing timber harvesting land base and non-contributing land bases. If these tools are used, however, it is critical to describe the relative importance of habitats that occur on the timber harvesting land base relative to habitats that occur outside of it (i.e., non-contributing areas).

Note that the amount of mature and old-growth forest that occurs in non-contributing areas is often assumed to simply grow old with time. Incorporating natural disturbance regimes (fire, insect, wind throw) is recommended as it provides a more realistic view of forested habitat availability over time.

F.2 Area Analysis – Alternative Approach

In the absence of habitat supply models or surrogate models for key indicators, the analysis may have to rely on static area summaries of habitat generated by a GIS. These GIS summaries could be used to determine how much habitat occurs in each existing and proposed resource management zone category (e.g., hectares of habitat in parks, special, general, enhanced timber zones) for selected environmental values. The main indicator used to assess each environmental value is the percentage of habitat indicator occurring in each of the resource management zone categories. To facilitate the interpretation of the area analysis, the management objectives and strategies must be considered explicitly, reflect the resource management zone intensity level (e.g., a special resource management zone can be differentiated from a general resource management zone) and be clearly differentiated from base case management strategies.

Typically, wildlife habitat **suitability maps** (1:250,000) would be developed by the B.C. Ministry of Environment and Climate Change Strategy for various species of management concern. The wildlife maps usually depict areas of high, moderate and low habitat values within the plan area, and, depending on the relative abundance of each habitat rating class, the high or high/moderate suitability classes could be used as the primary habitat-based indicator.

Within each resource management zone, the land base may be further broken down into areas potentially available for logging (i.e., the timber harvesting land base), forested areas presently excluded from logging (i.e., "forested exclusions") and non-forested areas. These area summaries can provide useful insights on the potential impacts of logging. While forest areas in the operating land base outside the timber harvesting land base generally have a lower probability of being logged than areas inside the timber harvesting land base, such areas should not be treated as protected areas in the analysis (i.e., it cannot be assumed that environmental values would not be disturbed).

The potential impact of other industrial or commercial activity on the environment, such as mining and commercial backcountry recreation, also needs to be addressed. In these instances, considering the "non-contributing" land base also becomes important, and the amount of gross habitat should be used as the primary indicator. Depending on the types of resource development activities in the plan area, other possibilities include intersecting wildlife habitat suitability maps with high mineral or tourism capability maps to determine the degree of conflict and, hence, potential risk.

Although the primary shortcoming of this approach is the inability to *quantitatively* forecast habitat availability over time (i.e., habitat supply), the area analysis can be used *qualitatively*, for example to conclude that mature and old-growth habitat that occurs in an enhanced timber zone will decline over time and is likely incompatible with maintaining old-growth-dependent species. Other limitations of the area analysis approach are related to the resultant area statistics themselves.

Seemingly small overlaps between wildlife habitat and the timber harvesting land base should be interpreted cautiously. This is particularly important for those species that have distinct seasonal habitat requirements (e.g., grizzly bear) and depend on areas that may only occur in valley bottoms. Thus, although the total amount of habitat at risk may be small, the seasonal habitats may be disproportionately affected. This kind of shortcoming can be avoided if fish and wildlife habitat mapping is developed to identify the distribution of specific seasonal habitats (e.g., spring feeding) or life requisites (e.g., nesting, spawning habitat).

Similarly, exercise caution when interpreting the amount of habitat area that falls outside the timber harvesting land base. Although some of these excluded areas can be viewed as land that contributes to the overall maintenance of biodiversity, their ability to function ecologically is related to their areal extent (i.e., patch size) and how they are spatially distributed over the landscape. That is, although the cumulative area may be large, this does not necessarily imply that these areas are all functioning as natural and viable ecosystems. Furthermore, human disturbance and resource development activities that occur within the timber harvesting land base itself can reduce the suitability of excluded areas, depending on their proximity.

In addition, some management objectives and strategies may apply to the whole plan area, limiting the interpretation of resource management zones.

F.3 Additional Environmental Risk Assessment Resources

B.C. Ministry of Forests. 1997. Forest Service Simulator (FSSIM) Beta Release. Users Manual. Available at: https://www.for.gov.bc.ca/ftp/HTS/external/!publish/FSSIM/docs/fssim_users_manual.pdf.

B.C. Ministry of Sustainable Resource Management. 2004. Resource Analysis Guide for Sustainable Resource Management Planning. Vol. 1. Available at: https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/policies-guides/resource_analysis_guide_w_appendices_srmp.pdf.

R. Keith Jones and Associates. 2002. A Strategy for Habitat Supply Modeling for British Columbia. Draft Volume 1. Available at: https://www.for.gov.bc.ca/ftp/hfp/external/!publish/FFT_Documents/Silviculture_Strat_Documents/pdffiles/HSM-Strategy-Vol-I-FINAL-Project-Rpt.pdf.

Technical Working Group. 2019. Haida Gwaii Timber Supply Review Analysis Report. Report for the Haida Gwaii Management Council. Old Massett, Haida Gwaii, B.C. Available at: http://www.haidagwaiimanagementcouncil.ca/wp-content/uploads/2019/11/HG_TSR_Result_report_Nov14_final.pdf.

Appendix G: Data and Information Sources

DISCLAIMER: Data sources listed in **Table G-1** are current as of March 2021; however, government and many other websites are subject to change. If a link does not work, we suggest that you conduct an Internet search for the document title or contact the relevant agency for a current reference. Current data sources and categories may be added to or superseded as knowledge is gained through ongoing land use planning and provincial and Indigenous initiatives. Engagement activities are invaluable in helping to identify relevant reports and data sources for specific planning initiatives. Additional references are provided throughout the guidance in text boxes and the list of references (**Section 4.0**).

Table G-1 Data and Information Sources for Plan Assessment

Data/Information Type	Document/Link	Source
General Land Use Planning		
Modernized land use planning in British Columbia	www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/modernizing-land-use-planning	B.C. Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD)
Active land use planning projects	www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/active-lup-projects	FLNRORD
Marine Plan Partnership for the North Pacific Coast	mappocean.org/	Marine Plan Partnership
Land use plans and legal direction by region	www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/regions	FLNRORD
Resource Analysis Guide for Sustainable Resource Management, Volume 1 (2004)	www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/policies-guides/resource_analysis_guide_w_appendices_srmp.pdf	FLNRORD
Socio-Economic and Environmental Assessment – Archived		
Morice Land and Resource Management Plan: Socio-economic and Environmental Assessment (2008)	www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/skeena-region/morice-lrmp/morice_lrmp_seea.pdf	FLNRORD
Socio-Economic Assessment of Haida Gwaii / Queen Charlotte Islands Land Use Viewpoints (2006)	www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/westcoast-region/haidagwaii-slua/socio_economic_assesstment_land_use_viewpoints.pdf	FLNRORD

Data/Information Type	Document/Link	Source
Indigenous Governance and Law		
B.C.'s *Declaration on the Rights of Indigenous Peoples Act* Truth and Reconciliation Commission Calls to Action Métis Nation Relationship Accord	www2.gov.bc.ca/gov/content/governments/indigenous-people/new-relationship	Province of B.C. B.C. Ministry of Indigenous Relations and Reconciliation
Land and Marine Use Data		
iMapBC	Geographic dataset map viewer: www2.gov.bc.ca/gov/content/data/geographic-data-services/web-based-mapping/imapbc	Province of B.C.
B.C. Consultative Areas Database Contacts for First Nation Consultation Areas	maps.gov.bc.ca/ess/hm/cadb/	Province of B.C.
Coastal Resource Information Management System (CRIMS)	Coastal resources map viewer: www2.gov.bc.ca/gov/content/data/geographic-data-services/topographic-data/coast	Province of B.C.
ParcelMapBC	Titles and public land map viewer: ltsa.ca/products-services/parcelmap-bc/	B.C. Land Title & Survey
Government Access Tool for Online Retrieval (GATOR)	Crown land and title registry: www2.gov.bc.ca/gov/content/industry/crown-land-water/crown-land/gator	Province of B.C.
B.C. Visual Landscape Inventory Visual resource management	www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/visual-resource-management/visual-landscape-inventory	FLNRORD
Major projects inventory	www2.gov.bc.ca/gov/content/employment-business/economic-development/industry/bc-major-projects-inventory	Ministry of Jobs, Economic Recovery and Innovation
B.C. Environmental Assessment projects	Map viewer: projects.eao.gov.bc.ca/	B.C. Environmental Assessment Office
Climate Change Data		
Greenhouse gas emissions data and inventories	www2.gov.bc.ca/gov/content/environment/climate-change/data	Province of B.C.
Environmental reporting B.C.	www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/reporting/environmental-reporting-bc	Province of B.C.
Climate resilience data explorer	adaptwest.databasin.org/pages/climate-resilience-data-explorer/	Conservation Biology Institute
Climate data and models	cfcg.forestry.ubc.ca/projects/climate-data/	University of B.C. Faculty of Forestry: Centre for Forest Conservation Genetics
Climate change scenarios	pics.uvic.ca/	Pacific Institute for Climate Change Solutions
Meteorological data portal	www.pacificclimate.org/data	Pacific Climate Impacts Consortium
Environmental Resources		
BC Species and Ecosystem Explorer CDC iMap	www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre/explore-cdc-data	B.C. Conservation Data Centre

Data/Information Type	Document/Link	Source
Species listed in *Species at Risk Act* (Sch. 1)	www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html	Government of Canada, Species at Risk Public Registry
Biogeoclimatic Ecosystem Classification (Archive) Natural disturbance types	www.for.gov.bc.ca/hre/becweb/	Ministry of Forests and Range, Research Branch
Terrestrial Ecosystem Mapping (TEM) Predictive Ecosystem Mapping (PEM) Sensitive Ecosystems Inventory (SEI)	www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre/explore-cdc-data/known-locations-of-species-and-ecosystems-at-risk/mapping-methods/ecosystems	B.C. Conservation Data Centre
Economy – General		
Provincial and territorial input-output multipliers	www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610059501	Statistics Canada
B.C. Provincial and Local Area Multipliers and Dependencies (2004)	frst318.forestry.ubc.ca/files/2013/01/2004-British-Columbia-Provincial-Economic-Multipliers-and-How-to-Use-Them.pdf	Gary Horne, BC Stats
B.C. economic accounts and GDP Economic indicators, household spending B.C. consumer price index	www2.gov.bc.ca/gov/content/data/statistics/economy/bc-economic-accounts-gdp www2.gov.bc.ca/gov/content/data/statistics/economy/other-economic-statistics www2.gov.bc.ca/gov/content/data/statistics/economy/consumer-price-index	Province of B.C.
Forestry		
Timber supply review and annual allowable cut	www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/timber-supply-review-and-allowable-annual-cut	Ministry of Forests, Lands, Natural Resource Operations and Resource Development
Wood flow analysis	www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/skeena-region/northcoast-lrmp/analysis_woodflow_coast_region.pdf	Ministry of Forests, Lands, Natural Resource Operations and Resource Development
Harvest billing system Historical timber harvest levels and stumpage rates	www2.gov.bc.ca/gov/content/industry/forestry/competitive-forest-industry/timber-pricing/harvest-billing-system	Ministry of Forests, Lands, Natural Resource Operations and Resource Development
Forest industry economics	www2.gov.bc.ca/gov/content/industry/forestry/competitive-forest-industry/forest-industry-economics	Ministry of Forests, Lands, Natural Resource Operations and Resource Development
Major primary timber processing facilities in British Columbia (2018)	www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/fibre-mills/2018_mill_list_report_final.pdf	Ministry of Forests, Lands, Natural Resource Operations and Resource Development
Forest industry statistics	forresweb.com/associations/coast-forest-products-association/	Coast Forest Products Association
B.C. forest industry workforce review (2007)	www.w-o-l-f.ca/wp-content/uploads/2015/01/BC_Forest_Workforce_Review_April_2007_FERIC.pdf	FP Innovations – FERIC
Mining and Mineral Resources		
Mineral occurrences and mineral potential (industrial and metallic)	MINFILE database: minfile.gov.bc.ca/	Ministry of Energy, Mines and Low Carbon Innovation
B.C. mine information	mines.nrs.gov.bc.ca/	Ministry of Energy, Mines and Low Carbon Innovation

Data/Information Type	Document/Link	Source
B.C. mining industry statistics	www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/further-information/statistics	Ministry of Energy, Mines and Low Carbon Innovation
Assessment Report Indexing System (ARIS)	Assessment reports from mineral exploration and development properties: www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/british-columbia-geological-survey/assessmentreports	B.C. Geological Survey
Coal Assessment Reports (COALFILE)	webmap.em.gov.bc.ca/mapplace/coal/search.asp	B.C. Geological Survey
Oil and Gas and Petroleum Resources		
Oil and gas industry statistics	Production statistics: www2.gov.bc.ca/gov/content/industry/natural-gas-oil/statistics	Ministry of Energy, Mines and Low Carbon Innovation
Royalties	www2.gov.bc.ca/gov/content/industry/natural-gas-oil/oil-gas-royalties	Ministry of Energy, Mines and Low Carbon Innovation
Oil and gas reserves	www.bcogc.ca/data-reports/reservoir-management/reserves/	BC Oil and Gas Commission
Petroleum sector activities	www.bcogc.ca/data-reports/data-centre/?category=4398/	BC Oil and Gas Commission
BC OGC open data portal	data-bcogc.opendata.arcgis.com/	BC Oil and Gas Commission
Tourism and Recreation Information		
Provincial tourism indicators	www2.gov.bc.ca/gov/content/data/statistics/business-industry-trade/industry/tourism	Province of B.C.
Performance indicator reports	www.destinationbc.ca/research-insights/type/industry-performance/	Destination BC
Outdoor adventure tourism sector profile	www.destinationbc.ca/content/uploads/2018/05/Tourism-Sector-Profile_OutdoorAdventure_May2014.pdf	Destination BC
B.C. guide outfitters by region	www.goabc.org/bc-regional-map/	Guide Outfitters Association of B.C.
Recreational fishing information	www2.gov.bc.ca/gov/content/industry/agriculture-seafood/fisheries-and-aquaculture/recreational-fishing	Province of B.C.
Hunting and harvesting activity	www2.gov.bc.ca/gov/content/sports-culture/recreation/fishing-hunting/hunting/hunting-data	Province of B.C.
Social and economic impacts of B.C. recreation sites and trails (2011)	www.orcbc.ca/wp-content/uploads/2019/07/RSTBC-Economic-1.pdf	Outdoor Recreation Council of British Columbia
Coastal Resource Information Management System (CRIMS)	Map viewer: www2.gov.bc.ca/gov/content/data/geographic-data-services/topographic-data/coast	Province of B.C.
Agriculture		
Census of Agriculture (2016)	www.statcan.gc.ca/eng/ca2016	Statistics Canada
Agriculture and seafood statistics	www2.gov.bc.ca/gov/content/industry/agriculture-seafood/statistics	Province of B.C., Statistics Canada
Aquaculture		
Current B.C. aquaculture licence holders	open.canada.ca/data/en/dataset/522d1b67-30d8-4a34-9b62-5da99b1035e6	Fisheries and Oceans Canada

Data/Information Type	Document/Link	Source
Socio-Economic Data		
Socio-economic profiles Population subgroups (people with disabilities, children and youth, seniors) Population projections Migration figures Census profiles for Indigenous Peoples	www2.gov.bc.ca/gov/content/data/statistics/people-population-community	BC Stats
Census profiles (2016 Census) Aboriginal population profiles (2016 Census)	www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E	Statistics Canada
B.C. regional and community statistics	www2.gov.bc.ca/gov/content/data/statistics	BC Stats, Statistics Canada
B.C. local governments	Links to BC local government information: www2.gov.bc.ca/gov/content/governments/local-governments	Province of B.C.
Community Health and Well-Being		
Municipal health profiles Community health service area profiles BC Community Health Atlas	communityhealth.phsa.ca/	Provincial Health Services Authority
Health and Well-being of Children and Youth	www.childhealthindicatorsbc.ca/	B.C. Office of the Provincial Health Officer
First Nations health status and service offerings (2018)	www.fnha.ca/about/news-and-events/news/report-offers-new-data-on-first-nations-health-status-and-service-usage-in-bc	First Nations Health Authority
Archaeological, Paleontological and Heritage Information		
Archaeological resources	www2.gov.bc.ca/gov/content/industry/natural-resource-use/archaeology	Province of B.C.

Appendix H: Glossary

Account: A category of the human or natural environment that has social, cultural, economic, health, environmental or other implications that are inclusive and flexible to the values of partners and stakeholders within the planning area.

Adaptive management: An approach that can be used to take action when unforeseen effects occur or the need for new or modified mitigation is identified.

Additive effect: Refers to a combined effect being the same as the sum of each individual effect (see cumulative effect).

Alternative scenario: A proposed change in land use and management practices in the plan area. The planning group will develop alternative scenario(s) to meet the management objectives of the land use plan, informed by results of engagement activities. A SEEA considers the potential economic, social, cultural and environmental implications of the alternative scenarios against the base case scenario.

Archaeological impact analysis: Also known as archaeological impact assessments, an archaeological impact analysis focuses on potential impacts to known sites and includes field investigation under permit to identify sites. This analysis is more detailed than an archaeological overview assessment. An archaeological impact analysis mainly applies to development projects that are subject to B.C.'s environmental impact assessment and review processes. However, the same principles can also apply to other developments.

Archaeological overview assessment: Refers to a study that compiles existing knowledge about recorded archaeological site locations, historical Indigenous land use, and cultural and environmental constants and changes in the area likely to affect site location. This information is used to build a model of where archaeological sites are expected to be located.

Area analysis: Using a Geographic Information System (GIS), an area analysis generates area-based statistics by overlaying mapped values upon one another in a computer database. This analysis is used in a SEEA to provide the hectarage of each resource value (e.g., grizzly habitat, timber harvesting land base, etc.) in each resource management zone (e.g., special management, general, agriculture-settlement and protected areas).

Base case scenario: This is the status quo, or a prediction from baseline (i.e., existing) conditions in the plan area. The base case scenario consists of existing and expected resource management strategies and land use designations, as well as the existing and expected socio-economic and environmental trends in the area.

Basic sector: Economic sectors such as such as forestry and tourism that provide direct employment and income in a region.

B.C. Input-Output Model: A model developed by BC Stats that includes a detailed set of B.C. industry/commodity accounting data that simulate the structure of the B.C. economy via a set of equations that describe the relationships among sectors. A major use of the model is to provide quantitative estimates at the provincial level of the indirect and induced employment impacts caused by a change in the output of a particular sector, such as forestry.

Bequest value: In economic analysis, a non-commercial, non-use value that describes the benefit from knowing that an environmental attribute can be available to future generations.

Biodiversity (biological diversity): The diversity of plants, animals and other living organisms in all their forms and levels of organization, including genes, species, ecosystems and the evolutionary processes that link them.

Biogeoclimatic zone: Represents an area with unique combinations of climate and flora at regional to local levels. A zone is a broad regional macroclimate and vegetation, such as the Sub-Boreal Spruce Zone. Further classifications include subzones (regional assemblages) and variants (sub-regional climate). The Biogeoclimatic Classification System is a hierarchical system of ecological classification combining three classification themes – climatic, vegetation and site – that uses climate and vegetation/soils data to produce a classification of ecosystems at regional to local levels (University of British Columbia Faculty of Forestry ndb).

Carbon sink: A carbon sink is any natural system that accumulates and stores carbon-containing compounds, lowering the concentration of carbon dioxide in the atmosphere. Vegetation (including forests) and the ocean are key carbon sinks.

Coarse filter: Refers to an approach for identifying indicators of ecological integrity. Coarse filters are ecosystem elements that provide for the vast majority of species, including indicators that represent ecosystems across the landscape and seascape; umbrella or wide-ranging species that have habitat that potentially also provides habitat for a wide array of other species; species that have a disproportionately higher ecological role than is suggested by their biomass; and indicator species that are sensitive and require a broad set of ecosystem elements.

Community-based participatory research: A partnered approach to research that includes all members of the community in primary research activities, with community-based researchers helping to guide and co-ordinate research activities.

Comprehensive SEEA: Addresses a number of complex environmental, cultural, resource management and/or economic development issues where there is the potential for significant effects to key values, such as large employment impacts, or alternative scenarios that contribute substantially to cumulative effects.

Condensed SEEA: Addresses a small number of land use planning issues of low complexity or contentiousness. Analysis is limited to a comparison of a base case scenario to a single alternative scenario.

Cost of living analysis: This analysis helps identify whether local inflation effects (due to increased demand for goods and services relative to supply) may differentially affect economically vulnerable population groups. A cost of living analysis is often used as a socio-economic determinant of health and it may also be assessed for the employment and income economic sub-account.

Critical value approach: In a SEEA, this is a comparison of economic values stemming from alternative uses of lands and marine areas. For example, while the environmental benefits of land protection may not be readily quantifiable, the estimated economic benefits associated with resource development may be considered to outweigh a qualifiable environmental loss. This comparison might be aided by estimating critical values on a per capita or per household basis.

Cultural impact analysis: A method of analysis that evaluates the implications for cultural values and practices of Indigenous Peoples associated with management changes in the plan area, identified through scoping, community engagement (e.g., meetings, interviews, land-based engagement, focus groups and workshops), ethnographic interviews, oral histories and studies. This type of analysis may be approached through community-based participatory research.

Cumulative effects: These are changes to socio-economic and environmental values caused by the combined effect of past, present and potential future activities and natural processes. Cumulative socio-economic or environmental effects result from the incremental effects of multiple activities and land uses, which may have minor direct impacts that add up to a major impact when combined.

Determinants of health: The suite of socio-economic and environmental factors that influence the physical and mental health of people and communities, ranging from economic factors (e.g., income and employment) to social (e.g., social networks and access to health services) and environmental (e.g., air and water quality). Determinants of health for Indigenous people may vary substantially from those for non-Indigenous people due to cultural, historical and ensuing social, economic and environmental factors.

Differential effects: Refers to understanding how some populations may be more vulnerable to negative effects from management decisions, while other groups may be better able to take advantage of positive effects. Factors that influence differential effects include age, sex, economic factors (e.g., employment, income level and skills), ethnicity, gender, health status, geographic location and many others (Status of Women Canada 2020a). The consideration of differential effects is often termed **gender-based analysis plus** (GBA+), referring to how gender and many other factors intersect to influence how different people or groups may experience differential effects of policies, programs, and initiatives.

Direct employment and income: The change in employment and income that occurs as a direct result of a change in industry activity (e.g., mill jobs affected due to a change in timber processed in that sawmill).

Economic efficiency: In the context of a SEEA, economic efficiency is concerned with maximizing the net economic value of resources in a plan area. Economic efficiency is achieved by allocating resources to uses such as forestry, recreation or carbon storage that generate the greatest value.

Economic impact analysis: An analytical technique that estimates the impacts of a land or resource management plan or initiative on income and employment in specific communities, regions or the province as a whole.

Ecosystem: A functional unit consisting of all living organisms (plants, animals and microbes) in a given area, together with the non-living physical and chemical features of their environment, which are interconnected through nutrient cycling and energy flow. An ecosystem can be of any size – a log, pond, field, forest or the earth's biosphere. Ecosystems are commonly described according to the major type of vegetation, for example, a forest ecosystem, old-growth ecosystem or range ecosystem.

Emission sources: Sources of particles and gases associated with air pollution and climate change effects (e.g., industrial emissions, vehicle emissions and smoke from wildfires and human uses).

Employment coefficient or ratio: In forestry, the number of person-years of direct forestry employment associated with the timber harvest for a particular area, divided by that area's harvest volume. The result provides the ratio of person-years of employment associated with each 1,000 cubic metres of timber harvest.

Existence value: In economic analysis, a non-commercial, non-use value derived by people from knowing that something exists (e.g., wilderness), even if they do not intend to use it.

External value driver: A contributor to cumulative effects that cannot be controlled by planning, such as climate change.

Extirpation risk: Risk of local extinction, or disappearance of a species or ecological community from the wild in B.C. Species or ecological communities that no longer exist in British Columbia may occur elsewhere.

Fine filter: Refers to an approach for identifying indicators of ecological integrity. Fine filters focus on special ecosystem elements that are likely to not be maintained by relying on coarse filters, such as key ecosystem processes, particular species at risk or rare habitat.

Focused SEEA: Addresses planning issues of moderate complexity or contentiousness, such as a limited set of issues across a large area, or a larger number of issues across a smaller area. The base case scenario is compared with a limited number of alternative scenarios.

Fossil impact assessment: An analysis to describe fossil resource potential. A fossil impact assessment process includes a review of resources inventory, a systematic pedestrian field study, an evaluation of the resources and management recommendations.

Gender-based analysis plus: Also referred to as differential effects analysis, this method of analysis examines how gender and many other factors intersect and influence how different people or groups may experience differential effects of policies, programs and initiatives.

Habitat: The specific environmental conditions under which species or a group of species lives, which is usually determined by physical and abiotic factors (e.g., soil, temperature range, moisture, etc.) and biotic factors (food availability, presence of predators, etc.) that support survival and reproduction.

Health impact assessment: This assessment specifically considers the direct physical effects on human health (i.e., related to environmental determinants of health), as well as effects on selected social determinants of health. A health impact assessment may be used to estimate the effects of actions of a planning scenario on selected health indicators for people living in or associated with the plan area.

Hedonic pricing: Hedonic pricing is used to estimate the effect of a non-market value such as ecosystem services or the environmental quality of environmental amenities on a market value, such as housing prices (e.g., Ma 2010).

Heritage impact analysis: Developed for assessing the potential impacts of a project on protected heritage sites and developing appropriate mitigation measures. The approach may also be applied to a SEEA for a planning initiative. The objectives of the heritage impact assessment for a plan would be to evaluate and understand the heritage values and significance of designated sites; identify and evaluate heritage resources within the project area; and identify and assess all impacts on heritage resources which might result from the plan.

Indicators: Used to determine how socio-economic and environmental conditions associated with the plan area may change as a result of the change in management direction (i.e., to understand the potential effects of implementing alternative scenarios). Potential indicators are informed by planning issues and concerns identified by the planning group and through primary and secondary research activities.

Indigenous knowledge: Indigenous knowledge may be defined as "…complex knowledge systems that reflect the unique cultures, languages, governance systems and histories of Indigenous Peoples from a particular location" (Government of Canada 2021). However, there is no universally accepted definition of Indigenous knowledge, and different Indigenous groups, organizations and individuals may define Indigenous knowledge differently in consideration of their unique culture and worldview. Reflecting Indigenous knowledge in a SEEA is subject to the discretion of the knowledge holder and their respective Indigenous nation.

Indirect employment and income: Employment and income generated by other industries that supply goods and services to the basic sector (e.g., trucking companies, legal firms, equipment suppliers). A change to indirect income or employment refers to workers in businesses that supply goods or services to the firm or sector that is experiencing the direct impacts, e.g., a change in machine shop (indirect) employment due a change in (basic sector) sawmill activity.

Induced employment and income: Employment and income that is generated by workers spending their wages in industries that sell goods and services to consumers (e.g., food, gas, accommodation). A change in induced income or employment refers to workers in businesses that rely on purchases of goods/services from wage-earners in the direct and indirect sectors experiencing the impacts (e.g., variations in motor vehicle sales to workers due to changes in sawmill or machine shop activity).

Interaction matrix: A matrix/table useful for the scoping phase of a SEEA that analyzes the draft accounts and indicators to identify the degree of overlap between selected indicators and plan scenarios (Table 2.2).

Long-term harvest level: The estimated annual harvest projection for unmanaged timber stands that is sustainable for an indefinite time period in a particular management unit, assuming that management constraints and other assumptions remain unchanged. The long-term level is based on the long-term timber productivity of the management unit and does not normally take into account the positive effects of managed silvicultural treatments on available timber volumes. In recent timber supply reviews by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development, the long-term level is assumed to occur between approximately years 80 and 180.

Management objectives: Management objectives define the desired future state of land, water and resources relevant to the modernized land use planning initiative. The planning group will define management objectives early in the planning process and use them to guide plan development.

Management practices: The guidelines, policies and plans that inform the approved use and conditions of use of a plan area or zone and incorporate processes for monitoring, reporting, developing, adapting and executing the policies. In a modernized land use planning context, management practices are based on the goals for environmental sustainability and future development directions developed by the planning group. Management practices include the development of strategic and operational plans and policies in accordance with Indigenous governance and laws and with provincial legislation, regulations and guidelines.

Mineral occurrences: Documented evidence of site-specific mineralization. Occurrences are divided into producing mines, past producing mines, developed prospects (occurrences with defined grades and tonnages), prospects (occurrences with some indication of dimension) and showings (occurrences that are not sufficiently defined to permit resource estimation.)

Mineral potential: Mapped estimates of the areas of the land base that are judged by the Ministry of Energy, Mines and Low Carbon Innovation to have either "high", "medium" or "low" capabilities for producing future mineral discoveries.

Mitigation: A measure that reduces the negative impacts of a particular action.

Monitoring programs: Monitoring programs are used to track the performance of identified indicators after the land use planning initiative has been implemented, to confirm that the effects predicted by the SEEA are as predicted and that mitigation measures are implemented and effective.

Multiple accounts analysis: This method is used to assess socio-economic and environmental impacts associated with changes in land use. A multiple accounts analysis separates potential impacts into different accounts or categories so that comparisons can be made among impacts on different values (e.g., forestry, wildlife, traditional land uses, mining, community values) within alternative scenarios and against the base case scenario.

Multiplier: A variable that, when calculated in the form of a numerical estimate, provides a quantitative approximation of the indirect and induced income/employment impact caused by a prior direct change in income/employment. Multipliers are applied to the direct income/employment impacts in resource industries to estimate the total income and employment effects in both the plan area and the province overall. For example, an employment multiplier of 2.0 for forestry would mean that each direct forestry job is associated with one additional "spin-off" job. Provincial-level multipliers are larger than local multipliers because at the local level a greater proportion of income "leaks" out of the area as people purchase goods and services in other towns.

Negative externalities: Refer to any costs that are caused by a resource activity but are not financially incurred by those directly involved in the activity but imposed on third parties. Examples could include noise and pollution created by a resource activity.

Net economic value: For SEEA purposes, net economic value refers to economic efficiency, and it may be calculated as the present value of revenues minus the present value of costs, accounting for returns to labour, capital and resources.

Net greenhouse gas (GHG) flux: Refers to net levels of GHGs resulting from both GHG emissions and carbon storage.

Net present value: A "lump sum" measure of the value of all future net government revenue impacts (positive and negative) over the entire time frame of analysis discounted to the present. The value in today's dollars of a future stream of cash payments, is predicated on the concept that a dollar received in the present is worth more than a dollar received in the future, since funds received in the present will earn interest immediately.

Non-basic sectors: Economic sectors such as retail services and accommodation that rely on basic sectors and spending by the employed labour force.

Non-commercial values: In economic analysis, effects on non-commercial values are evaluated to determine net economic value. Non-commercial values are grouped into two categories: use values and non-use values. Use values are associated with the direct consumption or use of the resource, such as the use of backpacking trails or the consumption of ecosystem goods and services such as a community's reliance on hydrological resources in a plan area for clean water. Non-use values are sometimes referred to as "preservation" or "passive use" values and consist of three types: option values, existence values and bequest values (see glossary entries).

Non-timber resource: Resources within the forest other than timber that include but are not limited to biological diversity, fisheries, wildlife, water quality and quantity, recreation and tourism, cultural and heritage values, and wilderness and aesthetic values.

No-regrets strategy: A strategy that can be enacted now without complete information (i.e., with uncertainty) about the effects of climate change. Measures can be taken that are precautionary, to respond to negative effects of climate change before they intensify and are justifiable whether expected effects occur or not. Such measures increase resilience, such as investing in green technologies and infrastructure, or changing management practices to reduce air and water pollution (e.g., Dillingham 2020, Overpeck and Udall 2010).

Old growth (forest): Several definitions are possible depending on the forest type and natural disturbance regime. Typical characteristics include: 1) moderate to high canopy closure, 2) a multi-layered, multi-species canopy, 3) a wide range in tree ages and sizes (including very large), 4) presence of large diameter standing dead and down-and-dead trees and 5) the occurrence of decadence in the form of broken branches, limbs or tops, which create a variety of canopy openings. The Biodiversity Guidebook (1995) identifies age class targets by natural disturbance type for old growth.

Operability effects: These occur when timber that was previously marginally economic to harvest becomes uneconomic due to the increase in costs (e.g., B.C. Ministry of Agriculture and Lands 2007). The operable forest is the portion of the productive forest that, under the current market conditions, can be logged economically.

Opportunity cost: The cost of choosing one option over another, or the value of the next best option that was not chosen.

Option value: In economic analysis, a non-commercial, non-use value that describes the benefit of maintaining the possibility of future use.

Person-year: One year of full-time work (e.g., one person working for 12 months or two people working six months). Person-year estimates are often used to facilitate comparisons of employment impacts among different sectors where seasonal jobs are an important component, such as in forestry or tourism.

Plan area: The area covered by a land use plan.

Planning group: Provincial and Indigenous government planning partners in a government-to-government approach, in collaboration with local governments, communities, industry, non-government organizations and other stakeholders.

Primary source: Information that is collected directly, through observations, interviews, workshops, surveys and ethnographic research.

Protected area: Land and/or water set aside from development by legislation in order to protect representative examples of the province's natural diversity and special features.

Qualitative: Qualitative data is descriptive and based on observation or perspective (e.g., factors affecting population change).

Quantitative: Quantitative data is measurable or counted as a quantity (e.g., total population).

Range of natural variability: Refers to the spectrum of ecosystem states and processes that are observed over long periods of time; typically referring to the range of ecosystem structures and processes existing before European settlement (Gayton 2001).

Recreation opportunity spectrum (ROS): A Ministry of Forests, Lands, Natural Resource Operations and Rural Development inventory that classifies the land base into various categories based on road density. ROS #1 (primitive non-motorized) is defined as areas greater than 5,000 hectares and more than eight kilometres from a four-wheel drive road, ROS #2 (semi-primitive non-motorized) is defined as areas greater than 1,000 hectares and more than one kilometre from a four-wheel drive road, and ROS #3 (semi-primitive motorized) is defined as areas greater than 1,000 hectares and more than one kilometre from a two-wheel drive road. ROS #4 and #5 (resource roaded) constitute the remaining land base.

Resilience: In environmental risk assessment, the ability of the resource value to resist or recover from human disturbance. Similarly, in a socio-economic setting, community resilience is the ability of a community or group to withstand, adapt to and recover from adversity.

Resource impact analysis: An analysis of the impacts on the physical units of a resource (e.g., m^3/year of timber, tonnes of mineral production, wildlife populations) resulting from changes in land use. This analysis is usually provided by the provincial resource agencies (e.g., Ministry of Forests, Lands, Natural Resource Operations and Rural Development timber supply analysis) and is based primarily on the area analysis (see above).

Riparian: An area of land immediately adjacent to a stream, river, lake or wetland that contains vegetation that, due to the presence of water, is distinctly different from the vegetation of adjacent upland areas.

Risk: Describes a situation where there is a chance of loss or danger, such as the risk of increased wildfires from climate change effects. In a SEEA, risk can be characterized as the effects of uncertainty on management objectives.

Secondary source: Publicly available information source identified through desktop research methods. Used in a SEEA for scoping activities to identify planning issues and concerns and to identify baseline conditions in the planning area. May be verified by primary sources (see above).

Sensitivity analysis: This method of analysis is used to identify the range of possible results. The method identifies the amount of variation in the input parameters for a given value that will affect the results. For example, economic impact analyses using input-output models can be run using a range of capital expenditures as inputs, associated with a range of future commodity price scenarios. A sensitivity analysis should be a standard part of quantitative analyses, but the technique can also be applied to qualitative assessment (such as a qualitative estimate of the likelihood of an outcome).

Short-term harvest level: The estimated annual timber harvest projection for a management unit that can be maintained from the present time for a specific limited period, usually less than several decades, assuming management constraints remain unchanged. Since the short-term harvest level is based primarily upon the stock of available mature timber, there can in fact be an infinite number of short-term harvest levels depending on how fast the harvesting of mature timber is assumed to occur.

Site series: Sites with similar soil nutrient and moisture regimes that would support the same climax plant species association within sub-regional areas. Each site series unit is named using the dominant vegetation, e.g., Hybrid Spruce/Douglas Fir – Pinegrass (SBSdw3/01).

Social impact analysis: Refers broadly to the collection of techniques for assessing the social, economic and cultural effects of planning scenarios, but may more specifically refer to effects on demographics, local government and community concerns.

Species at risk: A species that is considered to be at risk of being lost (or has been lost) from an area (extinct, extirpated, endangered, threatened, special concern).

a. Any wildlife species that, in the opinion of the deputy minister of Environment, Lands and Parks or a person authorized by the deputy minister, is threatened, endangered, sensitive or vulnerable

b. Any threatened and endangered plants or plant communities identified by the deputy minister of Environment, Lands and Parks or any person authorized by that deputy minister as requiring protection, and

c. Regionally important wildlife as determined by the deputy minister of Environment, Lands and Parks or a person authorized by that deputy minister.

Stakeholders: In a SEEA context, stakeholders include local and regional government; communities; forestry, mining, and oil and gas interests; conservation and environmental protection advocates; individual tourism operators and tourism associations; commercial fishing industry, aquaculture; hunters and trappers; farmers and ranchers; recreational groups and associations; and other special interest groups (Province of B.C. 2021b).

Sub-account: Used to further divide an account to narrow the focus.

Suitability/capability: Pertaining to mapping of wildlife suitability or capability: an interpretation of the suitability of an area or habitat type to provide the greatest potential to support a given species. The present habitat condition or successional stage is considered, and therefore suitability refers to the current seral stage and condition of the habitat.

Synergistic effect: A combined effect is greater than the sum of each individual effect (see cumulative effect).

Threshold: A limit beyond which cumulative change becomes a concern, such as extensive disturbance to a habitat resulting in the rapid collapse of a fish population, or when contaminants in soil suddenly appear in potable water supplies.

Timber harvesting land base: That portion of the land base of a defined management unit (e.g., a unit such as a forest district or timber supply area) considered by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development to be available for long-term timber supply. Therefore, from the gross land base, areas known as "forested exclusions" (e.g., non-merchantable timber) and non-forested exclusions (i.e., alpine areas) are "netted out" in arriving at the timber harvesting land base. It is assumed that forested exclusions generally contribute more to non-timber values, such as wildlife habitat, than do non-forested exclusions. Note that the timber harvesting land base often changes over time.

Timber supply model: A computerized analytical tool that, after inputting the appropriate data and assumptions (e.g., timber harvesting land base or growth rate of timber), provides forecasts of potential annual short- and long-term harvest levels over time.

Trade-off: Describes a situation where an increase in one type of value is associated with a decrease in another type of value, such as the relationship between economic output and environmental effects.

Traditional ecological knowledge: A form of Indigenous knowledge that generally refers to local, long-term observations about the environment that are held by individual knowledge holders. Traditional ecological knowledge is complementary to Western scientific data and can help reveal long-term trends for applications such as fisheries and wildlife surveys and understanding the effects of climate change.

Traditional use study: A study that is carried out by or on behalf of individual Indigenous nations and can focus on a specific context or area. Traditional use studies can help identify and provide oral history, Indigenous knowledge and current use information about important potentially affected traditional use sites and respective activities, through such means as narrative, photographs, spatial mapping and drawings.

Uncertainty: A partial or total lack of understanding about an event or result. In a SEEA, uncertainty could be associated with a lack of knowledge about the consequences and likelihood of planning scenarios.

Use and occupancy map survey: A method that combines interviews with knowledge holders and documenting place-based activities on a map to document oral histories and current uses of lands and waters by Elders and other knowledge holders in the community.

Values: In a general SEEA context, refers to any tangible or non-tangible aspect of the natural or human environment that is considered to be of importance in the planning area.

Value drivers: Things that drive, or influence, the condition of values. Key indicators may be value drivers, and the concept also overlaps with the concept of pressure indicators (indicators of pressures or stresses).

Watershed: An area of land that collects and discharges water into a single main stream through a series of smaller tributaries.

Western knowledge: Refers to the system of knowledge based on a European worldview, which is the basis for current Canadian and provincial legislation and policies (B.C. Environmental Assessment Office 2020a).

Wetland: A general term used to describe areas of land that are inundated by surface or groundwater for a long enough period of time to support vegetation that is distinct from adjacent upland areas and require saturated or seasonally saturated soils. Typical wetland types include swamp, marsh, bog and fen.

BRITISH COLUMBIA

Ministry of
Forests, Lands, Natural
Resource Operations
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