

Ecosystem Based Management Challenges to EBM for Alberta and Saskatchewan Forests

Section A: Values and Paradigms

fRI Research Healthy Landscapes Program

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A. VALUES AND PARADIGMS

This section covers EBM challenges, opportunities and recommendations associated with the highest level of consideration related to values and management paradigms. Included are “big picture” topics that set the stage for how and why policy, planning, and management occur and considerations to better implement EBM.

Alberta and Saskatchewan forests are facing increasing pressures from human uses, but pressures are not evenly distributed. Burgeoning population growth is increasing human use especially near major population centres and transportation corridors. Resource demands are increasing and are at or over ecological capacity in some areas. Overlapping resource use, especially between the forest and energy sectors, creates very busy landscapes in many areas. Human impacts and alterations to forest environments, ecological processes, and ecological conditions are increasing. Fire management, climate change, and invasive species are active challenges. Interwoven are changing social norms and differing frames and perspectives about how forests should be managed.

“EBM is not a ‘nice to do’, we have to ask ourselves if we can afford not to do it. EBM is an opportunity to optimize between competing values which provides a way to address some of the big challenges and ensure long term sustainability.” (Anonymous SME).

A1. SOCIETAL EXPECTATIONS

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The biggest challenge to implementation of any form of forest management, including EBM, is to successfully engage and reconcile societal expectations for how people want public forests to be managed. Understanding the diverse perspectives of diverse stakeholders contributes to addressing the wicked problem that is EBM (DeFries and Nagendra 2017). EBM cannot resolve all societal expectations and differences but it does provide opportunities to explore them cooperatively to seek common understanding toward improving forest management (Figure A1).

CHALLENGES

“Explanations exist; they have existed for all time; there is always a well-known solution to every human problem – neat, plausible, and wrong.” (H.L. Mencken 1920).



- Human opinions and agendas differ widely and there will always be differences in opinion about whether or not to apply EBM or do something else, and how to apply EBM if

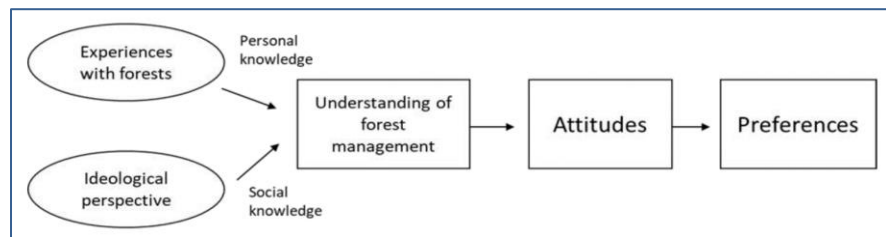


Figure A1. Conceptual model illustrating the factors thought to drive public attitudes and preferences (Kreye et al. 2019).

that is the direction to be followed. The challenge is to communicate the potential benefits of EBM as a contribution to the ongoing discourse (Mencken 1920).

- The collective will of society is constantly changing, which challenges the ability of processes to measure how well the collective will is being met (Government of Alberta 2009).
- Public ignorance and indifference towards forest management appears to be growing (Kreye et al. 2019).
- Substantial proportions of society view forests as stable ecosystems that they are strongly oriented to protect (Robinson et al. 2001; Ramirez 2021). This is the opposite of a scientific view that understanding disturbance regimes is requisite to understanding and conserving nearly every ecological process and value in a forest (Asner 2013). Raising awareness about the natural dynamics of forest ecosystems and the role that disturbance plays in driving variation to maintain ecological integrity and human wellbeing is a major challenge.
- Environmentalism tends to see humans as apart from nature and the ecosystems of which we form part, a worldview that Cronon (1996) said is doomed to failure. Even so, the “we are not part of nature” worldview is pervasive in society and is a huge challenge to EBM.
- The prevailing view of society about very large and very old trees is that they should be protected forever because the conditions that exist in many of these forests and ecosystems are non-renewable in any reasonable time frame (Gorley and Merkel 2020). This “let it be” approach makes sense when forest ecosystems are many centuries old and change very slowly through gap dynamic processes, but even then, there is a subjective question about how much to protect. The let it be approach also generally works in forests with frequent disturbances where the natural disturbance regime is allowed to continue, such as the non-commercial forests of the two provinces. Protection does not work well over the long term in dynamic forests where the natural regime is curtailed by policies such as fire suppression in commercial forests and some protected areas. For these areas, public perception of protection as a desirable “one size fits all” approach is a challenge.
- Public values and opinions are often focussed on specific activities rather than the outcomes of the activities (although outcomes are usually implied). For example, many people oppose forest fires of any kind (Dods 2002). More than half of survey respondents thought there was too much logging to sustain other values (Robinson et al. 1997). There is widespread opposition to



clearcutting (Bliss 2000), herbicides (Buse et al. 1995; Kayahara and Armstrong 2015), old-growth logging (Gorley and Merkel 2020), use of non-native or genetically modified trees (Hajjar et al. 2014), and many other forest management activities. Getting people to focus on outcomes first is a challenge, and some practices are likely to be opposed regardless of whether or not they lead to positive outcomes or avoid negative outcomes.

- Public perceptions about very dynamic fire-adapted Alberta and Saskatchewan forests are influenced by media, controversy, and comparisons with old-growth forests in temperate and tropical rainforests where trees grow to be very large and very old (e.g., Chase 2017; Dauvergne 2017).
- In Saskatchewan, public calls for managing fire-adapted forests in the same way as temperate gap-dynamic forests were so common (and vexing) that the Government of Saskatchewan developed communication materials pointing out the difference (SME interviews).
- Decision-making processes related to forests have long been dominated by federal and provincial governments, the forest sector, and professional foresters and other scientists (Harshaw et al. 2009). Some feel that land-use planning outcomes in Alberta and Saskatchewan have also been dominated by economic and political considerations (Kennett and Schneider 2008; Passelac-Ross 2011). This remains the case despite implementation of forest management public advisory committees for commercial forest tenures, (Parkins et al. 2006) public engagement processes related to forests (Sheppard and Meitner 2005; Passelac-Ross 2011), and increasing engagement of Indigenous people and communities (Wyatt et al. 2013; Baker and Westman 2018).
- Non-foresters have significantly more diverse forest values than foresters do (Harshaw and Tindall 2005).
- Disagreements are not easily resolved by education when they reflect fundamental differences between different segments of society. They are social problems that demand social solutions which address fundamental questions about the values (Mulder and Palmer 1994).
- Ecosystem management decisions that may seem to be a simple matter of setting scientific limits on resource use frequently fail because of the political process of decision-making, differing values and norms, and power imbalances (DeFries and Nagendra 2017). Most environmental change drivers are social and many of the biggest challenges facing EBM are social, economic and political (Newing 2010).
- Effective integration of diverse and differing values, knowledge, and information is a challenge for all forest management approaches.
- Limited knowledge about EBM and potential benefits is a challenge. People are unlikely to support things they are unfamiliar with.
- Insufficient communication about EBM is a challenge. This includes definitions, comparisons of similarities and differences from current management.



- Information about forests and forest management and availability of information to the public is highly variable in both provinces. Improving public and transparent access to information is a challenge.
- While some conflicts can be resolved with education, demonstration, and evaluation, others are not resolvable due to insufficient scientific understanding and are not amenable to scientific solutions (Mulder and Palmer 1994).
- Social science is under-represented in EBM theory (Newing 2010), and current understandings of social issues are fragmented and limited (Gilani et al. 2018). This could be part of the long-standing “nature-culture” divide that separates physical and biological sciences from social sciences (Berkes et al. 2008; Gilani et al. 2018).

RECOMMENDATIONS

"If people spend more time working on shared outcomes and less time arguing about specific rules and practices, they will find that they agree more than they think." (Anonymous SME).

- Beliefs that humans are part of nature and that nature is valuable and should be protected against unbridled development are not mutually exclusive or incompatible (Keeling 2008). One of the biggest opportunities is to increase broad societal support for more effective integration of diverse and differing values, knowledge, and interests in relation to forests and forest management. An opportunity could be a non-technical general discussion paper about what EBM is, how it compares to current forest management, and value propositions related to individual values, risks, adaptive capacity, etc. This could include that EBM strives for a balance and provides opportunities to reconcile ecological integrity and human wellbeing (Figure A2).
- There is widespread support for updated strategies and policies for the management of forests. An inclusive and collaborative process to develop and build consensus toward EBM would be supported (SME interviews).
- Most survey respondents, irrespective of sector or geography, saw value in considering an integrated, broader ecosystem approach as they manage their sector (Marshak et al. 2017, SME

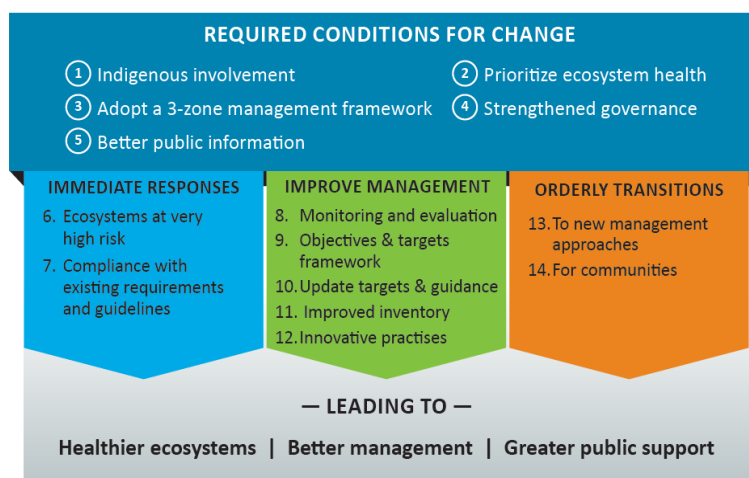


Figure A2. Summary of EBM-compatible recommendations for old-growth forest management in British Columbia (Gorley & Merkel 2020).



interviews). The opportunity is to develop between-sector communication materials and dialogue to explore opportunities for mutual benefit through EBM.

- More social science tools to complement existing approaches to understanding attitudes, beliefs, and perceptions of broad sections of society in relation to forest management (Harshaw et al. 2009).
- Individuals respond to presented evidence using complex evaluative schemes and surveyed people were often willing to change their initial opinions about forest management when given more information about the probable outcomes (Fischhoff and Fischhoff 2001). This highlights an opportunity to build conversations and value propositions about EBM and link them to the values, outcomes, and challenges that people think are important.
- Wellbeing concepts are dependent on cultural and geographic contexts (Mathews and Izquierdo 2008).
- Canadians consistently place more value on forest ecological integrity than on economic uses (Robinson et al. 1997). Public attitudes appear to support innovative policy strategies and perceptions of forest health, in addition to economic impact, will likely be the metrics society uses to assess the value of policy alternatives (Kreye et al. 2019). This provides opportunities for communication and discussion of EBM as a framework for implementing innovation.

A2. EBM VALUE PROPOSITIONS

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There is widespread agreement that the related concepts of ecosystem health, integrity, and resilience are primary forest management goals. Sustaining ecological integrity in turn sustains the goods, services, and other benefits that support human wellbeing. Managing with ecological integrity and resilience in mind recognizes that humans are part of ecosystems and that ecosystems are ultimately limited by the environment. There is no way to sustain humans over time without sustaining ecosystems (Grumbine 1997).

These concepts aren't unique to EBM; most are part of the current approach to managing forest ecosystems. Many EBM aspects are already included, with some quite far advanced in implementation and others still at the concept discussion stage. Why then should Alberta and Saskatchewan societies be interested in further EBM improvements? The short but not informative or persuasive answer is that EBM offers attractive improvements to the way we manage now. EBM can't solve all the challenges, but it does recognize and address many of the major shortcomings.

More EBM improvements are beneficial because existing planning and management goals have not been good enough (Slocombe 1998; Noss et al. 2006; Newman 2019) and it is desirable to build resilience by actively maintaining or enhancing ecological processes and increasing the capacity of ecological and human systems to cope with new or altered disturbance regimes and climate change (Pope et al. 2014; Chambers et al. 2019).



It is unclear if there is sufficient societal support to further advance EBM implementation. Moving in new directions will likely be difficult and take a considerable amount of time (SME interviews).

For change to occur there must be widespread dissatisfaction with the *status quo*. This is because it has recognized shortcomings or because credible forecasts of the future on *status quo* pathways reveal undesirable outcomes or unacceptable risks that a majority of people wish to avoid. In relation to forest management in Alberta and Saskatchewan, if people feel that current forests and their management are unsatisfactory or they believe that future forests will be worse, they may invest in moving toward a better vision for their future forests, and they may embrace EBM as a way to get there. Even if these conditions are met substantial numbers of people will subscribe to the eco-protection paradigm, the “don’t fix what isn’t broken”, “let it be” mantras, and many others will simply be ambivalent or ignorant.

A value proposition is a promise of value to be delivered, communicated, and acknowledged. In relation to EBM, a successful value proposition should convince an individual interested in forest management that EBM will be of more value to them than current approaches. In other words, an EBM value proposition answers the question of “*What’s in it for me?*” in relation to values people care about.

EBM value propositions can be developed for the *Five Ws* of problem-solving processes: why, who, what, when, and where. Value propositions from science, Traditional Knowledge, and general audience perspectives would be useful. It would be helpful to develop value propositions for individual values that are already recognized by societies as being important.



Box A1 provides an outline of a value proposition about how old-growth conservation could be improved by applying an EBM approach.

Box A1. EBM Value Proposition Example: Old Forest (Old-growth)

Aspect: Societal concern about losing old forests due to exploitation, especially logging.

VBA approach to old forest conservation:

- *No provincial-scale policies, directions, or plans.*
- *Mature-old forest has increased in protected areas that apply wildfire suppression. Continued increases will be concurrent with increased risk of fire, insects, and disease, which will occur periodically. Protected area managers either have no plans for disturbance-based management or have been unable to disturb at planned rates.*
- *Requirements to set old forest targets in commercial forest FMPs, minimum quantity standard in Saskatchewan.*
- *In commercial forests current approaches will eventually lead to old forest primarily in the passive landbase with very little on the active landbase.*
- *Old forest in non-commercial forests is probably within NRV because the historic fire regime is relatively intact.*
- *Old forest is not being managed in ecological units, at a variety of scales, and over time.*

EBM approach to old-growth conservation

- *Define old forest using ecological criteria (structure, composition, and function, not merely age).*
- *For multiple-scale ecological units:*
 - *Determine natural range of variation of old forest (proportion, composition, patch size, structure etc.).*
 - *Inventory of current conditions.*
 - *Scenarios of possible future forests using forecasts of management alternatives. Old forest is one of many indicators.*

Value Proposition

A comprehensive and inclusive societal discussion to choose a scenario that becomes an EBM plan with quantitative targets for old forest for relevant ecological units over whole landscapes over a long-term planning horizon. Use NRV to inform targets. Old forest targets are reconciled with all other values including wood supply and costs and offer a realistic pathway and plan for implementation with good prospects for achieving targets.

- *Implementation and adaptive management to achieve continual improvement.*
- *Public reporting and regular updates of plans and conditions in the forest.*

To be implemented, alternative forest management frameworks that offer positive prospects for affordably fixing shortcomings and producing better outcomes are needed. The value propositions must be compelling enough that people will accept associated risks and invest in change.

CHALLENGES

“Societal temperament in the past decade would suggest that a holistic “ecosystem-based approach” is no longer optional, but rather an adaptive, all-encompassing necessity in the attempt to accommodate multiple competing interests on forest landscapes.” (Anonymous SME).



- Existing forest management in Alberta and Saskatchewan compares favourably to other provinces and countries, but there are significant criticisms (Šimunović et al. 2018) and known shortcomings (Nocentini et al. 2017).
- Generalized value propositions about EBM as a management paradigm are increasing but they are still in the minority compared to messages about SFM and about individual values.
- SFM is perceived to be primarily a forest industry concept (SME interviews) and EBM is perceived to be primarily an academic ecological initiative (SME interviews).
- There are few value propositions that show how EBM could help to resolve known issues with contemporary forest management. The challenge is to recognize both strengths and weaknesses of existing management and growing pressures and then to use the information to develop value propositions for improvements through EBM.
- There are not enough EBM value propositions that are comprehensive, understandable, relatable, persuasive, and presented in non-technical ways that audiences understand and support.
- There are few EBM value propositions presented in terms that people are used to and directly addressing values that they are concerned about (Box A1). Lack of topic-specific value propositions is a challenge to increasing social support for EBM. Examples:
 - A value proposition that shows how EBM could be a better approach to species at risk recovery than the *status quo* approach.
 - A value proposition that shows how EBM could better maintain economic wood supplies for commercial forests.
- Taken as a whole over the 30–40 years since EBM first became prominent, there has been considerable progress in EBM implementation in Alberta and Saskatchewan (VanDamme et al. 2014; Odsen et al. 2019). Most of the improvements have been made by ‘adding to the pile’ of forest management driven by disjointed value-based initiatives managed by different institutions and focussed on activities rather than outcomes. This may lead to inefficiencies, ineffectiveness, and gridlock that contributes to missed opportunities or outcome failures for both ecological integrity and human wellbeing. The challenge is to recognize and rectify these issues to achieve better overall outcomes.

RECOMMENDATIONS

“There haven’t been convincing arguments to change the status quo. Politicians are focussed on votes and jobs. They need a reason to support EBM that speaks to those issues. Public servants aren’t usually wanting to rock the boat and stick their neck out for something new that may be controversial. Industry and others that want EBM have to partner and lobby the political level to get support.” (Anonymous SME).

- *“Show people, especially politicians, what’s in it [EBM] for them, in terms they understand and think are important.” (Anonymous SME).*



- Consider building a summary value proposition structured around what EBM aims to achieve (ecological integrity and human wellbeing) and also how to get there: manage to bring forests closer in structure, function, and composition to healthy, natural forests at all stages of successional development (Palik and D’Amato 2017). Include the processes to plan and set EBM targets.
- At its core EBM is a positive initiative intended to improve ecological integrity and human wellbeing by reducing risks associated with human actions. There is an opportunity to create value propositions related to reduction of known and perceived risks of current management. Examples:
 - Reducing natural disturbances through wildfire suppression alters ecosystems and leads to fuel buildups that increase risks of catastrophic wildfires.
 - Forests with more-natural mosaics of ages and ecological conditions are more resistant to pressures such as climate change and more resilient to their effects.
- Value propositions that speak directly to those who have interest in specific values, pointing out both positive and negative aspects of current approaches and the same for EBM alternatives. The propositions should include logic for why EBM approaches are equivalent to or superior to existing approaches.
- Top-level commitment to EBM is critical and could be supported by organization-specific business cases that show how EBM compares to *status quo* approaches.
- Opportunities to partner on common definitions and value propositions could help to increase common understandings and support (Canadian Boreal Forest Agreement 2010, 2015).

A3. FORESTS ARE DYNAMIC

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One of the key philosophical foundations underpinning EBM is the understanding of natural patterns, how they change and are sustained over time, and how that knowledge should inform management. All forests change over time within predictable ranges. Change is ecologically important and must be maintained over the long term to maintain ecological integrity (Hunter 1993; Noss et al. 2006). Most ecosystems establish a dynamic equilibrium of species abundance, community structure and landscape patterns produced by interactions of the disturbance regime, species competition, and the inherent topography, soils, and climate contexts (Turner et al. 1997). This complex dynamic is captured by the natural range of variation (NRV) and is subject to change over longer periods as the foundations that create NRV change (climate, species extirpations and establishments, etc.). Resistant ecosystems require more forcing to change the dynamic equilibrium and resilient ecosystems quickly return to dynamic equilibrium after disturbances (Cushman and McGarigal 2019). Human activities such as over-harvesting, species introductions, and alterations to disturbance regimes that reduce NRV and resilience



can cause shifts in dynamic equilibriums (Chambers et al. 2019). A key EBM foundation holds that maintaining forests within or closer to NRV is the lowest risk path to long-term sustainability of forest ecosystems within the inherent productive capacity of each ecosystem type across forest landscapes. Managing using an NRV strategy is also a key aspect of ecological resilience to maintain the capacity of forests to absorb, persist, and adapt to change (Curtin and Parker 2014).

CHALLENGES

“Protection from disturbance such as fire or logging is a choice. It deliberately interferes with ecological function and, in the long term, ecological integrity. In EBM protection as a tool has a role, but only after careful consideration of the consequences and likely ecological outcomes.” (Anonymous SME).

- The idea of ever-changing forests and the ecological necessity for continual change is an unwelcome and difficult concept for some people. Most people resist change, especially at local scales. Many decades of teaching that changes such as forest fires, floods, and logging are bad cannot be overcome quickly. A key EBM challenge is achieving social acceptance and support for management that embraces the need for, and plans for, ever-changing forests.
- Society has tended to focus on undesirable short-term ecological effects of disturbance and to compare those to undisturbed mature or old forests. When the change is due to human activity such as logging or prescribed fire, the appropriate comparison is to the natural disturbance that is being approximated; wildfire in this example.
- Short-term negative effects of disturbances are well documented and people tend to focus on negative aspects over positive, and short-term over long-term.
- Public perceptions of forests have been heavily influenced by conflicts and communications over management of tropical and temperate forests that have very large and very old trees and change slowly and at small scales through gap dynamic processes (Yamamoto 1992). These perceptions lead to protectionist views and opposition to large-scale forest changes that tend to be transferred to opinions about forests everywhere, including the very dynamic forests in most of Alberta and Saskatchewan.
- Small scale gap dynamics are an important ecological process in boreal forests (Cumming et al. 2000; McCarthy 2001) but forest dynamics are dominated by large scale disturbances, especially wildfires. Communicating the concept that managed disturbances should approximate the frequency and scale of disturbances in fire-prone forests is a challenge. Many people think all forests should be managed with infrequent gap dynamic scale disturbances and are averse to large natural disturbances (wildfires, insect/disease outbreaks, large windthrow events, floods, etc.). They are also against large-scale logging events for much the same reasons.
- Even if there was societal support for large disturbances it may not be practically feasible to create them with logging or prescribed fire (SME interviews).
- Land use designations have altered natural disturbance processes and introduced changes associated with human uses such as proliferation of human infrastructure footprints. Wildfire



suppression over about the last seven decades has altered forests in most areas with substantial human presence including protected areas and commercial forests (Andison et al. 2021). Logging is now a major change process in commercial forests but not for the passive landbase. Roads and other linear development features, and other human infrastructure, are now pervasive in many areas, as are non-native species. Change is occurring, but change has been altered. The challenge is to recognize and reconcile change processes that are managed or influenced by humans to better manage change for the benefit of ecological integrity and human wellbeing.

RECOMMENDATIONS

“The preservation paradigm is still in place today. EBM recognizes and manages change. New belief systems are needed to enable EBM.” (Anonymous SME).

- Opportunities to build support to manage for dynamic forests include research, demonstration, communication, and discussion of both natural processes and human activities designed to sustain them and the ecological conditions they produce. The [EBM Case Studies Project](#) is an example of an initiative that shows how alternatives to traditional approaches can work.
- Parks Canada has developed messages about the [role of natural disturbances](#) in maintaining ecological integrity. So has the [Government of Saskatchewan](#). These are examples of communications that could be expanded to encompass other forest lands in Alberta and Saskatchewan, and more audiences.
- Develop forest dynamics modules for K12 and graduate education (SME interviews).
- A forest EBM video game where users could select current forest conditions and human uses and design future forests that develop after user-selected choices. Winning the game occurs when the future forests have ecological integrity over time and supply a sustainable basket of benefits (SME interviews). The [Alberta Tomorrow](#) free online simulator is an existing tool that enables users to explore future forest scenarios.

A3.1 NATURAL RANGE OF VARIATION

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One of the key philosophical foundations underpinning EBM is the understanding of natural patterns, how they change and are sustained over time, and how that knowledge should inform management. The Natural Range of Variation (NRV; Box A2) is a quantitative representation of repeating natural patterns over time. The concept was introduced to characterize historic spatial and temporal variability as a part of ecosystem management (Cissel et al. 1994; Swanson 1994). Maintaining ecological aspects within or closer to NRV over time is most likely to sustain ecological integrity and the capacity of ecosystems to support themselves and human wellbeing (Slocombe 1993; Palik and D'Amato 2017). In essence, NRV defines ecological integrity for EBM indicators and an EBM strategy informed by NRV reduces risks associated with impairment of ecological integrity and the economic and social consequences that would follow.

Box A2. Natural Range of Variation

The range of natural ecosystem states and processes encountered over a long time period for a given area or aspect. In forest management, this commonly refers to the full range of ecosystem states and processes that occurred before major changes caused by non-Indigenous humans (pre-industrial condition). Because it is not possible to separate historic variation related to natural and human-caused sources (especially Indigenous burning and other activities) NRV is sometimes termed Historic Range of Variation (HRV). NRV also applies to biological consequences of ecosystem states and processes such as species population size variation.

CHALLENGES

- A general challenge is to increase understanding of forest change and the NRV concept as a way to characterize variation. Most people have likely never heard of NRV and many may struggle with abstract contexts like change of various measurable forest aspects over different geographic scales and time periods.

“NRV is a good concept but managers need to respond to heavily altered landscapes, the arrival of mountain pine beetle, ongoing climate change, etc. An NRV approach is still worthwhile to inform decisions but in many areas we have to be realistic about what can be done to remain within NRV.” (Anonymous SME).

- It is important to recognize that humans are part of nature and that humans were historically responsible for portions of disturbances and other alterations to ecosystems. Indigenous Peoples used fire as a tool (Murphy 1985; Lake and Christianson 2019) and we don't know how many historic fires were started by humans versus other sources. Accounting for and collectively managing all changes that can be influenced by humans is a central challenge of EBM.
- Alberta and Saskatchewan forests with altered natural disturbance regimes (mainly cessation of Indigenous burning and wildfire suppression) and increasing levels of human activities and footprints are now starting to show increasing divergence of forest conditions from NRV in many areas (Andison 2019, 2020).
- In protected areas wildfire suppression coupled with low rates of prescribed fire has reduced fire occurrence and altered ecological conditions and biological consequences. In National Parks with prescribed fire plans the number of ignitions and area burned has been lower than planned



for many decades (SME Interviews). The challenge is to find ways to increase disturbance to rates that maintain ecological conditions within NRV.

- In portions of both provinces where suppression is attempted for most wildfires the patterns of fires that do burn have been altered towards small fires that are extinguished or large fires that escape suppression efforts during extreme fire risk periods (SME Interviews).
- A series of very large fires in the Boreal Plains Ecozone in the past few decades has possibly altered NRV from a more natural mix of small and large fires (SME interviews).
- In commercial forests, management has long been concerned with reducing natural variability by trying to achieve stable ecological conditions (balanced forest age classes on the active landbase, wildlife habitat, etc.). Rules based on desires to maximize certain aspects (timber, harvestable wildlife, etc.) and minimize others (fire threat, flooding risk, visual impacts, etc.) act individually and in concert to create less-variable landscapes that are less resilient to disturbance (Thompson et al. 2009; Ibáñez et al. 2019), and less likely to provide sustainable supplies of the historical array of ecosystem services and other benefits (SME Interviews). Minimum standards intended to protect specific values (species at risk habitat, riparian protection, wetlands, etc.) also reduce natural variability and increase risks.

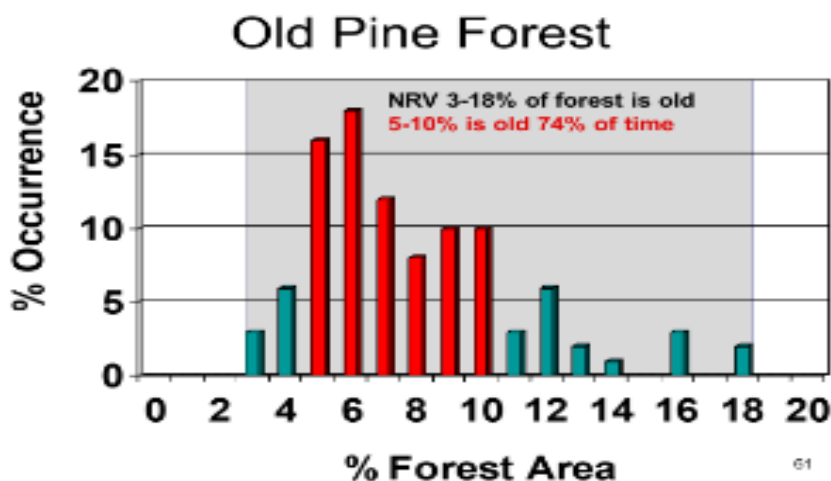


Figure A3. Example NRV distribution for old pine forest in an Alberta FMA in response to repeating disturbances over long periods. The pine forest type in this forest always had at least 3% old and never more than 18% old over time. Most often (74% over time) the proportion of old was 5–10%. The NRV frequency distribution can be displayed as means, medians, quartiles, or any other metric of interest.

RECOMMENDATIONS

“Past practices have moved forest conditions well outside the NRV produced by Mother Nature in many areas. Future forests would have lower ecological risks if conditions were moved closer to, or within NRV where that is feasible and practical.”
 (Anonymous SME).



- Humans are good at recognizing and using patterns, so there are many opportunities to increase understanding of NRV and how it can be used in EBM. One opportunity is to provide examples of typical NRV distributions for forest indicators that already have human interest (Figure A3).
- NRV is applicable to disturbances, ecological conditions, and biological consequences (Figure A4; Anderson et al. 2009). Ideally, patterns from each of these levels would be used as comparisons to measure overall EBM success. This is especially important where disturbance processes are altered (e.g., prescribed fire burn windows versus the full range of natural wildfire dynamics), substituted (e.g., logging instead of fire), or restricted (e.g., merchantable forest instead of flammable vegetation). Alterations, substitutions, and restrictions to natural ecological disturbance regimes may have unintended consequences so it is important to focus on outcomes and adjust actions (e.g., disturbances) to produce desired outcomes (e.g., seral stage patch sizes within NRV).
- There are many EBM opportunities to move closer to NRV by using an NRV strategy.
 - An initial step could be to prepare a discussion paper describing key aspects of forest patterns that have NRV, current NRV knowledge and conditions compared to NRV, guidance on using NRV to inform planning, and options to increase use of NRV in management planning.
 - Management plans at multiple levels that are based on NRV analysis and consideration.
 - Actions that increase variation within NRV.
 - NRV characterizations for indicators that have not yet been significantly used in forest management. Examples include wildlife habitat, watersheds and water metrics, species populations, carbon storage, etc.

The Healthy Landscape Model

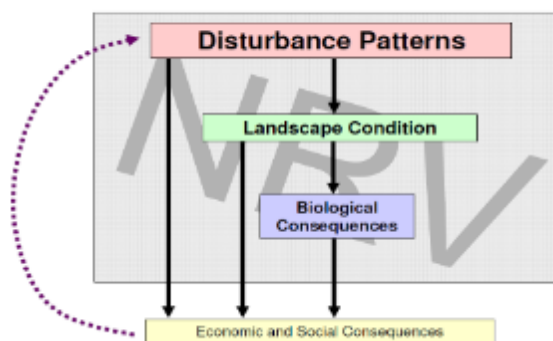


Figure A4. Healthy Landscape Model (Anderson et al. 2009).

A4. CLIMATE CHANGE AND ADAPTATION

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Climate change has many direct linkages to forests and forest EBM. Forest vegetation removes atmospheric CO₂ and stores carbon in biomass and soil carbon banks. Climate-associated changes to disturbance regimes, ecological conditions, and biological consequences are already occurring and driving concerns about future forests and management, which are the ongoing subject of much



discussion about effects and management options (Price et al. 2013; Boulanger and Pascual Puigdevall 2021).

Climate change, land-use change, burgeoning populations, and other stressors are rapidly transforming ecosystems and landscapes (Boulanger et al. 2019). Adaptive forest management strategies to conserve ecological integrity and support human wellbeing in ways that are resilient to environmental change are becoming more important than ever (Foley et al. 2005; Beller et al. 2020).

Forest carbon contained in biomass is directly related to ecological conditions and has an NRV, with changes roughly correlated to average tree age (Dale et al. 2000). Within NRV forests change back and forth between carbon sources (net carbon emissions) and carbon sinks (net carbon fixation) at any point in time (Kurz et al. 2008). Fire is the dominant driver of the carbon balance process (Bond-Lamberty et al. 2007). Carbon stored in soils, especially wetland soils, also has inputs and outputs but can continue to increase over time, especially for wetland soils (Scharlemann et al. 2014; Mayer et al. 2020).

In addition to ecological integrity impacts, climate change is likely to have related and far-reaching effects on human wellbeing. Adaptive capacity in society is the ability to be resilient and adjust to ecological changes driven by climate change.

CHALLENGES

“Alberta is on the climate change bullseye. It looks like risks of catastrophic fires will increase, and we need to get on that as fast as we can. Not all fires are equal, some have much different impacts, and some of the biggest fires now are record-setting and unprecedented, and produce unheard-of ecological impacts.” (Anonymous SME).

- Research is still mainly focussed on characterizing climate change and assessing potential impacts and vulnerabilities.
- Discourse about climate change actions is continuing in the theme of only looking at one value/challenge of a time, instead of a more integrated approach (Rayner et al. 2013; Delacámara et al. 2020). Disconnected initiatives like the [Canada 2 billion trees commitment](#) (Government of Canada 2021) and advocacy for [more forest protection in the name of climate change](#) (Moffatt 2021) are examples.
- Communication about needing to protect forests to reduce emissions and store carbon (Richards and Stokes 2004; Moomaw et al. 2019) is reinforcing public opinions against the value of disturbance in maintaining ecological integrity and creates unrealistic expectations about the possibility that forests could be protected from disturbance indefinitely. This is likely to challenge efforts to maintain disturbance to conserve ecological integrity. In particular, public opinions against fire appear to be increasing.
- Climate change has the potential to alter disturbance regimes, which increases uncertainty about the future and raises questions about the best way to use historical variation to inform future forest targets.



- Large wildfires, which can cause serious economic losses (MNP LLP 2016, 2017), are expected to become more frequent (Price et al. 2013) and severe (Jones et al. 2020).
- Near-term threats include from forest insects that have the potential for population outbreaks in response to relatively small temperature increases (Price et al. 2013). The ongoing mountain pine beetle outbreak is likely to have major effects that will persist for many decades (Cooke and Carroll 2017).
- Adopting EBM as an approach to increase adaptive capacity to mitigate climate change is challenged by the same institutional issues associated with the current governance system: complexities of multi-agency management, constricting legal requirements, economic and financial, governance and institutional, social and cultural, knowledge constraints and gaps, physical and biological constraints, under-developed institutional capacity, and the need to adhere to community expectations (Lukasiewicz et al. 2016; Nalau et al. 2018).

RECOMMENDATIONS

“How can we shift narratives? Perhaps with messages that forests are dynamic and forest management is part of the climate change solution. Policy comes from larger urban centers and we aren’t using the same language. Relating better to influencers in bigger urban centers who don’t realize there’s an intersection could be a good synergy with the forest sector.”
(Anonymous SME).

- Research and value propositions about how EBM can help to mitigate climate change and other pressures and provide resilience and adaptive capacity.
- Regional analyses of climate change management options in forests with active disturbance regimes to complement analyses done in long-lived forests (Law et al. 2018).
- Incorporation of climate change considerations into land use and subregional EBM plans.
- Assessments of forest vulnerability to increased fire, drought, insects, disease, invasive species, and other stressors associated with climate change (Lindner et al. 2010; Brice et al. 2020).
- Climate change is expected to provide some forest benefits including faster growth because of elevated CO₂, increased water-use efficiency, increased woody-plant biomass, compensatory physiological, morphological, and genetic mechanisms, and dampening ecological feedbacks (Allen et al. 2015). Including these in assessments and decisions provides opportunity to compare EBM with other approaches.
- Active approaches to reduce vulnerability and increase adaptive capacity include using genotypes adapted to future conditions, maintaining ecological variation and complexity, providing connectivity and reducing fragmentation (Stanturf 2015; Mansuy et al. 2020). These are all aspects of EBM and there is opportunity to characterize EBM as a contribution.
- Current research supports using silviculture treatments consistent with EBM to create forest landscapes that are more pest-resistant (Kneeshaw et al. 2021). The opportunity is consideration and analysis of pests in EBM planning.



- Research to explore how bioenergy initiatives could be used to maintain or increase forest disturbance in some forest types and also contribute to climate change mitigation and adaptation.
- Adapting forest management to climate change requires an understanding of the effects of climate on forests and people, how these may change, and how to make decisions in the face of uncertainty (Keenan 2015). EBM is well-suited to help build knowledge and capacity to improve decisions and their implementation.
- Building adaptation capacities by investing in social capital including EBM partnerships to better respond to a range of possible futures (Delacámara et al. 2020).
- Establish and maintain participatory dialogues on forest adaptation strategies and the opportunities for EBM to contribute to resilience in both ecological integrity and human wellbeing (Hajjar et al. 2014).
- EBM provides an ongoing linkage between former ecosystem processes and states and future forest visions that restore functions, increase resilience to change, and embrace novelty (Seastedt et al. 2008; Beller et al. 2020). By capturing the knowledge and wisdom of the past to inform choices about the future, EBM provides opportunities to adapt and sustain ecological integrity and human wellbeing.

A5. RISK, UNCERTAINTY, AMBIGUITY, AND IGNORANCE

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“EBM is a risk management approach that aims to reduce risks from failing to maintain the natural world and the negative effects that would have on humans” (Anonymous SME).

Life will always be full of risks. All human enterprises have general and specified risks related to both actions and inactions (decisions to do nothing). There will always be uncertainty and unpredictability about complex social-ecological systems such as forest management (Allen et al. 2011). Risk assessment is a well-established foundation for Environmental Management Systems (International Organization for Standardization 2015) and other projects (quality, safety, health, cost control, etc.) where managers



wish to effectively consider, avoid, and minimize consequential risks. Risks are commonly ranked in

Table A1. Assessment matrix that could be used to compare forest management aspects of current approaches with proposed or potential EBM approaches.

Category	Definition	Current	EBM
Risk	About the probability and consequences of outcomes		
Uncertainty	About the future and outcomes of change		
Ambiguity	About the nature of outcomes		
Ignorance	About both change and nature of outcomes		

terms of likelihood (probability of occurrence) and consequence (the scale of effect) for each aspect considered (Figure A5). The challenges break down to recognizing and managing risk, uncertainty, ambiguity, and ignorance. At its heart, EBM aims to improve management and outcomes for these challenges. With respect to EBM, risk aversion is related to unwillingness to change from current status and practice to try something new and different.



For EBM, risk assessment evaluates the probability that a particular management action will have an adverse impact on some component(s) of ecological integrity (Coast Information Team 2004) and, concurrently, on some component(s) of human wellbeing. For ecological integrity risk is the probability that an ecosystem, ecosystem function, or biodiversity element will be irreparably changed or lost following a particular management activity. This especially applies to processes such as disturbances, which are prominent aspects of EBM. For human wellbeing, risk is the probability of changes that are deemed unacceptable to society. Since society is not unified on what is considered unacceptable and views change over time, so too do perceptions of human wellbeing risks.

The current forest governance system and EBM both have the same broad goals and objectives and must address many of the same risks and uncertainties. One of the EBM opportunities is to be more comprehensive and integrative to better consider and address risks that are not adequately considered or resolved with current approaches. EBM is a risk management approach that requires a low-risk approach overall and explicitly considers risks associated with inaction (e.g., reduced disturbance rates) as well as action (e.g., infrastructure restoration).

The *precautionary approach* has become an underlying rationale for many international treaties and declarations in the fields of sustainable development, environmental protection, health, trade and food safety (Unesco/Commission Mondiale de l’Ethique des Connaissances Scientifiques et des Technologies. 2005). The precautionary approach emphasizes caution before implementing new innovations when adequate knowledge about likely outcomes is not available, primarily as an effort to avoid disastrous consequences. As a means of considering and managing risk it is a potentially useful EBM tool, especially when comparing between current management and potential improvements through applying EBM. Assessments (Table A1) are powerful tools to inform decision-making and the precautionary approach

		Consequence				
		Negligible	Minor	Moderate	Major	Catastrophic
Likelihood	Almost certain	Moderate	High	Extreme	Extreme	Extreme
	Likely	Moderate	High	High	Extreme	Extreme
	Possible	Low	Moderate	High	High	Extreme
	Unlikely	Low	Moderate	Moderate	High	High
	Rare	Low	Low	Low	Moderate	Moderate

Figure A5. A standard risk assessment matrix with four risk categories. Once categorized, managers may choose to develop actions in different ways, for example to avoid or minimize high and extreme risks, and to monitor low and moderate risks. For EBM, risk assessment will need to cover the traditional focus on near-future risks which are typically reviewed annually, and long-term risks which operate over much longer timeframes. For example, the likelihood of a wildfire in a particular location in a 5 year period might be low or moderate, while the likelihood over a 200 year period might be high or extreme.



can add value by considering challenges related to risk, uncertainty, ambiguity and ignorance (Stirling 2007).

Forest management and discourse about forest management comes with a great deal of complexity, confusion, and fuzziness. Ecological integrity and human wellbeing are EBM goals, but both concepts have to be defined through indicators and targets that are context-specific and inevitably controversial and contested. EBM

must be defined and implemented through public deliberation and negotiation in a political process supported by science, information, and technology. An EBM approach moves away from linearity, predictability, homogeneity and simplification and toward nonlinearity, complexity, surprises and cross-scale effects (Figure A6).

Current focus on risk and uncertainty as predominately negative things to be

avoided should be expanded to include positive outcomes including reducing risk, uncertainty, ambiguity and ignorance, and prospects to achieve better stability, durability, resilience and robustness (Leach et al. 2010).

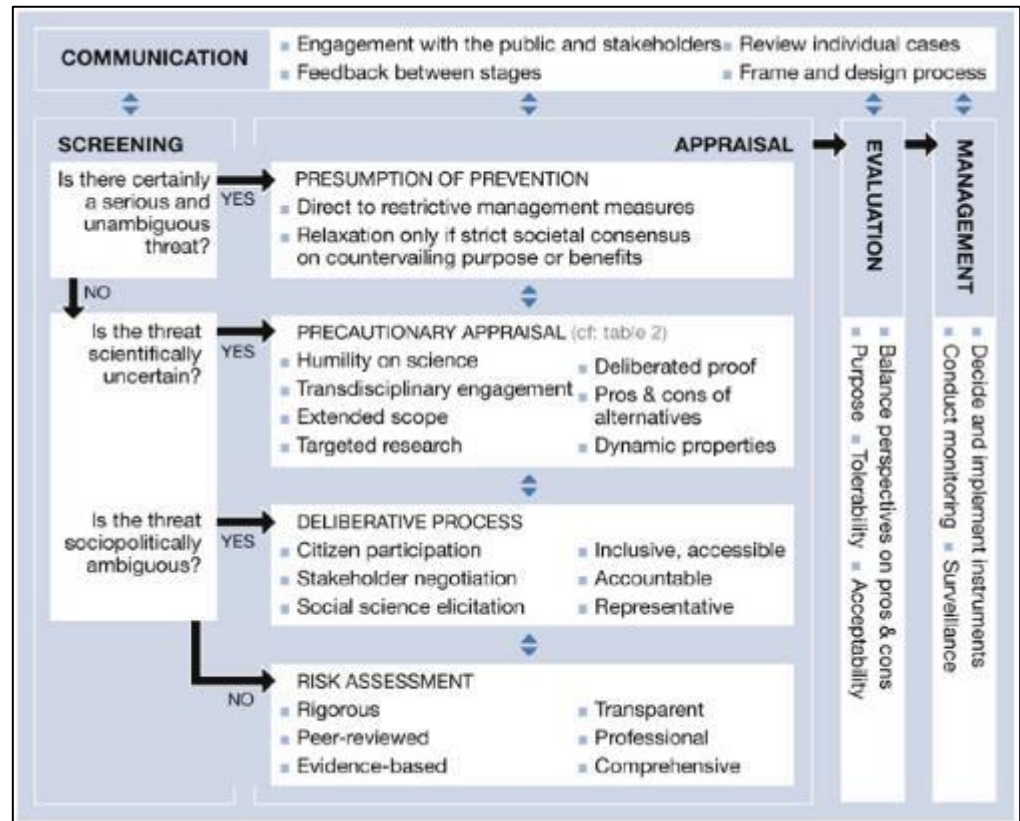


Figure A6. A framework for articulating precaution and risk assessment (from Stirling 2007).

CHALLENGES

“Rejection of proposed reforms is based on one of two unconscious assumptions: that the status quo is perfect, or that the choice we face is between reform and no action. We can never do nothing. We must compare the status quo with the proposed change and make decisions which don’t involve the assumption that only perfection is tolerable.” (D. Ludwig 2001).



- Uncertainty about the consequences of choices is one of the greatest challenges in decision making. The challenge is to improve processes to recognize and reduce uncertainty in decisions, and to reduce uncertainty over time through monitoring and learning (Chambers et al. 2019).
- Perceived risks are powerful reasons not to change. The challenge is to identify perceived risks and objectively assess them as a contribution to resolution.
- A key aspect of risks to ecological integrity is the concept of continual change and resilient response as the engine that organizes and maintains ecological integrity. EBM suggests that management must reorient from goals associated with achieving preservation, restoration, and optimization and toward goals associated with fostering and adapting to complexity, resilience, and adaptive capacity (Leach et al. 2010; Benson 2012). The challenge is to identify opportunities to change current approaches for the better through EBM, and then to implement promising changes.
- Risk assessment is common in management systems but has not been widely applied to whole management frameworks such as the current forest management system and EBM.
- Governments and others are very focussed on recognizing and minimizing a narrow definition of risk and don't do a good job of addressing uncertainty, ambiguity, and ignorance which are prominent aspects of forest management (Leach et al. 2010).
- Reforms to laws, policies, guidelines, and funding structures are needed to better address uncertainty and facilitate decision-making in the context of adaptive management (Garmestani and Benson 2013; Chambers et al. 2019).
- Risk assessment is often related to activities and short-term non-compliance with requirements rather than not achieving targets that may operate over longer timeframes.
- Risk assessment is often divided by aspect or value and known or suspected threats over relatively short timeframes. Managing risks independently is inefficient and ineffective for risks that crosslink between individual values and activities.
- Risk aversion (better safe than sorry; when in doubt, don't) is widespread and has been influenced by the precautionary approach which has sometimes been used as a way to paralyze innovation (Cooney 2004). The challenge is to recognize opportunities to take calculated short-term risks to implement EBM to achieve better outcomes including lower future risks. For example, the risks of prescribed fires escaping control are low but can paralyze opportunities to use if more widely and effectively and reduce risks of larger uncontrolled wildfires (Kolden 2019).
- Industry, government, and others have different risk tolerances that they are willing to accept in forest management policy and practice, and finding shared levels of acceptable risk is a challenge.
- All sides of regulatory and management choices involve risks (Sunstein 2002) which must be evaluated, not just the risks associated with new activities. For example, risks of catastrophic wildfire are high over large areas of Alberta and Saskatchewan. The question is whether current policy or an EBM approach might better recognize and address wildfire risk.



- Over time the precautionary approach has come to mean different things to different people and application has sometimes been controversial. Some think it is unscientific and an obstacle to progress and some think it is an approach that protects human health and the environment (Raffensperger and Tickner 1999; Bourguignon 2015).
- Precautionary approaches are often applied only, or mainly, to the ecological integrity side of EBM. For example, giving the benefit of doubt to ecological integrity, requiring human use proponents to prove no impact, and needing certainty of no damage before proceeding (Coast Information Team 2004) is well-meaning but discounts risks related to the status quo and may preclude consideration of opportunities for improvement.
- Organizations and individuals in positions of power tend to be risk-averse and favour the *status quo* because it meets their interests or they are concerned about their interests being compromised (risk increases) by doing something else (SME Interviews). This tendency is a challenge to EBM, which often actively seeks to implement positive change.

RECOMMENDATIONS

“A good first step is to ask for permission, maybe nobody is asking, or they’re asking in the wrong way. The political environment at any point in time is important. I think a large portion of the public service would like to go down the EBM road, but not if politicians don’t. Politicians listen more to the public than they do to the public service and lobbying can change what’s happening, especially from powerful interests.” (Anonymous SME).

- Research and plan scenarios that assess risks for whole management frameworks such as the current forest management system and variations of EBM. Assessments could include comparisons of perceived risks associated with change alternatives with risks associated with maintaining the *status quo*. Rebalance risk–benefit considerations using “intended consequences” to give additional emphasis to the costs of inaction and the potential benefits of intervention (Phelan et al. 2021).
- Risk can have both negative and positive connotations and can be characterized as opportunity, agency, or incentive, in addition to constraint, exploitation, or harm (Stirling 2007). EBM provides an opportunity to accept and use risk to initiate actions that achieve positive outcomes that are as good as, or better than current approaches, or fill gaps that current practices ignore. These intended consequences opportunities can help implement EBM through comparison with cautious conservation that does not consider the true cost of impeding innovation and overemphasizes the risks of unintended consequences (Mozelewski and Scheller 2021).
- Sensitivity analysis and frequent re-planning provide pathways to incorporate adaptive management and uncertainty and to manage risk.
- Discussions about the challenges and opportunities related to EBM implementation and diverse perspectives of participants provide opportunities to make better-informed decisions about complex risk questions using best available information while acknowledging uncertainties and knowledge gaps (Everest 1997).



- Precaution calls for consideration and discussion of conflicting policy or technology pathways, which provides an objective way to evaluate uncertainty, ambiguity and ignorance (Stirling 2007). Considering these in the contexts of risk governance, science-policy interfaces and linkages between precaution and innovation may lead to governance improvement opportunities (Bourguignon 2015).
- Defining EBM is likely to require precautionary assessment of the relative conservation threats and benefits posed by alternative strategies. Assessments will benefit from taking into account scientific knowledge, traditional and local knowledge, and social, economic, and political contexts (Cooney 2004).
- *“Data are few, knowledge of processes limited, and the act of management changes the system being managed. Surprise and change is inevitable.”* (Walters and Holling 1990). As an approach that recognizes and embraces surprises and changes, EBM is well suited to address related challenges and capitalize on opportunities.
- Opinions are divided about when to apply precautionary measures but it may be best used only where risks are potentially high and not easily calculable (Sunstein 2002).
- Innovation alternatives to the precautionary approach including responsible innovation and permissionless innovation may overcome deficiencies of the precautionary approach (Hemphill 2020).
- In the context of EBM, remaining within or closer to NRV and minimizing human footprints can be represented as the ultimate precautionary principle (Lieffers et al. 2020).
- Managing risks associated with disturbance could include emphasis on avoiding/minimizing unacceptable or undesirable changes in the short term, with the goal of supporting resilience and maintaining long-term ecological functions and conditions at top of mind.
- NIMBY is a rational reaction that should be recognized and remedied through proactive policies that engage individuals in interest-based dialogue to search for solutions.
- Acceptable levels of risk should be linked to adaptive management strategies.

A6. EBM IMPLEMENTATION OPPORTUNITIES

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Adopting EBM in principle is not the same as implementing EBM, which can be exceedingly difficult (Butler and Koontz 2005). EBM could be further implemented by adding more content and direction to the existing governance framework, addressing cumulative effects and integrating planning processes, or changing the management foundation from social, economic, and ecological values to the health and integrity of the entire ecosystem (Andison 2020). Incremental improvements are possible through an



adaptive management system, assisted by, for example, new technologies. These are not really distinct options, they all part of a continuum of a journey toward EBM (Andison 2020). To date, EBM has been implemented mainly by adding to the VBA framework, but progress has also been made on improving planning and integration processes and changing management foundations. Future progress is likely to follow multiple pathways and take advantage of opportunities to trial new processes and take advantage of compatible initiatives as they arise.

Implementing an EBM element or aspect could result from a catalyst, which is an event or person causing a change. Events predominate, and many have historically been based on conflict. The rise of many EBM concepts was triggered by massive conflicts over old-growth forests and threatened species in the USA Pacific Northwest (Chase 2017). Similar conflicts in British Columbia led to major reductions in forest logging in some areas such as Clayoquot Sound, the development of variable retention as a silvicultural system in coastal forests (Beese et al. 2003, 2019) and the EBM-based Central Coast Land and Resource Management Plan (Boulanger et al. 2019). Environmental campaigns against *status quo* forest management in the tropics led to development of forest management certification standards that promote sustainable forest management and, increasingly, EBM (Rametsteiner and Simula 2003; Mussells and Stephenson 2020).

Natural events can also be change catalysts. The great fire of 1919 burned more than two million ha from Lac la Biche in Alberta almost to Prince Albert, Saskatchewan. The conflagration led to the use of new firefighting equipment, the establishment of Prince Albert National Park, and eventually to policy change (Murphy 1985; Murphy et al. 2015). Reviews of devastating fires that burned parts of Slave Lake in 2011 (KPMG 2012) and Fort McMurray in 2016 (KPMG 2017) are factoring into fire management agency efforts to be better prepared for a future with more wildfire (Tymstra et al. 2020). The 2013 Southern Alberta floods were the worst flooding event in Alberta history, and one of the largest natural disasters in Canadian history (MNP LLP 2016). The floods triggered development of a flood recovery plan (Flood Recovery Task Force 2013) and ongoing flood mitigation efforts (Jabbal et al. 2020). Southern Saskatchewan experienced severe drought events in 2001–2002 and 2019 that were linked to dieback of aspen in forests (Hogg et al. 2008). The unprecedented 2015 wildfire season in northern Saskatchewan (Pavlovic et al. 2016) resulted in the largest evacuation in the province's history (Walker et al. 2020).

While conflicts and events catalysts often drive change including historical EBM definition and implementation, people and organizations as change catalysts are both challenges and opportunities for future EBM implementation.

CHALLENGES

“The squeaky wheel gets the grease. The people who ask get more of the attention. EBM advocates need to have a louder voice to counter increasingly loud voices for other viewpoints, most often single-issue advocates. EBM could help to bring disparate views together.” (Anonymous SME).



- EBM is probably best-advanced in a spirit of enterprise and cooperation rather than as an outcome of conflicts or events (SME interviews). The challenge is to harness the knowledge and skills of people and organizations as catalysts to define and implement EBM towards improved forest management outcomes.
- Complexity challenges are exacerbated by lack of agreement about what EBM is, and low levels of trust between interested parties.
- Where EBM offers prospects for solving problems and improving outcomes, more leaders are needed to envision how EBM could help, be better than the *status quo* approach or other alternatives, and lead to a better future for ecological integrity and human wellbeing. Leaders are needed in multiple organizations and positions, people who have understanding, knowledge, communications skills, and other leadership characteristics that can help to further EBM implementation as a journey (Andison 2020).
- Recent SARA Section 11 agreements and their commitments to develop landscape plans in large areas of Alberta and Saskatchewan (Government of Alberta and Government of Canada 2020; Government of Saskatchewan and Government of Canada 2020) arose from conflicts over woodland caribou recovery. These change catalyst initiatives are potentially EBM-compatible (an opportunity) but it will be challenging to use them to further EBM implementation. The agreements were developed under narrow terms of reference driven by the SARA and governments may be unwilling to adapt them to increase EBM compatibility.

RECOMMENDATIONS

“There is a strong need for a core partnership of big thinkers, leaders, and advocates in positions of influence to sell EBM.”
(Anonymous SME).

- EBM can grow through ongoing incremental implementation and does not require an abrupt paradigm shift (SME Interviews). However, a strong statement reaffirming commitment to EBM and a policy framework and actions could be created by provincial and federal governments as an opportunity to jumpstart the EBM journey. Taking advantage of emerging opportunities to promote the advantages of strong EBM policies would be appropriate.
- Winston Churchill said “never waste a good crisis”. Combinations of conflicts (strong public demands, legal disputes, etc.) and crises (ecological, economic, technological, etc.) drive change to maintain competitiveness, political influence or legitimacy (Beland Lindahl et al. 2017). A crisis that occurs when there is a political window and strong leadership from key organizations and people provides an opportunity for EBM implementation (Perry 2021). Whether or not there is currently a crisis to exploit is debatable, but EBM proponents can continue to lay the groundwork for EBM improvements to be better prepared to respond to future opportunities.
- EBM should not be implemented by layering new agencies and structures on top of existing ones which has failed in many places (Slocombe 1998). The opportunity is to create EBM planning and management frameworks that involve all of society to integrate management



processes, information flow, and planning and target-setting. This could be aided by research to identify where EBM implementation could be used to replace current approaches and provide better outcomes for equal or reduced costs. The ‘low-hanging fruit’ identified in the SME interviews could be a good place to start.

- Targeted research and discussion papers on options and “how to” guidance to implement EBM in Alberta and Saskatchewan would contribute to dialogue and perhaps inspire innovation and demonstration projects.
- Organizations interested in EBM usually already have EBM leaders. Recognizing these people and providing support for their interest is an opportunity to benefit from and grow existing resources and capacity. Mandates and resources to pursue EBM are powerful tools to capitalize on the capability of leaders.
- In the world of human enterprise, there are reams of information about how to identify, engage, and develop emerging leaders (Day 2000; Vogel et al. 2020). For EBM, new leaders will develop through these processes and from demand for human resources to meet needs as EBM grows. Opportunities arise from organizations actively seeking to develop EBM leaders.
- More leaders, and more support, can come from engagement and development at the community level, with voices that people trust or may grow to trust (SME interviews).
- Opportunities to promote EBM may arise by engaging with initiatives that arise from conflicts, events, or progressive improvement, and communicating how EBM could assist or improve the initiatives. For example, ongoing land-use and caribou landscape planning initiatives in both Alberta and Saskatchewan.

A6.1 EARLY SMALL WIN STRATEGY

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Part of managing ecosystems better, and ensuring that people see and appreciate the change, is implementing EBM close to the ground (Slocombe 1998). Small wins and early successes (quick wins) are key to getting started with EBM and building understanding and support across all levels of society (Murray and Marmorek 2003).

Small wins can be used to engage and energize people in a way that embraces complexity but acts locally to make progress as part of larger integrated frameworks. A small wins evaluation framework includes: identifying and valuing small wins, analyzing whether the right propelling mechanisms are activated so as to accumulate into transformative change, and organizing feedback into the policy process to activate new small wins (Termeer and Dewulf 2019).

CHALLENGES

“There are projects everyone likes but it doesn’t take on the ground. Why not? Break it down into bite size pieces – what are those we can do now, what is medium term, what is long term. Small wins as a pathway to success.” (Anonymous SME).



- EBM is a hugely complicated endeavour that, for most people, is difficult to understand. The challenge is to develop information and explanations that describe the overall intent of EBM in terms that are understandable, and to design and implement small projects that can be used to further dialogue and help to build support for wider applications.
- Capitalizing on small EBM wins would be supported by a framework outline with a list of potential small wins that could be pursued. This could help ensure that small initiatives are consistent with EBM and opportunities to pick priority wins can be realized.
- Disaggregating EBM into small win packages runs the risk of cherry-picking, where the easy and popular EBM initiatives are highlighted and the more difficult ones may never see the light of day.
- Initiating and communicating EBM wins requires partnerships and resources to collect, organize, and communicate examples as they are created.

RECOMMENDATIONS

“We have to start somewhere, and pilots and demonstrations are a low-risk way to try new things. We should include trying things that we don’t think will work to be fair and thorough and get more people onside.” (Anonymous SME).

- There are many potential small wins initiatives identified in [EBM is a Journey](#) (Andison 2020) and this report. These could be gathered into a framework that shows what has already been done, projects in progress, and additional opportunities for new small wins projects.
- Starting simply and small helps to ensure immediate short-term results or benefits to generate and maintain EBM momentum (Slocombe 1998).
- The new [Ecosystem Based Management in the Boreal Forest](#) website has many case studies that represent EBM in action, and the website is set up to have new case studies and EBM wins added as the information becomes available.
- The fRI Research Healthy Landscapes Program uses a structured process to envision and implement new projects that could be expanded to include small wins in areas not traditionally considered as part of the research mandate.

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