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Best Practices for Integrating Climate Change Into Protected and Conserved Area Management Plans and Planning Processes in Canada

Stephanie Barr

Christopher J. Lemieux
clemieux@wlu.ca

Pamela Wright

Jen Hoesen

Claudia A. Haas

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STEPHANIE BARR, CHRISTOPHER J. LEMIEUX,
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For more information, please contact:
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Stephanie Barr[1], Christopher J. Lemieux[2*], Pamela Wright[3], Jen Hoesen[4], and Claudia A. Haas[5]

1 Department of Geography and Environmental Studies, Wilfrid Laurier University, Waterloo, Ontario, Canada

2* (Corresponding Author) Department of Geography and Environmental Studies, Wilfrid Laurier University, Waterloo, Ontario, Canada, clemieux@wlu.ca

3 Faculty of Environment, University of Northern British Columbia, Prince George, British Columbia

4 Department of Geography and Environmental Studies, Wilfrid Laurier University, Waterloo, Ontario, Canada

5 Environment and Natural Resources, Government of Northwest Territories, Yellowknife, Northwest Territories

CCEA MISSION STATEMENT

To support the establishment and management of a network of ecological areas that will represent and conserve the natural diversity of Canada's terrestrial, freshwater, and marine ecosystems for the benefit of all Canadians.

ABOUT CCEA

The Canadian Council on Ecological Areas (CCEA) is an independent national organization constituted in 1982 to encourage and to facilitate the selection, protection and stewardship of a comprehensive network of protected areas in Canada. In 1995, the CCEA became a registered charitable organization. The Council draws its following and support from federal, provincial and territorial government agencies, non-governmental organizations, universities, industry, Indigenous Peoples, and private citizens concerned with protected areas.

The mission of the CCEA is to support the establishment and management of a network of ecological areas that will represent and conserve the natural diversity of Canada's terrestrial, freshwater, and marine ecosystems for the benefit of all Canadians. To this end, the work of the CCEA is centered on the following goals:

1. To support the identification, establishment, integration, and reporting on ecological areas in Canada;
2. To support the effective and equitable management and monitoring of ecological areas in Canada;
3. To promote the understanding of the importance of ecological areas in connecting Canadians to nature; and,
4. To collaborate with partners to advance ecological area networks in Canada and globally.

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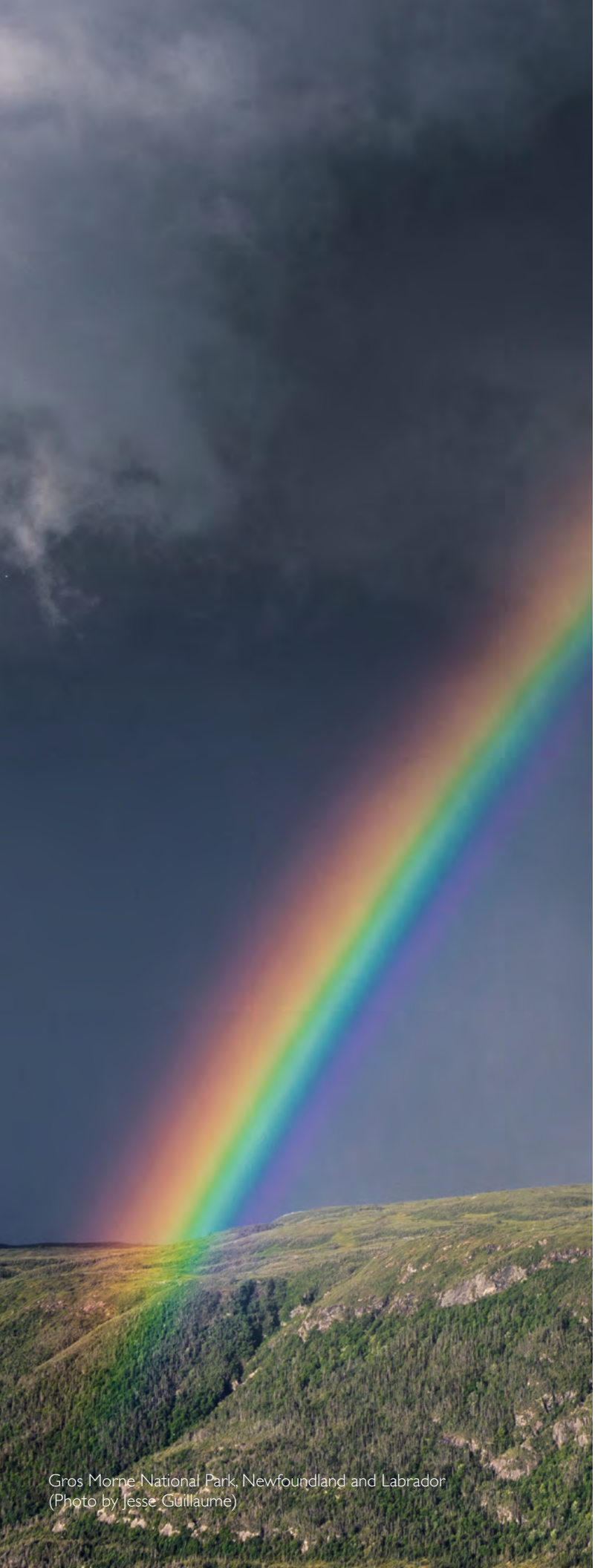


Gros Morne National Park, Newfoundland and Labrador
(Photo by Jesse Guillaume)

INTRODUCTION

Protected and conserved areas are a proven method for safeguarding biodiversity and for delivering important ecosystem services (Watson et al., 2014). Despite significant growth in the global protected and conserved areas estate, including a 1.2% and 4.6% expansion in terrestrial and marine protected and conserved area in the last decade alone (UNEP-WCMC IUCN and NGS, 2021), biodiversity loss continues at an unprecedented rate (Díaz et al., 2020). Evidence suggests that the current global systems of protected and conserved areas are not sufficiently large, well-connected, nor well-managed to maximize their contribution to biodiversity conservation (Convention on Biological Diversity, 2003). In Canada, persistent underfunding and capacity constraints affecting management effectiveness have been reported, including widespread under-staffing (e.g., Office of the Auditor General of Ontario, 2020), challenges to effectively integrate evidence into protected and conserved areas decision-making (Lemieux et al., 2021), and difficulties working collaboratively with rights holders and stakeholders on several pressing biodiversity issues, including climate change (Wright, 2012; Barr et al., 2021).

Climate change and biodiversity are of particular concern because, while inextricably linked, they have been functionally separated in policy and management (Pettorelli et al., 2021). This creates challenges associated with identifying, understanding, and ultimately integrating connected goals and management actions. Recently, an international report on biodiversity and climate change highlighted, this separation "…*may lead to taking actions that inadvertently prevent the solution of one or the other, or both issues*." (Pörtner et al., 2021) Given the risk of inadvertently prioritizing some challenges over others, and the propensity to ignore both synergistic effects and solutions (Pettorelli et al., 2021), continuing to address climate change and biodiversity separately will result in non-optimal or perhaps even maladaptive outcomes.

Management planning can highly influence management effectiveness and the related ability of protected and conserved areas to deliver conservation and other objectives. Management plans, often the outcome of the management planning process, work to define minimum requirements for examining and adjusting existing management direction. Thomas and Middleton (2003, p1) define a management plan

as: "*a document that sets out the management approach and goals, together with a framework for decision making, to apply in the protected area over a given period of time.*" Because plan development, in Canada, is often co-developed with Indigenous partners and/or subject to public consultation, they are also an important resource for Indigenous communities and the public and stakeholders who have an interest in participating in the planning process (Lockwood, 2010; Worboys et al., 2015). Finally, management plans also represent an important element of accountability. That is, the conservation values and goals contained within can be used to assess relevance and effectiveness of management direction and associated actions, within a broader framework of good governance (Lockwood, 2010).

Despite a long-standing desire by protected area managers to integrate climate change into management planning processes (Lopoukhine, 1990), recent studies have found that most protected area management plans do not consider climate change (Geyer et al., 2017; O'Regan et al., 2021). One potential reason for these shortfalls is that there is widely considered to be a lack of practical guidance for practitioners working in this space (Geyer et al., 2017). While some general adaptation guidance specific to protected and conserved areas does exist (e.g., Glick et al., 2011; Stein et al., 2014; Hopkins et al., 2015; Gross et al., 2016; U.S. NPS, 2021), it does not focus on management plan development including data collection, analyses, plan formulation, and consultation leading to the completion of a formally approved management plan, nor does it focus on management plan implementation, including the execution of management actions.

Furthermore, a recent horizon scan of emerging issues for protected and conserved areas in Canada revealed that climate change is expected to be the most significant issue impacting protected and conserved area design, planning, and management over the next 5-10 years (Dietz et al., 2021). Specific climate change issues identified by the expert panel included: 1) the long-term and large-scale ecosystem-level effects of climate change; 2) ecological integrity in a climate change context; 3) species translocations to and from protected areas; 4) the effects of changing snow patterns on protected areas management; and, 5) the effects of interplay between wildland fire and climate change. These findings underscore the need for best practices for managing climate change within a protected and conserved areas context management planning context, including the need to identify and implement proactive actions to effectively reduce threats, respond to potential opportunities, and enhance preparedness and capacity to adapt.

Recognizing the limitations of existing resources and the need for more specific guidance on this front, this study presents a set of best practices for mainstreaming climate change into protected and conserved areas management planning processes. The identified best practices are of value to practitioners worldwide as each part of the globe is challenged by climate change and seeking ways to move forward in a way that is effective, robust, and match the potential and importance of protected and conserved areas in national mitigation and adaptation action plans and associated strategies. Effective implementation of these best practices can be used to support the goals and targets of the recently agreed to United Nations (UN) Convention on Biological Diversity Kunming-Montreal Global Biodiversity Framework and the UN Decade on Ecosystem Restoration (2021-2030).

METHODS

We conducted interviews with 18 key informants to gain insights into best practices for incorporating climate change into protected area management plans and planning processes. Key informants were leading experts in the field(s) of climate change and protected and conserved areas management. Initially, interview participants were identified using purposeful sampling (Creswell & Poth, 2016) and a list of potential key informants was developed. Following the initial list creation, a snowball sampling approach was taken to identify additional participants (Etikan et al., 2016). Interviews stopped when no new names were being suggested and data saturation was reached (i.e., no new ideas surfaced out of subsequent interviews). Key informants represented diverse organization types in Canada and, in one case, the United States (Table 1).

Table 1: Types of organizations represented by interview participants.

Organization Type	Number of Participants
Federal government	6
Provincial / territorial government	5
Non-government Organization (NGO)	4
Research institution	2
Consulting	1
Total	**18**

Data analysis followed a thematic analysis approach (Braun & Clarke, 2006). The interview data analysis process began with the research team familiarizing themselves with interview content by transcribing, reading, and re-reading interview transcripts. Following the data familiarization stage, an initial first round of coding took place. Coding followed an inductive approach where the researcher allows theory to emerge from the data (Braun & Clarke, 2006; Strauss & Corbin, 1998). Numerous codes were identified in the first round with no limits placed on the number or types of codes created. Once all 18 interview transcripts had been coded in the first round, codes were reviewed, reorganized, and amalgamated. Based on these revised codes, potential themes (i.e., best practices) were identified.

In the second round of coding, sections of interviews were coded to the themes that resulted from the first round of coding, but coders were free to add new codes as necessary to capture ideas missing in the themes that resulted from the first round of coding. Codes from the second round of coding were reviewed by reading through quotes categorized under each code to ensure there was sufficient evidence to warrant each theme being deemed a 'best practice'. Some themes were combined in the final stages of data analysis as they were judged to be too repetitive or similar. The final theme list became our list of best practices.

Intervention management techniques, such as prescribed burns to restore and maintain remnant prairies and savannas, may be increasingly significant tools for mitigative, adaptive and restorative management of various biotic communities and species confronted by the impacts of climate change. (Rice Lake Plains Natural Area, south central Ontario, Photo Credit: Chelsea Marcantoni/NCC staff, Nature Conservancy of Canada).

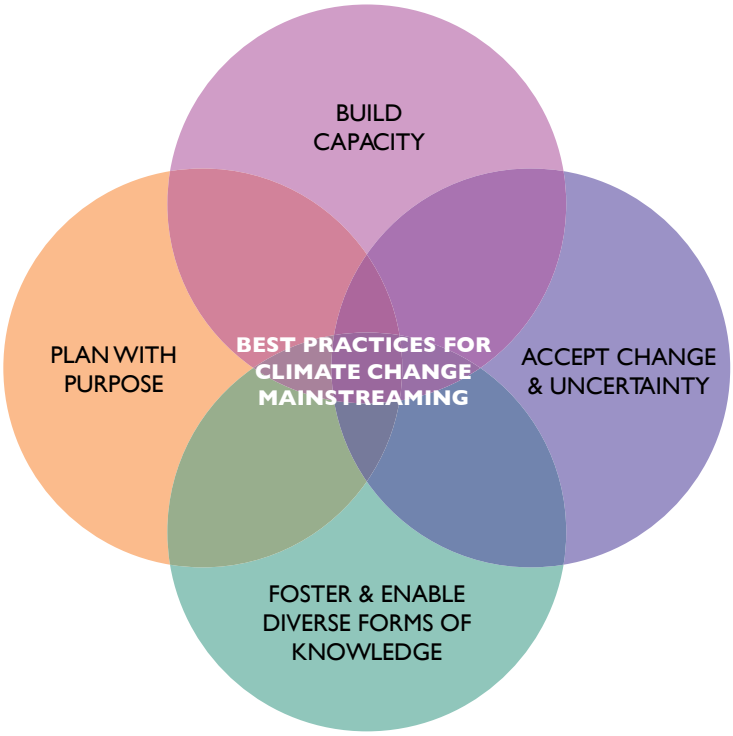
RESULTS AND DISCUSSION

After analyzing the key informant interviews, 12 best practices for incorporating climate change considerations into protected and conserved areas management planning were identified (Figure 1). These best practices can be organized under four broad categories: **1) Build Capacity; 2) Accept Change and Uncertainty; 3) Foster and Enable Diverse Forms of Knowledge; and 4) Plan with Purpose.**

First, interview participants identified **mainstreaming** as an overarching best practice. "*Basically*," as one participant noted, "*climate change should be considered at all steps and be cross cutting and not just at the at the end of the process.*" Another participant echoed this sentiment, stating:

> *"there used to be a section about climate change, and it would show trends and forecasted shifts and things like that, and what that might mean for values at quite a high level, and then there was a shift, maybe a year or two ago, where it was like hey, why is there a separate section on climate change, it should actually be embedded throughout, recognizing it's this really fundamental foundational piece that we should be thinking about throughout the document and throughout all of our planning actions."*

Many interview participants took the position that mainstreaming needs to become more commonplace because climate change impacts all aspects of PA management from species management to visitor experience planning. A more nuanced integration of climate change in all areas of management planning including those where climate change may not be the primary driver of change is necessary.



BUILD CAPACITY
1. Assess and Build Capacity
2. Diversify the Planning Team

ACCEPT CHANGE & UNCERTAINTY
3. Accept Change
4. Accept Uncertainty

FOSTER & ENABLE DIVERSE FORMS OF KNOWLEDGE
5. Leverage Diverse Knowledge Sources
6. Conduct a Vulnerable Assessment
7. Identify Refugia
8. Develop a Monitoring Plan

PLAN WITH PURPOSE
9. Provide High-Level Direction
10. Take a Nimble, Flexible Approach
11. Take a Regional Perspective
12. Consider Beyond Standard Planniing Horizon

Figure 1: Summary of best practices for mainstreaming climate change into the protected areas management planning process, as identified by key informants.

CATEGORY 1: BUILD CAPACITY

1 ASSESS AND BUILD CAPACITY TO MAINSTREAM CLIMATE CHANGE INTO THE MANAGEMENT PLANNING PROCESS

Prior to undertaking any management planning activities, the capacity of the management planning team to understand and plan for climate change needs to be understood and enhanced where necessary. Participants recognized that it is important to assess capacity from within and, following this, provide climate change training for the management planning team to develop capacity. As one participant stated, "*I think it's important to ensure that people are well versed in climate change so that they can appropriately highlight it as part of the plan.*" However, as Barr and Lemieux (2021) recently revealed, little is known about the institutional preconditions that enable or inhibit capacity to adapt to climate change within PA organizations. As such, it is recommended that organizations undertake assessments of organizational readiness (or capacity) to adapt to climate change as an initial step in the larger management planning process. Organizational readiness assessments have been shown to assist in identifying and understanding the root causes of climate change capacity strengths and challenges across a spectrum of management themes (Barr & Lemieux, 2021). Such an assessment is an important precursor to identifying staff training needs focused on enhancing capacity. As one key informant noted, "*[integration] requires expertise that is beyond what we typically have at our planning table.*" Staff training could focus on bringing in staff from other protected and conserved areas to share experiences and examples of where climate change had been incorporated efficiently and effectively in other jurisdictional management plans.

2 INCLUDE DIVERSE STAKEHOLDERS ON THE MANAGEMENT PLANNING TEAM

Collaborating within and across jurisdictional boundaries and sectors to develop and achieve shared goals is critical to addressing climate change (Schuurman et al., 2020). Most informants noted that more diverse stakeholders need to be included on management planning teams beyond those who are typically invited to the table. Traditionally, staff of the jurisdictional authority of the protected and conserved areas have been included in the development of management plans (which are usually ecologists, biologists, and planners). However, climate change presents new threats to protected and conserved areas management and necessitates the inclusion of more diverse players at table, such as climate change scientists, social scientists, and Indigenous knowledge holders, within a larger regional ecosystem context. As one participant noted:

> *"…climate change is a relatively new threat, it has a unique aspect to it, and so I think that calls for a larger social circle…Generically, more heads are better for thinking about new challenges. So, there's a strong argument in climate change adaptation for including a larger suite of people than one might do for a well-known and long-standing threat."*

While several participants raised concerns about the capacity of a typical park planning process to engage a broader range of external stakeholders and experts, recent innovations in remote and digital participation have highlighted that more is possible with limited resources. Relatedly, it was noted that bringing in additional stakeholders could expand the extent of human and financial resources available for management plan development and implementation. One participant stated that, "*[e]very agency needs to examine their own capacity at the strategic level down to the ground,*" while another emphasized the importance of, "*making space in the planning process to allow people the time to understand*".

While the nature and level of engagement of each stakeholder will be conditional on the broader governance context (and associated power dynamics at play), engaging stakeholders early in the process can also support other best practices (particularly Best Practices 5, 6, and 11).

Western Prairie White Fringed Orchid (Platanthera praeclara), Lake Manitoba and Lake Agassiz Plain. Photo by Megan Hamill)

CATEGORY 2:
ACCEPT CHANGE & UNCERTAINTY

3 ACCEPT CHANGE

When engaging in protected and conserved areas planning, change needs to be acknowledged and accepted. According to one participant, "*it needs to be recognized up front that climate change will be happening, shifts will be happening, we don't know what that's going to be, but we will adapt.*" As Schuurman et al. (2020) aptly point out, past managers often worked to reverse or mitigate many stressors or their impacts to approximate pre-disturbance ecological conditions (e.g., via habitat and species restoration. However, accelerated warming, changing disturbance regimes (such as wildfire), and extreme events associated with climate change can reduce or even eliminate the potential of returning to any sort of 'normal" (Kates et al., 2012). One participant noted the challenge that comes with moving to a new planning mindset because "*acceptance is the hardest part; we really don't know the full scope of what that change will mean.*" Regardless, accepting change can be used to help re-frame, or outright reconsider management goals (Lemieux et al., 2011). While management goals and objectives should take into consideration social, ecological, and economic aspects of PA management, once these goals are set, it also needs to be acknowledged that these goals may need to be adjusted as the climate changes.

The permanent, static boundaries of traditional protected and conserved areas make managing species in a non-stationary, high climate velocity environment very difficult (Stralberg et al., 2020). One participant questioned whether boundaries "*should define the protected and conserved areas, or perhaps [we] need to consider trans-boundary management approaches*" to address the dynamic issues of climate resource management. Indeed, species are dynamic both temporally and spatially, and more effective consideration of ecological networks can help manage for ecological uncertainty (see Best Practice 4) in an era of rapid climate change. While urgent calls and guidelines for maintaining and restoring ecological connectivity are increasing (Hilty et al., 2020), on-the-ground implementation has proven difficult in Canada and indeed elsewhere (Keeley et al., 2019; Lemieux et al., 2021). Ecological networks for conservation, which can be systems composed of protected areas and OECMs, supported by ecological corridors, can be used to support movement and adaptation responses to global change, including climate change. Relatedly, one participant noted how change can also be accepted and acknowledged on a smaller scale by recognizing that there are different ways to cope with climate change. Frameworks such as the Resist-Accept-Direct framework (RAD) (Schuurman et al., 2020), the climate vulnerability vs. capacity framework (Gillson et al., 2013), or the climate vulnerability vs. value (Belote et al., 2017) may prove useful in assisting managers in making informed, purposeful choices about how to respond to the trajectory of climate and ecological change, and can also be used to support resource managers in collaborating at larger scales across jurisdictions (Best Practice 11). One participant mentioned that RAD has helped them to explore the full spectrum of available adaptation options "*to help us accept some degree of change and uncertainty.*"

Caribou (Rangifer tarandus), Mariana Lake, Alberta (Photo by Jason Headley)

4 ACCEPT UNCERTAINTY

Key to accepting change is acknowledging uncertainties, recognizing that climate projections typically present a wide range of plausible future conditions. Waiting for greater scientific certainty around climate trends and impacts is not an option as devastating impacts on biodiversity are already occurring. Rather, protected and conserved areas managers must accept uncertainty and work with the best available information (Best Practice 5) while also accepting that change may be required (Best Practice 3).

One way to work with uncertainty that was identified in the interviews is through scenario planning techniques that envision multiple possible futures (Miller et al., 2022). This approach has been used in a few situations, as one participant stated, noting that their organization is following "*the lead of the military and the corporate world in using scenario planning to work with, rather than reduce or ignore or wait for, a resolution of uncertainty.*" Scenario planning optimizes management planning through better characterization of potential scenarios and outcomes (Lawrence et al., 2021). One participant noted that when talking about potential future climates "*We need to bring climate smart conservation together with scenario planning*" because "*all kinds of information are not being accounted for in any modelling and forecasting.*" In fact, this type of planning is already being tested to support climate informed decision-making in protected areas, as one participant notes, "*using a forecast based approach [is] a more useful way of talking about it with end users [because] climate change projections usually present quite a wide range of potential future conditions.*" Flexible approaches and criteria that promote reversible and incremental steps, and that favor ongoing learning and capacity to modify direction as situations change, will become increasingly important in the future (Peterson St-Laurent et al., 2022). Once a planning process is complete it is important to remember that the plan, and the information it is based on, may not be true and that as new knowledge is gathered, the plan will need to be adapted.

Climate change story at Herschel Island - Qikiqtaruk Territorial Park (Photos by Government of Yukon)

2016 pre-storm, normal shoreline and sea level

2016 during storm, high water level. This has never been witnessed in the history of the park.

2021 current shoreline and sea level.

CATEGORY 3:
FOSTER & ENABLE DIVERSE FORMS OF KNOWLEDGE

5 LEVERAGE DIVERSE KNOWLEDGE SOURCES

Effectively addressing conservation issues requires diverse knowledge sources, beyond traditional conservation fields, and consideration of insights from a broad spectrum of disciplines (Bennett et al., 2017). To overcome uncertainty, as one participant stated, "*we need to gather different sources of knowledge so that we can make decisions now using the best available information.*" However, the ability of managers to integrate various forms of evidence into decision-making has been assessed as low (Lemieux et al., 2021). As such, capacity issues (Best Practice 1) must be addressed by identifying and using techniques for more meaningful engagement of knowledge holders beyond traditional conservation disciplines.

Many climate change problems will require social science solutions (i.e., identifying effective and acceptable ways to do something about it) (Leber, 2022), and protected and conserved areas practitioners may not always be aware of the concerns of protected and conserved areas rights holders and neighbouring communities. For example, the establishment of protected and conserved areas has negatively impacted Indigenous Peoples globally through displacement, restrictions, and related cultural impacts. As one participant noted, "*we need to be bringing in other ways of knowing – so Two Eyed Seeing and bringing in the knowledge that the Indigenous communities can bring to the table, given their long history on the land.*" Therefore, management planning processes must be designed and implemented with full Indigenous participation and consent, and respecting Indigenous governance and knowledge systems, if they are to be successful (Townsend et al., 2020). Furthermore, as another participant highlighted, diverse knowledge "*that pertains to observed change on the landscape… [can be used]… to better place the protected area in a regional context, as opposed to treating it as a kind of an isolated entity.*" Ultimately, being explicit and conscious about considering and incorporating diverse knowledge sources, such as Indigenous and local non-Indigenous knowledge, is necessary to ensure that the potential benefit of various stakeholders is realized.

6 CONDUCT A VULNERABILITY ASSESSMENT EARLY, INCLUDING THE IDENTIFICATION OF KEY VALUES AND CONSERVATION GOALS

As noted in Best Practice 5, knowledge is key to robust protected and conserved areas management planning. One way to gather important information early in the process is to conduct a climate change vulnerability assessment (CCVA) at either the site (i.e., individual protected and conserved areas) or regional (i.e., a group or cluster of protected and conserved areas) level. CCVAs can help identify the full range of pressures and impacts that protected and conserved areas or regions face, and managers can use this information as a basis for identifying management options under alternative climate futures (Gross et al., 2016). When conducting a CCVA, it is important to identify key values, both social and ecological, as well as conservation goals for the protected and conserved areas. A CCVA will allow the management planning team to understand which aspects of the socio-ecological system have low, medium, and high vulnerability to climate change impacts (Glick et al., 2011). The information gained from a CCVA can then be used by the management planning committee to try to reduce negative impacts on identified values of the socio-ecological system, and to identify indicators for research and monitoring (Best Practice 8). Fortunately, several resources have been developed to support CCVAs specific to the protected and conserved areas sector (Gleeson et al., 2011; Glick et al., 2011; Gross et al., 2016).

7 IDENTIFY REFUGIA AND CONSIDER THEM IN MANAGEMENT PLANNING

Many participants acknowledged the value of identifying and protecting climate change refugia. Refugia, in the words of a participant, are:

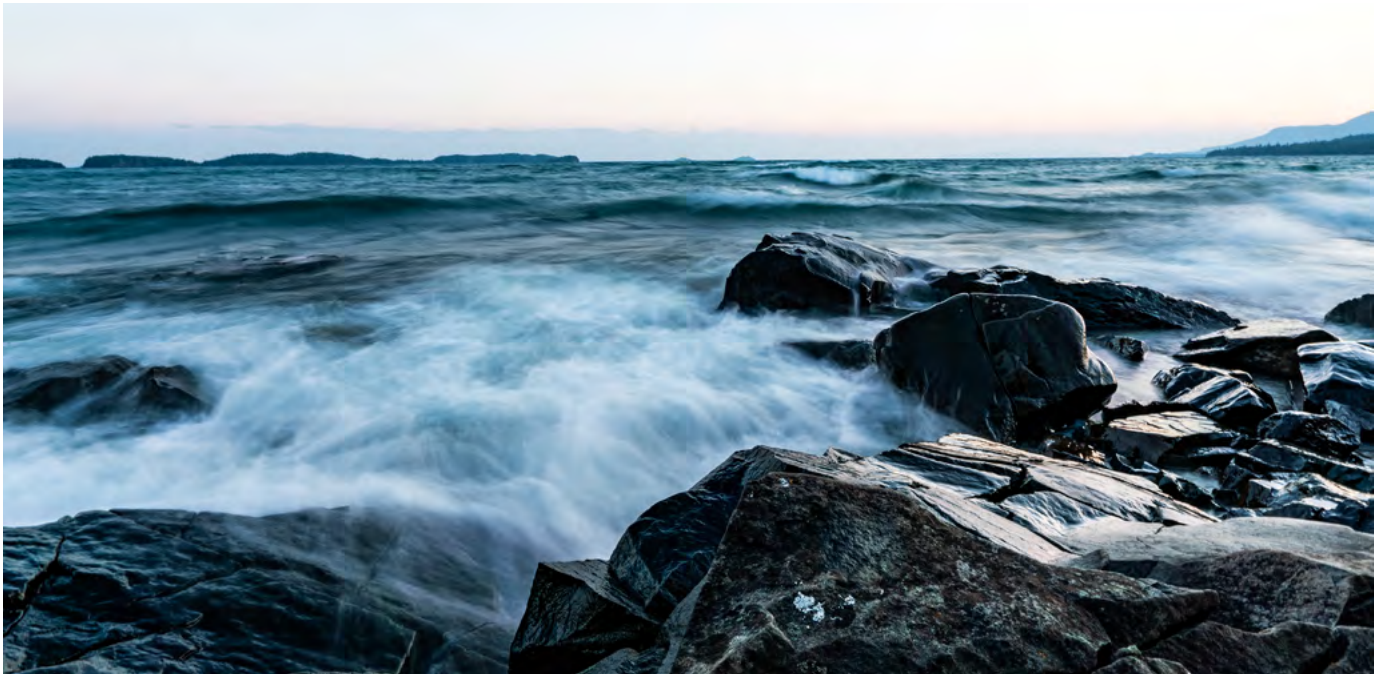
> *"areas where biodiversity elements like species will be able to persist under anthropogenic climate change… you can identify refugia not only from climate projections but also from landscape features such as peatlands, lake shores, and topography. So, there's a number of features in the landscape that will create these areas where species are somewhat buffered from climate change."*

Identifying and protecting refugia, perhaps through a dynamic mix of protected and conserved areas, OECMs, and ecological corridors (detailed in Best Practice 5 above), will provide climatically suitable habitat for species in the interim while more long-term solutions are developed and implemented (Stralberg et al., 2020). It is also important to consider connectivity between refugia. One key participant noted they are "*thinking much more about how to work towards mapping climate refugia, features and ultimately connectivity to bring discrete data*" together alongside ongoing planning processes. Increasingly, species will have to shift their ranges in response to climate change therefore ensuring connectivity between refugia is critical to allow species to get from where they are currently to where they will have a suitable climate in the future (Hilty et al., 2020).

8 INCLUDE A MONITORING PLAN WITH INDICATORS IN THE MANAGEMENT PLAN

Including a section within a management plan that addresses monitoring, with associated indicators, provides direction regarding what should be monitored to track progress, identify issues, and inform future management planning processes (Gross et al., 2016; Lawrence et al., 2021). Due to inherent uncertainty and complexity, climate change necessitates more intensive, frequent, and iterative monitoring (Baron et al., 2009). However, as noted in the introduction and in Best Practice1, capacity for monitoring within organizations can be low even without considering climate change. One participant provided a useful analogy regarding climate change and monitoring frequency, "*if you're driving a half mile an hour, you can afford to look down for a little while and then look up, but if you're driving 150 miles an hour you kind of need to be looking back at the road every couple of seconds. We're in a high velocity situation, so I think the nature of research and monitoring changes.*"

Well-designed indicators are essential not only for documenting outcomes, but in measuring the effectiveness of protected and conserved areas objectives alongside other stressors (Geldmann et al., 2021); such as rapidly changing climate impacts that vary in frequency and scale. Given that monitoring remains a challenging obstacle, it makes sense to introduce or adjust indicators to complement existing metrics to avoid further resource burden to the organization (Geldmann et al., 2021). It is important, however, that indicators be able to identify changing conditions attributed to climate change alongside other threats, as this information helps protected and conserved areas managers to update, as necessary, management objectives given the uncertainty around climate change (O'Regan et al., 2021). One key participant noted that, "*...[we] need to take a hard look at indicators that inform not only ecological integrity, but also the human indicators and the impacts to recreation...*" across different climate change scenarios. Planning and evaluative processes such as Conservation Measures or a Protected Areas Management Effectiveness process can help in many stages of incorporating climate change into management planning particularly with respect to designing measurable outcomes to assess success.



Lake Superior National Marine Conservation Area, Nipigon, Ontario (Photo by Sophie Deschamps)

CATEGORY 4: PLAN WITH PURPOSE

9 MANAGEMENT PLANS SHOULD NOT BE PRESCRIPTIVE BUT RATHER PROVIDE HIGH LEVEL DIRECTION

One trap management planning often falls into is trying to set out too much detail. While specific decisions will need to be made, a climate change integrated management plan should provide high level direction regarding effective and acceptable actions but should not be overly prescriptive. One participant emphasized the importance of scale in decision-making such that it "*encourages and enables you to think about climate informed goals as opposed to excising climate change out of your thinking until a strategy is in place.*" Management plans are an umbrella document meant to give direction, providing a high-level snapshot of where the key areas of interest are for the site (often over a 10-year period), and tie together other area-, issue-, or species-based plans. For example, a plan does not need to lay out specific adaptation options for protected and conserved areas but rather just state that adaptation options should be developed and implemented. One key participant noted that "*we need to do a better job of both exploring a variety of different solutions and documenting why we chose one over another*", reinforcing the opportunity for management plans to set the tone and provide direction for protected and conserved areas staff to begin climate change annual planning. To do so, the management plan needs to set the context for that protected and conserved areas as it relates to climate change by understanding what the trends are and interpreting what that mean in terms of anticipated changes on-the-ground.

10 BEST PRACTICE 10: TAKE A NIMBLE, FLEXIBLE APPROACH TO MANAGEMENT PLAN DESIGN

Management plans tend to be relatively static documents, once they are created, they are not updated or revised until the next management plan cycle begins, usually every 5 or 10 years. Monitoring and knowledge generation takes place during this time; however, there is no mechanism to incorporate this new knowledge into the management plan until a new plan is written, and many management plans fail to be updated even with legislative or other policy directives (Office of the Auditor General of Ontario, 2020). In this regard, one participant stated, "*[if] we had new data, that wouldn't actually affect a plan that was officially closed and published last week. It would be five years before we could even conceive of potentially using it.*" This rigid approach to management planning is not ideal in a rapidly changing world with a high degree of associated uncertainty.

Recognizing the lack of quick adaptability of traditional protected and conserved areas management plans, the United States National Park Service (USNPS), for example, is in the process of switching from general management plans to resource stewardship strategies (US National Park Service, 2020). As one key informant noted, resource stewardship strategies "*are more computer database based so they're dynamic tools. They do much of the same thing [as general management plans], but they try to be nimbler, faster, lighter.*" As part of the resource stewardship strategy development process, resources in the protected and conserved areas are screened or assessed in terms of their climate sensitivity and any resource that is deemed to be climate sensitive is explicitly managed with climate considerations in mind (US National Park Service, 2020). Such strategy documents, as well as "clustered" management plans that include several protected and conserved areas within a greater ecosystem context, could accompany a traditional management plan or replace it all together to offset organizational capacity constraints attempting to chase "moving targets".

Least Bittern (Ixobrychus exilis), Cape Sable Island, Nova Scotia (Photo by Mark Dennis)

11 TAKE A REGIONAL PERSPECTIVE AND FOSTER LANDSCAPE SCALE CONSERVATION

When undertaking a climate integrated protected and conserved areas management planning process, it is important to take a regional perspective to foster landscape scale conservation. One key participant noted that, "*placing the protected area in a regional context, as opposed to treating it as an isolated entity, will help us to better weave knowledge...*" into the management planning process. While this idea is not new, adopting a regional perspective, where stakeholders work across jurisdictional boundaries, has been difficult to achieve in practice (Lemieux et al., 2015). Due to climate change, species are shifting their geographic ranges and this needs to be considered in the management planning process (Dietz et al., 2021). Planning for an individual site needs to include consideration of what is happening in the broader region, such as the species that are likely to move into (and out of) the protected and conserved areas and vise-versa. This is being done to some degree on a trial basis, as one participant noted, "*We've used a contribution matrix model for whole landscape level planning, [where] a key component of that relies on management experiments that require a treatment and a control.*" Taking a trans-boundary approach, thinking outside of protected and conserved areas boundaries, and working with other jurisdictional authorities will aid in maintaining the health of the protected and conserved areas through cooperation and greater awareness of external threats.

12 CONSIDER BEYOND THE STANDARD PLANNING HORIZON

Climate change is a long-term threat, the impacts of which are likely to become progressively more pronounced over the coming decades. The impacts of climate change on protected and conserved areas are likely to become progressively more pronounced over the coming decades. Consequently, management planning processes need to consider beyond the 5- or 10-year planning horizon to consider climate change projections 20, 50, or 100 years in the future. One participant noted that, "*...in the last year, we experienced a 100-year flooding event, a 100-year snowfall event, and a 100-year heat wave*" underscoring that climate change extremes are already at the forefront. However, this can be a challenge for management planning teams to reconcile. Without capacity to track or evaluate outcomes, fully accounting for all possible scenarios may overburden the system and erode the effectiveness of decision-making.

Being able to assess the suitability of different strategies helps managers to pivot towards the most effective suite of actions, those developed to address key climate risks (Lawrence et al., 2021). For example, having a sense of what conditions could be like in 100 years but realizing at the 10-year mark that observations are not going to be as drastic as initially expected means that the appropriateness of strategies and short-term actions in relation to long-term uncertainty needs to be addressed more regularly (Lawrence et al., 2021). As one participant suggested "*...you measure the action steps in these 5- and 10-year increments, that's appropriate, but you have to set the principles or the values on long-term thinking.*" While specific actions will be impossible to determine based on the uncertainty of such a long-term perspective, recognizing that these areas are here to stay and aiming to ensure they remain for many generations will shift the focus of management planning to allow for uncertainty of climate change while, at the same time, supporting the information needs of protected and conserved areas managers.

Tombstone Territorial Park, Yukon Territory
(Photo by Natulive Canada)

CONCLUSIONS

Despite long-standing calls for greater integration of climate change considerations into PA management planning processes, this has yet to be realized within Canada. All the while climate change impacts are becoming increasingly apparent, particularly in Canada, and are projected to intensify in the future (Bush et al., 2022; Intergovernmental Panel on Climate Change (IPCC), 2022). Protected area practitioners widely acknowledge these impacts and the fact that action is needed to mitigate risk through management planning processes (Barr et al., 2021).

While guidance documents have echoed this sentiment previously (Gross et al., 2016), the best practices detailed here provide specific, critical entry points to support the mainstreaming of climate change into protected and conserved areas management planning processes. It is our hope that the best practices detailed here can be used by managers to support the transformational change that has been urgently called for to bolster the resilience and adaptive capacity of species and ecosystems in a rapidly changing climate and, by extension, ensuring that the role of protected and conserved areas in supporting biodiversity and ecosystem health is not compromised by a rapidly changing climate.

Planting native species in protected and conserved areas and critical ecological
many species-at-risk in highly fragmented landscapes vulnerable to climate char
central Ontario, Photo Credit: Chelsea Marcantonio/NCC staff, Nature Conser

corridors may assume added importance to restore and sustain key biodiversity areas and
ge throughout Canada's settled southern regions. (Rice Lake Plains Natural Area, south
vancy of Canada).

REFERENCES

Baron, J.S., Gunderson, L., Aleen, C.d., Fleishman, E., McKenzie, D., Meyerson, L.A., Oropeza, J., & Stephenson, N. (2009). Options for national parks and reserves for adapting to climate change. *Environmental Management*, 44(6), 1033-1042. https://doi.org/10.1007/s00267-009-9296-6

Barr, S.L., Larson, B.M.H., Beechey, T.J., & Scott, D.J. (2021). Assessing climate change adaptation progress in Canada's protected areas. *The Canadian Geographer*, 65(2), 152-165. https://doi.org/https://doi.org/10.1111/cag.12635

Bar, S.L., & Lemieux, C.J. (2021). Assessing organizational readiness to adapt to climate change in a regional protected areas context: lessons learned from Canada. *Mitigation and Adaptation Strategies for Global Change*, 26(8), 1-21.

Belote, R.T., Dietz, M.S., McKinley, P.S., Carlson, A.A., Carroll, C., Jenkins, C.N., Urban, D.L., Fullman, T.J., Leppi, J.C., & Aplet, G.H. (2017). Mapping conservation strategies under a changing climate. *BioScience*, 67(6), 494-497.

Bennett, N.J., Roth, R, Klain, S.C., Chan, K.M.A., Clark, D.A., Cullman, G, Epstein, G., Nelson, M.P., Stedman, R., Teel, T.L., Thomas, R.E.W., Wyborn, C., Curran, D., Greenberg, A., Sandlos, J., & Verissimo, D. (2017). Mainstreaming the social sciences in conservation. *Conservation Biology*, 31(1), 56-66. https://doi.org/10.1111/cobi.12788

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101.

Bush, E., Flato, C. Gillett, J., Greenan, N., James, B.J.W., Kirchmeier-Young, M., Mudryk, L. & Zhang, X. (2022). *Canada's Changing Climate Report in Light of the Latest Global Science Assessment*. https://changingclimate.ca/site/assets/uploads/sites/2/2022/03/CCCR-2022-Supplement-Final.pdf

Convention on Biological Diversity. (2003). UNEP/CBD/SBSTTA/9/5/Rev.1. *Status and Trends of, and Threats to, Protected Areas*.

Creswell, J.W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.

Dietz, S., Beazley, K. F., Lemieux, C. J., St. Clair, C., Coristine, L., Higgs, E., Smith, R., Pellatt, M., Beaty, C., & Cheskey, E. (2021). Emerging issues for protected and conserved areas in Canada. *FACETS*, 6(1), 1892–1921.

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), 1–4.

Geldmann, J., Deguignet, M., Balmford, A., Burgess, N. D., Dudley, N., Hockings, M., Kingston, N., Klimmek, H., Lewis, A. H., Rahbek, C., Stolton, S., Vincent, C., Wells, S., Woodley, S., & Watson, J. E. M. (2021). Essential indicators for measuring site-based conservation effectiveness in the post-2020 global biodiversity framework. In *Conservation Letters* (Vol. 14, Issue 4). John Wiley and Sons Inc. https://doi.org/10.1111/conl.12792

Geyer, J., Kreft, S., Jeltsch, F., & Ibisch, P. L. (2017). Assessing climate change-robustness of protected area management plans—The case of Germany. *PloS One*, 12(10), e0185972.

Gillson, L., Dawson, T. P., Jack, S., & McGeoch, M. A. (2013). Accommodating climate change contingencies in conservation strategy. *Trends in Ecology & Evolution*, 28(3), 135–142.

Gleeson, J., Gray, P., Douglas, A., Lemieux, C. J., & Nielsen, G. (2011). A practitioner's guide to climate change adaptation in Ontario's ecosystems. *A Practitioner's Guide to Climate Change Adaptation in Ontario's Ecosystems*.

Glick, P., Stein, B. A., & Edelson, N. A. (2011). Scanning the conservation horizon: a guide to climate change vulnerability assessment. *Washington, DC: National Wildlife Federation*. 168 p.

Gross, J. E., Woodley, S., Welling, L. A., & Watson, J. E. M. (2016). *Guidance for protected area managers and planners Adapting to Climate Change Developing capacity for a protected planet Best Practice Protected Area Guidelines Series No. 24*. www.iucn.org/pa_guidelines

Hilty, J. A., Worboys, G. L., Keeley, A., Woodley, S., Lausche, B., Locke, H., Carr, M., Pulsford, I., Pittock, J., White, J. W., Theobald, D. M., Levine, J., Reuling, M., Watson, J. E. M., Ament, R., & Tabor, G. M. (2020). *Guidelines for Conserving Connectivity Through Ecological Networks and Corridors (Issue 30)*. International Union for the Conservation of Nature (IUCN). https://portals.iucn.org/library/node/49061

Hopkins, A., McKellar, R., Worboys, G. L., and Good, R. (2015) 'Climate change and protected areas', in G. L. Worboys, M. Lockwood, A. Kothari, S. Feary and I. Pulsford (eds) *Protected Area Governance and Management*, pp. 495–530, ANU Press, Canberra.

IPBES (2019): Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz, J. Settele, E. S. Brondízio, H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas (eds.). IPBES secretariat, Bonn, Germany. 56 pages. https://doi.org/10.5281/zenodo.3553579

Intergovernmental Panel on Climate Change (IPCC). (2022). *Climate Change 2022: Impacts, Adaptation, and Vulnerability: Summary for Policymakers. https://report.ipcc.ch/ar6wg2/pdf/IPCC_AR6_WGII_SummaryForPolicymakers.pdf*

Kates, R. W., Travis, W. R., & Wilbanks, T. J. (2012). Transformational adaptation when incremental adaptations to climate change are insufficient. *Proceedings of the National Academy of Sciences, 109*(19), 7156–7161.

Keeley, A. T. H., Beier, P., Creech, T., Jones, K., & Jongman, R. H. G. (2019). Thirty years of connectivity conservation planning: an assessment of factors influencing plan implementation. *Environmental Research Letters*, 14(10), 103001.

Lawrence, D. J., Runyon, A. N., Gross, J. E., Schuurman, G. W., & Miller, B. W. (2021). Divergent, plausible, and relevant climate futures for near- and long-term resource planning. *Climatic Change*, 167(3), 38. https://doi.org/10.1007/s10584-021-03169-y

Leber, R. (2022, March 1). *Why climate soltions will fail without the help of social scientists*. Vox. https://www.vox.com/2022/3/1/22954724/climate-change-report-ipcc-adaptation-justice

Lemieux, C. J., Beechey, T. J., & Gray, P. A. (2011). Prospects for Canada's protected areas in an era of rapid climate change. *Land Use Policy*, 28(4), 928-941. https://doi.org/10.1016/j.landusepol.2011.03.008

Lemieux, C. J., Halpenny, E. A., Swerdfager, T., He, M., Gould, A. J., Carruthers Den Hoed, D., Bueddefeld, J., Hvenegaard, G. T., Joubert, B., & Rollins, R. (2021). Free Fallin': The decline of evidence-based decision-making by Canada's protected area managers. *Facets*, 6(1). https://doi.org/https://dx.doi.org/10.1139/facets-2020-0085

Lemieux, C. J., Jacob, A., & Gray, P. (2021). *Implementing Connectivity Conservation in Canada*. Canadian Council on Ecological Areas (CCEA) Occasional Paper No. 22. Canadian Council on Ecological Areas, Wilfrid Laurier University, Waterloo, Ontario, Canada. vi + 216 pp. https://ccea-ccae.org/new-report-implementing-connectivity-conservation-in-canada/

Lemieux, C. J., Thompson, J., Slocombe, D. S., & Schuster, R. (2015). Climate change collaboration among natural resource management agencies: lessons learned from two US regions. *Journal of Environmental Planning and Management*, 58(4), 654–677.

Lockwood, M. (2010). Good governance for terrestrial protected areas: A framework, principles and performance outcomes. *Journal of Environmental Management, 91*(3), 754–766. https://doi.org/https://doi.org/10.1016/j.jenvman.2009.10.005

Lopoukhine, N. (1990). *National parks, ecological integrity and climatic change*. (WU/G--CE04173). Sanderson, M. (Ed.). Canada. http://inis.iaea.org/search/search.aspx?orig_q=RN:23086650

Miller, B. W., Schuurman, G. W., Symstad, A. J., Runyon, A. N., & Robb, B. C. (2022). Conservation under uncertainty: Innovations in participatory climate change scenario planning from U.S. national parks. *Conservation Science and Practice*, 4(3). https://doi.org/10.1111/csp2.12633

Office of the Auditor General of Ontario. (2020). *Value-for-Money Audit: Conserving the Natural Environment with Protected Areas*. https://auditor.on.ca/en/content/annualreports/arreports/en20/ENV_conservingthenaturalenvironment_en20.pdf

O'Regan, S. M., Archer, S. K., Friesen, S. K., & Hunter, K. L. (2021). A Global Assessment of Climate Change Adaptation in Marine Protected Area Management Plans. *Frontiers in Marine Science*, 8, 711085.

Peterson St-Laurent, G., Oakes, L.E., Cross, M., & Hagerman, S. (2022). Flexible and comprehensive criteria for evaluating climate change adaptation success for biodiversity and natural resource conservation. , 127, 87-97.

Pettorelli, N., Graham, N. A. J., Seddon, N., Maria da Cunha Bustamante, M., Lowton, M. J., Sutherland, W. J., Koldewey, H. J., Prentice, H. C., & Barlow, J. (2021). Time to integrate global climate change and biodiversity science-policy agendas. *Journal of Applied Ecology*, 58(11), 2384–2393.

Pörtner, H.-O., Scholes, R. J., Agard, J., Archer, E., Arneth, A., Bai, X., Barnes, D., Burrows, M., Chan, L., & Cheung, W. L. (2021). Scientific outcome of the *IPBES-IPCC co-sponsored workshop report on biodiversity and climate change*, Bonn, Germany.

Runhaar, H., Wilk, B., Persson, Å., Uittenbroek, C., & Wamsler, C. (2018). Mainstreaming climate adaptation: taking stock about "what works" from empirical research worldwide. *Regional Environmental Change*, 18(4), 1201–1210. https://doi.org/10.1007/s10113-017-1259-5

Schuurman, G., Hawkins-Hoffman, C., Cole, D., Lawrence, D., Morton, J., Magness, D., Cravens, A., Covington, S., O'Malley, R., & Fisichelli, N. (2020). *Resist-accept-direct (RAD)—a framework for the 21st-century natural resource manager*. Natural Resource Report. NPS/NRSS/CCRP/NRR—2020/ 2213. National Park Service. Fort Collins, Colorado. https://doi.org/10.36967/nrr-2283597

Stein, B.A., P. Glick, N. Edelson, and A. Staudt (eds.). 2014. Climate-Smart Conservation: Putting Adaptation Principles into Practice. National Wildlife Federation, Washington, D.C

Stralberg, D., Carroll, C., & Nielsen, S. E. (2020). Toward a climate-informed North American protected areas network: Incorporating climate-change refugia and corridors in conservation planning. *Conservation Letters*, 13(4), e12712.

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research techniques*.

Thomas, L., & Middleton, J. (2003). *Guidelines for Management Planning of Protected Areas. Best Practice Protected Area Guidelines Series No. 10*. Cambridge, UK: IUCN. 79pp. https://portals.iucn.org/library/efiles/documents/pag-010.pdf

Townsend, J., Moola, F., and Craig, M-K. 2020. Indigenous Peoples are critical to the success of nature-based solutions to climate change. *FACETS*, 5(1), 551-556.

UNEP-WCMC IUCN and NGS. (2021). *Protected Planet Report 2020: Tracking progress towards global targets for protected and conserved areas*. https://livereport.protectedplanet.net/

US National Park Service. (2020). *Resource Stewardship Strategy: Supplemental Guidance - Integration of Climate Change Scenario Planning Into the Resource Stewardship Strategy Process*. https://irma.nps.gov/DataStore/DownloadFile/640179

U.S. National Park Service. (2021). Planning for a changing climate: Climate-smart planning and management in the National Park Service. United States Park Service, Fort Collins, Colorado.

Watson, J. E. M., Dudley, N., Segan, D. B., & Hockings, M. (2014). The performance and potential of protected areas. *Nature*, 515, 67-73. https://doi.org/10.1038/nature13947

Worboys L., G., Lockwood, M., Kothari, A., Feary, S., & Pulsford, I. (2015). Protected Area Governance and Management. In *Protected Area Governance and Management*. https://doi.org/10.26530/oapen_569111

Wright, P. (2012). Field staff perspectives on managing climate change impacts in British Columbia's parks and protected areas. *Journal of Ecosystems and Management*, 13(2), 1–23.

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Healthy Outside-Healthy Inside: The Human Health and Well-being Benefits of Alberta's Protected Areas. Towards a Benefits-based Management Agenda. CCEA Occasional Paper No. 20. 2015. C. J. Lemieux, S. T. Doherty, P. F. J. Eagles, J. Gould, G. T. Hvenegaard, E. Nisbet and M. W. Groulx.

Protected Areas and Climate Change in Canada: Challenges and Opportunities for Adaptation. CCEA Occasional Paper No. 19. 2010. C. J. Lemieux, T. J. Beechey, D. J. Scott and P. A. Gray.

Canadian Guidebook for the Application of IUCN Protected Area Categories. CCEA Occasional Paper No. 18. 2008. Canadian Council on Ecological Areas.

Protected Areas in Northern Canada: Identifying Ecological Areas to Represent Mammals. CCEA Occasional Paper No. 17. 2007. Y. F. Wiersma.

Protected Areas in Northern Canada: Designing for Ecological Integrity. CCEA Occasional Paper No. 16. 2005. Y. F. Wiersma, T. J. Beechey, B. M. Oosebrug and J. C. Meickle.

Guidelines for Annual Jurisdictional Reports to the Canadian Council on Ecological Areas. CCEA Occasional Paper No. 15. 2002. Canadian Council on Ecological Areas.

A Perspective on Canada's Ecosystems: An Overview of the Terrestrial and Marine Ecozones. CCEA Occasional Paper No. 14. 1996. E. B. Wiken, D. Gauthier, K. Lawton and H. Hirvonen.

CCEA Framework for Developing a Nation-wide System of Protected Ecological Areas: Part 2 - Case Studies. CCEA Occasional Paper No. 13. 1995. D. Gauthier, K. Kavinaugh, T. Beechey, L. Goulet and E. Wiken.

CCEA Framework for Developing a Nation-wide System of Ecological Areas: Part 1 - A Strategy. CCEA Occasional Paper No. 12. 1992. D. Gauthier (Editor).

First Approximation of Principles and Criteria to make Canada's Protected Areas System Representative of the Nation's Ecological Diversity. CCEA Occasional Paper No. 11. 1991. E. B. Peterson and M. Peterson.

CCEA Annual Meeting in Ottawa: Selected Papers and Workshop Results. CCEA Occasional Paper No. 10. 1990. J. R. Reid.

Marine Ecological Areas in Canada. CCEA. Occasional Paper No. 9. 1990. R. Graham (Editor)

Valuing Public and Scientific Involvement with Ecological Areas. CCEA Occasional Paper No. 7. 1991. G. Francis.

Neglecting the Protected. CCEA Occasional Paper No. 6. 1991. Y. Edwards

Guidelines for the Selection of Protected Ecological Areas. CCEA Occasional Paper No. 5. 1989. T. J. Beechey.

Sustainable Development, Scientific Research and Ecological Areas. CCEA Occasional Paper No. 4. 1989. P. A. Keddy.

Guidelines for Annual Jurisdictional Reports to CCEA. CCEA Occasional Paper No. 3. 1989. T. J. Beechey.

Ecological Areas Decision-making Process and Case Studies. CCEA Occasional Paper No. 2. 1984. R. D. Thomasson and J. M. Shay.

Guidelines for Management and Research in Ecological Areas. CCEA Occasional Paper No. 1. 1984. CCEA Management Committee.

Climate change has driven and will continue to drive changes to biodiversity and challenge contemporary approaches to conservation and visitor management in protected and conserved areas across Canada. In fact, a recent horizon scan of issues likely to impact the effective management of protected and conserved areas in Canada over the next 5-10 years revealed climate change to be the number one issue facing managers. Considering this challenge, this report identifies and discusses 12 best practices for incorporating climate change considerations into protected and conserved area management planning, organized under four broad headings that focus on: 1) Building Capacity; 2) Accepting Change and Uncertainty; Fostering and Enabling Diverse Knowledge Sources; and 4) Planning with Purpose. Overall, these best practices can be used my managers to achieve protected and conserved area goals and objectives more effectively through a combination of strategies that work to reduce risks, take advantage of opportunities, and foster equitable and effective participation in management planning processes in an era characterized by rapid climate change and uncertainty.

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