

A policy scan related to assisted migration as a climate change adaptation tactic in Canada reveals major policy gaps

S.J. Cooke ^a, J. Vermey^a, J.J. Taylor^a, T. Rytwinski^a, W.M. Twardek^a, G. Auld^b, R. Van Bogaert^c, and A.L. MacDonald^c

^aCanadian Centre for Evidence-Based Conservation, Department of Biology and Institute of Environmental and Interdisciplinary Science, Carleton University, 1125 Colonel By Dr., Ottawa, ON K1S 5B6, Canada; ^bSchool of Public Policy and Administration, Carleton University, 1125 Colonel By Dr., Ottawa, ON K1S 5B6, Canada; ^cClimate Change Section, Office of the Chief Ecosystem Scientist, Parks Canada, 30 Rue Victoria, Gatineau, QC J8X 0B3, Canada

Corresponding author: S.J. Cooke (email: Steven.Cooke@carleton.ca)

Abstract

Assisted migration is increasingly being considered as a potential climate change adaptation tactic even though it also comes with potential risk to ecosystems and society. When implementing conservation actions that involve risk, it is prudent to have policies and guidelines to ensure that such actions are conducted in ways that conform to regional standards and consider risks. Here, we report on a policy scan focused on assisted migration in the context of climate change adaptation originally as a protected areas tactic only, but then broadened to ecosystems in Canada beyond those boundaries. Policy scans are a useful strategy for understanding the evolving policy and regulatory landscape for a given topic and can guide the development of such policies in other jurisdictions. Our scan focused on Canada, where multi-scalar governance systems exist relevant to biodiversity and environmental management. Our comprehensive policy scan (involving scans of legislation, policies, and guidelines found online and through direct inquiries with government bodies) revealed major gaps in the assisted migration policy landscape with very few provincial/territorial or federal policies in Canada. A more rudimentary scan in the United States revealed a similar pattern. There was evidence that some jurisdictions anticipated need for such policies and even a few examples of very specific policies (e.g., seeds) that had already been developed, but there were not comprehensive policies or frameworks. Governments and other relevant bodies/organizations may wish to consider working collaboratively toward the development of robust, evidence-based policies for assisted migration given that we anticipate this conservation intervention becoming more popular as climate change impacts on ecosystems become more evident and dire.

Key words: assisted migration, climate change, conservation, legislation, policy scan

Introduction

Climate change poses challenges to those tasked with the management and conservation of biodiversity and ecosystems (Heller and Zavaleta 2009; Bellard et al. 2012). Climate change is altering the suitability of habitats and ecosystems for species and populations that are adapted to local environmental conditions. Various taxa of flora and fauna are at risk of local extinction near their trailing-edge range limits (Wiens 2016; Gilbert et al. 2020). Limiting climate change impacts on these species will require use of novel strategies (Dawson et al. 2011; Gillson et al. 2013). One such strategy that has been the subject of extensive debate is that of assisted migration (Hewitt et al. 2011), both in protected and conserved areas for reasons of species conservation, as well as in other areas for economic, cultural, and even legal reasons. Assisted migration is an umbrella term for actions that involve the human-assisted movement of plant and animal seeds/zygotes (i.e., genetic material) or individuals from

populations (Ste-Marie et al. 2011). Assisted migration may involve the movement of organisms within their historical range, moving them just outside their natural range to facilitate range expansion, or movement further from their historical range to locations that are deemed to be appropriate for a given population (see Vitt et al. 2009; Aitken and Whitlock 2013). Approaches such as ecological replacement where new species are introduced to ecosystems to provide a functional role lost due to extinction represent another less common form of assisted migration (McCormack 2018). A detailed analysis of the various modalities of assisted migration is beyond the scope of this paper but what is salient is that we have long-been conducting assisted migrations inadvertently (St. Clair et al. 2020; Steiner et al. 2021). Assisted migration has already been attempted (Willis et al. 2009; Ren et al. 2016a, 2016b; Widhalm et al. 2020) and is being considered for further applications across a range of taxa and systems. A recent evidence map on the topic of assisted mi-

gration serves as a key resource on this topic (Twardek et al. 2023).

Assisted migration is controversial due to its potential ecological, cultural, legal, and socio-economic risks (as well as the risks of not using assisted migration when potentially beneficial; Hewitt et al. 2011); it thus raises ethical issues (Ahteensuu and Lehv virta 2014; Palmer and Larson 2014). Polarizing perspectives on assisted migration have likely limited its implementation by decision-makers. There are few cases to date where it has been used to achieve climate change adaptation goals (discussed in Hewitt et al. 2011; Williams and Dumroese 2013; Butt et al. 2021). As such, there is a need to better understand assisted migration and proceed cautiously. Use of risk assessments (Karasov-Olson et al. 2021), modeling (Peterson and Bode 2021), and extensive engagement with relevant actors (e.g., rightsholders, conservation experts, and communities; Pelai et al. 2021) are common approaches used to understand uncertainty. Frameworks for considering the merits of assisted migration have been proposed (McLachlan et al. 2007; Schwartz and Martin 2013). However, such frameworks lack a current legal basis. Legal analyses suggest goal conflicts between existing conservation statutes (e.g., the US Endangered Species Act (ESA)) and assisted migration as a tactic (Camacho 2010), while also assessing how certain statutory goals (e.g., historical fidelity vs. extractive and consumptive use) affect the ability of government agencies to develop robust climate change adaptation plans (Camacho and Glickman 2016). These existing works, however, fail to provide governments or other responsible bodies with formal policy guidance for making decisions about assisted migration. Others have explored potential policy tools for implementing assisted migration (see Sansilvestri et al. 2015) or recommended flexibility in implementation to accommodate assisted migration under an existing statute (for analysis of the US ESA, see Lopez 2015; Camacho and Kelly 2021), yet to our knowledge there has yet to be a policy gap analysis specific to this topic.

Here, we report on a policy scan focused on assisted migration in the context of climate change adaptation originally as a protected areas tactic only, but then broadened to ecosystems in Canada beyond those boundaries. Policy scans are a useful strategy for understanding the evolving policy and regulatory landscape for a given topic and can assist other agencies or organizations in developing or refining their own policies and regulations (Cox 2014). Often such scans have a specific jurisdictional focus to ensure relevance to a given community. Our scan focuses on Canada, where multi-scalar governance systems exist relevant to biodiversity and environmental management. Canada has many protected areas, with commitments to establish more over time, and has interest in assisted migration as a potential adaptation strategy, given the potential and realized effects of climate change on biodiversity and ecosystems (Lemieux and Scott 2005; Dietz et al. 2021).

Approach

A policy scan was conducted to search for Canadian regulations, policy documents, directives, and standards (here after

“policy”) that enable assisted migration to be used as a climate change adaptation option. This search included those policies created by provincial and/or territorial governments in each of the 13 provinces and territories in Canada, and at the national level by the federal government. To assess efforts more broadly in North America, we also conducted more rudimentary searches in the United States and Mexico (in English) to supplement the Canadian-focused efforts.

Searches were conducted using the search engine Google between 26 January and 10 March 2022. We used Google rather than just Google Scholar in that Google Scholar hits are also picked up in Google and to ensure that any form of assisted migration was captured (not just peer reviewed papers). Search terms/phrases related to assisted migration and their synonyms were scoped and a comprehensive list was established (see Supplemental Material 1). Each term in the list was paired with every province and territory across Canada (e.g., Ontario Assisted Migration, Manitoba Managed Relocation) as well as with “USA” and “Mexico”. The first two pages of results for each search were screened for eligibility. The websites of Canadian federal departments and agencies (i.e., Environment and Climate Change Canada, Natural Resources Canada, and Fisheries and Oceans Canada) were also searched. To broaden the search beyond Canada, an abbreviated list of search terms (i.e., assisted migration, tree migration, and assisted translocation) was used in combination with each state in the United States and in Mexico.

To capture information or strategies that may not be published online, targeted emails were sent to contacts at each provincial, territorial, and federal government department/agency across Canada. We targeted individuals within biodiversity, resource management, and/or climate change sections at sufficiently high levels where there would be a strong likelihood that the individual would be aware of any existing or forthcoming policies related to assisted migration. The emails included the text presented in Supplemental Material 1.

Initial requests were sent out on 24 January and 25 January 2022 and follow-ups were made when needed until 29 March 2022. In cases where no response was received, phone calls were made, and voicemails left with the most relevant department/division. Attempts were made until a response was received from at least one representative from each provincial and federal government agency, which sometimes involved following leads provided by those initially contacted. Responses were returned either via email or with a phone call.

Between January and February 2022, calls for information were also posted on social media. Calls were shared broadly on Twitter and on the Facebook pages of the Society for Conservation Biology and Canadian Wildlife Professionals.

Policy scan findings

The searches conducted on the websites of Canadian federal departments and agencies and using Google yielded 20 unique documents that mentioned assisted migration in North America. Responses to the call for information were re-

ceived from contacts at each provincial, territorial, and federal government department/agency across Canada either via email or phone conversation (see Supplemental Material—Table 2). Depending on the scope of the department/agency, some calls resulted in many responses or conversations; for example, we received responses from nine staff members from Environment and Climate Change Canada (ECCC) across divisions or protected area regions.

Given the scarcity of information on the use of assisted migration as climate change adaptation technique in protected areas, the eligibility criteria were kept broad. Any reference made to assisted migration in the context of climate change, or policies/legislation that could enable it, was included in the attached database. We acknowledge that our US and Mexican-oriented searches were less exhaustive than our attempts to locate policy from Canadian jurisdictions.

A list of policy documents that may enable assisted migration can be found in Supplemental Material (Table 2A). Searches returned very few relevant results and none specific to assisted migration as a climate change adaptation tactic. Aside from acts or policies that allow species movement more broadly, only two in Canada are specific to species movement as a climate change strategy. Both documents are enacted at the provincial level (Ontario and British Columbia (BC)) and regulate seed transfer in the forestry sector based on climate data.

While we found no policies directly mentioning assisted migration in the USA, there are several policies that could enable it. These policies allow for assisted migration, mainly in the forestry sector, where there has been sufficient research to show that the species will be adaptable to the given location. The USA also allows assisted migration as part of ongoing studies where there is consistent monitoring.

Through communications with government representatives, the general message was that assisted migration is not currently being applied or planned for, but that they are aware of the tactic and foresee it being used in the future (Supplemental Material 2—Table 2B). Many contacts were interested in the outcomes of this review and jurisdictional scan for their own use.

It was mentioned by several contacts that there are existing regulations or policies that would allow the movement of plants or animals but that assisted migration for climate change adaptation is not necessarily named in the piece of legislation. For example, the Province of Alberta Wildlife Act (<https://www.qp.alberta.ca/documents/Acts/W10.pdf>) currently allows the movement of animals but in practice is being used more reactively (e.g., problem animals and reintroduction of extirpated cutthroat trout with nearby stable populations) than proactively. At the Federal level, assisted migration could be allowed under certain circumstances with existing regulations that broadly govern the handling, disturbance, or movement of plants and wildlife including permits under the Species at Risk Act (SARA) (<https://laws.justice.gc.ca/eng/acts/S-15.3/>), Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act (WAPPRIITA) (<https://www.canada.ca/en/environment-climate-change/services/environmental-enforcement/acts-regulations/wild-species-protection.html>),

CITES (<https://cites.org/eng>), Canada Wildlife Act (<https://laws-lois.justice.gc.ca/eng/acts/w-9/>), or the Migratory Birds Convention Act (<https://laws.justice.gc.ca/eng/acts/M-7.01/>) (see Supplemental Material 2 A for specific sections). These statutes do not mention assisted migration and instead lay out the conditions under which conservation interventions (e.g., assisted migration) could occur, typically through permitting or special authorizations. For example, the Government of Canada explains WAPPRIITA (<https://www.canada.ca/en/environment-climate-change/services/environmental-enforcement/acts-regulations/wild-species-protection.html>) in the following manner “The act [WAPPRIITA] forbids the import, export and interprovincial transportation of these species, unless the specimens are accompanied by the appropriate documents (licences, permits)” (S.C. 1992, c. 52) and the SARA states “The agreement may be entered into, or the permit issued, only if the competent minister is of the opinion that: (a) the activity is scientific research relating to the conservation of the species and conducted by qualified persons; (b) the activity benefits the species or is required to enhance its chance of survival in the wild; or (c) affecting the species is incidental to the carrying out of the activity” (S.C. 2002, c. 29). At the provincial level, Nova Scotia’s Biodiversity Act states “The Minister may take any measure the Minister considers necessary for the conservation of biodiversity in the Province” (2021, C.3). In most situations, one can assume that a case for the necessity of assisted migration would need to be made, and permits sought from the appropriate authorities, to satisfy the requirements under existing legislation.

For aquatic organisms, regional Introduction and Transfer Committees (<https://www.dfo-mpo.gc.ca/aquaculture/management-gestion/contact-intro-eng.htm>) review applications on a case-by-case basis to introduce or transfer cultured aquatic species to assess risks for possible disease, ecological and genetic effects on native species and ecosystems under the National Code on Introductions and Transfers of Aquatic Organisms (<https://www.dfo-mpo.gc.ca/aquaculture/management-gestion/it-code-eng.htm>).

In other cases, the relationship to climate change is more obvious. The Chief Forester’s Standard for Seed Use (<https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/tree-seed/legislation-standards/chief-forester-s-standards-for-seed-use>) outlines the requirements for the planting of seedlings or cuttings in BC, and it contains a detailed list of where seedlings or cuttings can be planted based on climate. Similarly, in Ontario it is mandatory for managers to consider future climate when making seed transfer decisions as outlined in the Ontario Seed Transfer Policy (<https://www.ontario.ca/page/ontario-tree-seed-transfer-policy>). Multiple policies in the USA like the USDA Forest Service Reforestation Policy and the Genetic Resources Management Policy also mention “adaptability” and “accommodating projected changes in climate” in reference to forestry practices (see Supplemental Material 2 A).

Significant progress has been made at the provincial level in BC related to climate-based seed transfer. While a limited form of assisted migration for forestry was implemented

over a decade ago, in 2018 a climate-based seed transfer (<https://www2.gov.bc.ca/assets/gov/farming-natural-resource-s-and-industry/forestry/tree-seed/climate-based-seed-transfer/tr099.pdf>) system was initiated across all of BC, obligating foresters to choose seeds from slightly warmer areas based on climate data from the province. Recently (i.e., April 2022), further changes were made to only allow seeds to be selected based on future climate scenarios instead of geography, with these standards coming into effect 1 August 2022. The contact with the province of BC suggested that other interested land managing organizations start with small experimental trials as a proof of concept (e.g., 50 trials, 100 trees from 10 species), based on experience with such an approach in BC. There have been provenance trials happening in BC for over 30 years (testing seeds in different parts of the province), and these trials just happened to provide excellent long-term data that can be interpreted in the context of climate change. Experimental designs of some provenance trials can be found here: <https://www.for.gov.bc.ca/rsi/research/nsites/specind.htm>.

These demonstration plots can provide evidence that species can thrive elsewhere in climates that are similar to their historic climate zone. The contact also clarified that it is usually not a new species that is being introduced in situations of assisted migration; usually it is the seed source, and these decisions are based on years of provenance data.

Some jurisdictions (e.g., Yukon Territory, province of Saskatchewan) mentioned a strong focus on naturally self-sustaining wildlife populations and prioritizing management at an ecosystem level. Some even have policies that intentionally prohibit the movement of species (e.g., Bat Exclusion Policy, Plant Translocation Policy, and Amphibian Salvage Policy, all in Saskatchewan). Contacts in the Pacific and Prairie regions of Environment and Climate Change Canada reported that National Wildlife Area management focuses more on improving ecosystem health and resilience and reinforcing habitats to withstand potential effects of climate change. The same theme of enhancing habitats was also highlighted in New Brunswick, where the focus is on improving connectivity and offering corridors to support the most climate-vulnerable species, habitats, and landscapes. Canada's National Program for Ecological Corridors (<https://parks.canada.ca/nature/science/conservation/corridors-ecologiques-ecological-corridors>), administered by Parks Canada, similarly helps to address biodiversity loss and climate change impacts by connecting protected and conserved areas across landscapes and helping species to adapt.

Contacts from several jurisdictions also highlighted that, while there is little movement on the topic at higher levels, staff at lower levels are discussing it and see assisted migration as a mechanism that will eventually be necessary. In the Northwest Territories, some forestry staff have already attended workshops, while other jurisdictions have indicated that they already have the expertise in house (e.g., PhD-level ecologists and registered professional biologists) or could collaborate with academic institutions to increase capacity if needed to apply or study assisted migration.

Synthesis and addressing the policy gaps

While our policy scan returned remarkably few policies that explicitly inform or guide the eventual use of assisted migration as a climate change adaptation strategy, it did highlight a strong interest in the topic across Canada. It also highlighted progress being made in certain areas, particularly forestry, albeit slowly and at times constrained by lack of multi-sectoral integration and “policy legacies” whereby past decisions impede the ability to respond to this issue (Wellstead and Howlett 2017). It is worth noting that our online searches may not have captured existing policies that would enable assisted migration if these documents do not specifically name it as such (as in the examples above). Given that assisted migration in the context of climate change is not currently being applied or considered by most jurisdictions across the country, the lack of policies that explicitly name it is not surprising, but it does limit our ability to search for them. Nonetheless, we supplemented those searches with targeted requests, which confirmed that there are indeed limited formal policy products in Canada. Collectively, our policy scan gives us reasonable confidence that there is a major policy gap related to this topic in Canada and more broadly in North America.

It is difficult to know the specific reasons for a lack of policies in Canada (and apparently more broadly) on assisted migration. Novel issues, particularly those that have some level of controversy, may gestate a long time before any guidelines and regulations come into place. The adaptability of existing statutory goals to approaches outside the typical conservation toolkit does appear to matter (Camacho and Glickman 2016). Arguably, the advanced position of the forest sector is an unintended outcome of years of reforestation work focused on ensuring seedlings were well suited to the existing biogeolimatic zones of the forestry jurisdiction for commercial purposes.

Beyond policy documents, some evidence of interest in assisted migration or related climate change adaptation tactics can be seen in public climate strategies at the provincial and territorial level, even if only vaguely. For example, the “A Made-in-Manitoba Climate and Green Plan” (https://www.gov.mb.ca/asset_library/en/climatechange/climategreenlanddiscussionpaper.pdf) mentions the importance of identifying potential solutions to ensure their forests stay resilient to climate change, but does not provide examples. The 2030 NWT Climate Change Strategic Framework (https://www.gov.mb.ca/asset_library/en/climatechange/climategreenlanddiscussionpaper.pdf) briefly mentions assessing the impacts of climate change adaptation projects (including assisted species migration) on wildlife as a potential adaptation effort to implement the framework in the Northwest Territories. However, several provinces and territories (e.g., Nunavut (https://climatechangenunavut.ca/sites/default/files/3154-3155_climate_english_reduced_size_1_0.pdf), Saskatchewan (<https://www.saskatchewan.ca/business/environmental-protection-and-sustainability/a-made-in-saskatchewan-climate-change-strategy/saskatchewans-climate-change-strategy>)) do not mention assisted migration as a strategy being considered. This exercise highlighted the value of personal

Box 1. The Florida torreyia



The Florida torreyia (*Torreya taxifolia*) is an endangered tree located in the southeastern US. A Citizen Science group known as the Torreya Guardians was formed in the early 2000s with the goal of protecting the species. They argued the species would survive best in a cooler climate and took advantage of a legal exception to the Endangered Species Act, which allowed them to implement their own assisted migration project outside established institutions. Seeds and seedlings were moved from Florida (and South Carolina) to North Carolina, and later Wisconsin, Michigan, and New Hampshire. After about a decade of implementation, the Florida torreyia has thrived in some states, while in other states with cooler climates, the tree manages to survive, but is having more trouble growing than in warmer places. Although this assisted migration was criticized for its lack of scientific planning prior to implementation, it has provided noteworthy results in terms of this tree species' post-migration performance. Photo credit: Malcolm Manners via Flickr (CC BY 2.0 Deed—Attribution 2.0 Generic).

communication with individuals in agencies across the country to enable sharing of government documents that would otherwise not be readily accessible, or general discussions of current progress or future plans and capacity levels.

Given continued climate change pressures on ecosystems combined with other intersecting and cumulative stressors, assisted migration is likely to become increasingly considered as an adaptation tactic. Robust policy frameworks and regulations will be needed to ensure assisted migration is used in ways that are responsible, ethical, scientifically sound, and legal regarding ecological and socio-economic impacts and outcomes. As environmental professionals and the organizations they work for consider embracing assisted migration as a climate change adaptation tactic, collaboration with other agencies and partners across the country (and beyond) will be critical. For example, a pan-Canadian working group could develop core principles that could then be refined regionally given local context and with input from key actors (e.g., rightsholders) and that includes experts with ability to contribute to ethical, ecological, and socio-economic dimensions (Pelai et al. 2021). However, given that we also found evidence of policy gaps in other North American juris-

dictions, we have reason to believe that this issue could benefit from international coordination and dialogue. In fact, the International Union for the Conservation of Nature (IUCN) indicates the need for policy in their guidelines for reintroductions and other conservation translocations (see <https://portal.s.iucn.org/library/efiles/documents/2013-009.pdf>). Given the existing trilateral (i.e., Canada, USA, and Mexico) engagement related to conservation matters via the Trilateral Committee for Wildlife and Ecosystem Conservation and Management (<https://www.trilat.org/home-nav>), such pathways would be profitable for knowledge exchange or working together to develop core aspects of a policy. Brodie et al. (2021) call for global policy for assisted colonization (their wording—includes migration), which was published in the journal “Science” is a prominent call for such work. Nonetheless, Brodie et al. (2021) did not conduct a policy scan as we did here. Given that assisted migration will undoubtedly involve moving organisms or seeds/zygotes across jurisdictions, policy support will be needed in both the providing jurisdiction and the recipient jurisdiction (Sansilvestri et al. 2015).

Our review draws attention to the timeliness and value of collaborative work toward the development of robust policies for assisted migration. While published evidence for as-

sisted migration as a conservation tactic is lacking (Twardek et al. 2023), this policy development will have to proceed in the absence of a complete set of evidence, and be informed by new knowledge as more evidence emerges. Because the ways in which assisted migration can be deployed are diverse (Ste-Marie et al. 2011; Twardek et al. 2023), this will introduce challenges to policy development. Similarly, seeds and fish, for example, are very different such that it may be difficult to develop one-size-fits all policies that work across taxa and context. Collaborative work in this area could take stock of early experiments with these techniques to translate them into specific advice for updates or changes to existing policies in specific jurisdictions. Work in this direction is beginning (e.g., a proposed rule change to the US ESA to allow for movement of species outside traditional range; see <https://www.regulations.gov/document/FWS-HQ-ES-2021-0033-0001>), and much more is needed, particularly for those species that do not benefit from a history of active management (like in the forestry or agricultural sectors). Governments and other relevant bodies/organizations may wish to consider working collaboratively toward the development of robust policies for assisted migration—in the absence of a complete set of evidence—given that we anticipate this conservation intervention becoming more important and popular. Failure to engage in proactive policy development related to assisted migration could hamper efforts to be responsive to climate change and lead to ad hoc actions that could do more harm than good. Moreover, given that there appears to be acceleration in climate change impacts on the environment and societies (i.e., the Great Acceleration; Steffen et al. 2015), there is some urgency, hence the need to share experiences and make rapid progress on assisted migration policy and practice.

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Data availability

Data generated or analyzed during this study are provided in full within the published article and its supplementary materials.

Author information

Author ORCIDs

S.J. Cooke <https://orcid.org/0000-0002-5407-0659>

Author notes

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Author contributions

Conceptualization: SJC, JJT, TR, WMT, RVB, ALM

Data curation: JV

Funding acquisition: SJC, JJT

Investigation: JV

Methodology: GA

Project administration: SJC, JJT, TR

Resources: RVB, ALM

Supervision: JJT, TR

Writing – original draft: SJC, JV, WMT

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Supplementary material

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