



Aanji-bimaadiziimagak o'ow aki

Climate Change Vulnerability Assessment Version 2
Great Lakes Indian Fish and Wildlife Commission



Introduction



As it has been for centuries, Anishinaabeg descendants of those who migrated to the Great Lakes from the east guided by the miigis (shell) continue to rely upon animal and plant relatives to meet spiritual, ceremonial, medicinal, subsistence, and economic needs. Their on- and off-reservation hunting, fishing, and gathering activities demonstrate their exercise of treaty rights, tribal sovereignty, and cultural survival. Historically, tribal members were prosecuted for the exercise of their treaty rights and persecuted for practicing their culture and spirituality. Over time, activism, litigation, and intergovernmental agreements have facilitated a resurgence of culture and its expression through subsistence lifeways. However, climate change poses a new and potentially existential threat to Indigenous lifeways, culture, and identity. Indigenous peoples, particularly those who express their culture and relationship to their ancestral lands through subsistence practices, will be uniquely and disproportionately affected by these changes in climate.

Treaty Rights and Climate Change

Throughout their history the Anishinaabeg have been known as an adaptable people. For generations, this adaptability was demonstrated by the “seasonal round,” where the people moved with the seasons, separating and coming together in semi-permanent villages to hunt, fish, and gather food and medicine. In the Great Lakes and upper Midwest this included activities such as spearing ogaa (walleye) and harvesting namebinag (suckers) during their spawning runs, making Anishinaabe-zhiiwaagamizigan (maple syrup) in spring sugar camps, gathering wiigwaas (birch bark), medicinal plants, tubers, berries, and nuts in the summer, harvesting manoomin (wild rice) in the early fall, and hunting waawaashkeshi (white-tailed deer) and trapping other animals and furbearers throughout the summer, fall, and winter. This seasonal subsistence lifeway was possible because the Ojibwe occupied large landscapes with diverse land- and water-based resources and their mobility allowed them to adapt more easily to changing environmental conditions.

Access to this large land base was lost as Euro-Americans began to exploit the natural resources of and settle in the Great Lakes region in the early to mid-19th century. In the Treaties of 1836, 1837, 1842, and 1854, Ojibwe bands who communally owned and controlled lands and waters that make up large parts of what are now known as Michigan, Wisconsin, and Minnesota were coerced by threat of war or forced removal to cede the bulk of their territory (over 60,000 square miles) to the United States and to live on reservations scattered throughout their former homeland (Figure 1). Each of the treaties contain variously worded guarantees, now described as treaty rights, that tribal members continue to hunt, fish, and gather and practice their lifeways in the ceded lands and waters (hereafter referred to as the Ceded Territories) in perpetuity. These treaty rights were not granted to the tribes by the United States government but represent inherent sovereign land use rights reserved by the tribes in the treaties for the benefit of future generations of tribal members.

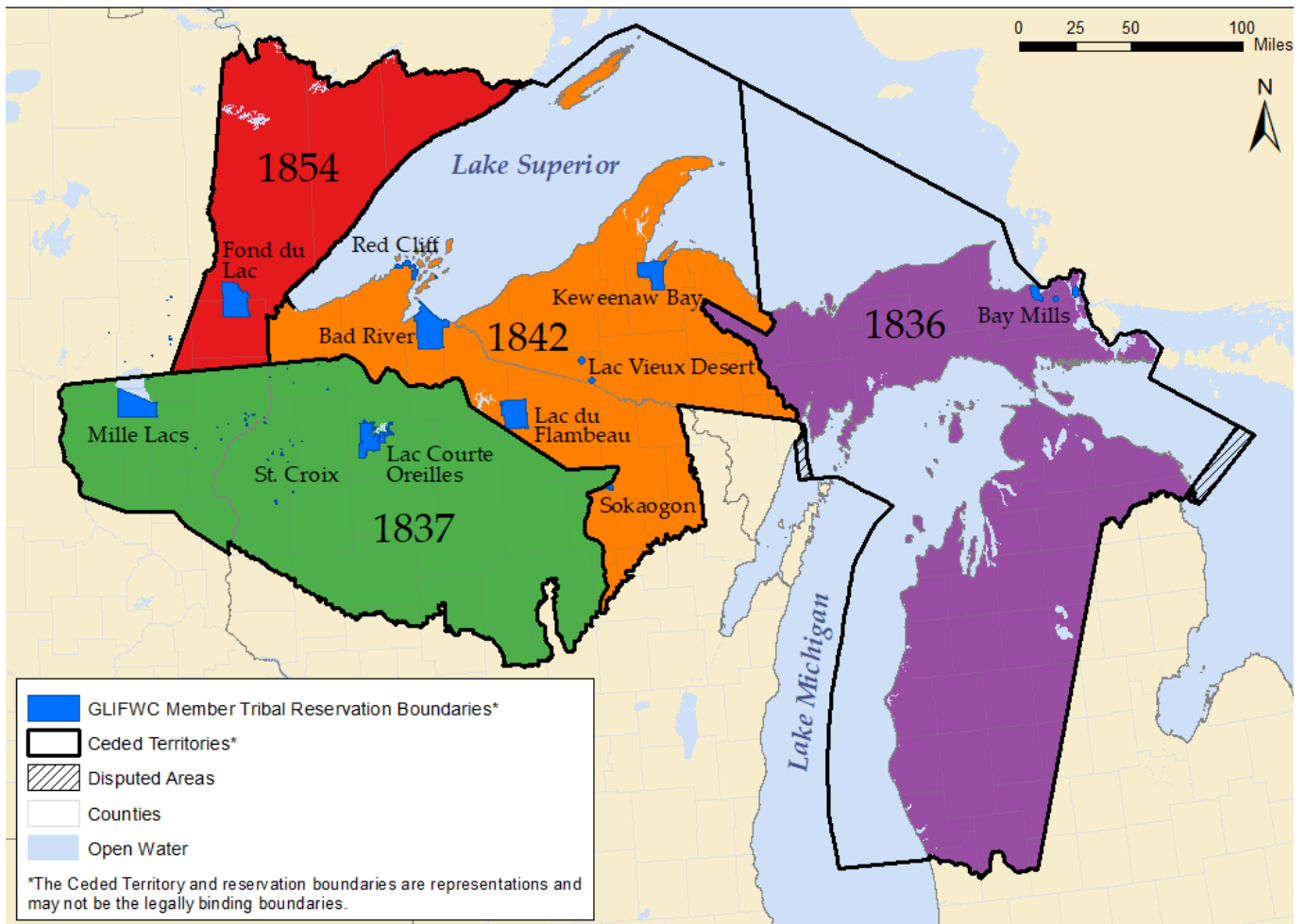


Figure 1. The 11 reservations of the tribes served by the Great Lakes Indian Fish and Wildlife Commission and the four Ceded Territories (1836, 1837, 1842, and 1854) in which they are situated.

Upon their formation in the mid-1800s, the states of Minnesota, Wisconsin, and Michigan began regulating hunting and fishing and refused to recognize that federally guaranteed treaty rights and tribal sovereignty preempted state regulation. State enforcement of hunting and fishing regulations, both off- and on-reservation, resulted in prosecution and incarceration of tribal members who continued practicing subsistence lifeways, separating families and intensifying ongoing intergenerational trauma.

After more than a century of conflict between the tribes and the states, multi-jurisdictional agreements and state and federal court decisions recognized, reaffirmed, and upheld the Ojibwe tribes' off-reservation treaty rights. This includes the ability to hunt, fish, and gather on ceded lands and waters, including areas of Lakes Superior, Michigan, and Huron, and to make a "modest living" from the land, which includes the harvest of resources for subsistence and for sale. Also guaranteed and reaffirmed is the sovereign authority of tribes to regulate the behavior of their members and cooperatively manage the natural resources of the Ceded Territories. Today each of the 11 Ojibwe tribes served by the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) has adopted on- and off-reservation conservation codes that guide tribal members in the exercise of their treaty rights and protect vulnerable or important beings (species) in a culturally aware and appropriate fashion. GLIFWC and tribal natural resources staff work to protect beings and habitats throughout the Ceded Territories, both unilaterally and in concert with their state and federal co-managers. Since the late 20th century, tribal members have been able to increase their off-reservation hunting, fishing, and gathering throughout the Ceded Territories, expanding their ability to practice their cultural heritage and utilize the treaty rights their ancestors reserved for them.

Now, however, climate change is affecting culturally significant plants and animals. As culturally important treaty-harvested beings respond to climate change, they may become locally or regionally extirpated, shift their ranges outside reservation and Ceded Territory boundaries, or otherwise become unavailable or unsustainable for treaty harvest. Because reservation and Ceded Territory boundaries are legally fixed in place, and treaty rights are limited in geographic scope, Ojibwe tribal members today do not enjoy the same ability to move across the landscape in response to changing environmental conditions that allowed their ancestors to survive and thrive.

The effects of climate change on treaty resources are already being felt in the Great Lakes region. In the case of wiigwaasaatig (paper birch), warming temperatures and increased periods of drought, combined with non-climate stressors such as commercial demand in the home decoration sector, have led to the implementation of tribal harvest restrictions. Some beings, such as waabooz (snowshoe hare), are responding to changes in their environment by shifting their ranges to the north and may eventually shift their ranges out of the Ceded Territories entirely. Others, such as baapaagimaak (black ash), are threatened by bakaan ingoji gaa-ondaadag which can overwinter in greater numbers as winter temperatures warm. Finally, many climate change-related factors, including more frequent intense rainstorms and warmer summer nights, have affected and will continue to affect manoomin (Figure 2). Manoomin, gifted by the Creator to the Anishinaabeg, is a being so deeply embedded in culture and spirituality that many tribal members fear a loss of identity as their ability to maintain their relationship with manoomin is lost due to the cumulative effects of climate change and changes in water quality, disease, manidoonsag (little spirits/pests and pathogens), and other stressors.



*Figure 2. Manoomin (wild rice) is deeply embedded in Ojibwe culture and spirituality.
Photo credit: CO Rasmussen (GLIFWC).*

Results



Vulnerability Scores

Swimmers had the highest median vulnerability score and four-leggeds had the lowest median vulnerability score in the worst-case scenario. Median scores for swimmers fell into the HV ranking, median scores for crawlers and plants fell into the MV ranking, and median scores for flyers and four-leggeds fell into the LV ranking (Figure 32). Ten beings had a vulnerability score in the worst-case scenario over 16 (in the EV category) — manoomin, waabooz, odoonibiins (tullibee), mashkiigwaatig (tamarack), mooz, mashkiigobag (Labrador tea), giizhikaatig (northern white cedar), adikameg (lake whitefish), waabizheshi, and ininaandag (balsam fir). Manoomin was the most vulnerable being in the assessment. Miskomin (raspberry) and zhingos (long-tailed weasel) were the least vulnerable beings (Figure 33).

The scores of 63 beings were adjusted an average of 1.07 (± 2.49) points after review — 41 scores were increased and 22 were decreased. Of the 63 adjusted, six scores were adjusted enough to change the vulnerability rankings (LV, MV, HV, EV). The scores of 17 beings were adjusted again according to information gathered in TEK interviews. The scores adjusted according to information gathered in TEK interviews were adjusted an average of 0.75 (± 0.54) points. All but two of the scores increased — the scores of aandeg and ininishib (mallard) decreased with the addition of information from TEK interviews. None of the resulting vulnerability rankings were changed by including information from TEK interviews (Table 4).

For more information on each being, see individual pages in the Beings pages section on pages [66–234](#).

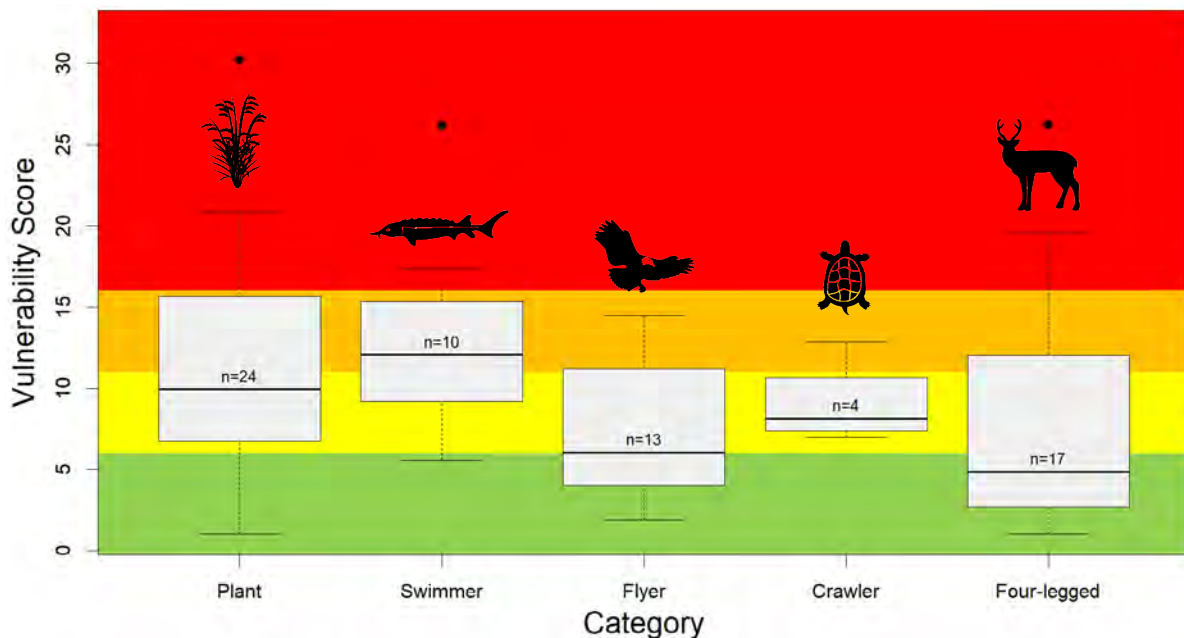
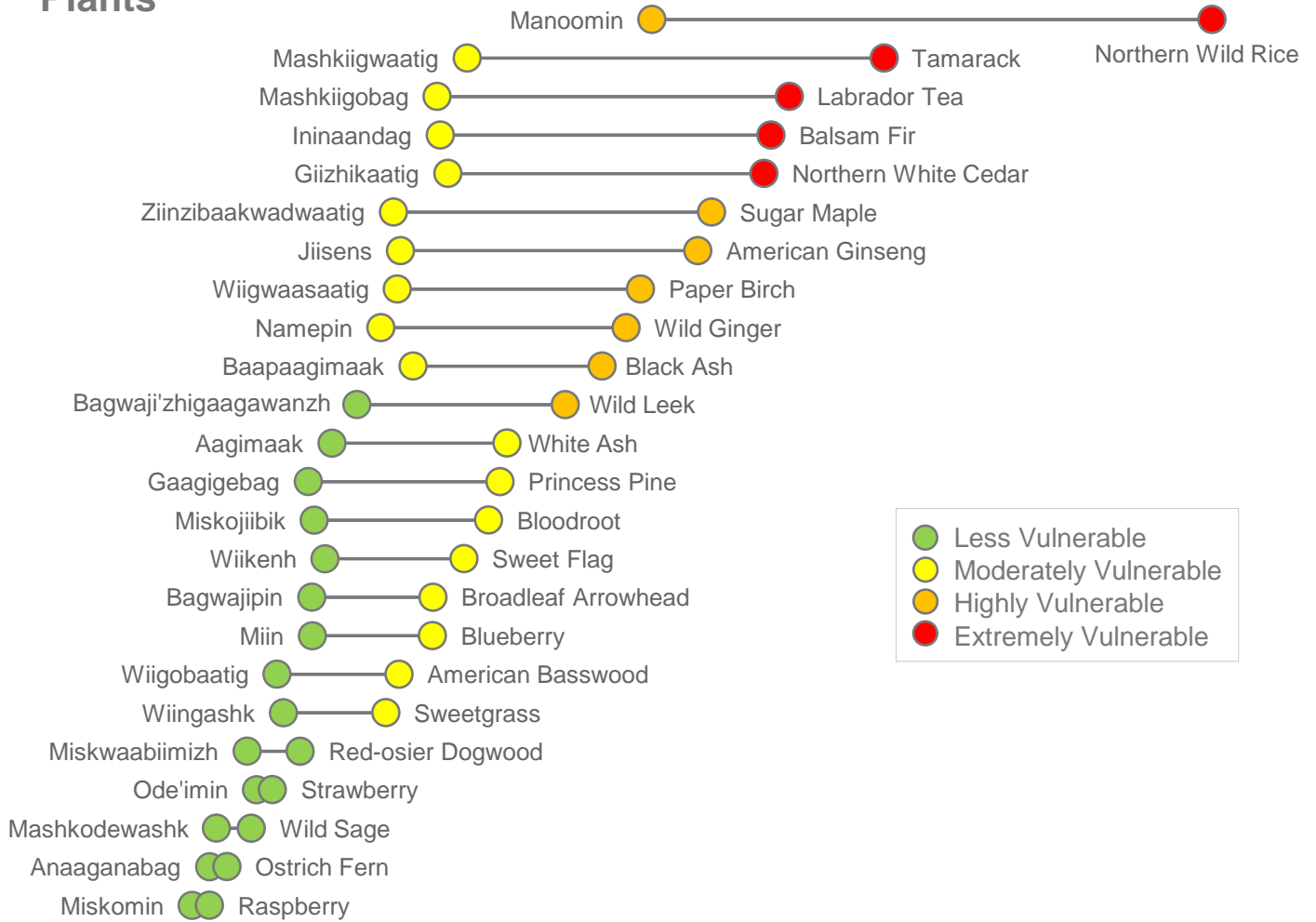


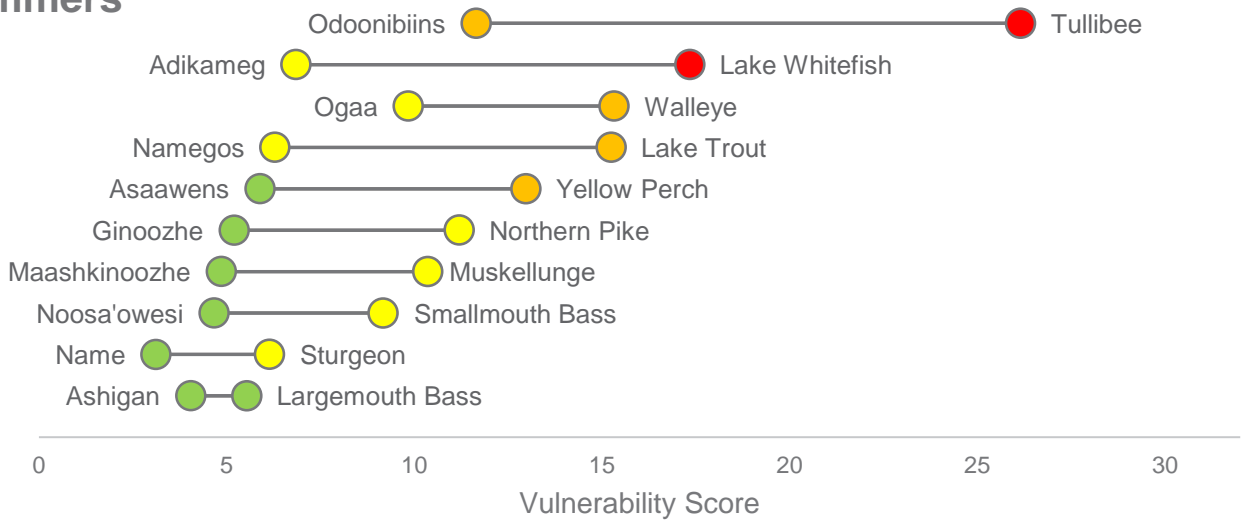
Figure 32. Average vulnerability score by category, in the worst-case scenario (MIROC5 model, RCP8.5). Two categories (four-legged and plant) contained outliers. The outlier in the four-legged category was waabooz and the outlier in the plant category was manoomin. Colors indicate overall vulnerability ranking: green = less vulnerable (LV), yellow = moderately vulnerable (MV), orange = highly vulnerable (HV), and red = extremely vulnerable (EV). LV indicates available evidence does not suggest that abundance and/or range extent within the geographic area assessed will change substantially by 2050. MV indicates abundance and/or range extent within the geographic area assessed is likely to decrease by 2050, HV indicates abundance and/or range extent within the geographic area assessed is likely to decrease significantly by 2050, and EV indicates abundance and/or range extent within the geographic area assessed is extremely likely to substantially decrease or disappear by 2050.

Ojibwe name (best-case vulnerability score) English name (worst-case vulnerability score)

Plants



Swimmers



Ojibwe name (best-case vulnerability score) ————— English name (worst-case vulnerability score)

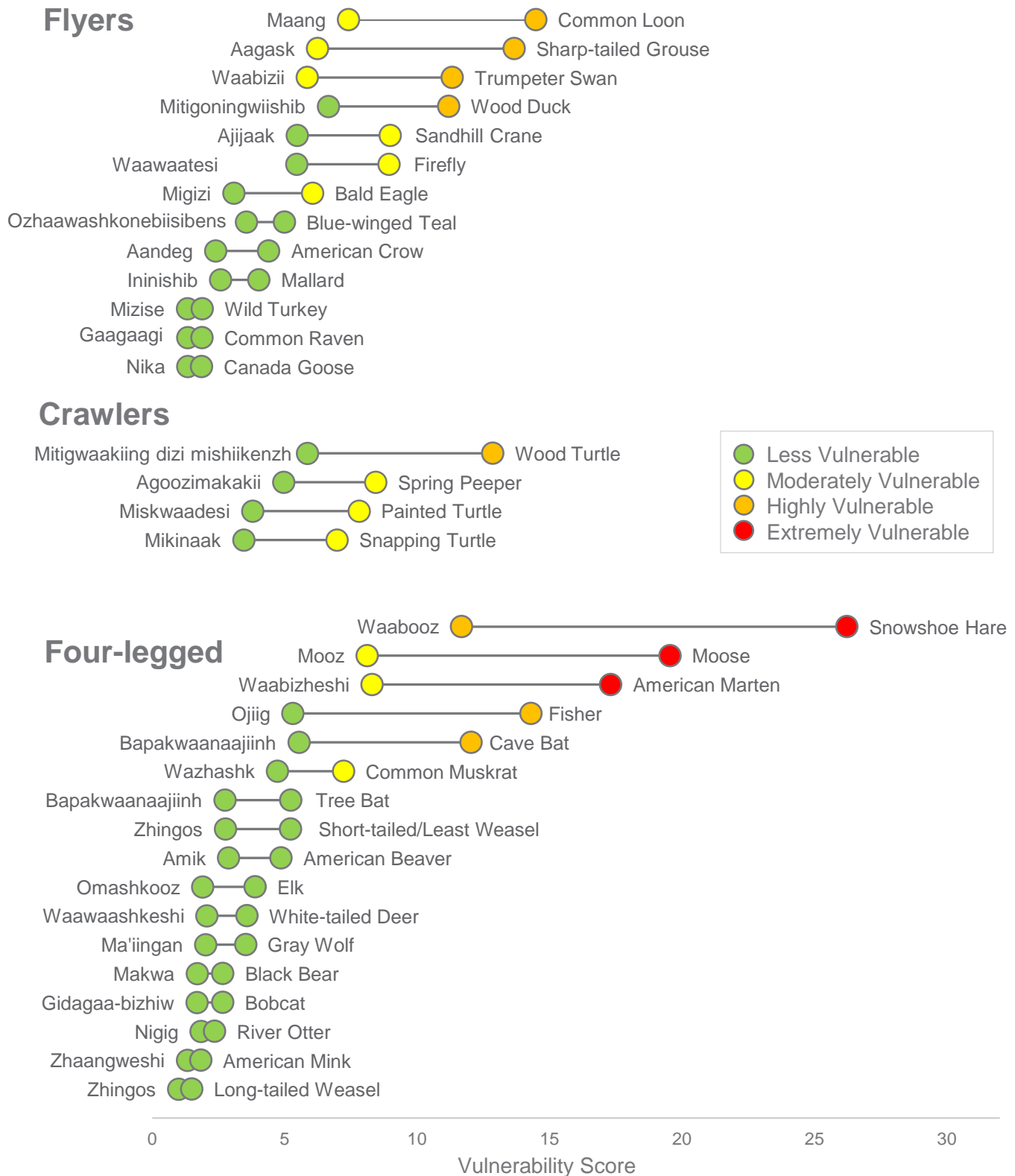


Figure 33. Vulnerability of all beings, grouped by category, in the best case (MRI-CGCM3 model, RCP8.5; dot on left side) and worst case (MIROC5 model, RCP8.5; dot on right side) scenario. Note that tree and cave bats are separated here, as are short-tailed/least weasels and long-tailed weasels. Less vulnerable indicates available evidence does not suggest abundance and/or range extent within the geographic area assessed will change substantially; moderately vulnerable indicates abundance and/or range extent within the geographic area assessed is likely to decrease; highly vulnerable indicates abundance and/or range extent within the geographic area assessed is likely to decrease significantly; and extremely vulnerable indicates abundance and/or range extent within the geographic area assessed is extremely likely to substantially decrease or disappear, all by 2050.

Discussion



Many beings of interest to GLIFWC's member tribes will be affected by climate change in the upper Midwest Ceded Territories, regardless of which emissions scenario unfolds. In the worst-case scenario, 45 of 66 beings were categorized as moderately vulnerable or higher. Many of these will decrease in abundance and/or shift their ranges by the mid-21st century. In some cases, their ranges may shift out of the Ceded Territories entirely, putting at risk relationships held with Ojibwe people for centuries. Despite being categorized as less vulnerable, the remaining beings will also be impacted by increasing temperatures, variable precipitation, extreme storms, warmer winters, and/or the arrival of bakaan ingoji gaa-ondaadag, among a growing list of climate change effects.

Swimmers were the most vulnerable category, mostly due to higher scores for questions about physiological thermal niche, manidoonsag or predators, competition, dietary versatility, and projected decreases in range and population size ([Appendix 3](#)). Scores were not similar across all swimmers, however. Cool/cold-water swimmers (e.g., oгаа, odoonibiins) had moderate to extreme vulnerability scores while warm-water swimmers such as ashigan and noosa'owesi had low to moderate scores. Cool/cold-water swimmers may be limited in the habitat they can occupy, particularly in the summer when surface temperatures are too warm and oxygen levels are too low near the bottom of a waterbody. Changes in land use after European settlement and climate change have reduced the oxy-thermal habitat of cool/cold-water fish habitat in stratified lakes in the upper Midwest in the last century (Jacobson et al. 2019). Forested areas in catchments around these lakes should receive high priority for protection to maintain cool/cold-water habitat (Jacobson et al. 2019). As for warm-water swimmers such as ashigan, research indicates that population size and range may expand in the upper Midwest as the climate changes and habitats become more favorable for these beings (Hansen et al. 2017).

Plants were almost as vulnerable as swimmers on average and made up five of the ten most vulnerable beings. Manoomin was the most vulnerable being in the assessment and is discussed in greater detail below. Plant beings had higher scores for questions about dispersal ability, dependence on other beings for dispersal, impacts of hydrology, interspecific interactions, and a documented response to climate change ([Appendix 2](#)). As plants disperse across the landscape slowly, in many cases they may be unable to respond quickly enough to the rapid pace of climate changes, and local hydrological impacts will affect them to a much larger degree than other beings. Many plants also have close relationships with other plant beings, and most have relationships with mycorrhizal fungi that will be challenged as climate change creates conditions favorable to some beings and less favorable to others. Many plant beings, particularly understory beings, are under-researched in general and in relation to climate change, with many climate change studies focusing primarily on trees (e.g., Janowiak et al. 2014). A lack of data made it more difficult to assess those understory plant beings, and therefore confidence levels for many of those beings are low. This assessment will provide a baseline for investigating climate change effects on some culturally important beings often overlooked in the scientific literature.

Four-leggeds and flyers were the least vulnerable categories on average, though scores varied widely. For both groups, but particularly for flyers, this is likely due in part to their ability to travel longer distances across the landscape to respond to changing conditions and cross barriers that can prevent the movement of other beings. Four-leggeds also scored the lowest in the questions pertaining to hydrologic changes and other disturbances, manidoonsag and predators, and genetic variation. As four-leggeds are often higher on the food chain than other beings, in general they have fewer predators and often have methods of dealing with manidoonsag (Hart 2011). However, many of the four-legged beings, such as waabooz, mooz, waabizheshi, and ojiig, are northern beings highly dependent on winter conditions and a deep snowpack. Migratory flyers also have another set of climatic conditions to contend with on their wintering grounds, which were not investigated in this assessment, and which may increase their vulnerability beyond what we have considered here.

The average vulnerability score for crawlers was moderate. Crawlers scored the highest for the questions about barriers, disturbances, and genetic variation. These beings also disperse short distances, and as small, mostly aquatic beings, are affected by many natural and manmade barriers to dispersal as well as changing hydrologic conditions. Nearshore nesting sites are susceptible to flooding during heavy rain events. There are many references to frogs and toads as “indicators” of ecosystem health, including in Great Lakes coastal wetlands, as they are documented to be sensitive to a variety of human stressors (Price et al. 2007). Climate change will continue to add to existing stressors for these beings.

Other assessments in the upper Great Lakes region found many of the same beings to be vulnerable to climate change, though there were some differences in the levels of vulnerability projected. These differences are likely due to differences in regional climate impacts, and the different interactions among living and non-living beings (e.g., earth, water, fire, and air) in each assessment area (Janowiak et al. 2014, Inter-Tribal Council of Michigan, Inc. 2016, Stults et al. 2016, Wisconsin Initiative on Climate Change Impacts [WICCI] 2017). For example, manoomin was found to be moderately vulnerable in 1854 Treaty Authority’s Vulnerability Assessment and Adaptation Plan (Stults et al. 2016). There may be a few reasons for the difference in vulnerability ratings between the two assessments – the 1854 Ceded Territory extends farther north than the 1837, 1842, or 1836 Ceded Territories. Local variance in water quality, climate impacts, genetic variation, manoomin abundance, among others, may also be different in the different, although overlapping, assessment areas.

The factors that had the most influence on the vulnerability of beings in this assessment were manidoonsag and predators, changing hydrological conditions, and an increase in disturbances. Manidoonsag and predators (called “pathogens or natural enemies” in the CCVI) were the most influential factor in the assessment, affecting the scores of 45 out of 66 beings. Warmer winter nights in particular will likely allow many manidoonsag to overwinter in higher numbers or allow new manidoonsag to move into the Ceded Territories and have increased impacts on many beings, particularly plants. Some examples of this are baapaagimaak, which will be increasingly affected by the emerald ash borer; manoomin, which can be impacted by rice worms and brown spot disease; mooz, which is affected by winter ticks; and bapakwaanaajinh, which is affected by white nose syndrome. Other studies have confirmed that manidoonsag are moving north to new places (Bebber et al. 2013). However, because these beings have such complex, unstable relationships that are not very well understood, there is still a large amount of uncertainty in what will happen with many of these interactions as the climate changes (Dukes et al. 2009). Predators increasing in population due to climate change was an additional part of this factor; some beings favored by climate change, such as gidagaa bizhiw, are predators that have the capacity to hunt many other beings. Browsing by waawaashkeshi influenced the vulnerability of many plant beings, including giizhikaatig (Weiskopf et al. 2019). Disturbances such as extreme storm events (including flooding, wind, and wave action) influenced the vulnerability scores of 38 beings. When extreme storm events occur, sedimentation can disrupt fish spawning grounds, wind and wave action can displace eggs or larvae, and flooding can inundate the roots of plant beings and damage the homes of animals. Though wildfire is not common in most of the Ceded Territories, increases in intense fires may impact some beings in the assessment. Changing hydrologic conditions impacted the scores of 32 beings. Longer periods of drought or increased rainfall can disrupt the habitat of beings that depend on consistently moist conditions, such as baapaagimaak and waawaatesi. These changing conditions will also cause varying water levels, which will impact beings such as mitogoningwiishib and manoomin.

Shifting ranges or changes in population size and density of beings due to climate change and other factors will bring new interactions and relationships (e.g., Hansen et al. 2001; Van der Putten et al. 2010). Other new interactions will occur when beings are assisted in their migration by humans, when bakaan ingoji gaa-ondaadag expand their ranges or are introduced into new areas, or when other changing environmental conditions influence the migration of certain beings. Areas within the Ceded Territories are being promoted by mainstream media and some non-governmental organizations as “climate refuges” for humans escaping more severely impacted areas of the world. Increased human migration into the Ceded Territories will likely lead to more development, deforestation, industrial agriculture, and impacts to nibi (water) to meet

the demands of more people, all of which will impact Ceded Territory beings and ecosystems. While Ojibwe people have adapted to changing relationships for millennia, the speed of these climate-related changes will affect their ability to maintain cultural relationships with beings that they have held for centuries. Some of these relationships may be lost as beings are no longer found in the Ceded Territories, and with those relationships, culture, language, and traditions surrounding those beings will be lost as well. However, there may also be new relationships forged with beings that have not previously resided in the Ceded Territories or had previously been in low abundance. There are current examples of this, in which beings brought from other countries are now commonly used by Ojibwe people. For example, common mullein and broadleaf plantain were introduced in the 18th century and are now used medicinally. These relationships will continue to change with the climate.