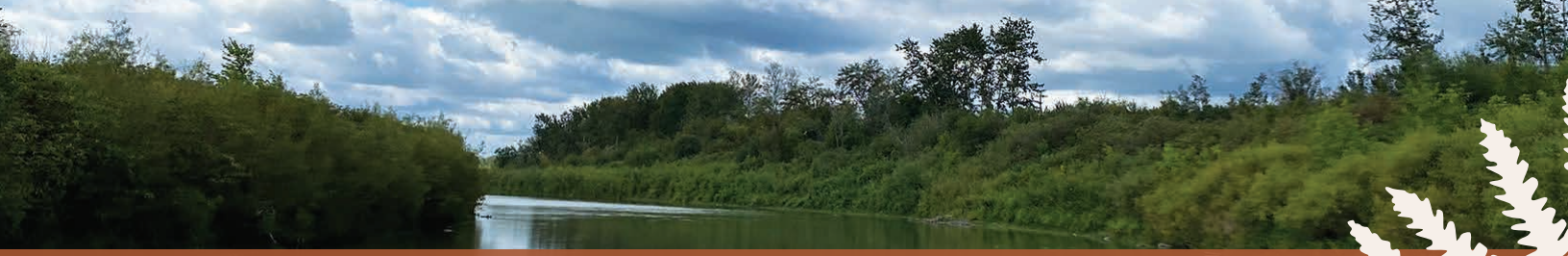


HEALTHY LAND, HEALTHY PEOPLE

INDIGENOUS-LED CLIMATE ACTION:
Assessing land changes and the links to health

Prepared by Rebecca Zalaski and Denise Webb

Whitefish Lake First Nation #128 (WFL #128) is a vibrant and culturally rich First Nations community in Treaty Six territory within northeastern Alberta. WFL #128 is a self-governing community covering an area of over 50 square kilometres with a population of approximately 3,237 members, two-thirds of whom reside on reserve (WFL #128, personal communication, May 2025).

WFL #128 is a leader in environmental stewardship and sustainability for both current and future generations. Goodfish Lake Business Corporation, a development corporation within WFL #128 that employs much of the WFL #128 population, recognized the need for an environmental division to be created directly in the community. In response to this need, Mother Earth Environmental Services was established to work towards remediating and protecting the environment of WFL #128, while also establishing environmental career opportunities for both WFL #128 members and non-members within the community.

In 2023, WFL #128 began a two-year project to assess how lands across the territory have changed over time and the effect this has had on wildlife and plant species and their habitats.[1] Climate change can affect lands by changing and raising temperatures, impacting harvesting, displacing plants and animals, degrading ecosystems, and disrupting seasonal patterns (Galway et al., 2022). These changes are pertinent to public health because of the direct links to food security, mental well-being, livelihoods, and physical and respiratory health from water and air quality, among other examples (Galway et al., 2022; National Collaborating Centre for Indigenous Health [NCCIH], 2022). This fact sheet summarizes the WFL #128 land change assessment and its results, highlights the links to human health and well-being, and draws connections to related research to address some of the key findings. Unless otherwise cited, the information presented in this fact sheet is sourced directly through personal communications with WFL #128.

[1] This project was completed in partnership between WFL #128 and WSP Canada Inc. (WSP), with financial contributions from the Environment and Climate Change Canada (ECCC) Terrestrial Cumulative Effects Initiative (TCEI). The views expressed herein do not necessarily represent the views of WSP or ECCC.

National Collaborating Centre for Indigenous Health
Centre de collaboration nationale de la santé autochtone

GOOD FISH

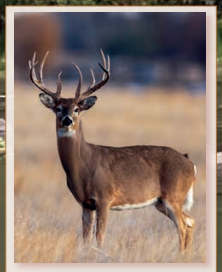
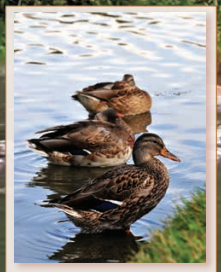
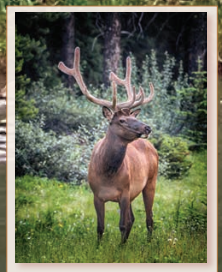
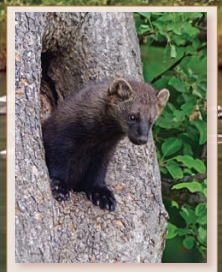
MOTHER EARTH ENVIRONMENTAL SERVICES
A FIRST NATION COMPANY

Whitefish Lake FIRST NATION #128

Indigenous communities across Canada have been gathering traditional plants and medicines and hunting and trapping since time immemorial, providing subsistence and exercising food sovereignty (Joseph/styawat, 2021; Poirier & Neufeld, 2023). When an environment permits – in sustainability and safety – gathering, hunting, and trapping contributes to physical, mental, emotional, and spiritual health; strengthens familial and community connections; and enhances food security. Wild plants provide nutrients and medicines; wildlife too can transfer medicines from the plants they consume (Priadka et al. 2022).

Research with First Nations hunters found **hunting activities contributed to light, moderate, and vigorous physical activity,** and exceeded Government of Canada recommendations for 150 minutes of physical activity per week. Hunting may improve cardiovascular and physical health, especially if a hunt is successful, which can lead to heavy lifting and strenuous walks (Paul et al. 2024). Hunting and trapping can also create opportunities to transfer knowledge between generations, fostering the health and well-being of generations to come (NCCIH, 2022).




This resource is one in a series of fact sheets that showcase WFL #128's climate action, whilst viewing the climate crisis through a public health lens. Aimed at knowledge sharing with First Nations communities, policy- and decision-makers, and interested readers alike, this resource emphasizes the vast connections between climate action and protecting and promoting the health and well-being of Indigenous Peoples[2] and communities.

WFL #128's land change assessment: What did the project entail?

Voices of WFL #128 members steered the project, starting off with interviews with community members and Elders – **particularly hunters, trappers, and plant gatherers – to first identify plant and animal species of significance to the community.** Biologists matched the identified plants and wildlife to the types of land covers that support their habitats. These land covers were then ranked in importance from high to low based on how many different species they are able to support, with the highly rated land covers deemed land cover classes of significance (LCCS), denoting the type of land cover as significant to the WFL #128 community.

WFL #128 then conducted a field survey program within the reserve boundaries in which land cover boundaries were clearly drawn using GPS points. WFL #128's ground-level field survey data was combined with high-

[2] The term 'Indigenous Peoples' is used here to refer to First Nations peoples, Inuit, and Métis peoples collectively.

Food sourced from wild game meat is widely recognized for its high nutritious content and nutrient density in comparison to store-bought foods. In a study comparing First Nations peoples' diets with and without hunted foods, diets with game meat had more protein and less fat and sugar; higher levels of Vitamins A, C, D, and B, including B6, B12, riboflavin, and niacin; more essential minerals, including iron, zinc, magnesium, potassium, phosphorus; and lower levels of sodium (Batal et al. 2021).

Deer (both white-tailed and mule, two of the wildlife species found to have an abundant habitat in the WFL #128 area), when roasted, is an excellent source of protein, riboflavin, niacin, and iron, as it provides 25% or more of the daily need of these nutrients. Deer liver, when cooked, also provides an excellent source of these nutrients as well as Vitamins A and C (First Nations Health Authority, n.d.).

resolution satellite imagery from 1984 to 2022 and data from the Alberta Biodiversity Monitoring Institute (i.e., ground truth data covering wildlife species, habitats, and characteristics of human footprints in the area) to create a comprehensive, all-encompassing geodatabase to assess use. Land cover maps were created from the geodatabase using remote sensing and artificial intelligence technologies. The maps located LCCS in the WFL #128 territory. Linear features – such as roads, cutlines, ATV lines, and fences – were also identified on the maps using satellite imagery and Google Earth data.

The land cover maps were analyzed to first track changes in the landscape over time, then assess how these changes had affected LCCS that host habitats for plant and wildlife species. Changes in land features were assessed to identify effects on the vitality of and community access to plants and wildlife. Each step of the project was then pulled together to understand which species in the area are secure in their habitats and which may be at risk as a result of a changing climate and human activity.

What did the WFL #128 land change assessment find?

WFL #128 community members identified **beaver, coyote, deer (white-tailed and mule), duck, elk, fisher, geese, prairie chicken, marten, moose, skunk, weasel, and rabbit as important wildlife in the area**. The LCCS that were matched to the species and received high rankings (meaning they supported habitats for nine or more of the wildlife species) consisted of riparian, cropland, grassland, deciduous forest, and marsh.

In terms of plants, WFL #128 community members identified 38 plant species of importance in the area. These plants came from a variety of classes, including trees and shrubs (e.g., "birch bark," blueberries, cedar, hazelnut), forbs (e.g., bear root, fireweed, goldenrod, mint, sage), graminoids (e.g., sweet grass), and fungus (e.g., "chaga", diamond willow fungus).[3] LCCS of riparian, grassland, deciduous forest, and swamp were matched to the plants and highly ranked, as each supports habitats for 15 or more plants.

The LCCS for wildlife and plant species were found and located on the WFL #128 land cover maps. Deciduous forest (a highly ranked LCCS for both wildlife and plant species), cropland, grassland (also highly ranked for both), open water, and shrubland were the most abundant LCCS in the area. Other LCCS, such as marsh, swamp, barren, mixedwood forest, and riparian were identified to a smaller extent.

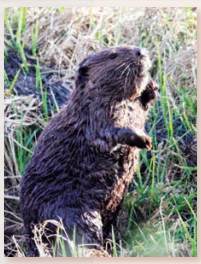
[3] While this fact sheet offers examples of medicinal and healing properties of plant medicines, this information does not provide medical advice.

Plants are food and medicine. Fireweed (the plant species with the largest habitat in the WFL #128 region) is found in woodlands and clearings and can be used for skin irritations and consumed to treat intestinal worms. Fireweed leaves are rich in Vitamin C and contain 6.5 g of protein per 100 grams (Marles et al. 2000).

Diamond willow fungus, found in wetland areas, can be burned and inhaled to treat headaches or placed directly in an ear to treat earaches (Marles et al. 2000).

Northern gooseberry (found to have an expanding habitat in the WFL #128 region) can be consumed fresh or as a jam, and used to support menstrual and maternal health. Fresh gooseberries provide a good source of potassium and one gram of protein per 100 grams (Marles et al. 2000).

Valerian root ("little root") has many health benefits. The roots can be used as a sleep aid, to treat gastrointestinal cramps, lower blood pressure, or help reduce anxiety and stress; the stems and leaves can be used as a tea to treat colds, fevers, or aches; and the leaves can be used for maternal and fetal care (Marles et al. 2000).



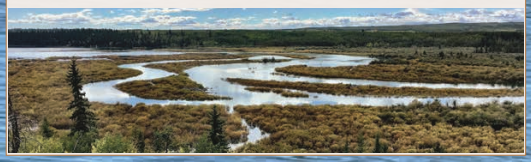
Valerian root and beaver, two critical plant and wildlife species within the WFL #128 territory, can be paired together for medicinal and health purposes. For instance, facial rashes can be treated by creating an ointment using dried valerian root leaves and beaver fat (Marles et al. 2000).

Deciduous forests – draped with trees that shed their leaves in the fall, such as aspen, balsam poplar, and white birch – are important to human health. These forests have strong ties to improving mental health and immune system function; decreasing stress; enhancing air quality; and mitigating floods, droughts, and noise (Karjalainen et al. 2010). Both walking and sitting in deciduous forests have been found to decrease tension, anxiety, depression, anger, hostility, and fatigue; while walking in deciduous forests can be particularly effective in increasing vitality, energy, attention, and focus (Wu et al. 2023).

Grasslands, a highly undervalued ecosystem, are becoming increasingly threatened. Grasslands support food security and agriculture, and provide pasture for grazing. They are also extremely effective at storing terrestrial carbon over long periods of time, helping to mitigate the effects of climate change (Lyons et al. 2023).

Cropland improves livelihoods and food security. When sparse, the presence of cropland can improve mental health among populations (Li & Managi, 2024). However, when overly abundant, disease vectors can grow on cropland and contaminate waterways, increasing the risk of infectious disease among humans (Myers, 2012).

Wetlands - marshes, swamps, peatlands, and open water – purify water, prevent flooding and drought, preserve soil, and support food production (Horwitz & Finlayson, 2011). Their presence has some of the strongest positive impacts on mental health among populations, compared to other land types, especially in urban areas (Li & Managi, 2024).



Riparian areas – located adjacent to rivers, streams, and lakes – improve water and air quality, prevent floods, and provide recreation (Singh et al. 2021). Hiking riparian trails has been found to significantly decrease stress (cortisol) levels, particularly when hikers see the trail as having high aesthetic value based on vegetation, trees, water, wildlife, or other riparian attributes (Opdahl et al. 2021).

A positive result of the assessment showed that over time, the majority (61.79%) of the WFL #128 landscape remained intact, with maps showing unchanged land cover class between 1984 and 2022. Northern areas experienced more changes than the south. Some LCCS increased over time, including cropland, deciduous forest, barren land, and open water; while others decreased, including swamp, marsh, peatland, coniferous forest, mixedwood forest, riparian, grassland, and shrubland.

Between 2010 and 2023, 81.90% of the linear features – which include cutlines, ATV lines, roads, and fences – remained the same, while 15.44% increased.

Pulling together the results of each step of the project — interviews, map development, and trend analysis — WFL #128's land change assessment revealed effects on habitat areas, with some wildlife and plants being more secure than others. For instance, habitats for wildlife species expanded for prairie chicken, weasel, and geese over the years; decreased for duck, beaver, marten, and moose; and remained the same for fisher, coyote, deer, skunk, and rabbit. Habitats for plant species expanded for valerian root ("little root"; common), rhubarb, gooseberry, and hazelnut; and decreased for yarrow, juniper, onion, sage, sweet grass, red willow, diamond willow, horsetail ("stove pipe"), dandelion, red clover, mint, rose, diamond willow fungus, valerian root ("little root"; northern), spruce gum, and blueberry.

WFL #128's assessment indicates that some wildlife and plant species may be at risk of extinction due to decreasing habitat areas. If current trends continue, WFL #128's assessment found the following species are anticipated to be extinct: duck by the year 2091 and beaver by 2107; juniper, prairie onion, sage, and yarrow by 2067; red willow by 2074; dandelion and red clover by 2089; and valerian root ("little root"; northern) by 2114.

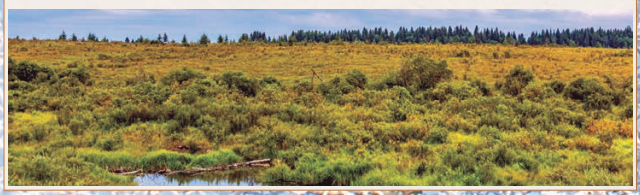
What can be done? Insights from related research

Just as First Nations peoples' health and well-being is interconnected with the lands and waters, First Nations knowledges and languages are intimately connected to adaptation strategies that can protect plants and animals in a changing climate (Dickson-Hoyle et al. 2021). First Nations people must be supported to lead solutions on their respective territories, as respected rights holders and stewards of the land, and in partnerships — with ecologists, biologists, environmental scientists, or others — that are grounded in respect, reciprocity, and responsibility to the land, plants, and animals (Dickson-Hoyle et al. 2021; Druschke et al. 2024). For example, Etuaptmumk (two-eyed seeing) may guide adaptation strategies to blend and balance Indigenous and western sciences, while privileging Indigenous worldviews to move the work forward (M's-it No'kmaq et al. 2021). This is also the mission of Mother Earth Environmental Services as the environmental division within WFL #128 — to combine Traditional Ecological Knowledge with western environmental science to assess the environment through a more holistic approach.

Barren land – bare and open spaces – can result from forest fires and deforestation, leading to a significant loss of vegetation and posing a risk to soil health and food security for humans. Barren land is often an indicator and result of anthropogenic (human) presence and/or activity.

Forests reduce carbon dioxide in the atmosphere through photosynthesis, improving air quality and reducing respiratory conditions such as asthma (Nowak et al. 2014). Broadleaf deciduous forests, followed by coniferous forests and croplands, are especially effective in removing carbon, more-so in rural areas than urban (Rogers & Chen, 2022). Studies have linked living in forested areas to improved moods and mental health, and lessened stress (Nisbet et al. 2020), as well as lower direct health care costs in the United States (Van Den Eeden et al. 2022).

Peatland is a critical wetland for combating climate change and its effects on human health (NCCIH, 2022). Over both long and short periods of time, peatlands in the boreal forest can store and sequester more carbon than trees (Beaulne et al. 2021), pinpointing peatlands specifically as important ecosystems for climate change adaptation strategies. Lack and loss of peatland ecosystems is often an indicator of an unhealthy or depleting environment.



Linear features are structures and pathways that are designed to increase human access through outdoor spaces and contribute to livelihoods and recreation. While beneficial, linear features can adversely affect human access to critical plant and wildlife species, thereby also affecting common health links to food security and physical and mental health. Linear features influence the growth and movement patterns of plants and wildlife, and the quality of their habitats. They can influence soil health and quality, interrupt growth and migration patterns, and lead to increased risks of wildlife mortality from vehicle collisions.

Indigenous Peoples' health and the health of the land are one in the same, interconnected by a reciprocal relationship. The health of the land is a determinant of Indigenous Peoples' health. Plants and animals' health and security can thus have a profound impact on mental, spiritual, and physical health, and cultural identity (Galway et al., 2022; Hatala et al., 2024).

Research on climate adaptation strategies — with an aim of preserving, conserving, and restoring habitats for wildlife and plants — is growing. Based on WFL #128's assessment, the following sections focus on beaver and duck habitats and look to related external research to gather ideas about potential climate adaptation strategies to protect their habitats.

Relational approaches to beaver habitat restoration: Wetlands and riparian

Research suggests beaver habitat restoration begins with the end – beavers; that is, beavers are capable of restoring degraded wetlands and expanding riparian environments by mere reintroduction to an area and their creation of ponds and dams (Dittbrenner et al., 2018). When the area is suitable, appropriate, and safe, beavers can restore wetland ecosystems in dry and temperate environments, creating habitats over time for a host of species, including ducks, fish, and frogs, and can improve the potential for carbon sequestration to also combat climate change (Hood & Bayley, 2008; Law et al. 2017).

Beavers are sometimes thought of as ecosystem engineers because of their meticulous ability to construct dams and forage trees and plants (Dittbrenner et al. 2018). However, before employing beavers to do their restorative work, climate scientists caution that a relational approach is needed to guide the process for the benefit of beavers, land, and humans (Druschke et al. 2024). A relational approach is one that sees beaver as a teacher and collaborative partner and is accountable to beaver's safety and well-being. Place-based and relational knowledge is considered, such as: are relations critical to beaver survival supported in this new environment? Are current or past predators nearby? What will be the long-term effects of the restoration, such as on landscape and local fisheries? (Druschke et al. 2024). A relational approach can set the foundation for habitat restoration that combines both Indigenous and western knowledges.

Place-specific plant habitat restoration: Grasslands

Grassland restoration – for juniper, prairie onion, sage, and yarrow – is site-specific and depends on many factors such as climate, grassland type and its vegetation, and the reasons behind its degradation (Lyons et al. 2023). Speaking with and learning from local experts to an area and its local climate and ecosystems can tailor restoration projects to root causes (Kleemann et al. 2017). For instance, one study interviewed local First Nations Elders and learned that water is vital to grassland ecosystems and its sources and quality must be considered before restoration projects are implemented (Blackstock & McAllister, 2004). Elders described First Nations water irrigation practices that pre-date colonial interventions such as using small ditches, the flow regulated by humans, to slowly water plants and soak the soil as needed. The Elders described how this process also facilitated water conservation (Blackstock & McAllister, 2004).

First Nations fire practices are another common approach to restore grasslands and manage plant habitats. Depending on the community, this practice often involves small, controlled, frequent fires in early spring to clear dead plants, stimulate new growth, replenish soil nutrients, and control invasive species (Dickson-Hoyle et al. 2021). However, with increased temperature and decreased precipitation trends as a result of climate change, fire practices are cautioned as they require increased care in planning and consideration Other methods of restoring grasslands include seeding to introduce plant species; grazing to disperse the seeds; and using microbes (e.g., micro-organisms, such as bacteria living in the soil) to increase grassland biodiversity, which will strengthen plants and improve the grassland's restorative capacity (Lyons et al. 2023). In many cases, grassland restoration requires replenishing soil nutrients and protecting restorative projects from wildlife, using fences or other barriers (Blackstock & McAllister, 2004; Lyons et al. 2023).

Future analysis

In addition to climate change, there may be other factors that are driving land changes in the WFL #128 territory which may be uncovered with further environmental or anthropogenic (e.g., human activity) analysis. For example, in a study across Alberta, researchers found that human effects (e.g., increases in population levels and road construction) were more influential on land use changes than natural environmental effects such as weather events (Ruan et al. 2016). Human-related political, social, or economic factors may be driving land changes, warranting additional investigation to identify these factors and anchor climate adaptation strategies to address all contributing causes.

Conclusion

WFL #128's land change assessment uncovered many changes that are actively occurring. The assessment showed a decline in wetlands, which are essential ecosystems for a healthy environment. Wetlands were predominantly replaced by cropland and barren land, demonstrating a displacement of natural environments to lands changed by humans. An increase in linear features – pathways and structures such as cutlines, ATV lines, roads, and fences – was shown, also demonstrating anthropogenic (human) activity. These combined changes to the landscape affect the health of the habitats upon which specific plant and wildlife species rely on for their survival; the same plant and wildlife species that provide healing medicines and nutritious foods. Projected declines of plant and animal species of importance due to climate change (and development pressure) is of great concern to WFL #128, sparking a shift in focus to preventing ecosystem habitat loss through land conservation.

This fact sheet reveals linkages between land management and public health. For instance, WFL #128's land change assessment found deciduous forest increased over time. By drawing on the links to health, conserving deciduous forest from the effects of climate change may mean conserving the effects deciduous forest has on improving immune system function and mental health, including stress, anxiety, vitality, and energy. It also means conserving habitats for moose and in turn sustaining access to their rich source of nutritious food. Wetlands, including swamps, marshes, and peatlands, were found to have decreased. Health links suggest this decrease may affect water quality and purification, food production, and mental health for nearby community members. It may also affect access to traditional medicines sourced from diamond willow, an inhabitant of wetlands. The decrease of riparian areas may adversely impact stress, while the increase of cropland may improve food security among the WFL #128 community. Each land type (habitat) is uniquely connected to health and well-being, establishing a nexus between land management and public health. As such, investigating how the land is changing can inform land conservation to protect both ecosystems and their effect on health on a population level.

WFL #128's land change assessment shares a story of wildlife, plants, land types, and ecosystems that are important to the territory and upon a deeper look, are vastly connected to human health and well-being. WFL #128's assessment process, using both qualitative and quantitative methods, may provide guidance and direction for other communities on their climate action journey. The health effects of climate change are far reaching: from the air we breathe, food we harvest, water we drink, and lands we play on. In the next steps, relational and reciprocal approaches will be needed to restore and protect lands, waters, plants, animals, and humans.

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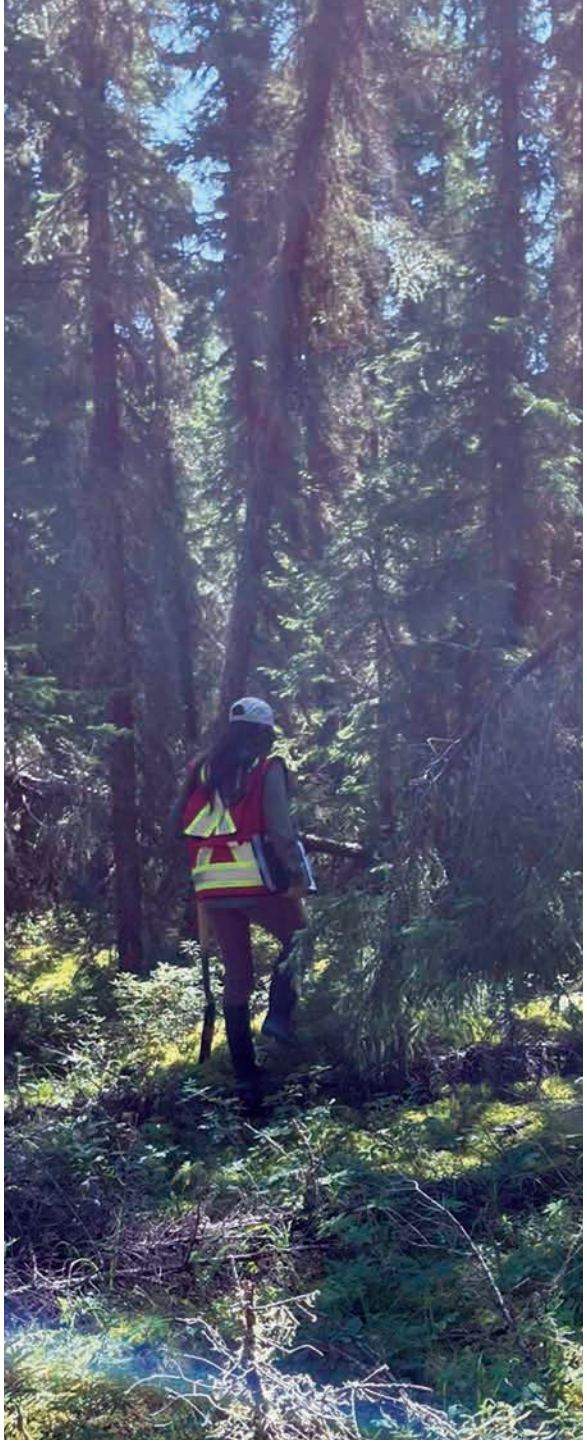
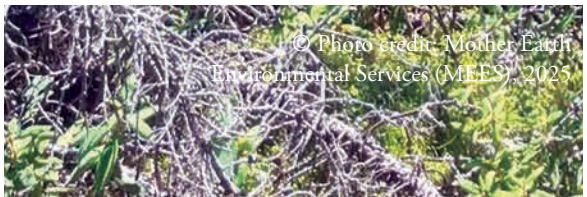
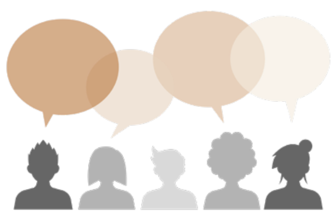




HOW TO USE THIS FACT SHEET

REFLECT

Talk to others in your community, reflect on the content of this fact sheet, and contemplate how you could make a difference in the health and well-being for yourself, your family or your community.



ENGAGE

Find local friendship centers, community organizations or groups where you can volunteer or participate in healthy positive actions. You too can share knowledge and make a difference in the health and well-being of First Nations, Inuit, and Métis Peoples' of Canada.

sharing knowledge · making a difference
partager les connaissances · faire une différence
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National Collaborating Centre for Indigenous Health
Centre de collaboration nationale de la santé autochtone

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