



Assessing Conservation Through a Habitat Lens

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International and national biodiversity targets require protected area networks to be ecologically representative of the larger landscapes they aim to protect.

We piloted an approach to assess this in Alberta that showed:

- As of June 10, 2025, there are 102,910 km² of protected areas and 255 km² of “other effective area-based conservation measures” (OECMs) within Alberta, covering 103,165 km² or 15.6% of Alberta.
- Pine (27% or 15,393 km²), Spruce (33% or 15,938 km²), and Fens (23% or 21,348 km²) have the highest proportion of their habitat area conserved.
- Mixedwood (3.5% or 2,523 km²), native grass and shrublands (5.2% or 6,350 km²), and Marsh (10% or 1,389 km²) habitats have the lowest proportion of their habitat area conserved while having also experienced high levels of historic footprint (61%, 59%, and 51%, respectively).
- A habitat-representativeness approach identifies which habitats are covered specifically by protected, conserved, and OECM land status. Progress towards conservation goals may also be achieved through a range of other stewardship and land-use activities.





Introduction

In recent years, there has been an increasing effort by international organizations to develop indicators that can be used for tracking biodiversity and conservation targets outlined in international agreements such as the Convention on Biological Diversity. One of the key indicators used in reporting tracks how much of species' ranges, and their associated habitats, are included in protected area networks.

Some targets have further requirements for the networks to be ecologically representative of the broader landscape. Here, we demonstrate an approach to assess the ecological representativeness of protected area networks at a subnational scale using the province of Alberta.

Canada uses the Canadian Protected and Conserved Areas Database (CPCAD) for its own reporting towards these targets. We use the same data in order to align with reporting agencies, but acknowledge there are other forms of land management and other conservation areas not included in this database.

Our approach provides a snapshot of the current representation of habitats within Alberta's protected area network and whether the rate of development is outpacing those conservation contributions. Targets such as those explored below offer useful evidence-based reference points to inform future conservation planning decisions, identify underrepresented habitats within the conservation network, and support reporting against international frameworks.

As CPCAD is updated to incorporate new conserved areas, this analysis could also be updated.





Methods

Defining Habitats and Disturbance

There is an ever-expanding catalogue of geospatial products that map the distribution of natural land cover and anthropogenic disturbances. These inventories vary in their spatial and temporal resolutions and level of attribution (e.g., “wetland” or “bog”). For our analysis, we used four sources of geospatial information:

- **ABMI Wetland Inventory:** A province-wide dataset for Alberta that maps wetland classes in alignment with the Alberta Wetland Classification System (i.e., bog, fen, swamp, marsh) and open water circa 2018.¹
- **ABMI Backfilled Vegetation Inventory:** A province-wide land cover dataset for Alberta that harmonizes information across multiple sources to create a map of native land cover in the absence of human footprint.²
- **ABMI Human Footprint Inventory:** A province-wide dataset of human footprint in Alberta. We utilized the 2022 Human Footprint Inventory.³
- **Environment and Protected Areas Green/White Areas:** An administrative distinction in the province of Alberta between areas with different overall land uses (e.g., forestry, private land, or agriculture).⁴

However, the methods we outline here can be applied using any land cover inventory of interest.

¹ ABMI. (2021). ABMI Alberta Wetland Inventory Data. Alberta Biodiversity Monitoring Institute. <https://abmi.ca/data-portal/40.html>

² ABMI. (2017). Alberta Wall-to-Wall Vegetation Layer Including “Backfilled” Vegetation in Human Footprints (Version 6). Alberta Biodiversity Monitoring Institute. <http://abmi.ca/home/publications/451-500/467>

³ ABMI and Alberta Human Footprint Monitoring Program. ABMI Human Footprint Inventory (HFI) for Alberta 2022 (version 1.0). Geodatabase. Last modified March 31, 2025.

⁴ Alberta Environment and Parks. (2022). Green/White Area [Dataset]. Open Alberta. <https://open.alberta.ca/dataset/gda-df54991b-d9db-494f-b2e0-0a8d711d9cab>

⁵ ECCC. (2024). Canadian Protected and Conserved Areas Database. Environment and Climate Change Canada. <https://www.canada.ca/en/environment-climate-change/services/national-wildlife-areas/protected-conserved-areas-database.html>. Accessed on June 10, 2025.



Defining Conservation Areas

In our analysis, we used the **Canadian Protected and Conserved Areas Database (CPCAD)**⁵ to define conservation areas. This data product is the most up to date spatial representation of marine and terrestrial protected and conserved areas and other effective area-based conservation measures (OECMs) in Canada. This database is maintained by Environment and Climate Change Canada (ECCC) in collaboration with reporting authorities such as federal, provincial, and territorial governments and non-profits.

Sites included in this database need to meet the International Union for Conservation of Nature **guidelines for applying protected area management categories**, or the definitions for OECMs as defined at the **14th meeting of the Conference of the Parties to the Convention of Biological Diversity (COP14)**. Indigenous Protected and Conserved Areas (IPCAs) are included in this database if they are recognized as either protected areas or OECMs. However, it is important to acknowledge that reporting authorities may interpret these criteria in different ways. Therefore, the extent of protected areas and OECMs is subject to change based on the reinterpretation or changing guidelines with defining these areas.

For each conservation area within CPCAD, the year of establishment and the qualifying year (when the protected area or OECM is able to be included in national reporting) is reported. In order to maintain alignment with international reporting, we use the qualifying year to track changes in conservation areas over time.



Defining Conservation Targets

Conservation targets provide valuable information for supporting the design, planning, and management actions required for landscape-scale conservation. These targets can be developed for individual species (e.g., in recovery strategies for species at risk), regional objectives (e.g., land-use frameworks), and international conservation goals (e.g., Kunming-Montreal Global Biodiversity Framework Targets). Many conservation targets note that protected area networks should be representative of the full range of existing ecosystems and ecological processes.

For our analysis, we assessed the ecological representativeness of conservation areas in the context of three targets:

- Aichi Biodiversity Target 11 (17%)⁶
- Kunming-Montreal Global Biodiversity Framework Target 3 (30%)⁷
- Habitat-specific Targets

Our approach uses these targets as example benchmarks against which we assess whether certain habitats are over- or under-represented within conservation areas. However, our approach is flexible and can be applied to any similar conservation target.

While Alberta has not formally adopted these specific targets and thus they do not represent provincial policy commitments, they remain a useful evidence-based reference point.

⁶ https://publications.gc.ca/collections/collection_2016/eccc/CW66-524-2016-eng.pdf

⁷ Convention on Biological Diversity. (2022). Kunming-Montreal Global Biodiversity Framework (CBD/COP/15/L.25). <https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf>

Aichi Biodiversity Target 11 (17%)

In 2015, the government of Canada adopted the “2020 Biodiversity Goals and Targets for Canada”. Canada Target 1 (Aichi Target 11) was to conserve 17% of terrestrial areas and inland waters and 10% of marine and coastal areas by 2020.

Kunming-Montreal Global Biodiversity Framework Target 3 (30%)

In 2022, the government of Canada adopted the Kunming-Montreal Global Biodiversity Framework, which is meant to guide global efforts for restoring and protecting biodiversity through 2030. Target 3 of this agreement is to conserve 30% of terrestrial areas, inland waters, and marine and coastal areas by 2030.

Habitat-specific Targets

Using the methodology of the [Species Protection Index](#) (developed to support Aichi Biodiversity Target 11), we set targets for individual habitat types based on their distribution. Briefly, habitats with small ranges (e.g., less than 10,000 km²) have the highest targets (100%), widely distributed habitats (e.g., greater than 250,000 km²) have the lowest targets (15%), and habitats with distributions in between having targets (15-100%) based on a log-linear relationship.





Defining Baseline Conditions

The extent of different habitats is always changing on the landscape. If we always apply our conservation targets to the most up-to-date land cover inventories (e.g., landscape condition in 2025), the total area of each habitat that we aim to conserve will change as those habitats are disturbed or lost (i.e., as the total area of a particular habitat decreases, so does the total area required to reach a given conservation target).

We address this challenge of shifting baselines in two approaches based on habitat class:

- **Terrestrial habitats:** The ABMI Backfill Vegetation layer uses a rules-based approach to infer what natural vegetation type was present prior to anthropogenic disturbance. This means we are basing our conservation targets on the distribution of habitats as if no human footprint was on the landscape.
- **Wetland habitats:** It is challenging to determine the historical distribution of wetland habitats in Alberta. Our approach for terrestrial habitat “backfilling” is not feasible for wetlands, especially in areas of extensive footprint such as the agricultural regions of Alberta. Instead, we estimated the reference distribution of wetlands separately for the provincial Green and White Areas.
 - Green Area: We calculated the total amount of human footprint within the Green Area and allocated 30% of the disturbed areas (wetlands make up roughly 30% of Alberta’s forested area⁸) to each wetland class based on the current distribution of those classes.

- White Area: Previous research in Alberta indicates that 60-70% of wetlands have been lost in the White Area⁹. Therefore, we estimated the total area of wetlands remaining on the landscape as 35% of the predicted baseline area:

$$\frac{\text{Current Total Wetland Area}}{35\%} = \text{Baseline Wetland Area}$$

This total area was then allocated to individual wetland classes based on their current distribution in the region.

While using a baseline condition that represents the landscape prior to anthropogenic disturbance may lack realism, the approach allows us to evaluate habitat representativeness and our progress towards various targets while acknowledging historical habitat loss. Alternative baseline conditions could be used, based on engagement with relevant rights holders and land stewards, and clearly communicated through transparent methodologies. As more precise estimates of historic wetland loss become available, these should be incorporated into the definition of baseline condition.

Using the defined targets and baseline condition, we define the percentage of the target currently conserved as:

$$\text{Percentage of Target} = \frac{\text{Habitat Area Currently Protected}}{\text{Target Habitat Area}} \times 100\%$$

⁸ <https://wetland-report.abmi.ca/atlas-home/2.0-Alberta-Wetlands/2.2-Wetlands-Boreal-Region.html>

⁹ <https://www.alberta.ca/wetlands-overview>



Results

How much land is conserved in Alberta and by whom?

As of June 10, 2025, there are 102,910 km² of protected areas and 255 km² of OECMs within Alberta (103,165 km²; Figure 1). This represents 15.6% of the province. Of the currently conserved areas, 58% were established prior to 1960, 20% between 1960-2010, and 22% after 2010, with the federal (54%) and provincial (45%) governments holding 99% of all areas. The remaining 1% or 952 km² of conservation areas are legally owned by a mixture of municipalities, individual landowners, non-profit organizations, and Indigenous Peoples (CPCAD User Manual Table 14).

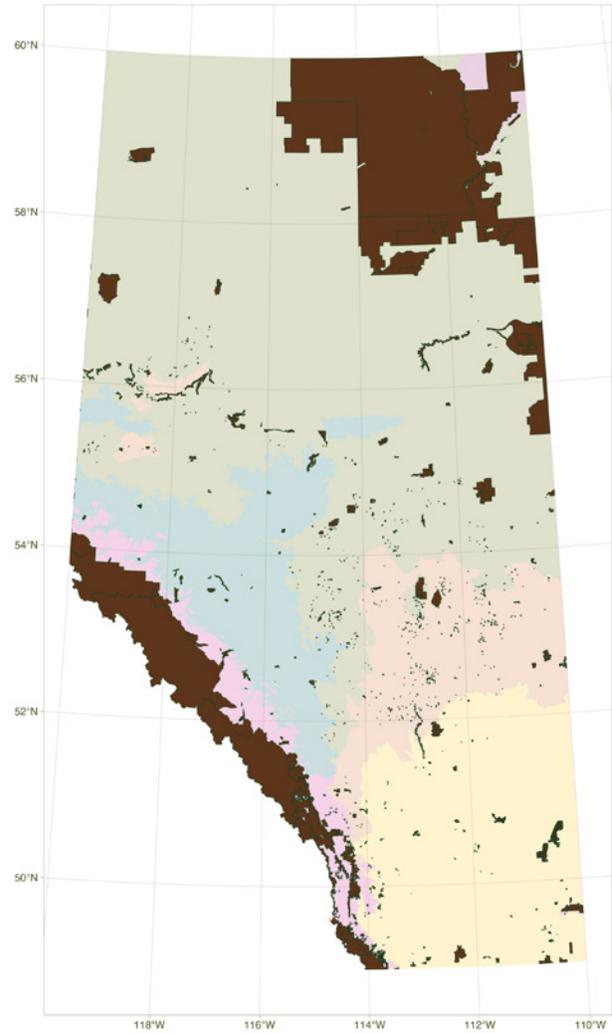
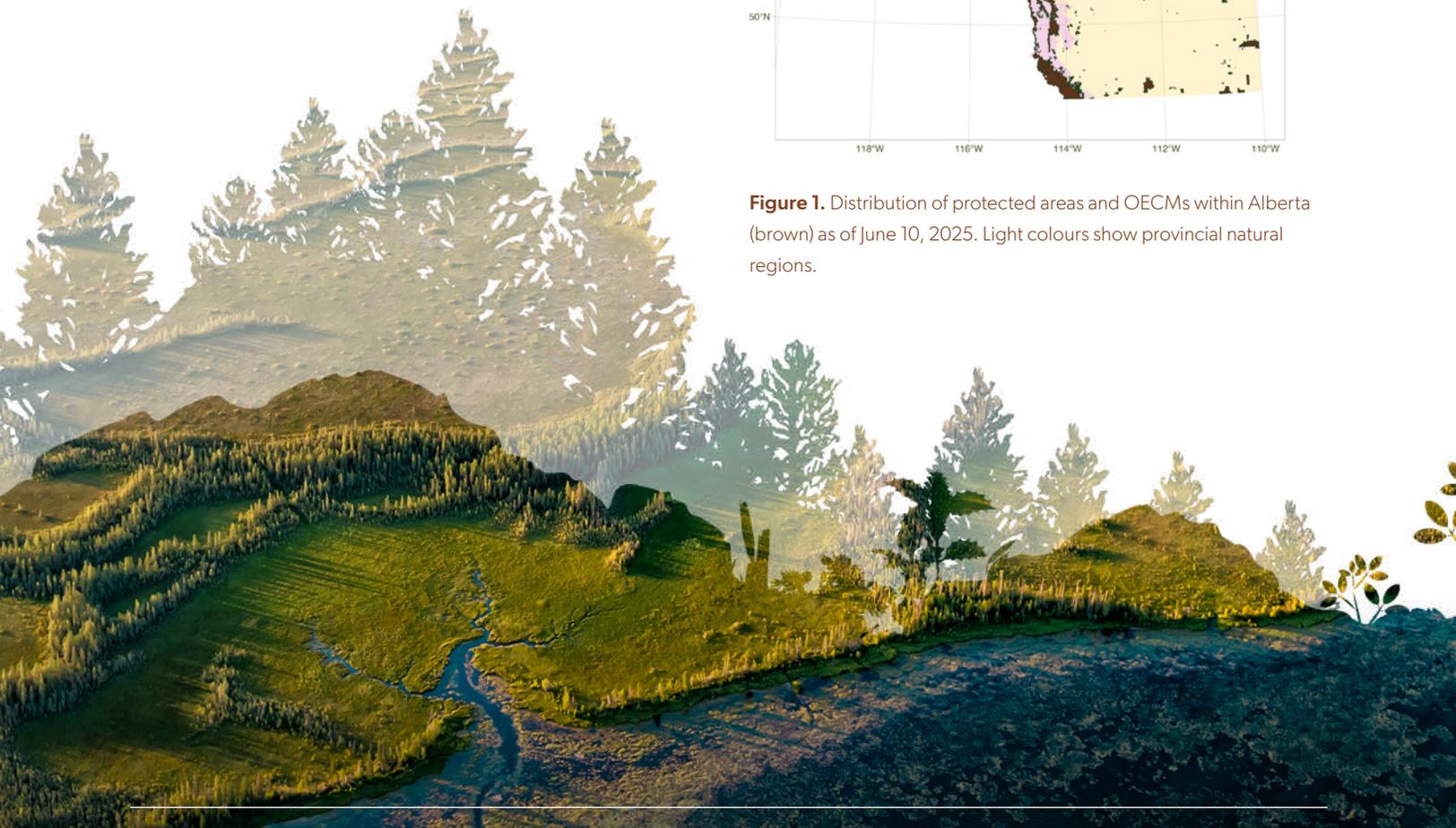


Figure 1. Distribution of protected areas and OECMs within Alberta (brown) as of June 10, 2025. Light colours show provincial natural regions.



Which habitats are currently well-represented in conserved areas?

Fens are currently the most conserved habitat type within Alberta (21,348 km²), largely within Wood Buffalo National Park and the surrounding provincial parks (e.g., Birch River Wildland, Caribou Mountains Wildland, Kazan Wildland) in northeastern Alberta. Spruce (15,938 km²) and Pine (15,393 km²) stands are the terrestrial habitats most represented in conservation areas (Figure 2). This is largely a result of the extensive protection of White Spruce (*Picea glauca*) and Lodgepole Pine (*Pinus contorta*) within the mountain national parks (i.e., Jasper, Banff, and Waterton), and Jack Pine (*Pinus banksiana*) in the aforementioned national-provincial park complex in northeastern Alberta.

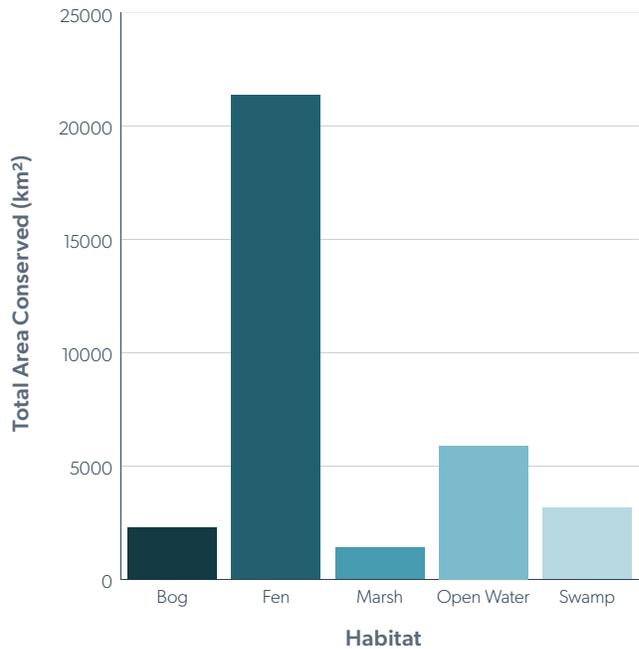
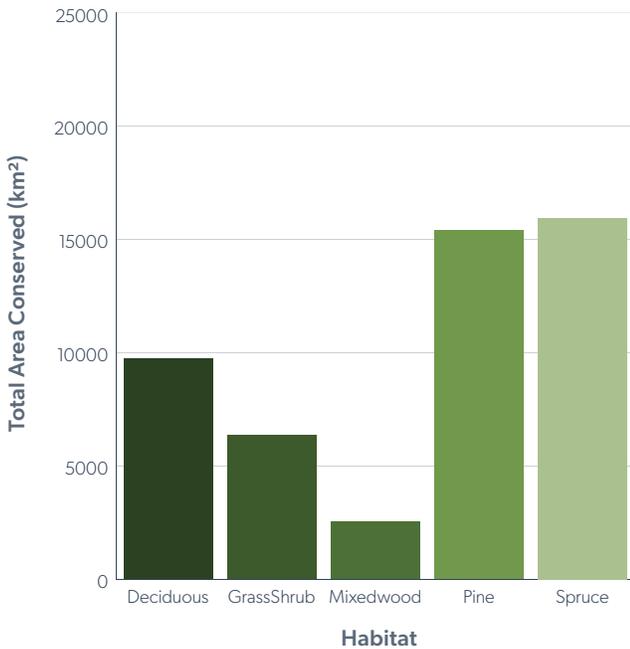


Figure 2. Total area currently conserved for terrestrial habitats (left, in greens) and wetland habitats (right, in blues) as of June 10, 2025.

Which habitat types are represented in different conservation targets?

Under most targets, most habitat types are under-represented within Alberta’s current conservation areas, while a few are well- or over-represented under certain targets. For upland habitats, Pine, and Spruce habitats are either close to meeting or exceed most targets (Figure 3), while Deciduous, Mixedwood, and Grassland-

shrubland habitats fall short of meeting targets. These patterns are consistent across targets. For wetland habitats, representation varies substantially depending on the target used. Using habitat-specific targets, only Fens are well-represented in current conservation areas. However, Fen, Bog, and Open Water habitats all exceed a 17% target.



Figure 3. Percentage towards target of terrestrial and wetland habitats included in the current protected area network based on three target types (habitat-specific, 17% of baseline, 30% of baseline) as of June 10, 2025. Habitat-specific targets were defined based on their estimated distribution prior to disturbance. Values of 100% (or higher) indicate that the given habitat type has reached (or exceeded) the conservation target.



How much of each habitat has been disturbed or conserved?

We calculated the percentage of disturbed, conserved, and native habitat without a conservation designation for each habitat type as follows:

$$\text{Percentage Conserved} = \frac{\text{Habitat Area Currently Conserved}}{\text{Baseline Habitat Area}} \times 100\%$$

$$\text{Percentage Disturbed} = \frac{\text{Baseline Habitat Area} - \text{2022 Habitat Area}}{\text{Baseline Habitat Area}} \times 100\%$$

$$\text{Percentage Native} = 100\% - \text{Percentage Conserved} - \text{Percentage Disturbed}$$

Based on our baseline condition and the 2022 Human Footprint Inventory, terrestrial habitats with the lowest levels of representation in the Alberta protected area network have also experienced the highest levels of footprint as of 2022 (Figure 4). Nearly 60% of Grass-Shrub and Mixedwood habitats have been disturbed, with less than 5% of the baseline reference area having formally designated conservation status.



A similar proportion of wetland habitat types have been conserved when scaled relative to their baseline extent (10-23%; Figure 5). As a representative proportion, Marsh and Open Water wetlands have experienced the largest amounts of anthropogenic disturbance. This is primarily driven due to the historic wetland loss within the White Area of Alberta where Marsh and Open Water wetlands were more common.

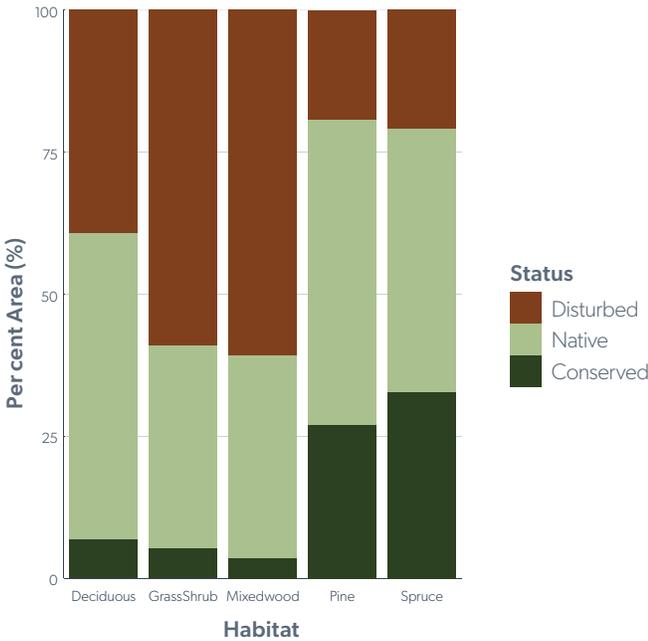


Figure 4. Per cent area of terrestrial habitat types within Alberta as of 2022 that have been conserved, disturbed, or remain intact as native habitat but aren't currently recognized with a conservation status ("Native"). The percent area is scaled based on the estimated total area of each habitat prior to anthropogenic disturbance.

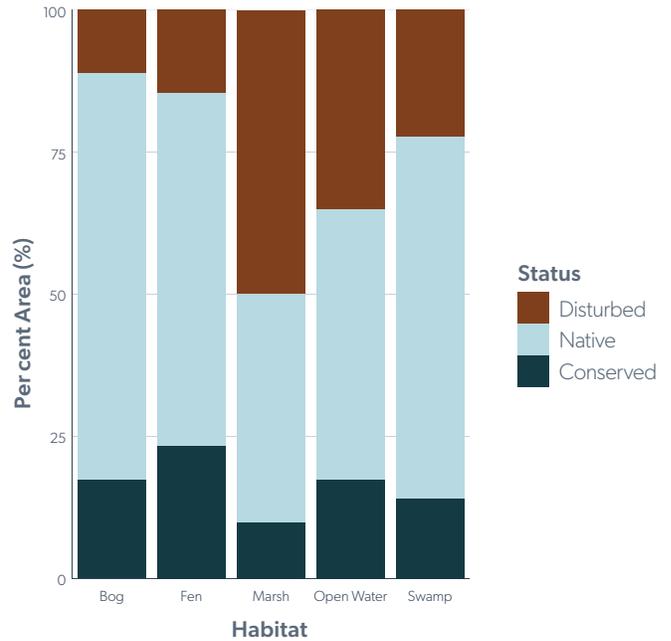


Figure 5. Per cent area of wetland habitat types within Alberta as of 2022 that have been conserved, disturbed, or remain intact as native habitat but aren't currently recognized with a conservation status ("Native"). The percent area is scaled based on the estimated total area of each habitat prior to anthropogenic disturbance.

Where are habitats conserved?

Though some habitats appear to nearly meet or exceed the example targets (i.e., Pine and Spruce), it is important to understand both “how much” and “where” habitats are conserved to ensure the breadth of biodiversity on the landscape is included. To be ecologically representative, habitats should be protected across their geographic range. This is because the habitats within the Rocky Mountains support different biodiversity (e.g., Mountain Chickadee) than those in the Boreal forest (e.g., Cape May Warbler), even though they both might have the same dominant tree cover type. For instance, in Alberta, Pine and Spruce habitats have been predominantly conserved within the Rocky Mountain and Boreal natural regions, with small amounts of areas in the Foothills (Figure 6). This means that not all pine and spruce species, as well as the biodiversity they support, are equally conserved.

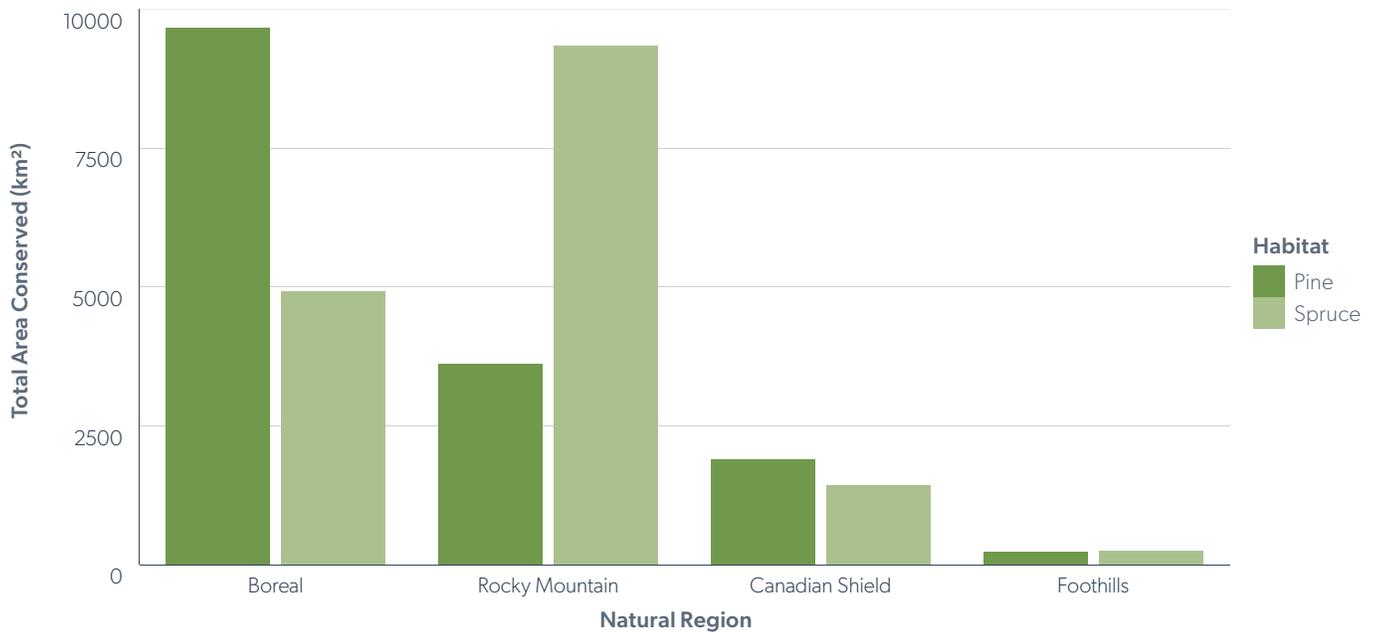


Figure 6. Total area of Pine and Spruce habitats that have been conserved in Alberta’s natural regions as of June 10, 2025. The Grassland and Parkland natural regions are excluded as Pine and Spruce habitats occur in low abundance throughout these regions.



What are the biggest gaps in habitat representation?

The approach used here is useful in informing how habitats are represented within Alberta’s current protected areas and OECMs. However, based on the defined management targets and how much remaining habitat exists on the landbase, land managers may face challenges in effectively reaching these targets. For example, 68% of the remaining Mixedwood forests would need to be conserved

to reach the 30% target (based on baseline habitat availability), while habitats like Fens require less than 7.8% of the remaining habitat to be conserved to meet the same target (Figure 7). Approximately 145% of the remaining Marsh habitat would need to be conserved to meet the habitat-specific targets, indicating that restoration efforts of disturbed Marsh habitats would be required to meet this goal.



Figure 7. The proportion of remaining native land cover that would have to be newly conserved to reach each target (habitat-specific, 17%, and 30% targets). For example, a value of 75% would indicate that 75% of the remaining undisturbed area outside of existing conservation areas for that habitat class would have to be conserved to reach the given target. Values of 0% indicate that the target for that habitat class has already been reached. Values greater than 100% indicate that habitat restoration would be required to meet the proposed target.



Caveats and Limitations

International Indicators

National targets such as Aichi Biodiversity Target 11 (17%) and Kunming-Montreal Global Biodiversity Framework Target 3 (30%) were not designed to account for habitat representation outside of broad terrestrial and marine designations, so we are considering habitat representation at a finer class resolution than the targets originally intended. However, both targets identify that protected area networks should be ecologically representative of the broader landscape and component indicators such as the Protected Area Representativeness and Connectedness (PARC) aim to provide more detailed information. We also acknowledge the value in assessing the representativeness of habitats both within and across jurisdictional boundaries¹⁰ as it can provide novel insights about how well conserved areas are protecting species and their habitats.

The ABMI does not endorse any specific target as a standalone policy prescription. Rather, we use these targets as widely recognized benchmarks to evaluate ecological representativeness and to support transparent discussion of how habitats are currently reflected within existing areas recognized by CPCAD. Decisions about future conservation actions, including the appropriate mix of protected areas, stewardship, restoration, and other effective measures, require engagement with the relevant jurisdictions, Indigenous Nations, land managers, and stakeholders.

Defining Conservation Areas

The eligibility of conserved and protected areas and OECMs is continually under review. Areas with current legal protections are being reviewed and added to CPCAD, while current and new approaches of land stewardship are being evaluated against the criteria for inclusion in CPCAD. In addition, there is acknowledgement of Indigenous Protected Areas in CPCAD, but these are currently small areas within Alberta (e.g., 62 ha managed by the Otipemisiwak Métis Government). This means that the representativeness of habitats within protected and OECM areas is subject to change as we continue to evaluate and expand our definitions of conserved areas.

Defining Baseline Conditions

Defining a baseline for evaluating targets is essential to avoid issues with shifting baselines caused by new human footprint. Using a recent baseline year (e.g., 2000) may be appropriate for regions with minimal habitat loss. However, in areas that have experienced large amounts of historical habitat loss, such as the 60-70% of wetlands lost



in Alberta's White Area, we risk evaluating conservation targets using only the habitat currently remaining on the landscape. This means that if we keep shifting our baseline year and if development continues, these indicators will show we can meet conservation targets by continually disturbing habitats outside current conserved areas. In other words, an increasing proportion of the remaining habitat will occur within conserved areas. Therefore, it is important that organizations are transparent in how they define baseline conditions and acknowledge the limitations of their definition.

Defining Habitats

There is no single way to define habitat. CPCAD broadly classifies habitats as either terrestrial or marine ecosystems, while we use coarse-scale classes based on the dominant vegetation type. Habitats could also be defined by natural region or subregion or for individual species. All of these perspectives are valuable and can be used to glean ecologically important information about which aspects of biodiversity fall within protected areas and OECMs.

Geospatial Errors

As with any geospatial data analysis, discrepancies in polygon boundaries between the land cover inventories, CPCAD, and provincial boundaries used here can result in small errors in the total area presented.

¹⁰ Currie, J., Liang, C., & Snider, J. (2025). [Protected area targets: Spatially evaluating progress and prioritizing areas to reach 30×30 in Canada.](#) *Conservation Science and Practice*, 7(7), e70087.



Conclusions

Our approach is a simple yet effective way to assess the ecological representativeness of protected area networks at any scale where detailed land cover mapping is available. In Alberta, how and why different habitats are included or outside of conservation areas is a legacy of land management. For instance, the historic establishment of the extensive mountain parks system (e.g., Banff and Jasper National Parks) means high-elevation pine and spruce habitats are well-represented in the protected area network.

Our approach shows that the choice of conservation target and habitats under consideration can affect our conclusions. For instance, wetland habitats within Alberta exceed some targets (e.g., 17% Aichi target) or have similar levels of representation across wetland classes (e.g., a 30% target). However, when using a habitat-specific target, only Fens have high levels of representation while Marsh habitats cannot meet this target without habitat restoration. Conversely, terrestrial habitat types have varied representation no matter the target used.

Practically, progress toward conservation targets may be achieved through a range of complementary approaches. As such, meeting targets need not be limited to the creation of new protected areas, but may also be advanced through diverse stewardship and management strategies.

Our intent is not to evaluate commitments to or performance against policy targets, but rather to provide a consistent, transparent framework to understand how habitat types are currently represented in conservation areas and help assess the achievability of any conservation target system when applied across a variety of ecosystems.

The Alberta Biodiversity Monitoring Institute (ABMI) tracks changes in wildlife and their habitats across Alberta. We report on a range of biodiversity indicators that act as a guide for establishing management goals and tracking performance against those goals.

Preferred Citation

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