Miistakis Institute

Value of Private Land Conservation in Alberta 2.0

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April 2023

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Acknowledgements

This project was undertaken with the financial support of:
Ce projet a été réalisé avec l'appui financier de :

Environment and Climate Change Canada
Environnement et Changement climatique Canada

and:

Alberta

and:

ALBERTA ecotrust

We would like to thank the following land trusts and organizations that participate in private land conservation that worked with us on this project:

- Alberta Conservation Association (ACA)
- Ducks Unlimited Canada (Alberta office)
- Edmonton and Area Land Trust (EALT)
- Foothills Land Trust (FLT)
- Legacy Land Trust (LLT)
- Nature Conservancy of Canada (Alberta office) (NCC)
- Southern Alberta Land Trust Society (SALTS)
- Western Sky Land Trust

Executive Summary

Private land conservation (PLC) is an important strategy for conservation in Alberta but there is little known about where PLC occurs in Alberta and how it contributes to conservation goals. We built upon a preliminary analysis of PLC in Alberta by broadening our scope of land trusts and other organizations that participate in private land conservation, and by providing a more in-depth quantitative assessment of private land conservation in Alberta.

Private land conservation has grown steadily from 1987 to present and as of December 2022, 479,286 acres of land were protected – this was an increase of almost 50,000 acres since our preliminary assessment was conducted. Considered by acre, conservation easements are the more popular private conservation tool comprising 58% of total private land conservation, whereas when considered by number of properties, fee simple is more commonly used.

Environment and Climate Change Canada's (ECCC) Ecological Gifts Program and the Government of Alberta's (GoA) Land Trust Grant Program are two key land conservation programs supporting PLC in Alberta. The Ecological Gifts Program has supported 233 properties and 305,923 acres, and the Alberta Land Trust Grant Program has supported 162 properties and 244,908 acres.

Land trusts identified the primary conservation purpose for the majority of properties as "ecological" whereas the secondary conservation purpose varied and included recreational, open space and scenic preservation, agricultural, ecological research and environmental education.

The number of acres of PLC varies across geographic regions in the province and that difference was illustrated using natural regions, natural subregions and Watershed Planning and Advisory Council (WPAC) areas. We identified that PLC occurred most often in Parkland and Grassland natural regions, which also held the most opportunity for conservation growth since much of the land in these regions are owned privately. At the natural subregion level, Central Parkland followed by Foothills Fescue, holds the highest number of PLC acres, but Foothills Parkland, followed by Montane have the highest percentage of land that is privately conserved. We identified that the Oldman Watershed Council's region contains the largest amount of PLC, followed by Red Deer River Watershed Alliance and the Bow River Basin Council.

In Alberta, there are approximately 65,000,000 acres of private land making up approximately 40% of the total area in Alberta. Given the large proportion of land owned and managed privately, private land conservation offers an opportunity to maximize conservation benefits. In this report we illustrate and discuss these conservation benefits relative to four themes: biodiversity, watershed resiliency, climate change resiliency, and human well-being.

Private land conservation promotes biodiversity by protecting important habitat for various species:

- Over 220,000 acres of PLC in watersheds with low to no at-risk native trout. PLC was lowest in watersheds of Athabasca Rainbow Trout, a species that is federally listed as endangered.
- Nearly half of the watersheds where Westslope Cutthroat Trout are low to extirpated is privately owned, and 3% of this total region is already protected through PLC.
- Nearly 150,000 acres of PLC are within the ungulate winter range. Conservation in this area supports these species during a particularly challenging season which can put pressure on survival.
- 167,021 acres of PLC are located within a 5 km buffer of federal or provincial parks and protected areas. Protection in this buffer zone can increase connectivity for wildlife.
- Wetlands and riparian areas are hotspots for biodiversity. Nearly 80% of the land within Ducks Unlimited's Joint Venture priority area is privately owned, and 1.6% of the total area is currently conserved through PLC.

Private land conservation supports watershed resiliency by protecting areas that contribute to maintaining desirable water quality and quantity:

- Over 70% of the land within watersheds identified as priority for mitigating droughts and floods and promoting water quality are owned privately. Between 0.5 and just over 1% of those watersheds are conserved privately.

- The Oldman watershed has the highest number of acres and percent of land privately conserved compared with the Bow and Red Deer watersheds.

Private land conservation strengthens climate change resiliency through protecting refugia and corridors identified under climate change scenarios. Protecting wetlands can act as carbon sinks and also provide natural infrastructure to adapt to climate change impacts like increased floods and droughts:

- Nearly 150,000 acres of bird refugia are protected through PLC.
- Nearly 300,000 acres of tree refugia are protected through PLC.
- Over 275,000 acres of areas identified as climate corridors are protected through PLC.
- Over 16,000 acres of Joint Venture priority area wetlands is protected through PLC.

Private land conservation fosters human well-being by supporting sustainable recreational hunting and fishing activities, extending the benefits of our existing federal and provincial protected areas, and some offering additional recreational opportunities for Albertans:

- 18% of ungulate winter range is located on private land and 1.3% of the total area is currently privately conserved.
- 19% of watersheds where at-risk native trout are low to extirpated is privately owned and less than 1% is currently privately protected.
- 2% of all protected areas in the province are privately conserved and some PLC properties are open to the public for recreational purposes.

A website was developed to interactively view the contributions of private land conservation in Alberta.

Introduction

Private land conservation (PLC) is an important strategy for conservation but where and how PLC contributes to conservation goals are not well understood (Cortés Capano et al., 2019; Palfrey et al., 2021). This issue is amplified by land trusts largely acting independently of one another (Ryan et al., 2014). A larger-scale view of private land conservation would allow land trusts, municipalities, and other levels of government to identify areas in need of more general protection or protection targeted to specific ecosystem services (Ryan et al., 2014). The identification of priority lands before development or other land uses that permanently alter the landscape is key to the conservation and protection of important ecosystem services, such as flood and drought mitigation.

In 2021, the Miistakis Institute worked with the land trust community in Alberta to develop high-level metrics to highlight contributions of PLC in Alberta (Lee et al., 2021). Since then, the Miistakis Institute has built upon that initial work by growing the number of partner organizations included in our discussions, compiling a central database with land trust data, and increasing the scope of the metrics that were assessed to monitor the contributions of private land conservation.

In Alberta, there are approximately 65,000,000 acres of private land (Government of Alberta, 2020), making up approximately 40% of the total area in Alberta. Given the large proportion of land owned and managed privately, private land conservation offers an opportunity to maximize conservation benefits. In this report we illustrate and discuss these conservation benefits relative to four themes:

- Biodiversity
- Watershed resiliency
- Climate change resiliency
- Human well-being.

As part of this project, a website was developed to interactively view the contributions of private land conservation in Alberta. The objective is to identify measures that can be reassessed over time to highlight the ongoing role of the land trust community to conservation in Alberta.

This technical report presents the methodology used to derive the metrics including the spatial data sources and serves as a companion piece for the results that are comprehensively displayed on the website.

Methodology

Land trust participants

The following eight land trusts and organizations that participate in private land conservation contributed to this project by sharing data and providing input and feedback on the metrics to evaluate and track the impacts of private land conservation in Alberta:

- Alberta Conservation Association (ACA)
- Ducks Unlimited Canada (Alberta office)
- Edmonton and Area Land Trust (EALT)
- Foothills Land Trust (FLT)
- Legacy Land Trust (LLT)
- Nature Conservancy of Canada (Alberta office) (NCC)
- Southern Alberta Land Trust Society (SALTS)
- Western Sky Land Trust

For the purposes of this report, 'land trusts', 'land trusts in Alberta", or "Alberta's land trust community" refer collectively to these eight organizations. A common goal for land trusts is to maintain natural systems for the benefit of both people and wildlife.

Selecting metrics

To highlight the value of PLC in Alberta, we developed a suite of metrics to demonstrate the role of PLC in maintaining biodiversity, watershed resiliency, climate change resiliency and human well-being. A preliminary list of metrics was identified during a workshop with land trust representatives and were prioritized by participants using an online survey. Metrics were then selected based on rank, and availability and quality of data.

Description of metrics

Table 1 provides a short definition of each metric and indicates which theme(s) the metric relates to. Table 2 provides information on the spatial data source and any thresholds that were applied to the data before private land conservation areas were estimated.

Most of the metrics presented in this report and on the website are displayed as the number of acres of privately conserved land relative to a specific area of interest. Please refer to the maps in Figure 28 to Figure 42 to view the spatial context for each metric.

Table 1. Metric name, definition and the theme(s) each metric relates to.

Metric Name	Theme				Definition
	Biodiversity	Watershed Resiliency	Climate Change Resiliency	Human Well-being	
Aquifer vulnerability		✓			Areas containing aquifers with high vulnerability (5-6) to surface contamination.
Biodiversity Intactness	✓				Alberta Biodiversity Monitoring Institute's (ABMI) index comparing current to historic species presence as a reflection of current biodiversity. We used values ≥75.
Bird refugia	✓		✓		Areas identified as bird refugia from climate change effects. We used the top 50% of the index presented.
Climate connectivity	✓		✓		Areas identified as viable corridors between current species distributions and predicted climate refugia.
Drought priority areas		✓			Watersheds identified by the GoA's Watershed Resiliency and Restoration Program (WRRP) as having a high priority (5) to maintain intact for drought resilience.
Environmentally significant areas	✓				Areas considered important to the long-term maintenance of biological diversity, physical landscape features or other natural processes based on 4 criteria: focal species, rare or unique focal habitat, ecological integrity, water quality and quantity.
Fish species/fishing	✓			✓	Areas identified where adult populations of three at-risk native trout species are low, very low, or extirpated.
Flood priority areas		✓			Watersheds identified by the GoA's WRRP as having a high priority to maintain intact for flood resilience.
Hydrologically significant areas		✓			Areas with natural assets that provide beneficial hydrologic services (top 50% of classes selected). Only calculated for Red Deer, Bow and Oldman watersheds.

Metric Name	Theme				Definition
	Biodiversity	Watershed Resiliency	Climate Change Resiliency	Human Well-being	
Natural regions	✓				Land classifications based on natural or biogeographic features (geology, landform, soil, hydrology) including climate, vegetation and wildlife. Alberta has 6 natural regions.
Natural subregions	✓				Land classifications based on natural or biogeographic features (geology, landform, soil, hydrology) including climate, vegetation and wildlife. Alberta has 21 natural regions.
Proximity to parks	✓			✓	Land trusts located within a 5 km buffer from parks and protected areas; contribute to larger intact areas and improve connectivity.
Riparian areas	✓	✓			Riparian areas along the Red Deer, Bow and Oldman Rivers.
Tree biomass			✓		Areas with high above-ground (tree) biomass was used as a proxy for soil carbon quality and quantity. We used the top 50% of this index.
Tree refugia	✓		✓		Areas identified as tree refugia from climate change effects. We used the top 50% of the index presented.
Ungulate winter range/hunting	✓			✓	Area defined as ungulate winter range.
Water quality priority areas		✓			Watersheds identified by the GoA's WRRP as having a high priority to maintain intact for water quality resilience.
Watershed Planning and Advisory Council		✓			Independent, non-profit organizations that are designated by the Alberta Government to act as stewards of Alberta's major watershed.
All wetlands	✓	✓	✓		Areas within ABMI's wetland data set
Priority wetlands	✓	✓	✓		Area within Ducks Unlimited's Prairie Joint Venture Priority Areas

Value of private land conservation to Indigenous cultural or traditional significance scored highly and was included it in our preliminary data gathering steps. However, we felt that value to Indigenous culture was not a metric adequately represented with existing spatial data layers. We recommend an alternative approach be used to understand the relationship between private land conservation and Indigenous cultural values. Similarly, the species at risk metric received a high rank from land trusts and we included this metric in preliminary drafts of our results. But, following land trust feedback with concerns of data limitations, we removed this metric from this report and the website and recommend that this metric be reviewed using new data sources and analytical methods when available.

Table 2. Data sources and notes on how data were selected or treated before PLC conservation area was estimated.

Name	Data Source Name	Data Selection Criteria	Data Source Information
Aquifer vulnerability	GoA Aquifer Vulnerability Index	Highest vulnerability - values 5-6. Data were limited to agriculture areas.	Government of Alberta, 2002, Aquifer Vulnerability Index, https://open.alberta.ca/opendata/gda-3a2a8bb2-aaaa-4741-8f4c-bd148bfcbc80
Biodiversity Intactness	ABMI Species Intactness - All species	Selected areas with a value ≥75.	ABMI, 2016, Species Intactness - All Species, https://www.abmi.ca/home/data-analytics/da-top/da-product-overview/GIS-Biodiversity-Data/Intactness.html
Bird refugia	Climate Adapt West Bird Refugia	Top 50% of model organized by quantile.	Stralberg, D, Carroll, C., Wilsey, C., Pedlar, J., McKenney, D. & Nielsen, S. 2018. "Macrorefugia for North American trees and songbirds: climatic limiting factors and multi-scale topographic influences. Global Ecology and Biogeography. https://doi.org/10.1111/geb.12731 https://adaptwest.databasin.org/pages/climatic-macrorefugia-for-trees-and-songbirds/
Climate connectivity	Climate Adapt West Backward shortest-path Centrality	Data were broken into 10 quantiles and the highest 8 quantiles were selected.	Carroll, C. , Parks, S. A., Dobrowski, S. Z. and Roberts, D. R. (2018), Climatic, topographic, and anthropogenic factors determine connectivity between current and future climate analogs in North America. Global Change Biology 24:5318-5331. doi:10.1111/gcb.14373. https://adaptwest.databasin.org/pages/climate-connectivity-north-america/
Proximity to parks	GoA Parks and Protected Areas	This layer includes national parks. Parks and Protected Areas were buffered by 5 km.	Government of Alberta, 2022, Parks and Protected Areas of Alberta, https://open.alberta.ca/opendata/gda-6b96341f-2e19-4885-98af-66d12ed4f8dd
Drought priority areas	GoA WRRP Drought Priority Areas	Highest priority areas - 5	Watershed Resiliency and Restoration Program, 2016, Priority Areas
Environmentally significant areas	GoA Environmentally Significant Areas	ESA_SUM > 0.189 - the classification level of ESAs	Government of Alberta, 2014, Environmentally Significant Areas, https://www.albertaparks.ca/albertaparksca/library/environmentally-significant-areas-report/
Fish species	GoA Fish Sustainability Index (HUC8 and HUC10) - Current Adult Density Metric	Low to functionally extirpated watersheds for Athabasca Rainbow Trout, Bull Trout and Westslope Cutthroat Trout	Government of Alberta, 2014, Alberta Fish Sustainability Index, https://www.alberta.ca/fish-sustainability-index-overview.aspx
Flood priority areas	GoA WRRP Flood Priority Areas	Highest priority areas - 5	Watershed Resiliency and Restoration Program, 2016, Priority Areas
Hydrologically Significant Areas	NCC Hydrologically Significant Areas	Top 50% after organizing into 8 classes using geometric intervals. Data were limited to the Oldman, Bow and Red Deer River watersheds	Nature Conservancy Canada, 2018-2021, Hydrologically Significant Areas
Natural Regions	GoA Natural Subregions		Government of Alberta, 2006, Natural Regions and Subregions of Alberta, https://open.alberta.ca/opendata/gda-2f36921e-41e3-4cd8-813e-3333ea3c5983

Name	Data Source Name	Data Selection Criteria	Data Source Information
Natural Subregions	GoA Natural Subregions		Government of Alberta, 2006, Natural Regions and Subregions of Alberta, https://open.alberta.ca/opendata/gda-2f36921e-41e3-4cd8-813e-3333ea3c5983
Recreational hunting	GoA Key Wildlife and Biodiversity areas		Government of Alberta, 2021, Key Wildlife and Biodiversity Zones, https://www.alberta.ca/wildlife-sensitivity-maps.aspx
Riparian areas	GoA Lotic Riparian - Digital Elevation Model (DEM) Derived; Lotic Riparian - Strahler Order Derived	Two data sets were combined; Data limited to Oldman, Bow and Red Deer River watersheds	Government of Alberta, 2011, Lotic Riparian - Digital Elevation Model (DEM) Derived, https://open.alberta.ca/opendata/gda-14e2b4a7-aca7-4ba9-b9ed-fbe8b0ffe5b9 Government of Alberta, 2011, Lotic Riparian - Strahler Order Derived, https://open.alberta.ca/opendata/gda-557d68b0-6c82-4923-8ad8-a86d2e0fa49a
Tree biomass	GlobalBiomass Above Ground Biomass	Top 50% of model organized by quantile	Santoro, M. et al. (2018): GlobBiomass - global datasets of forest biomass. PANGAEA, https://doi.org/10.1594/PANGAEA.894711, https://globbiomass.org/wp-content/uploads/GB_Maps/Globbiomass_global_dataset.html
Tree refugia	Climate Adapt West Tree Refugia	Top 50% of model organized by quantile	Stralberg, D, Carroll, C., Wilsey, C., Pedlar, J., McKenney, D. & Nielsen, S. 2018. "Macrorefugia for North American trees and songbirds: climatic limiting factors and multi-scale topographic influences. Global Ecology and Biogeography. https://doi.org/10.1111/geb.12731 https://adaptwest.databasin.org/pages/climatic-macrorefugia-for-trees-and-songbirds/
Water quality priority areas	GoA WRRP Water Quality Priority Areas	Highest priority areas (5)	Watershed Resiliency and Restoration Program, 2016, Priority Areas
Wetlands - All	ABMI Wetlands Inventory		DeLancey ER, Simms JF, Mahdianpari M, Brisco B, Mahoney C, Kariyeva J. Comparing deep learning and shallow learning for large-scale wetland classification in Alberta, Canada. Remote Sensing. 2020 Jan;12(1):2. doi: https://doi.org/10.3390/rs12010002. ABMI. 2021. “ABMI Wetland Inventory – Metadata.” Edmonton, Alberta, Canada. https://abmi.ca/home/data-analytics/da-top/da-product-overview/Advanced-Landcover-Prediction-and-Habitat-Assessment--ALPHA--Products/ABMI-Wetland-Inventory.html
Wetlands - Priority	Ducks Unlimited Prairie Habitat Joint Venture - Priority Areas	Area limited to Prairie Habitat Joint Venture priority area	Ducks Unlimited, 2021, Prairie Habitat Joint Venture - Priority Areas

Results: Value of Private Conservation

Private land conservation at a glance

Protective mechanisms

Private land conservation typically occurs using one of two main tools: conservation easements and fee simple. In a fee simple arrangement, the land is purchased or donated by the landowner, and the land is managed and owned by the land trust. Conservation easements, on the other hand, continue to be owned by the landowner but a voluntary, legal agreement between the landowner and the land trust puts mutually agreed upon restrictions on some activities on the land.

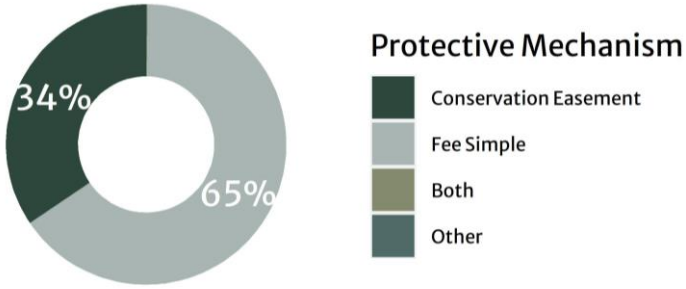


Figure 1. Percent of privately conserved land based on number of properties conserved through conservation easements or fee simple.

Based on information provided by the land trusts, we identified that, in Alberta, most properties that are conserved privately (number of properties) are conserved through the fee simple mechanism (Figure 1), whereas when evaluated on a per-acre basis, conservation easements are the more popular tool (Figure 2).

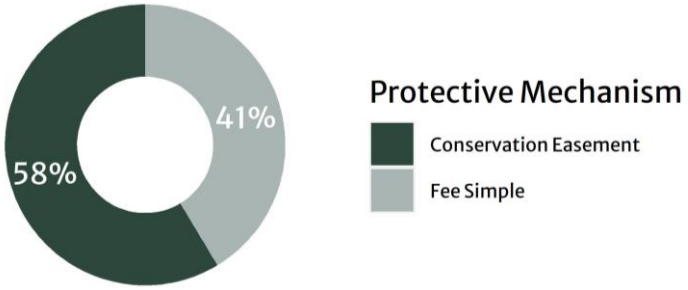


Figure 2. Percent of privately conserved land based on acres conserved through conservation easements or fee simple.

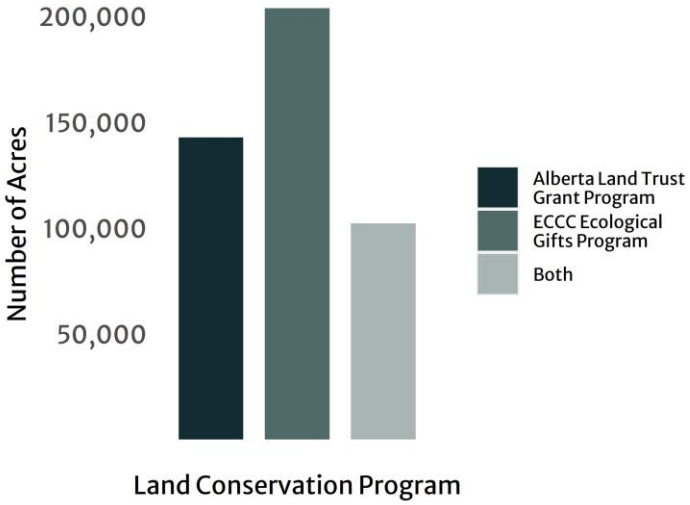


Figure 3. Number of acres of private land conservation funded through the Alberta Land Trust Program, ECCC's Ecological Gifts Program or both.

Land Conservation Programs

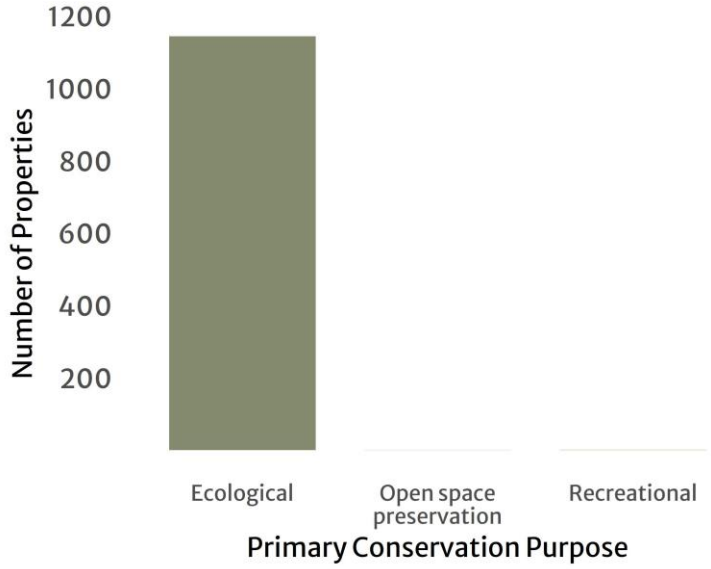
Two key land conservation programs for private land conservation in Alberta are Environment and Climate Change Canada's (ECCC) Ecological Gifts Program and the Government of Alberta's (GoA) Alberta Land Trust Grant Program.

The Ecological Gifts Program offers significant tax benefits to landowners who donate ecologically sensitive land. The program began in 1995 and by March 31, 2022, had received 1697 donation valued at over 1 billion dollars (Environment and Climate Change Canada, n.d.).

Figure 4. Number of properties funded through the Alberta Land Trust Grant Program, ECCC's Ecological Gifts Program or both.

The Alberta Land Trust Grant Program was established in 2011 and provides funding directly to land trusts.

According to information provided by the land trust organizations, as of December 31, 2022, the Alberta Land Trust Grant Program had supported 162 properties and 244,908 acres of private land conservation, and the Ecological Gifts Program had supported 233 properties and 305,923 acres. Just over 100,000 acres of land within 92 properties were funded by both programs (Figure 3, Figure 4).



Conservation purposes

While the primary conservation purpose for PLC is ecological for nearly all properties (**Error! Reference source not found.**), the secondary conservation purpose varied (Figure 5).

Land trusts identified recreation, open space preservation and scenic preservation as the secondary conservation purpose for most properties but agricultural purposes were important for 250 of the 843 properties for which this information was reported. For the remaining properties, land trusts identified ecology-related purposes such as ecological research and environmental education.

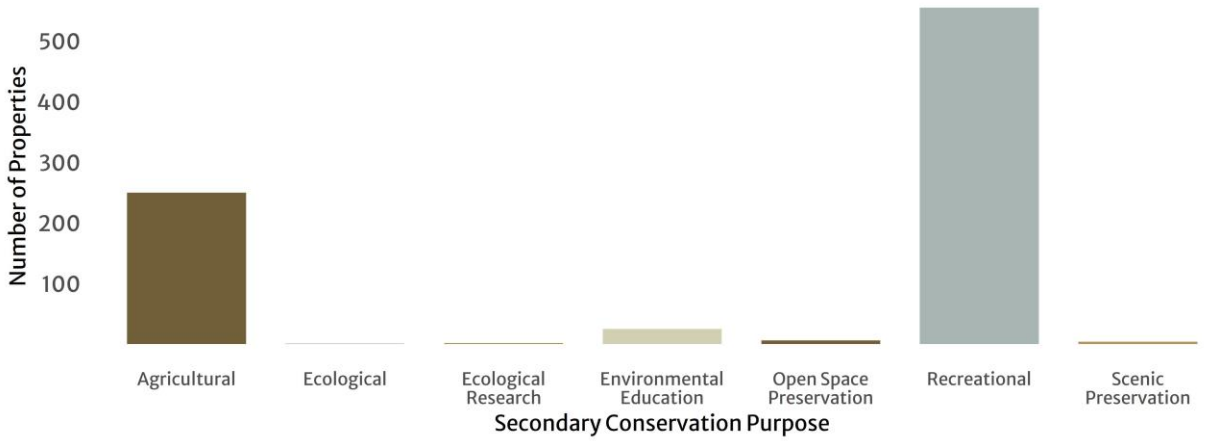


Figure 5. Secondary conservation purposes for privately conserved land identified by land trusts.

Conservation over time

Based on data provided by the eight land trusts, private land conservation has grown steadily in Alberta since 1987 (Figure 7) with some years reflecting notably higher growth in conservation (Figure 6). Since 2020, when a preliminary assessment of PLC in Alberta conducted by the Miistakis Institute, an additional 49,964 acres have been conserved through private land conservation (Lee et al., 2021).

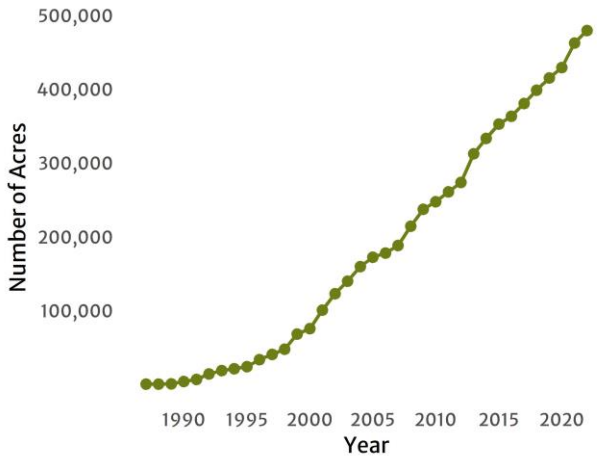


Figure 7. Cumulative acres of privately conserved land in Alberta between 1987 and 2022.

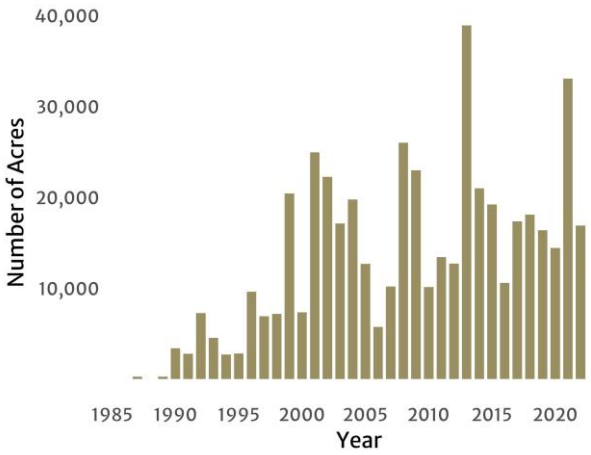


Figure 6. Number of new acres of privately conserved land in Alberta presented from 1987 to 2022.

Conservation over space

NATURAL REGION

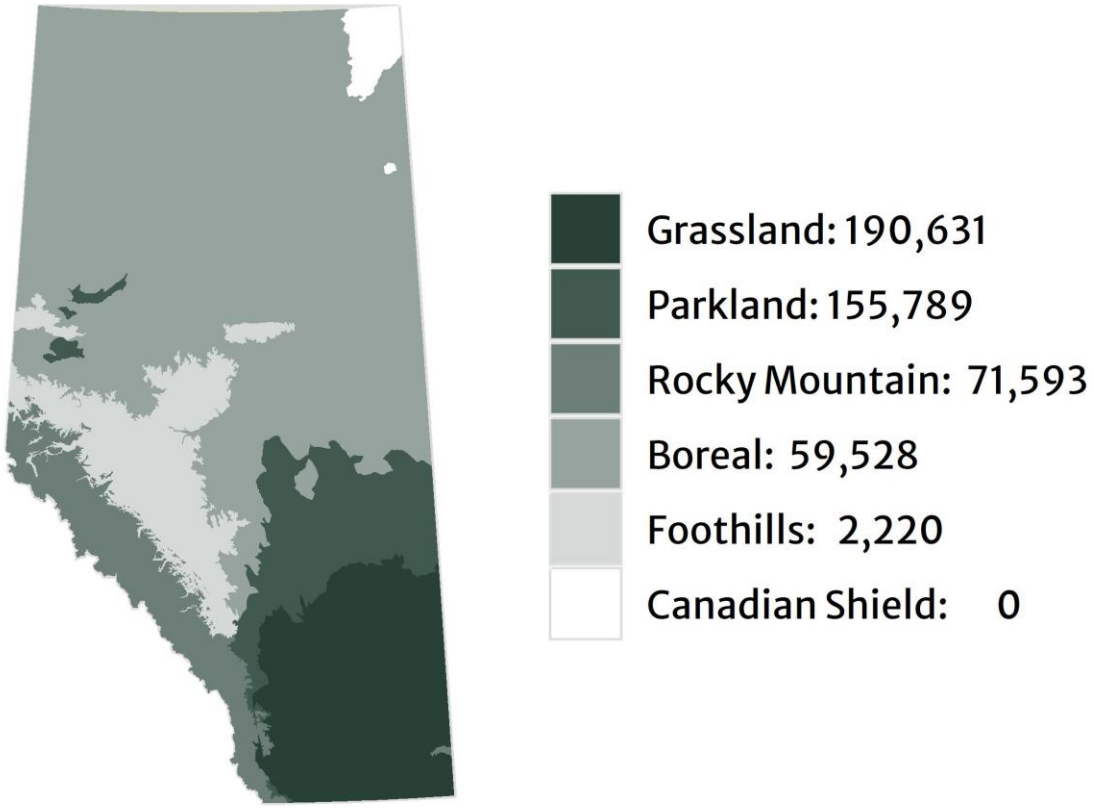


Figure 8. Number of acres protected by private land conservation presented by natural region.

As previously indicated by Lee et al., (2021) the number of acres of privately conserved land varies geographically within the province with the highest number of acres located in the Grasslands natural region, followed by Parkland and Rocky Mountain regions (Figure 8, Table 3). These acres typically represent less than a percent of total land available in the region except for Parkland, which was just over 1% (Figure 9).

Parkland and Grassland natural regions contained the highest percentage of private land, indicating that these natural regions have the highest growth potential for private land conservation.

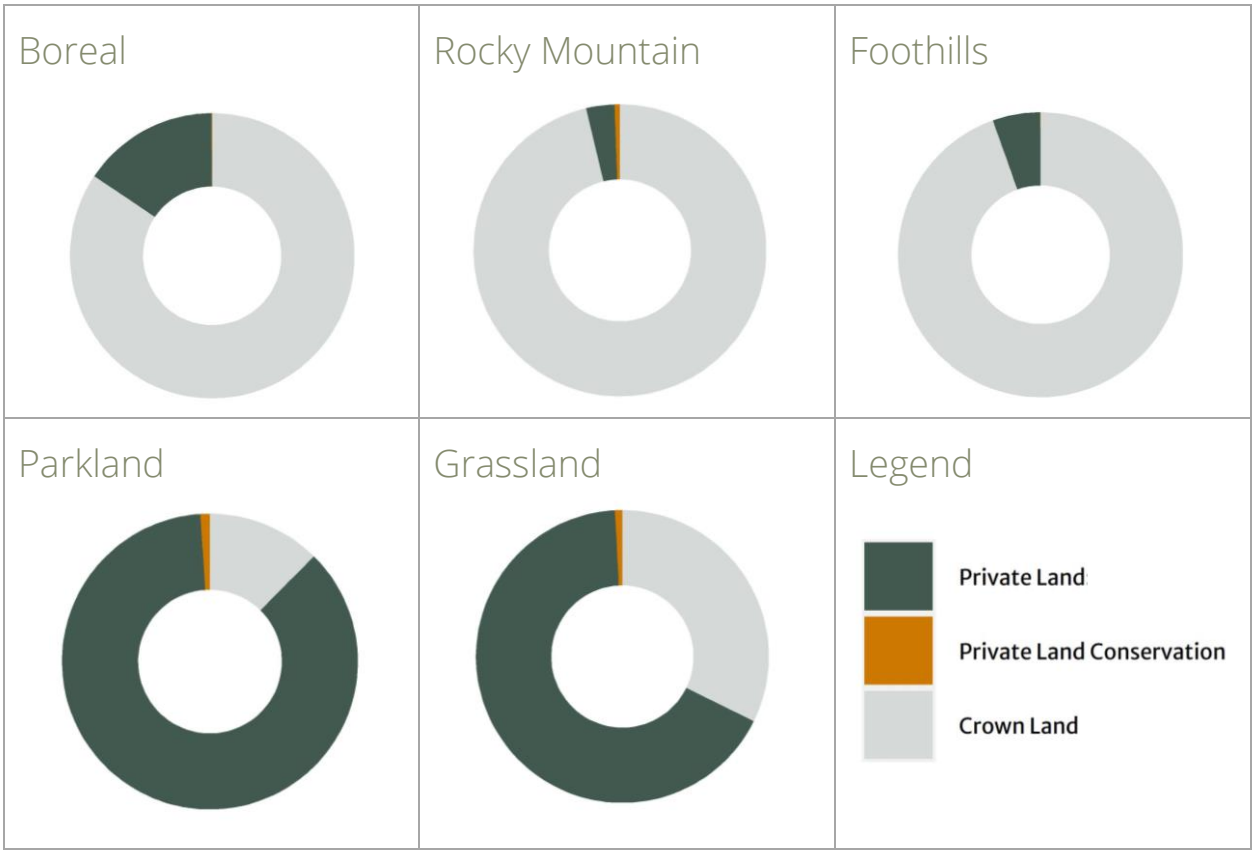


Figure 9. Percent of natural region areas by crown land, private land (un-conserved) and private land conservation. Canadian Shield is not shown since it is entirely crown land. For percentage values please refer to Table 3.

Table 3. Division of natural regions by private land conservation, private land and crown land, shown in acres and as a percent of the total area. Canadian shield is not shown because it is entirely crown land.

Natural Regions	Private Land Conservation		Private Land (Total)		Crown Land	
	Acres	Percent	Acres	Percent	Acres	Percent
Boreal	59,528	0.06	15,437,512	15.56	83,775,289	84.44
Foothills	2,220	0.01	1,207,778	5.44	20,994,032	94.56
Grassland	190,631	0.81	15,937,701	67.72	7,597,002	32.28
Parkland	155,789	1.04	13,122,268	87.60	1,857,490	12.40
Rocky Mountain	71,593	0.59	451,397	3.72	11,682,934	96.28

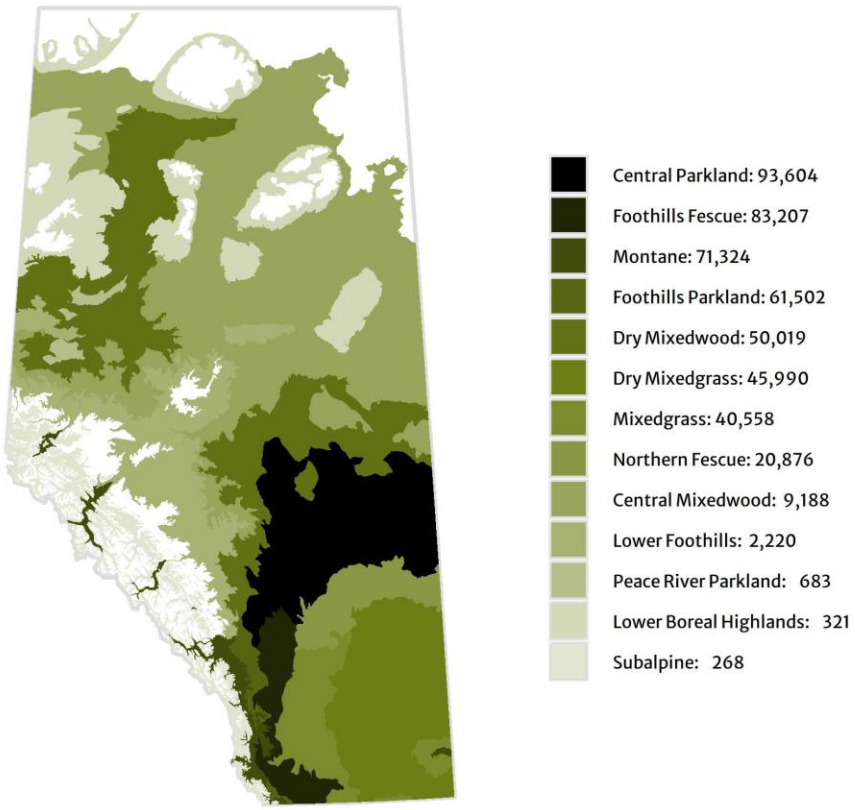


Figure 10. Number of acres protected by private land conservation presented by natural subregion. Eight natural subregions where PLC is not present are not listed in the legend.

Figure 10, Figure 11 and Table 4 present similar information as the natural region assessment, but on a finer scale with natural subregions. Central Parkland and Foothills Parkland (within the Parkland natural region), Foothills Fescue (within Grassland natural region) and Montane (within Rocky Mountain natural region) contain the most privately conserved acres. The highest percentages of each total subregion protected through private conservation were in the Foothills Parkland, Foothills Fescue and Montane subregions. There are several subregions that contain over 50% private land indicating a higher potential for private land conservation growth.

Figure 11. Percent of natural subregion areas by crown land, private land (un-conserved) and private land conservation. Canadian shield is not shown since it is entirely crown land. For percentage values please refer to Table 4. Eight natural subregions with no PLC are not shown.

Table 4. Number of acres and percent of natural subregions that are privately conserved, private land (including conserved) and crown land. Please note that some percent values show 0.00 where acres show values because of rounding.

Natural Subregion	Private Land Conservation		Private Land (Total)		Crown Land	
	Acres	Percent	Acres	Percent	Acres	Percent
Alpine	0	0.00	55	0.00	3,727,400	100.00
Athabasca Plain	0	0.00	20	0.00	3,342,130	100.00
Boreal Subarctic	0	0.00	6	0.00	2,921,441	100.00
Central Mixedwood	9,188	0.02	2,238,965	5.40	39,238,937	94.60
Central Parkland	93,604	0.71	11,809,645	88.99	1,461,385	11.01
Dry Mixedgrass	45,990	0.40	6,712,976	57.88	4,885,408	42.12
Dry Mixedwood	50,019	0.24	12,325,536	58.46	8,757,779	41.54
Foothills Fescue	83,207	2.47	2,748,218	81.64	618,196	18.36
Foothills Parkland	61,502	6.35	704,141	72.66	264,926	27.34
Kazan Uplands	0	0.00	232	0.01	2,401,332	99.99
Lower Boreal Highlands	321	0.23	86,171	78.46	13,656,548	99.37
Lower Foothills	2,220	0.02	889,112	0.63	10,205,700	91.99
Mixedgrass	40,558	0.82	3,634,738	8.01	1,325,083	26.72
Montane	71,324	3.29	442,826	73.28	1,723,723	79.56
Northern Fescue	20,876	0.57	2,895,325	20.44	794,771	21.54
Northern Mixedwood	0	0.00	1,521	0.02	7,291,322	99.98
Peace-Athabasca Delta	0	0.00	0	82.52	1,367,828	100.00
Peace River Parkland	683	0.09	636,313	0.13	134,757	17.48
Subalpine	268	0.00	8,110	0.00	6,223,485	99.87
Upper Boreal Highlands	0	0.00	0	0.00	2,930,222	100.00
Upper Foothills	0	0.00	4,528	0.09	5,317,470	99.91

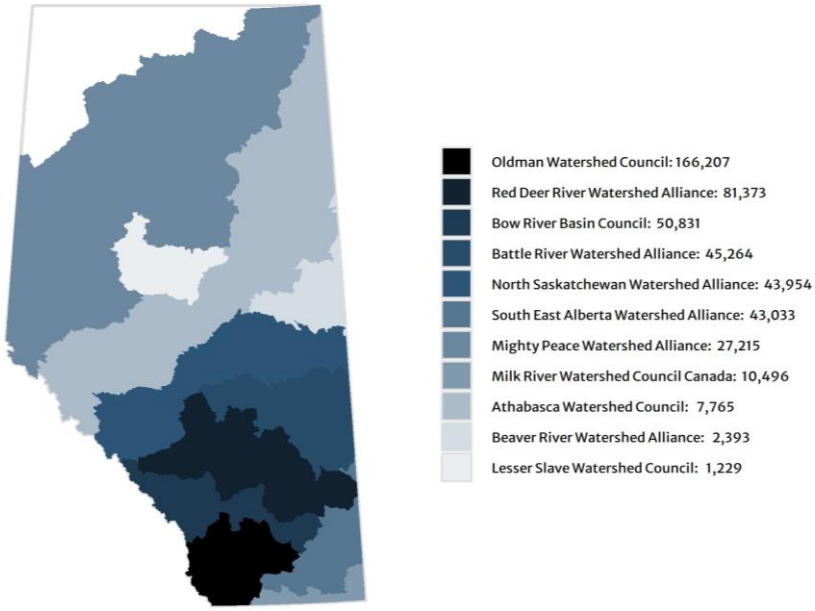


Figure 12. Number of acres of privately conserved land presented by Watershed Planning and Advisory Council (WPAC)

Private land conservation acres were also assessed by the Watershed Planning and Advisory Council (WPAC) areas of responsibility (Figure 12). WPACs are independent non-profit organizations that are designated by the Government of Alberta to act as stewards of Alberta's major watersheds.

The highest number of acres privately conserved occurred in the Oldman Watershed Council's region, followed by the Red Deer River Watershed Alliance, and then the Bow River Basin Council. Oldman Watershed also had the highest percentage of its area conserved privately (Table 5).

Table 5. Number of acres of privately conserved land and its representation as a percent of total area in the watershed.

Watershed Planning and Advisory Council	Private Land Conservation	
	Acres	Percent
Athabasca Watershed Council	7,765	0.02
Battle River Watershed Alliance	45,264	0.51
Beaver River Watershed Alliance	2,393	0.05
Bow River Basin Council	50,831	0.8
Lesser Slave Watershed Council	1,229	0.02
Mighty Peace Watershed Alliance	27,215	0.05
Milk River Watershed Council Canada	10,496	0.62
North Saskatchewan Watershed Alliance	43,954	0.31
Oldman Watershed Council	166,207	2.54
Red Deer River Watershed Alliance	81,373	0.66
South East Alberta Watershed Alliance	43,033	0.88

Rationale for themes

Biodiversity is declining worldwide at an alarming rate. In response, the Convention on Biological Diversity developed targets of land and water that must be protected by specific dates. An initial target was to conserve 17% of terrestrial and inland water by 2020, and was followed by a target to conserve 25% by 2025 and 30% by 2030. Private land conservation has been recognized as a necessary tool to help reach this goal (Chapman et al., 2023). In some areas in Alberta, the majority of land is privately owned (Lee et al., 2021), and as such private land conservation may offer the only tool to protect biodiversity and other ecosystem services in those regions.

Watershed health is under constant pressure from human land uses and in the face of climate change. Alberta faces many challenges around water quantity and balancing this with growing demand for this resource. While Alberta is generally fortunate to have clean water resources, it is necessary to protect this resource.

Resiliency to climate change includes both mitigation (i.e., actions that reduce greenhouse gas emissions) and adaptation (i.e., actions that allow societies to minimize the impacts of climate change). The ability to do either is likely to become more challenging and costly over time and multiple tactics are required to see overall advances in this challenge.

In rapidly developing landscapes with increasing demands to meet numerous societal needs, opportunities for enjoying nature and doing so in a sustainable way can become a challenge. Particularly in and near urban environments, it can be a challenge to maintain those natural spaces.

Of course, there is a lot of interconnection between these themes where some metrics relate to more than one theme, but also where benefits to one theme have implications for one or more of the other themes. For example, healthy watersheds are more likely to provide the natural infrastructure resources needed to adapt to climate change. As well, loss in biodiversity is expected to have an impact on human well-being (Isbell et al., 2023).

Biodiversity

Biodiversity metrics

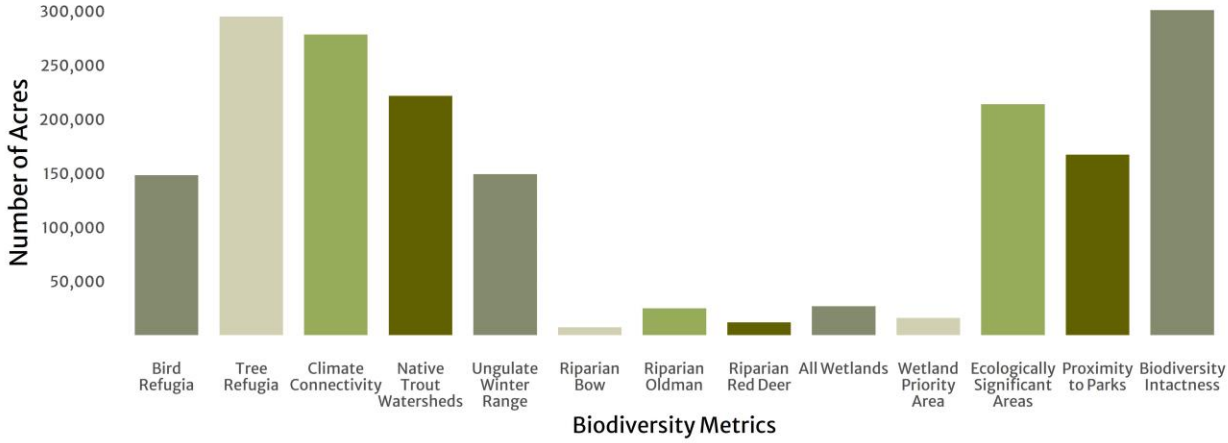


Figure 13. Acres of private land conservation for all metrics under the biodiversity theme presented on the same scale to improve comparability. For specific acre values, please refer to

Table 6. Acres and percents of private land conservation, private land and crown land for the biodiversity theme.

Metric Name	Private Land Conservation		Private Land (Total)		Crown Land	
	Acres	Percent	Acres	Percent	Acres	Percent
Biodiversity Intactness	300,796	0.26	7,172,831	6.20	108,517,987	93.80
Bird refugia	147,882	0.17	12,378,615	14.23	74,610,947	85.77
Climate Connectivity	278,124	0.40	25,086,741	36.08	44,444,138	63.92
Environmentally significant areas	213,729	0.29	4,370,381	5.93	69,329,128	94.07
Fish/fishing - at-risk native trout						
All species	221,263	0.86	5,009,301	19.47	20,719,005	80.53
Athabasca Rainbow Trout	775	0.01	373,602	4.82	7,377,470	95.18
Bull Trout	193,514	0.90	3,874,588	18.02	17,627,009	81.98
Westslope Cutthroat Trout	211,204	3.09	3,038,883	44.46	3,796,211	55.54
Proximity to Parks	167,021	0.38	5,494,096	12.50	38,458,671	87.50
Riparian						
Bow	7,294	1.17	253,847	40.72	369,550	59.28
Oldman	24,782	3.93	358,557	56.86	272,039	43.14
Red Deer	11,783	0.83	845,990	59.59	573,694	40.41
Tree refugia	294,769	0.16	25,515,914	13.85	158,714,514	86.15
Ungulate winter range	148,990	1.29	2,112,430	18.29	9,437,215	81.71
Wetlands						
ABMI wetland layer	26,741					
Joint Venture priority area	16,017	1.60	799,627	79.88	201,408	20.12

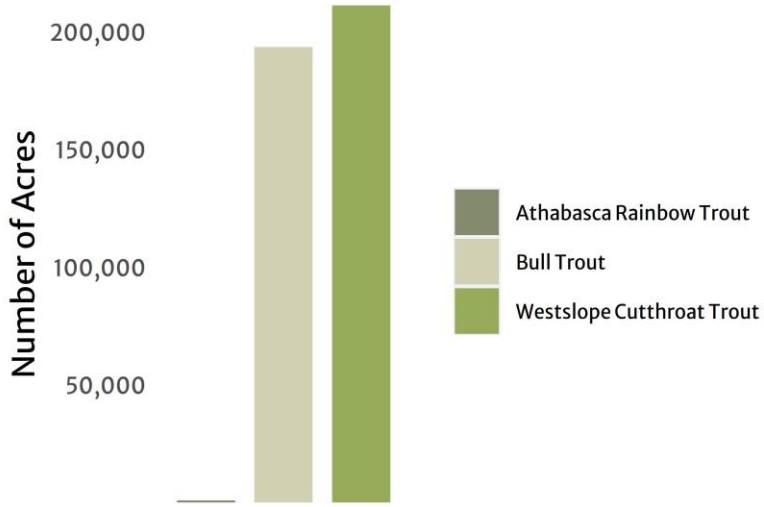


Figure 14. Number of acres of private land conservation in watersheds where at-risk native trout are low to extirpated.

Fish population health

Alberta is home to three native trout species that are federally listed Species at Risk. One of the key threats they face is habitat loss and degradation (Sinnatamby et al., 2020). Measures to address habitat loss and degradation, including habitat fragmentation, are identified as recovery strategies for these species (Fisheries and Oceans Canada, 2019, 2020b, 2020a)

Figure 14 shows the number of privately conserved acres within watersheds where these populations are low in density or extirpated where they previously existed.

Privately conserved land offers a tool to alleviate some of the land-use stressors in these watersheds. Our results indicate that the number of privately conserved acres within these key watersheds for the endangered Athabasca Rainbow Trout is low. Athabasca Rainbow Trout habitat also had the lowest percentage of conservation (Table 6).

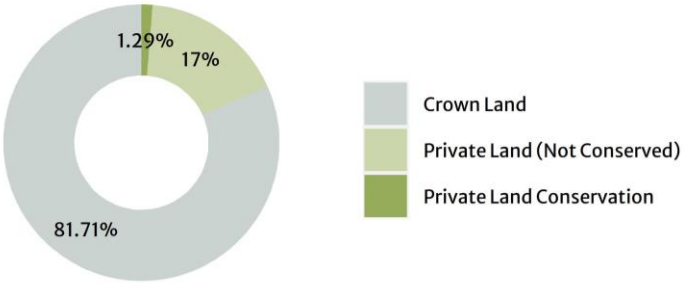


Figure 15. Percent of land within ungulate winter range that is crown land, private land (not conserved) and privately conserved land.

Ungulate population health

Winter is a particularly challenging season for ungulate survival (Kautz et al., 2020). Private land conservation can contribute to biodiversity in this group of species by protecting land in their winter range, improving connectivity, and reducing stress on these species.

Our comparison of privately conserved land in relation to ungulate winter habitat indicated that PLC protects nearly 150,000 acres of this habitat and 1.29% of the total area (Figure 16, Table 6).

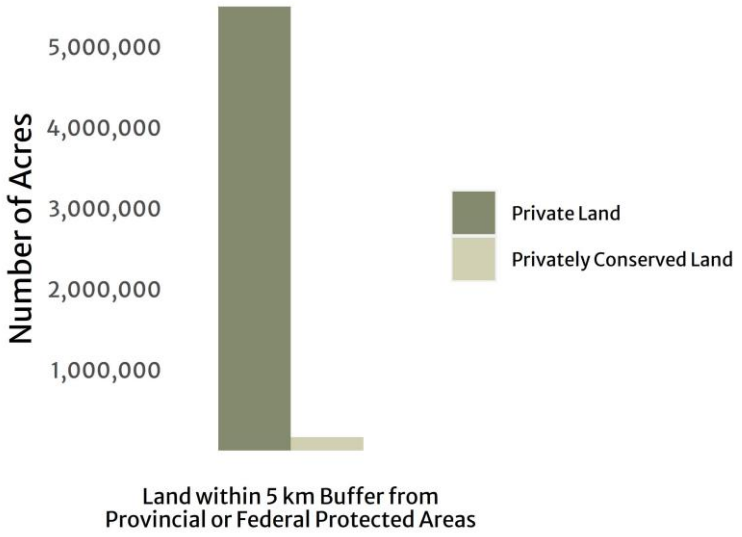


Figure 16. Number of acres of land within a 5 km buffer around federal and provincial parks and protected areas that is private (protected and unprotected) and privately conserved.

Proximity to parks

Private land conservation near other protected areas can amplify the effects of those protected spaces on biodiversity by increasing the footprint of undeveloped land, increasing connectivity with areas already known to provide habitat for wildlife, and creates a buffer with those spaces and other land uses.

Private land conservation in Alberta located within a 5 km buffer of other protected spaces contributes about 3% of the existing private land (0.38% of the total area) (Figure 16).

Biodiversity intactness

Biodiversity intactness is an index that was developed and calculated by ABMI. This index compares current biodiversity to historical where deviations (positive or negative) from historical estimates result in a lower score. We recorded over 300,000 acres of privately conserved land within the top 25% of this index (Table 6, Figure 13).

Environmentally significant areas

Environmentally significant areas are important to the long-term maintenance of biological diversity, physical landscape features or other natural processes based on four criteria: focal species, rare or unique focal habitat, ecological integrity, water quality and quantity. We identified 213,729 acres of privately conserved land within these environmentally significant areas in Alberta (Table 6, Figure 13).

Refugia and connectivity

Bird and tree refugia and climate connectivity corridors are necessary to preserve biodiversity under climate change scenarios (Figure 13, Table 6). Please refer to the climate change section for more information.

Wetlands and riparian areas

Wetlands host a disproportionate amount of biodiversity relative to their size (Dudgeon et al., 2006; Kingsford et al., 2016) including microbes, plants, terrestrial, aquatic and amphibious species. Similarly, riparian environments are hosts to unique plant species that have remarkable adaptations to living in areas that fluctuate dramatically with respect to water level. Likely because of the variable nature of these environments, they tend to be hotspots for biodiversity by offering a variety of habitat characteristics that can meet the requirements of different species variably throughout their life cycle. Please see the watershed resiliency section below for more information about private land conservation of these habitats.

Watershed Resiliency

Watershed resiliency metrics

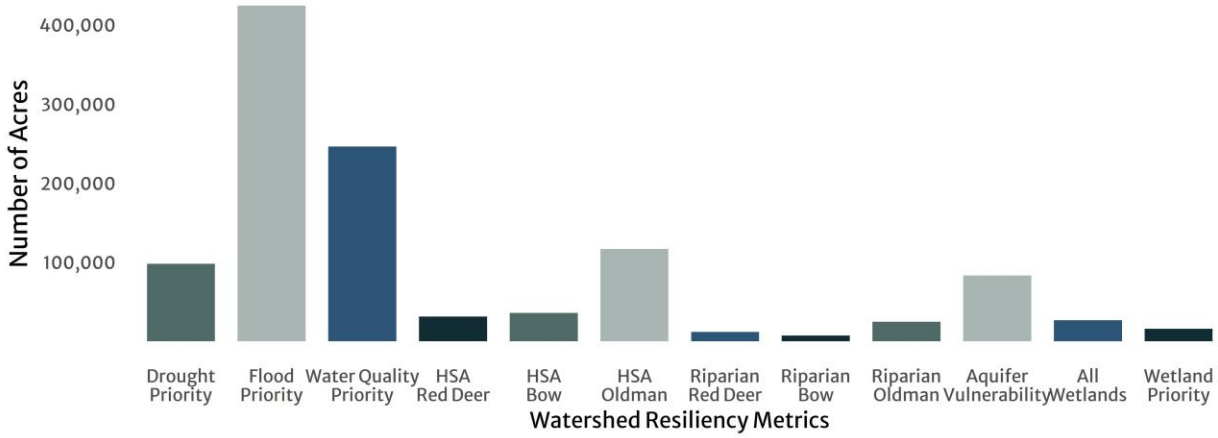


Figure 17. Acres of private land conservation for all metrics under the watershed resiliency theme presented on the same scale to improve comparability.

Table 7. Acres and percents of private land conservation, private land and crown land for the watershed resiliency theme.

Metric Name	Private Land Conservation		Private Land (Total)		Crown Land	
	Acres	Percent	Acres	Percent	Acres	Percent
Aquifer Vulnerability	83,289	1.21	4,069,475	59.12	2,813,940	40.88
Hydrologically significant areas						
Bow	36,066	1.70	615,033	28.99	1,506,502	71.01
Oldman	116,838	5.27	909,433	41.02	1,307,615	58.98
Red Deer	31,164	0.63	3,434,961	69.44	1,511,700	30.56
Riparian						
Bow	7,294	1.17	253,847	40.72	369,550	59.28
Oldman	24,782	3.93	358,557	56.86	272,039	43.14
Red Deer	11,783	0.83	845,990	59.59	573,694	40.41
Watershed Resiliency and Restoration Metrics						
Drought	98,154	1.07	6,769,873	73.80	2,403,397	26.20
Flood	424,394	0.50	59,737,698	70.38	25,141,100	29.62
Water quality	246,330	0.88	20,280,261	72.45	7,711,818	27.55
Wetlands						
ABMI wetland layer	26,741					
Joint Venture priority area	16,017	1.60	799,627	79.88	201,408	20.12

Hydrologically significant and riparian areas

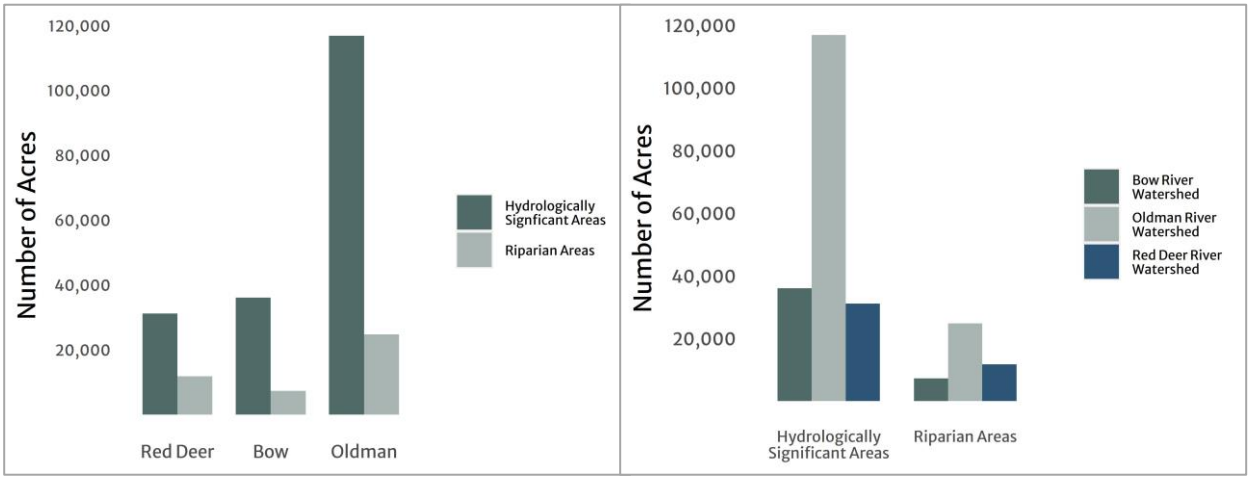


Figure 18. Hydrologically significant areas and riparian areas within the Red Deer, Bow and Oldman watersheds displayed in two ways: (left) grouped by watershed, (right) grouped by metric.

Hydrologically significant areas were defined and estimated by Nature Conservancy Canada for the Red Deer, Bow and Oldman river watersheds. They are defined as areas containing natural assets that provide hydrological services such as maintaining water quality and quantity. More information about the development of the hydrologically significant areas along with basin-specific reports can be found here.

Riparian areas are known to play an important role in maintaining water quality by trapping sediment, stabilizing banks and reducing erosion.

Our assessment of private land conservation within these three watersheds found that the Oldman watershed had the largest number of acres and also representing the highest percent of the total area for both hydrologically significant areas (over 115,000 acres of private land conservation, representing over 5% of the total area) and the riparian zone (almost 25,000 acres, representing nearly 4% of the total area, Figure 18, Table 7). The Bow and Red Deer watersheds had lower levels of private land conservation in their hydrologically significant areas (1.7% and 0.63%, respectively) and riparian zones (1.17% and 0.83%, respectively). Interestingly, the watershed with the highest proportion of privately owned land within the areas that define these two metrics was Red Deer.

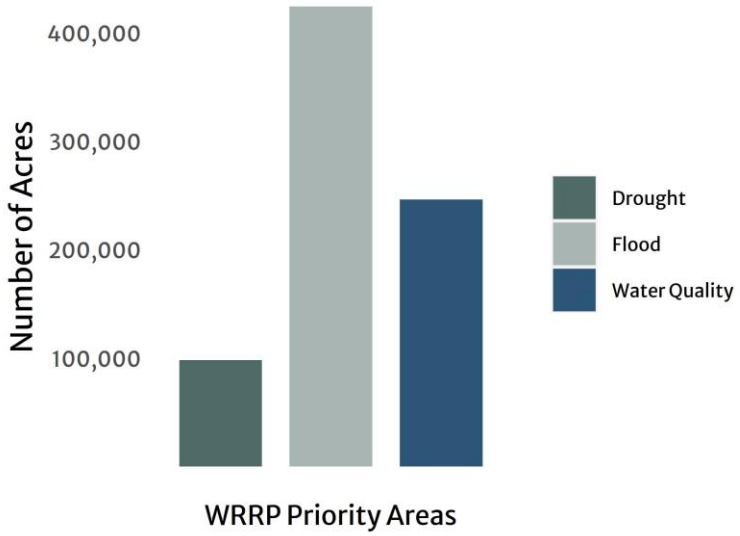


Figure 19. Number of acres of privately conserved land within areas of priority for drought and flood mitigation and maintaining water quality determined by the Government of Alberta's Watershed Resiliency and Restoration Program.

Watershed Resiliency and Restoration Program priority areas

The Government of Alberta's Watershed Resiliency and Restoration Program (WRRP) identified watersheds in the province that are priority for mitigating flood and drought and for maintaining water quality. More information about how those watersheds were scored can be found here.

Our assessment of private land conservation in the high priority (5) watersheds indicated that almost 100,000 acres of drought priority areas (1% of total area), over 400,000 acres of flood mitigation areas (0.5% of total area) and nearly 250,000 acres of water quality mediating areas (0.88% of total area) were conserved on private land (Table 7, Figure 19).

Aquifer vulnerability

The Aquifer Vulnerability Index in Alberta presents the level of vulnerability of aquifers to potential contamination from surface inputs based on permeability of geological formations and the depth of the aquifer. Aquifers that are located closer to the surface and overlain with more permeable geological materials are more vulnerable to contaminants compared to deep water aquifers overlain by less permeable geological materials. Our assessment of private land conservation in Alberta indicated that 83,289 acres of land are located in areas where aquifers are more vulnerable, representing 1.2% of the total area (Figure 17, Table 7).

Wetlands

Wetlands are an integral part of a healthy, resilient watershed. They provide natural infrastructure for mitigating drought and flood impacts, and provide water purifying services as they slow down water flow allowing sediment to settle out, and also provide habitat for many plant species that control nutrient levels and remove toxins from the water. Our assessment of private land conservation relating to wetlands found that over 26,000 acres of wetlands are protected Alberta-wide and about 16,000 acres of that is specifically within the Ducks Unlimited's Joint Venture priority area (Table 8, Figure 20). The majority of land within the Joint Venture area is privately owned (almost 80%) and private land conservation presents a promising opportunity to protect this vitally important ecosystem.

Climate Change Resiliency

Climate change resiliency metrics

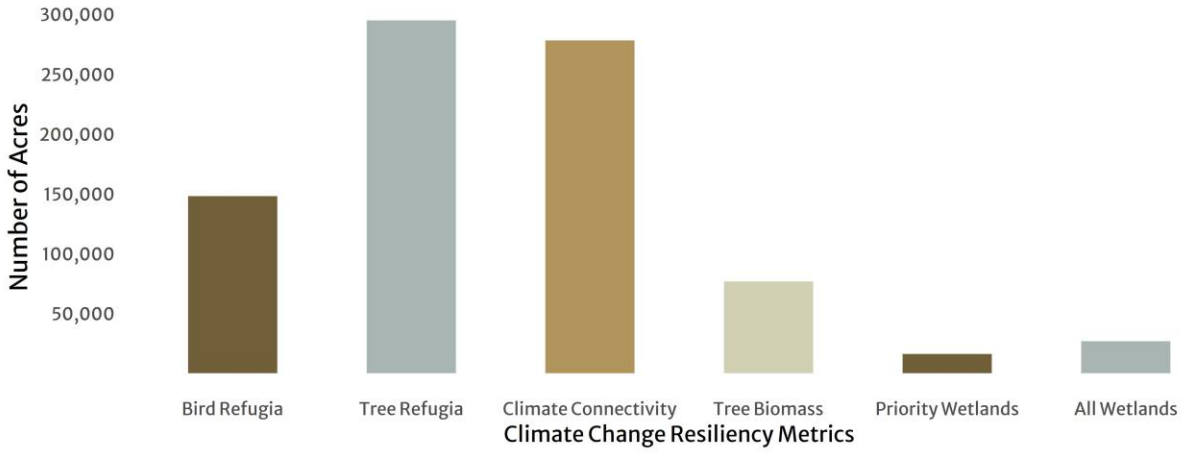


Figure 20. Acres of private land conservation for all metrics under the climate resiliency theme presented on the same scale to improve comparability.

Table 8. Acres and percents of private land conservation, private land and crown land for the climate change resiliency theme.

Metric Name	Private Land Conservation		Private Land (Total)		Crown Land	
	Acres	Percent	Acres	Percent	Acres	Percent
Bird refugia	147,882	0.17	12,378,615	14.23	74,610,947	85.77
Climate connectivity	278,124	0.40	25,086,741	36.08	44,444,138	63.92
Tree biomass	76,634	0.10	4,222,507	5.51	72,411,015	94.49
Tree refugia	294,769	0.16	25,515,914	13.85	158,714,514	86.15
Wetlands						
ABMI wetland layer	26,741					
Joint Venture priority area	16,017	1.60	799,627	79.88	201,408	20.12

Refugia and connectivity under climate change

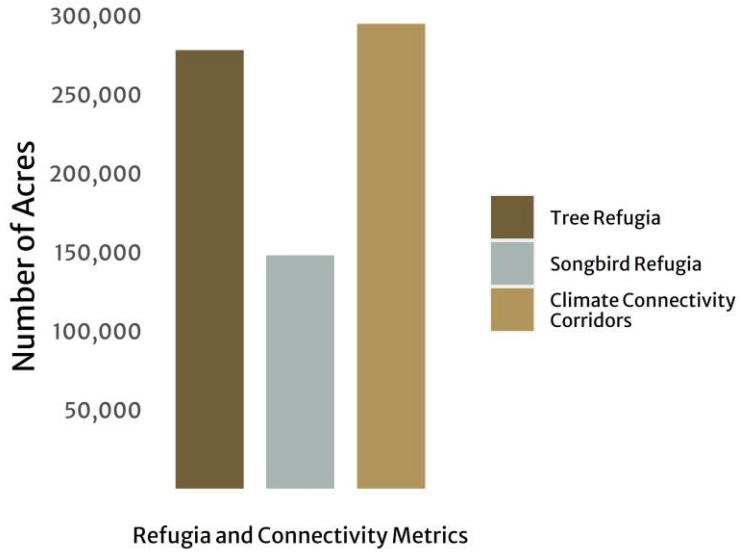


Figure 21. Number of acres of areas of private land conservation within the region predicted to act as tree and songbird refugia under climate change scenarios, and the number of acres of private land conservation in predicted climate connectivity corridors.

Stralberg et al., (2018) mapped predicted spatial patterns of tree and songbird microrefugia in North America using species distribution models under climate change scenarios. The ability for species to use those refugia, however, may be dependent on their ability to reach those areas. As such, it is important to consider connectivity as well and Carroll et al., (2018) developed climate corridor maps to identify corridors likely to link between current and predicted distributions.

Our comparison of private land conservation locations in reference to these refugia and climate corridors indicated between about 150,000 and 300,000 acres conserved depending on the specific metric (Figure 21), which accounts for about less than 0.5% of the total land in these regions (Table 8).

Tree biomass

Tree biomass is an estimate of above ground carbon storage, which acts as a proxy for soil carbon storage. Trees also mitigate climate change by reducing the amount of greenhouse gases in the atmosphere. Our analyses estimated 76,634 acres of privately conserved land in the top 50% of the index that was identified as containing above ground biomass (Figure 20, Table 8) (Santoro et al., 2018).

Wetlands

Wetlands are a valuable resource for climate change mitigation since they act as carbon sinks that can reduce greenhouse gases in the atmosphere. Wetlands also provide natural infrastructure that play an important role in enabling societies to adapt to climate change effects by dampening flood impacts (Kabisch et al., 2017), and by holding water on the landscape for longer periods, combatting drought. Please see the watershed resiliency section above for more information.

Human Well-being

Human well-being metrics

Figure 22. Acres of private land conservation for all metrics under the human well-being theme presented using the same scale to improve comparability.

Table 9. Acres and percents of private land conservation, private land and crown land for the human well-being theme.

Metric Name	Private Land Conservation		Private Land (Total)		Crown Land	
	Acres	Percent	Acres	Percent	Acres	Percent
Fish/fishing - at-risk native trout						
All species	221,263	0.86	5,009,301	19.47	20,719,005	80.53
Athabasca Rainbow Trout	775	0.01	373,602	4.82	7,377,470	95.18
Bull Trout	193,514	0.90	3,874,588	18.02	17,627,009	81.98
Westslope Cutthroat Trout	211,204	3.09	3,038,883	44.46	3,796,211	55.54
Proximity to Parks	167,021	0.38	5,494,096	12.50	38,458,671	87.50
Ungulate winter range	148,990	1.29	2,112,430	18.29	9,437,215	81.70

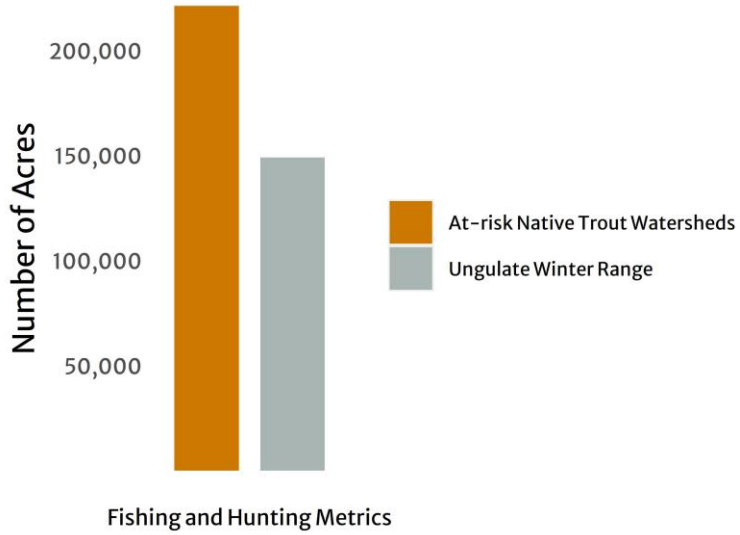


Figure 23. Number of acres of privately conserved land within watersheds with low to extirpated at-risk native trout populations, or within ungulate winter range.

Recreational hunting and fishing

The fish and ungulate metrics presented here (Figure 23) were both also presented under the biodiversity theme. Private land conservation in these regions supports healthy populations which has benefits for human well-being through also supporting sustainable recreational opportunities to fish and hunt. It should be noted that although the fish species are federally listed under the *Species at Risk Act*, their recovery plans contain exemptions for catch-and-release angling (Fisheries and Oceans Canada, 2019, 2020a, 2020b).

Over 18% of the ungulate winter range area is private land and 7% of that area (1.3% of the total area) is privately conserved (Table 9). Over 19% of the watersheds with low to extirpated at-risk native trout is private land and 4.4% of that area (0.86% of the total area) is privately conserved.

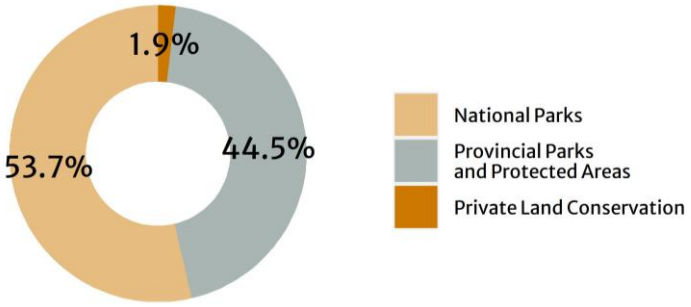


Figure 24. Percent of protected land in Alberta in National Parks, Provincial Parks and Protected Areas and privately conserved.

Protected areas in Alberta: national, provincial and private

Private land conservation in Alberta makes up nearly 2% of the total protected areas in the province, which is otherwise made up of national parks and provincial parks and protected areas (Figure 24).

Proximity to parks

Private land conservation near other protected areas (Figure 22) can amplify the effects of those protected spaces on biodiversity as was discussed above, but this can also have implications on human well-being by increasing open space and scenic views within the province. Private land conservation contributes nearly 2% of the total protected areas in the province and some privately conserved land is open to the public for recreational opportunities (Figure 25).

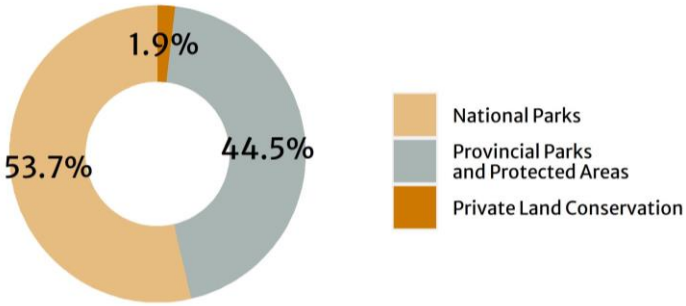


Figure 25. Percent of protected land in Alberta in national parks, provincial parks and protected areas and private land conservation.

Web Portal

An open-access website was developed to display key metrics results from the combined land trust data. The website presents graphs, maps and key messaging about private land conservation in Alberta at a glance and how it contributes to the four themes: biodiversity, watershed resiliency, climate resiliency and human well-being (Figure 26).

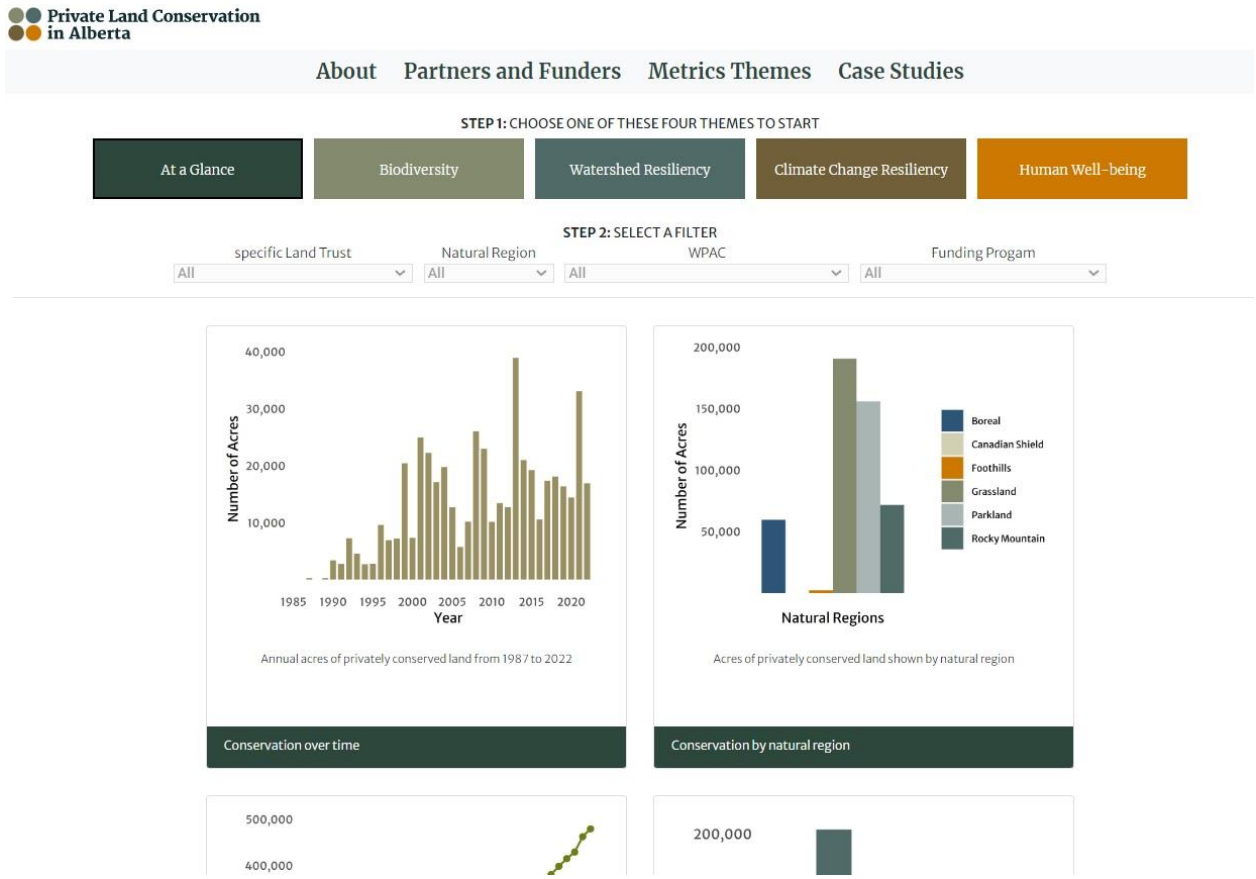


Figure 26. Home page of private land conservation metrics website. Links at the top of the webpage allow the user to visit the About and Partners and Funders pages to learn more about the project. The Metrics Themes link provides more detail about the metrics and a link to download this report. And Case Studies link provides a more in-depth look at the value provided by private land conservation using specific examples that go beyond metrics. Step 1 allows users to view high-level metrics in the At a Glance section or select from the four themes: biodiversity, watershed resiliency, climate change resiliency and human well-being.

Filters

While this technical report displays only the high-level results for Alberta or some regions when relevant (e.g., riparian, hydrologically significant areas), the website shows each metric, when feasible, broken down further based on various filters (Figure 27). The filters include land trust, natural region, watershed planning and advisory council, and land conservation program with a separate filter for ECCC's Ecological Gifts Program and the Alberta Land Trust Grant Program.

Figure 27. Demonstration of the dropdown menu under the Land Trust filter. When a land trust is selected, the resulting figures will only show data from that land trust. There are similar filters for each of the natural regions, watershed planning and advisory councils, and land conservation program (Ecological Gifts Program, Alberta Land Trust Grant Program).

Case studies

Case studies were developed to present more in-depth examples and provide more context for some benefits of private land conservation. These case studies will be presented on the website and available for the land trusts to use as specific examples to highlight the benefits of their work. For example, we featured the Golden Ranches Conservation Area to showcase how private land conservation can contribute to increase connectivity in an area and provide opportunities for restoration.

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Appendix

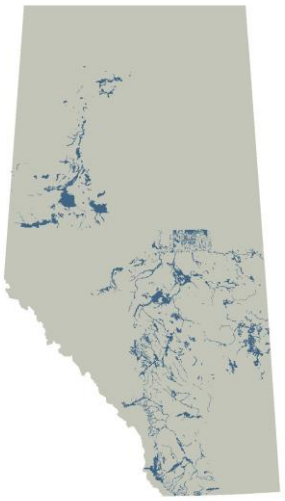

*Figure 28. **Aquifer vulnerability**: Areas containing aquifers with high vulnerability (5-6) to surface contamination*

*Figure 29. ABMI's **biodiversity intactness** index for with values >75 indicating areas where current biodiversity estimates are similar to historical estimates.*

*Figure 30. Areas identified as likely **bird refugia** under climate change scenarios – top 50% of the index presented in Stralberg et al.* (2018)

*Figure 31. **Climate connectivity** corridors between current and predicted species distributions under climate change scenarios as identified by Carroll et al.* (2018)

*Figure 32. Priority watersheds for **mitigating drought** identified by the GoA's Watershed Resiliency and Restoration Program. Areas shown had the highest priority score (5).*

*Figure 33. Government of Alberta identified **environmentally significant areas**.*

*Figure 34. **Fish**: Watersheds where adult densities of at-risk native trout (Athabasca Rainbow Trout, Bull Trout and Westslope Cutthroat trout) were classified as low, very low, or extirpated. Classifications were derived from AEPA's Fisheries Sustainability Index available on FWIMT.*

*Figure 35. Priority watersheds for **mitigating floods** identified by the GoA's Watershed Resiliency and Restoration Program. Areas shown had the highest priority score (5).*

Figure 36. ***Hydrologically significant areas*** *identified in the Oldman, Bow and Red Deer river watersheds only.*

Figure 37. ***Proximity to parks****: Federal and provincial parks and protected areas (light orange) and a 5 km buffer around those areas (dark orange).*

Figure 38. ***Riparian areas*** *were only assessed for the Red Deer, Bow and Oldman river watersheds.*

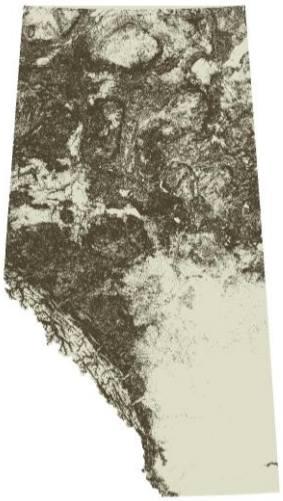

Figure 39. Areas with high above-ground ***(tree) biomass*** *as estimated by Santoro et al.* (2018)*.*

*Figure 40. Areas identified as likely **tree refugia** under climate change scenarios – top 50% of the index presented in Stralberg et al.* (2018).

*Figure 41. **Ungulate winter range** shows areas classified as important winter areas for elk, moose, deer and bighorn sheep.*

*Figure 42. Priority watersheds for **maintaining water quality** identified by the GoA's Watershed Resiliency and Restoration Program. Areas shown had the highest priority score (5).*


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