Photo by Marika Ai-Li

Biodiversity Mapping Workshop 2023 Report

Action for Adaptation

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January 2024

Executive Summary

In November 2023 UBC Botanical Gardens, UBC's Earth Observation and Spatial Ecology Lab and the Coastal Douglas-fir Conservation Partnership (CDFCP) held a Biodiversity Mapping Workshop at the Mary Winspear Centre, Sidney. The workshop was completed to feed into a project called Action for Adaptation. The Project aims to support local governments and First Nations to accelerate climate adaptation and resilience by providing mapping and tools that they have indicated are needed to conserve and restore nature-based solutions (NBS) for climate change.

The goals of the workshop were to;

- share progress on the Biodiversity Atlas and its emerging mapping layers and learn how this work could support local governments and First Nations;
- discuss how the pilot mapping layers could connect to decision making that supports biodiversity; and,
- support planners and decision makers to strengthen the network of knowledge holders on the south-west coast.

To date, the project team has held in-depth interviews and a workshop in October 2022 with planners, decision makers and mappers, to better understand the needs and priorities of spatial data users, identify gaps and deficiencies, and identify potential collaborations and opportunities for filling them (**Figure 3**). This work identified the need for the following six mapping layers;

- Land cover and land cover change
- **Environmentally Sensitive Areas**
- Terrestrial carbon
- **Species at risk and/or of cultural value**
- **Ecosystems connectivity**
- Hydrologically sensitive ecosystems

The Biodiversity Mapping Workshop held in November 2023 focused on the mapping layers that are highlighted in bold. The workshop was structured to share information on local examples of mapping that has been completed / or is ongoing in relation to each of the topic areas; to present pilot options for mapping these layers and to review with attendees, through breakout groups, the challenges and opportunities of the pilot layers. The Sunshine Regional District was the focus area for the pilot layers.

A summary of what was heard during the discussion groups is presented in **Table A**. Table A also presents the next steps for the Atlas team based on the information shared in the workshop.

Table A – A summary of conclusions of breakout groups relevant to the development of the Biodiversity Atlas.

Discussion Group Topic	Opportunities to be consider by the Atlas	Challenges to be considered by the Atlas	How the Atlas will Respond
Species at Risk and of Cultural Value Mapping			
Citizen science species records	-Enables more records to be collected. -Enables increased engagement with the community, planners and decision makers.	-The records are biased by where people live; the species they can see or the species they are interested in. -There is potentially a higher risk of error. -The records may be harder to defend to the public.	The Atlas team will: -include citizen science records in the Atlas, clearly stating the source and level of validation
Culturally valuable species records	-Creates an opportunity for western science and indigenous knowledge to be presented together. -Provides evidence for the protection of sites with culturally valuable species. -Could help to build relationships.	-Data sovereignty / confidentiality of information / miss use of information would need to be considered. -Capacity might be limited for First Nations to engage in this work. -The project needs to work with each Nation to understand their needs. -Places a focus on single species vs whole environment.	The Atlas team will: -continue conversations with each of the First Nations within the project area to understand how these records could/should be presented.
Habitat suitability models for species at risk	-The models alleviate observer bias by drawing on a lot of resources to identify potentially suitable habitat. -Extends beyond jurisdictional boundaries. -Can be used to identify where to complete detailed surveys.	-The quality of the model is impacted by the quality of the information it is based on. -Models could only be completed for a few species. -The models would be difficult to enforce / regulate. -Need a clear indication of assumptions and how to use the models.	The Atlas team will: -consult the province on the use of their habitat suitability models. -use the models to support ecosystem connectivity mapping layers.
Ecosystem Connectivity			
Effect of scale on ecosystem connectivity	-Encourages collaboration, communication, resource sharing between jurisdictions. -Needs to be undertaken at a scale appropriate to the user e.g. local, regional and territory. -Is enforceable through OCP, if supported through zoning. -Provides information for the planning and decision-making process.	-No provincial mandate to protect connectivity. -The existence of jurisdictional boundaries can impact implementation. -Connectivity is different for different species. -Landscape is continually changing due to development, resource extraction and climate change. -Lack of influence on private land.	The Atlas team will: -review approaches to regional and local connectivity mapping. -consult with the provincial biologists on methodology. -review policy supporting implementation
Climate micro-refugia	-Presents climate change adaptation in action and would provide a good communication tool when working with the public. -Could provide incentive for protection, restoration, conservation, and stewardship. -LiDAR could be useful for this approach to mapping. -Need to consider the resolution of mapping e.g. micro-niches. -Mapping could open conversations with people excluded by data.	-Our understanding of climate change and its effects are evolving. -Using TEM (1:20,000) as the basis for this mapping could miss local refugia. -This approach is new and would need to be integrated into planning. -Who would decide on the criteria for climate refugia? -Capacity of local governments and First Nations to use this tool would need to be increased.	The Atlas team will: -consult with the province and academia on methodology/standards. -consider alterative fine scale approaches. -review how this layer could be incorporated into policy. -reflect on how local governments and First Nations can respond with limited capacity.

Discussion Group Topic	Opportunities to be consider by the Atlas	Challenges to be considered by the Atlas	How the Atlas will Respond
	-Could be used in planning resilience for culturally significant species.		
Restoration of connectivity	-Corridor restoration will enable species to respond to climate change. -Could be used to prioritise land acquisition. -Could be incorporated into Official Community Plans leading to improved decision making.	-The practicality of implementation on private land is a constraint. -It takes a lot of resources to restore a site versus protecting existing high value sites. -Policy may not be able to stop development.	The Atlas team will: -focus on identifying existing connectivity corridors. -identify significant barriers to key connectivity corridors.
Environmentally Sensitive Areas			
Extending SEI	-Would increase coverage and is a viable input in regulatory tools. -LiDAR, satellite and AI could help fill gaps, enable updates in a cost-effective way. -Could support First Nations, as the relationship to archaeological layers is important for Nations. -Would enable planners to look beyond their jurisdiction.	-The province would need to accept the approach as a proxy for the traditional approach to SEI mapping. -TEM has not been completed across the whole province. -The product would need to be verified on the ground. -Doesn't include an indigenous way of knowing. -The scale of mapping will impact its value. -The frequency of updates will affect its value. -Need to include coastal and high elevation ecosystems.	The Atlas team will: -review the approach with the province and look for ways to automate. -look to include coastal ecosystems. -look to verify products on the ground. -consult with First Nations on how to incorporate indigenous ways of knowing.
Grading ESA	-Could provide an easy-to-understand map of values and local priorities. -Could provide a framework for evaluating the value of sites.	-It would be difficult to develop a grading system that reflected everyone's values and that would cross jurisdictional boundaries. -Who would establish the grading system?	The grading of ESAs will not be a focus area for the Atlas team at this time due to the challenges highlighted. We will revisit later in the project.
Frequency of updates	-Some areas have never been mapped. Therefore, map at least once. -Updates should be linked with the planning cycle e.g. at least every five years. -Increase the scale before increasing the frequency of updates.	-Need to reduce the cost of mapping to increase frequency. -Once sensitive ecosystems are identified they should be protected removing the need for regular updates.	The Atlas team will: -consult with the province on guidance / standards on mapping ESA's. -consider frequency of updates / change mapping.
Presentation and Interpretation of Mapping			
Mapping at a parcel scale	-Would improve engagement with the community because it is of relevance to them. -Parcel scale information is useful to planners and decision makers. -Could link to an evaluation framework to provide consistency and transparency.	-Could become political due to the perceived accuracy of information. -Regular updates would be required. -Accuracy of data would have to be high. -Could decrease the value of a property or increase the cost for conservation land acquisition. -Land parcels won't align with ecological features.	The Atlas team will: -review the methods used by Maryland and others to describe value. -undertake consultation with local government and First Nations to understand priorities for presentation.
Prioritisation	-Can translate complicated mapping into useable products. -Can be useful for prioritising areas. -Could provide consistent planning across all levels of government. -Could inform policy and regulation.	-Needs interpretation and supportive material. -Methods would need to have transparency.	The Atlas team will: -review existing prioritisation tools to see if the Atlas layers could be analysed through these.

Contents

Acknowledgements

We would like to acknowledge that this project is being delivered within the unceded territories of 63 First Nations. The project seeks to provide mapping that these First Nations have indicated could be useful during land use planning and referrals.

We would like to acknowledge the support that has been provided by the private sponsor of UBC Botanical Gardens and by Environment and Climate Change Canada.

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We would like to acknowledge the time given in kind by planners, mapping specialists and mapping users before and during the workshop as these inputs are guiding the development of the Biodiversity Atlas.

January 2024

1 Introduction

1.1 Introduction to the Biodiversity Mapping Workshop

In November 2023 UBC Botanical Gardens, UBC's Earth Observation and Spatial Ecology Lab and the Coastal Douglas-fir Conservation Partnership (CDFCP) ('Project Team') held a Biodiversity Mapping Workshop at the Mary Winspear Centre, Sidney. The workshop was completed to feed into a project called Action for Adaptation. The Project aims to support local governments and First Nations to accelerate climate adaptation and resilience by providing mapping and tools that they have indicated are needed to conserve, steward and restore nature-based solutions (NBS).

The goals of the workshop were to;

- share progress on the Biodiversity Atlas and learn how this work could support local governments and First Nations.
- discuss how the pilot mapping layers could connect to decision making that supports biodiversity.
- support planners and decision makers to strengthen the network of knowledge holders on the south-west coast.

A total of 58 people (+4 hosts) attended the workshop. The pie chart below (**Figure 1**) presents the number of people who represented each sector at the workshop.

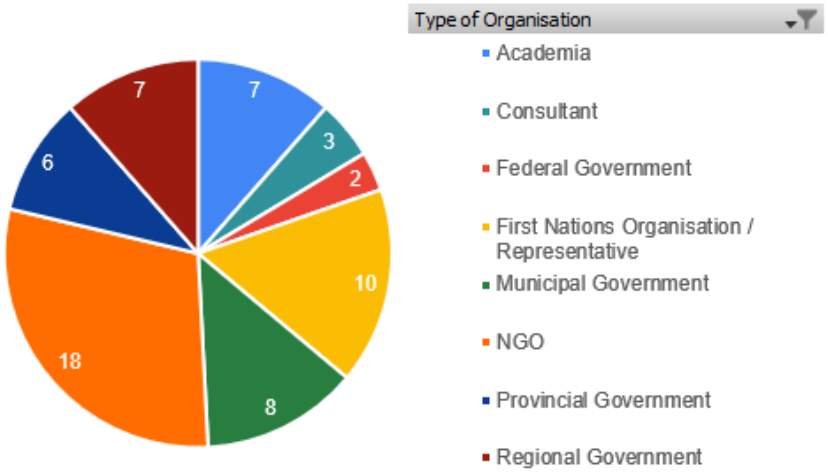


Figure 1 – The sectors represented by all workshop attendees.

1.2 Challenges Facing the Southwest Coast of BC

Southwest BC hosts around 60% of BC's population (WorkBC, 2023) and includes the Coastal Douglas-fir subzone (CDFmm), home to 237 species at risk and 44 ecosystems at risk (CDC, 2023)[1]. The forests and

[1] These figures exclude species listed as extinct or if the status of a species has not been assessed.

soils on the southwest coast represent significant carbon stores within Canada (Sothe *et al*, 2022), with the old growth being some the highest carbon storing ecosystems in the world (Smithwick *et al*, 2002).

The ecosystems on the southwest coast of BC also provide additional ecosystem services, such as supplying water, controlling floods, improving air quality, providing salmon habitat, recreation and climate refuge. As the traditional territory of the Coast Salish and other First Nations, these ecosystems are also important to indigenous food security, and support a multitude of culturally important plants and animals.

However, these ecosystems and the important services they provide, are under mounting pressure from development, timber harvesting, and climate change. Less that 1% of old growth remains in the CDFmm (Madrone, 2008), and almost half (49%) the range of the CDFmm has been permanently converted by human activities (Hectares BC, 2013). These pressures are compounded by climate change which is increasing the intensity and frequency of heat, droughts, flooding, and wildfires. This subsequently threatens the well being of BC's south coast communities, and their capacity and long-range options for adapting to climate change.

Healthy functioning ecosystems are our front-line defence against climate change. Nature-based climate solutions (NBS) are policies and actions that conserve and restore natural areas to reduce carbon emissions (climate change mitigation) and buffer climate change impacts (climate change adaptation). Approximately 80% of the CDFmm is privately owned, and large areas of Vancouver Island are private managed forest land (Floberg *et al*, 2004). As a result, the region is governed by a complex suite of federal, provincial and local government policies, bylaws, and regulations. This creates the risk of fragmented, competing or incompatible policies, and the potential emergence of perverse outcomes whereby trying to solve one kind of environmental problem makes another worse. Alignment of policies and actions is critical to halting extinction and protecting biodiversity livelihoods in the southwest coast of BC.

1.3 Nature Based Solutions and Biodiversity Atlas Project for the Southwest Coast of BC

In June 2022, the CDFCP and UBC Botanical Garden entered a partnership (**Appendix A**), with the aim of producing a digital Biodiversity Atlas for south-west BC (**Figure 2**). The goal of the atlas is to provide First Nations, local governments and land managers with the geospatial tools they need to make informed decisions in relation to biodiversity conservation and climate change mitigation and adaptation.

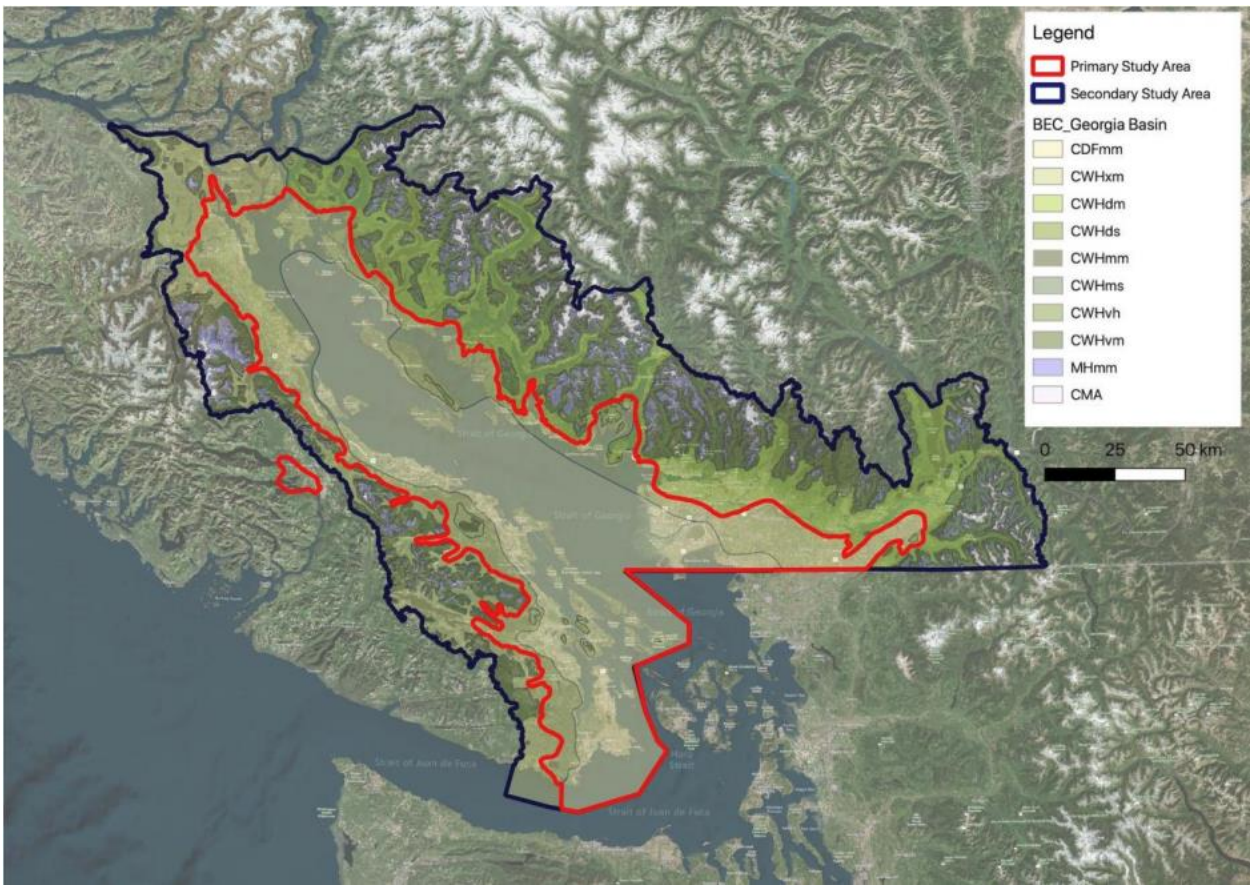


Figure 2 Primary study area outlined in red (CDFmm and CWHxm1) and the secondary study area outline in blue which pulls in the water catchments that feed into the primary study area.

The objective of this joint project is to align efforts of various groups and agencies working in South-west BC by:

- Identifying a preferred set of spatial layers for land use planning (with a focus on local government and First Nation's needs).
- Pooling resources and efforts to improve, expand, update and/or amalgamate existing spatial layers for the above themes, where suitable and as needed.
- Where needed, developing new region-wide spatial layers to address gaps in existing spatial data.
- Identifying best practices for mapping standards and application.
- Assembling and developing supporting policy and planning guidance.
- Assembling geospatial data into a user-friendly interface: i.e. Biodiversity Atlas (which will include guidance on how to use the data to guide policy development).

1.4 Progress of the Project

Two priorities for the project are to engage and collaborate with First Nations and local governments and build on existing spatial and policy tools where possible. To date, the project team has held in-depth interviews and a workshop in October 2022 with planners, decision makers and mappers, to better understand the needs and priorities of spatial data users, identify gaps and deficiencies, and identify

potential collaborations and opportunities for filling them (**Figure 3**). Results of this work identified the need for the following six mapping layers;

- Land cover and land cover change
- Environmentally Sensitive Areas
- Terrestrial carbon
- Species at risk and/or of cultural value
- Ecosystems connectivity
- Hydrologically sensitive ecosystems

The Biodiversity Mapping Workshop held in October 2022 also identified the need to pilot potential mapping layers. In 2023, the focus for the pilot was the Sunshine Coast Regional District. This area was selected due to the number of land use planning processes that are currently being undertaken:

- The shíshálh-B.C. Land Use Plan.
- Sunshine Regional Coast Official Community Plan Review.
- District of Sechelt is considering updating sections of their Official Community Plan.

Figure 3 Diagram illustrating 2022-2023 engagement with planners, decision makers and mappers leading up to the workshop in 2023.

1.5 Workshop Structure

The workshop was focused on three of the six layers that the project is aiming to produce;

- Environmentally Sensitive Areas.
- Species at risk and/or of cultural value.
- Ecosystems connectivity.

The presentations and group discussions were structured to provide information on local examples of mapping that are being completed in relation to each of the topic areas; to present options for mapping these layers and to review with attendees through the breakout groups the challenges and opportunities of the pilot layers. The Sunshine Regional District was the focus area for the pilot layers.

Image 1 2023Workshop attendees outside the Mary Winspear Centre in Sydney, BC.

1.5.1 Morning Session

1.Welcome and Introductions

- Welcoming – WIOMELWET Elder Eydie Pelkey, SȾÁUTW̱ (Tsawout) First Nation.
- Setting the context: what we heard and who is involved (Tara Moreau, UBC Botanical Gardens and Lyndsey Smith, CDFCP).

2. Policy Context

- Connecting mapping to policy – Prof. Deborah Curran, Executive Director, Environmental Law Clinic, University of Victoria.

3. Species at Risk and Cultural Value

- Species at risk and of cultural value mapping – Jessica Lukawiecki, Research Supervisor, Stó:lō Nation.
- Prototype layers – Erin Crockett, Earth Observation and Spatial Ecology lab, UBC Okanagan.
- Break out groups to discuss approaches to mapping species at risk and of cultural value.

4. Ecological Connectivity Mapping

- Mapping ecological connectivity in cities –Aubrey Butcher, DiamondHead Consulting.
- Prototype layers – Erin Crockett, Earth Observation and Spatial Ecology lab, UBC Okanagan and Kelly Chapman – Independent Consultant.

1.5.2 Afternoon Session

Ecological Connectivity Mapping cont'd

- Break out groups to discuss approaches to ecological connectivity mapping.

5. Environmentally Sensitive Areas Mapping

- Environmentally Sensitive Areas Mapping - Nancy Gothard, Acting Manager of Development Planning, City of Courtney.
- Prototype layers - Erin Crockett, Earth Observation and Spatial Ecology lab, UBC Okanagan and Kelly Chapman – Independent Consultant.
- Break out groups to discuss approaches to Environmentally Sensitive Areas mapping.

7. Using Mapping to Inform Policy and Decisions

- Colin Robertson, Independent Geospatial Scientist, The Spatial Lab
- Break out groups to discuss approaches to accessing mapping information online.

8. Conclusion and Next Steps

2 Overview of Presentations

2.1 Introduction

An objective of the workshop was to share information about mapping projects that are being undertaken by others in the project area in relation to; species at risk and of cultural value; ecosystem connectivity and Environmentally Sensitive Areas (ESAs).

As indicted in **Section 1.5** there were four keynote speakers at the workshop;

- Connecting Mapping to Policy – Prof. Deborah Curran
  Recording - https://youtu.be/vrjp9pzd6Qw
- Species at Risk and of Cultural Value - Jessica Lukawiecki
  Recording - https://youtu.be/odoqPdTOzbw
- Mapping Ecological Connectivity in Cities – Aubery Butcher
  Recording - https://youtu.be/b2AazhrPoWs
- Environmentally Sensitive Areas Mapping in the City of Courtenay – Nancy Gothard
  Recording - https://youtu.be/7bhFfZwszD0

A summary of the presentations delivered by the keynote speakers has been provided in **Section 2.2 – 2.5** and a recording of each of the presentations can be accessed through the Action for Adaptation website (Biodiversity Map Workshop 2023 | Action For Adaptation (square.site)).

2.2 Connecting Mapping to Policy

Prof. Deborah Curran, Executive Director, Environmental Law Clinic, University of Victoria.

Deborah Curran began the presentation by highlighting that in the last 25 years green bylaws have not significantly changed and there are a lot of tools that local governments could use to conserve the natural environment, but they are never used to their full extent.

The presentation covered three areas;

- Jurisdiction and UNDRIP
- Connectivity, Systems, Scale
- Environment Development Permit Areas (eDPAs) for Protection of the Natural Environment

UNDRIP - Declaration of the Right of Indigenous Peoples ACT (DRIPA) in BC does not legally implement UNDRIP, but it commits the BC government to move towards implementing UNDRIP. DRIPA does three things;

- It commits to making BC laws consistent with the UN declaration.
- It allows for delegated agreements.
- It allows for consent-based agreements.

Municipal bylaws are laws, which means that these bylaws also need to be consistent with DRIPA and UNDRIP. This is not in the current 5-year provincial action plan for DRIPA, but local governments will need to consider what this means for them going forward. The Environmental Law Centre is producing a toolkit of good examples of Indigenous communities and municipalities working together on joint decision making in 2024 (further reading – click here).

Connectivity – there is no point in understanding where sensitive ecosystems are if you don't back that up with a municipal or region-wide connectivity strategy. These should be identified in the Official Community Plan (OCP) and then focus down to a site-specific scale. Deborah Curran provided examples of connectivity including the City of Surrey. More information is provided in the Green Bylaws Toolkit.

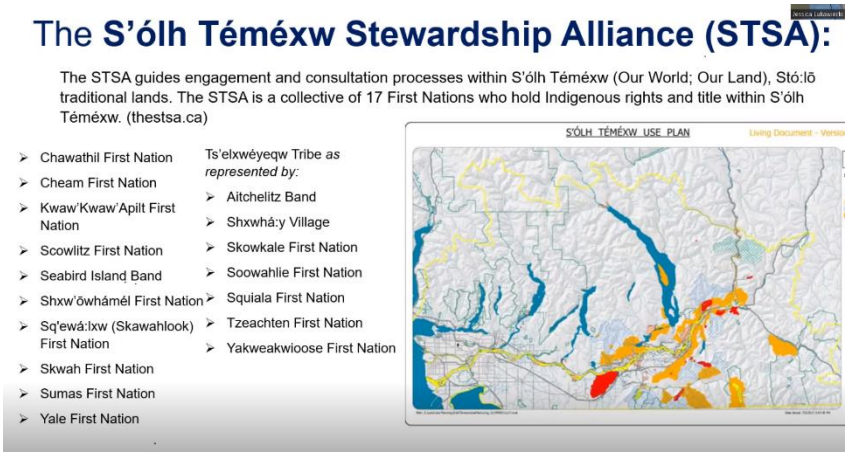
Environment Development Permit Areas – these work at a site level and require the landowner to obtain a permit before development in connection to criteria set out in a zoning bylaw. The challenge is that to implement an eDPA takes a lot of time and they are difficult to enforce. Deb provided an overview of case law in relation to eDPA and provided examples of eDPAs including the Village of Cumberland (blanket eDPA), Resort Municipality of Whistler (blanket eDPA), Regional District of Central Okanagan (aquatic eDPA with 30 m setback).

Take home messages:

- Green bylaws are never used to their full extent.
- Bylaws will need to be updated in the future to reflect UNDRIP.
- Mapping and conservation priorities to be backed up through all layers of policy and planning.

2.3 Species at Risk and of Cultural Value Mapping

Jessica Lukawiecki, Research Supervisor, Stó:lō Resource and Research Management Centre (SRMC) which is part of the S'ólh Téméxw Stewardship Alliance (STSA)



Stó:lō is the hul'q'umi'num word for river and for the hul'q'umi'num speaking people who live in the lower Fraser River Watershed.

S'ólh Téméxw is the name of the shared traditional territories of the Stó:lō people. In English it can be translated as "our world" or "our land".

There is a Stó:lō principle that everything is connected. The environment is holistic and interconnected and everything including plants, animals, rocks, trees, fish, water and other elements are perceived as being part of a wider extended family. There are 17 First Nations that hold Indigenous rights and title within S'ólh Téméxw.

Conservation of Species, Ecosystems and Indigenous Values in S'ólh Téméxw Project (COVIST). The goal of project is to identify priority areas that maximise the overlap, complementarity and or adjacency of multiple values such as species, ecosystems and indigenous value (cultural, spiritual or harvesting area). A key intention is to identify conservation activities in priority areas. The project is running a pilot and is using PrioritzR to identify the priority areas. This project is being delivered by SRMC and the Province's Ministry of Water, Land and Resource Stewardship (WLRS).

Species at Risk and Stewardship Project (SRSP) is being delivered by the S'ólh Téméxw Stewardship Alliance (STSA) and the Canadian Wildlife Service and is focused on collaborative planning around the planning and design of conservation activities that protect and restore culturally important species at risk in Stó:lō territory. Goals are to build relationships with Environment and Climate Change Canada (ECCC), and build capacity to take part in conservation and stewardship activities for culturally valuable species including, but not limited to, wolverine, coastal giant salamander, western red painted turtle and grizzly bears. This project is focused on on-the-ground activities such as interviews with knowledge holders and elders, identification of cultural important sites, monitoring of degraded areas of species at risk. Examples of monitoring projects include wolverine and coastal giant salamander.

COVIST and SRSP Projects are linked. COVIST provides high-level mapping, which is complemented by the on ground work of the SRSP which is aiming to fill gaps of information. The information collected and generated will guide work to conserve sites.

Take home messages:

- The environment is holistic, interconnected and is part of a wider extended family.
- COVIST and SRSP are interconnected projects aiming to conserve culturally valuable species at risk.

2.4 Mapping Ecological Connectivity in Cities

Aubrey Butcher, DiamondHead Consulting.

The presentation highlighted that as our cities develop valuable habitats are lost and being fragmented leading to a loss of ecological connectivity. This connectivity is important as it;

- Allows wildlife to access their habitat.
- Allows populations to interbreed.
- Prevents the isolation of genetics.
- Prevents an imbalance of predator and prey dynamics.
- Prevents the constraint of wildlife movements leading to an increase in predation.

The aim of an ecological network is to maximise the value of natural areas that remain post-development as it is not possible to restore back to the level of connectivity that has been lost.

When we think about connectivity you need to consider the size of patches, the amount of habitat edge, how species move and their tolerance to urban areas e.g. urban adaptors/exploiters or urban tolerators or urban avoiders.

One approach to reflect biodiversity on the landscape is through biodiversity ranking. Using LiDAR and other modelling tools, you identify natural areas and then apply modifiers (e.g. type of ecosystem, size patch etc.). This provides a numeric value to allow a comparison between areas.

The natural areas are then broken into habitat hubs, habitat sites and movement corridors. These can then be further broken down into large hubs (>10 ha), small patches (<10 ha), regional corridors (>30 m) and local wildlife corridors (10-30 m); greenway corridors (roads, rail etc.); aerial corridors (street trees); urban matrix (gardens). The level of division will be dependent on the focus / scale of the project.

The appearance of an ecological network is impacted by the scale at which the ecological mapping is completed, e.g. municipality, regional, provincial. At a local level in an urban area, you might be focused on maintaining corridors for urban tolerators/ exploiters and no longer looking to provide connectivity for urban avoiders e.g. grizzly bear. Examples were shared of connectivity mapping for City of North Vancouver (urban area); City of Bellingham (focal species mapping – frog, small mammal, bird); District of Saanich (inclusion of agriculture); Metro Vancouver (regional); City of Vancouver (coastal).

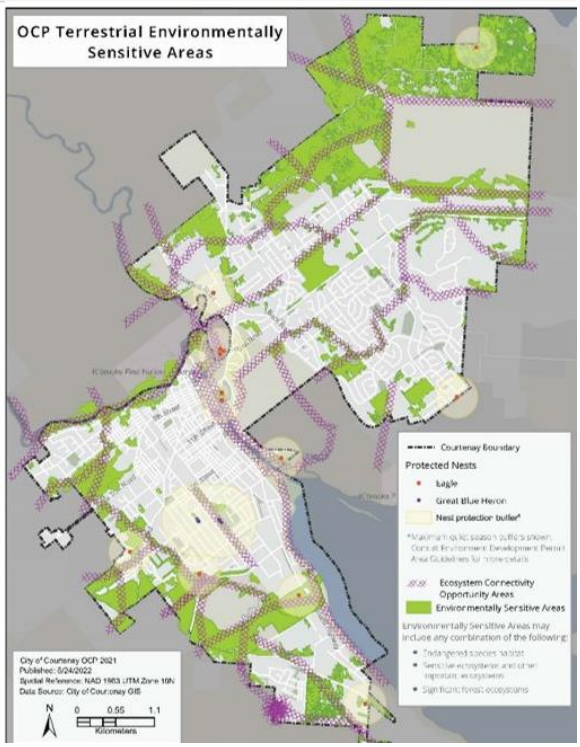
Take home messages:

- Ecosystem connectivity is seeking to maintain existing linkages and replace them where they have been lost.
- Ecosystem connectivity mapping is influenced by the scale at which mapping occurs.
- There are several different methods to identifying connectivity e.g. connecting important habitat area (structural) vs using the habitat value of vegetation to species (functional).

2.5 Environmentally Sensitive Areas Mapping

Nancy Gothard, Acting Manager of Development Planning, City of Courtney.

City of Courtney is located within the traditional territories of the Comox First Nation. The Environmental Sensitive Areas (ESAs) mapping in the Official Community Plan (OCP) are presented on two maps – Terrestrial and Aquatic. There are two maps because it is difficult to show all the information on one map and for it to remain legible.



The aquatic mapping includes streams, rivers, wetlands and estuaries are shown with a 30 m buffer. The maps show ditches and watersheds. The terrestrial mapping (presented to the right) shows eagle and heron nests, SEI, invasive species and significant forest. The significant forest areas were included for the first time in mapping in 2022. Forest canopy cover was identified using LiDAR imagery (2016) collected as part of the Urban Forest Strategy this informed ecosystem connectivity opportunity areas.

As part of the Urban Forest Strategy, imagery was produced to highlight areas where forest loss had occurred. This information was useful when engaging with the community on the OCP. The Strategy also included ground truthing which allowed the forest to be characterised and highlighted forest patches that were 60 years old and will develop into old growth forest. The Strategy also considered ecosystem connectivity using a Conefor model based on focal species; red legged frog, red squirrel and brown creeper. The analysis identified hubs, corridors and barriers to connectivity. They found that connectivity overlaid with sensitive ecosystem features such as riparian corridors.

The City of Courtney's eDPA guidelines brought in some new requirements; all sites with an ESA or >1 acre require an environmental assessment; connectivity corridors need to be assessed by an RP Bio and a 30 m buffer on all Riparian Area Protection Regulation Streams.

The local government included a 30 m setback from streams. However, a recent court case in Cowichan has ruled that the blanket application of this type of setback is not acceptable, therefore, further investigation is required to determine what this will mean.

Take home messages:

- LiDAR and ground truthing enabled the inclusion of forest habitat that was not included in the outdated SEI mapping.
- Connectivity mapping highlighted existing connectivity and areas where it needed to be reinstated.
- Further investigation in needed in relation to stream setbacks because of a recent court case.

3 Breakout Group Discussions

3.1 Introduction

The workshop included four breakout group covering the following topic areas;

- Species at risk and of cultural value.
- Ecosystem connectivity.
- Environmentally Sensitive Areas.

Each of the breakout group sessions were structured in the same way.

1. Pilot mapping layers were shown to workshop attendees, which were focused on the Sunshine Coast Regional District and the District of Sechelt.
2. The workshop attendees were broken into seven breakout groups (<10 people) to respond to 2-3 questions, focusing on the opportunities and challenges of the maps they had been shown.
3. All comments were captured on post it notes.
4. Attendees were then asked to report back to the whole group on one key opportunity or challenge for each question. These are listed in Section 3.2 – 3.5 as the top opportunities and challenges.

3.2 Breakout Group 1- Species at Risk and Cultural Value

3.2.1 Summary of Pilot Mapping Layers

Erin Crockett (UBC Okanagan – Earth Observation and Spatial Ecology Lab) presented the maps listed in for the Sunshine Coast Regional District (**Table 1)**.

Table 1 Pilot maps of species at risk and of cultural value.

Key information display on a map	Map No, Appendix A
CDC species at risk records	Map 1
CDC plus critical habitat and wildlife areas	Map 2a and b
CDC, plus community science (GBiff) research grade records	Map 3a and b
CDC, community science plus culturally important species (GBiff)[2]	Map 4a and b
Habitat suitability maps for marbled murrelet; spotted owl and spring foraging for elk.	Map 5, 6, 7

These maps illustrated collection bias in relation to the species at risk and of cultural value records. The mapping showed that there is a strong correlation between the areas that people live and where species have been recorded. This means that for the areas not visited by the public, there are gaps in the information. The Provincial government has undertaken habitat modelling to fill some of these gaps in

[2] The culturally important species mapped were identified from published literature rather than through consultation with the local First Nations. The intent was to illustrate that there are species of value on the landscape that go beyond those listed as at risk by the provincial and federal government. Consultation will be undertaken with the 63 First Nations who have traditional territories with the project area to understand if it is appropriate to map any species as of cultural value.

information, but this work is focused on key species e.g. elk, marbled murrelet, northern goshawk, mountain goat and spotted owl.

The attendees were asked to consider the following three questions based on the pilot mapping layers that had been shared with them.

1. What opportunities and challenges could you see with using citizen science species at risk data for planning and decision making?
2. What do you think are the opportunities and challenges with mapping culturally valuable species for planning and decision making?
3. What are the opportunities and challenges in using provincial or other habitat suitability mapping in planning and decision making?

3.2.2 Question 1 – Citizen Science Mapping

What opportunities and challenges could you see with using citizen science species at risk data for planning and decision making?

Table 2 The opportunities and challenges of using citizen science records.

Top Opportunities	Top Challenges
• can motivate people to be connected to nature and consequently care for it. • provides an opportunity to have a more comprehensive / larger dataset. • records collected through GBIF provides a collation of all data sources that are verified. • enables multiple generation engagement. • is crowd sourcing which enables the identification of more species.	• enables the presence of species to be recorded but not their absence. • reflects where people can access, but not where the species are. • is not a random sample. • the quality of species identification may not be high if the recorder is relying on AI. • could mean that verified science is neglected. • people may only identify what they recognize with tools such as iNaturalist.
All Opportunities	**All Challenges**
• enables the collection of data that could be used for unknown future projects. • leads to more people recording data and consequently more records. • can influence decisions in different ways. • enables photo and GPS data to be captured. • mapping highlights areas that haven't been surveyed. • citizen science can provide a better representation of species distributions than provincial records alone. • records are collected in the field. • increases enthusiasm and public interest. • enables validation with open-source data. • data can be used to validate critical habitat areas. • includes unvalidated data, but this is still useful. • increases involvement which leads to positive community interactions. • provides more information leading to the protection of more areas.	• data is biased towards who can collect it. • datasets will include error e.g. inaccuracy of GPS on phones, misidentification of species etc. • will be biased towards certain species and locations. • needs ground truthing / validation to confirm mapping. • focuses on single species rather than whole ecosystems. • may not be defensible to public. • will have biases due to access restrictions or people's preferred location to walk, leading to clusters of data. • will have data biased towards species that are active during the day or are charismatic. • data may be viewed as unreliable / not trusted. • may have limited applications. • Needs standards to increase around data collection.

Top Opportunities	Top Challenges
• Provides people with flexibility on where to record and access to areas scientists might not be able to go. • enables people to be part of the solution. • next generation - strong environmental leaders.	

3.2.3 Question 2 – Culturally Valuable Species Mapping

What do you think are the opportunities and challenges with mapping culturally valuable species for planning and decision making?

Table 3 The opportunities and challenges of mapping culturally valuable species.

Top Opportunities	Top Challenges
• could be viewed as reconciliation in action. • could be of value for restoration activities. • could save First Nations time by reducing the number of queries relating to culturally valuable species. • would enable the involvement of elders and youth. • could combine and weave western science and indigenous knowledge to provide a shared perspective. • could enable connections to cultural knowledge.	• sovereignty / confidentiality of information / data protection complexities / data sensitivity. • Nations may not want this information to be public. • First Nations capacity to support this work might be limited. • culturally important species will differ between First Nations. Mapping cultural valuable species • will be dependent on relationship building and the development of trust with each First Nation. • places a focus on single species vs whole system. • may not be possible when everything (whole environment) is culturally valuable.
All Opportunities	**All Challenges**
• provide context around their value and keep the human connection. • help build relationships. • provide more support and protection for areas that have culturally valuable species e.g. IPCAs. • allows us to protect for important species for future generations. e.g. red cedar. • promote community involvement in the protection of culturally valuable species. • improve co-management.	• needs to consider that information might be limited. • needs a lot of explanation as to how the data will be used. • how the data would be access e.g. public or held by the Nations. • we assumed that culturally important means culturally important for First Nations, but this was not explicit.

3.2.4 Question 3- Habitat Suitability Mapping

What are the opportunities and challenges in using provincial or other habitat suitability mapping in planning and decision making?

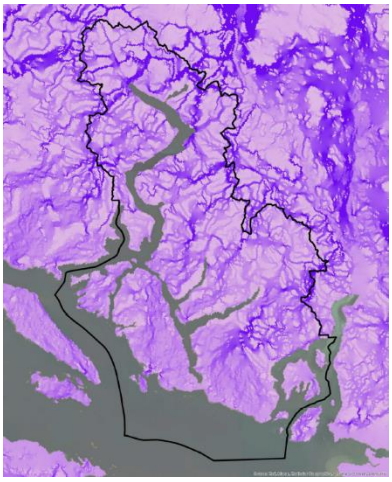
Table 4 The opportunities and challenges of habitat suitability mapping.

Top Opportunities	Top Challenges
• compiles over 100 resources / information in one map. • is great for broadening areas to alleviate observer biases. • is better than nothing. • will improve with technology as this leads to more modelling. • shows connectivity outside of landownership boundaries. • could provide a standardization in approach to valuing species at risk habitat.	• the quality of data that the modelling is based on and scale repeatability. • models built on other models can compound errors (e.g. VRI, TEM, etc.). • they highlight potential habitat, but can animals get there. • the models can only be used for 0.01% of species. • habitat suitability models are based on specific place and time, so when you extrapolate you might miss potential areas. Species are not present in one place at one time (season) life stages. • it is difficult enforcing critical habitat which has legislation behind it so implementing habitat suitability mapping would be more difficult.
All Opportunities	**All Challenges**
• could access historical knowledge from restoration work to help guide modelling. • could help with building relationships. • could provide opportunities to collect information in private land. • could inform interim measures while getting more detail survey information. • could provide a lower cost solution to field data collection. • provides some baseline data to focus field surveys to find species.	• could give a false impression of suitability for species e.g. undervalue or overvalue habitats. • could be based on models that have huge gaps in the data or that use old data - garbage in equals garbage out / models are best guesses. • may accentuate biases from data clustering. • increases the risk of static data, they wouldn't reflect our changing climate. • could be impacted by a lack of access to private land (bias). • needs to be accompanied by a clear understanding of the data used and assumptions that go into the models to produce habitat suitability mapping. • doesn't work well for micro ecosystems. • would be hard to regulate. • are species-oriented vs ecosystem oriented. • needs to take into consider data sensitivity – species at risk and culturally valuable species. • needs to be generated from data that has been verified. • hard to predict the presence of species when there is a high level of disturbance on the landscape. • can be applied inappropriately due to a lack of understanding of the information by the user. • needs more boots on ground for observation to increase geographic coverage.

3.3 Breakout Group 2 – Ecosystem Connectivity

3.3.1 Summary of Pilot Mapping Layers

Erin Crockett, UBC Okanagan – Earth Observation and Spatial Ecology Lab), presented two maps to facilitate discussion in relation to the opportunities and challenges with mapping ecosystem connectivity.



The first map (**Appendix A Map 8**) was produced by Pither *et al* in 2023. The mapping sought to '*test the hypothesis that functional connectivity for multiple species can be estimated across Canada using a single upstream connectivity model*'. The mapping was undertaken at a 300 m resolution. The study concluded that it was effective at mapping connectivity for caribou, wolves, moose and elk in western Canada but not for herpetofauna in Ontario. It was observed in the Sunshine Coast Regional District that the predicted areas of high movement were focused on the tops the mountain ranges. This doesn't correlate to the location of mature big tree forest favoured by many species, which is typically towards the bottom of the valleys and along the coast.

A second map (**Appendix A Map 9**) presented a simplified approach to presenting connectivity in the District of Sechelt. The mapping took a structural connectivity approach focusing on the presence of forest and stream ecosystems. The mapping highlighted primary and secondary connectivity corridors and identified locations for reinstating corridors that have been lost through urban development.

Kelly Chapman (Kwest) and Allison Haney, independent consultants, introduced a pilot climate micro-refugia layer. Climate change predictions indicate that the south-west coast of BC will experience:

1. **Warmer temperatures** – which will result in more days in the summer where heat levels are considered extreme and fewer winter days when there is frost or ice.
2. **Longer summer dry spells** – summer rainfall is predicted to reduce and the periods without rainfall are likely to increase causing drought.
3. **Wetter fall and winters** – over the year it is anticipated that rainfall will not increase significantly but rainfall in the fall and winter will increase.
4. **More extreme precipitation events** – rain events will become more extreme and these extreme rain events will become more frequent.
5. **Decreased snowpack** – spring snowpack is predicted to decrease compared to present day.

Climate micro-refugia could be areas that will remain cool and moist relative to surrounding ecosystems and are more likely to persist in their current form as the climate changes. To identify the potential

location of climate micro-refugia (**Appendix A Map 11 a and b**) the following information was amalgamated;

- Riparian areas / floodplains.
- Streams and rivers.
- Wetland habitats.
- Moist forest.
- Old forest.
- Ancient and high elevation forest.
- Mature forest with big trees.

The attendees were asked to consider the following three questions based on the pilot mapping layers that had been shared with them.

1. What could be some of the opportunities and challenges with using ecosystem connectivity mapping at a territorial, regional and city scale in relation to planning and decision making?
2. What opportunities and challenges do you see with using the example of climate refugia mapping provided in the workshop in your planning and decision making?
3. How would you use a map that indicates potential ecosystem connectivity corridor restoration areas in your planning and decision-making documents?

3.3.2 Question 1 – The Effect of Scale on Ecosystem Connectivity Mapping

What could be some of the opportunities and challenges with using ecosystem connectivity mapping at a territorial, regional and city scale in relation to planning and decision making?

Table 5 The opportunities and challenges of ecosystem connectivity mapping

Top Opportunities	Top Challenges
• at a regional scale puts local connectivity into context. • it helps set expectations for decision making. • is undertaken with First Nation governments at different scales. • encourages collaboration, communication, resource sharing between jurisdictions. • needs to include human knowledge when modelling. • helps educate the community about the values of connected areas. • could help engage newly elected council when they are onboarding.	• the existence of territorial boundaries is a challenge. • there is no provincial mandate / legal requirement for habitat protection or the use of connectivity mapping by local government. • the scale varies based on species e.g. frog vs bear. • landscape not static, but mapping can be. • the high level of existing disturbance means we have a low amount of habitat to start with. • habitat connectivity for what species? • corridors can support the migration of invasive species
All Opportunities	**All Challenges**
• at a regional level can help develop corridors that avoid developed areas. • is an ecosystem approach. • needs to be completed at an appropriate scale for the user. • needs to be completed at local scale for decision making.	• can include land that is in private ownership and the ability of local government to enforce is limited. • collaboration and communication across jurisdictions (local / provincial) when planning connectivity would be difficult due to different priorities. • is scale, what do you plan for species vs ecosystems? • connectivity looks at the minimum to protect.

Top Opportunities	Top Challenges
• Needs to be integrated into the land use planning processes. • needs to align with housing development as the biodiversity crisis and housing crisis go hand in hand. • can be done with existing data and it can be put in place in a reasonable timeframe. • Provides another layer of argument for protection. • Emphasizes the watershed bioregional approach. • is enforceable through OCP. Zoning is key. • Enables jurisdictions to look beyond their boundaries, i.e. bioregional. • needs to consider what are the local values. • can establish a baseline in less developed areas. • provides information going into the planning and decision-making process	• can include generalization with different species. • consistency between scales is challenging e.g. local vs regional. • the lack of supportive policy at each relevant scale and across scales. • ecosystem mapping at a regional scale can miss small sites that are of value at a municipal level. • could miss core areas if there are no corridors to them. • regional mapping can miss local species at risk. • do we plan for the current BEC zones or future BEC zones? • maps are static and do not reflect land cover change or climate change.

3.3.3 Question 2 – Climate Micro-refugia

What opportunities and challenges do you see with using the example of climate refugia mapping provided in the workshop in your planning and decision making?

Table 6 The opportunities and challenges of climate refugia mapping.

Top Opportunities	Top Challenges
• presents climate change adaptation in action, and would provide a good communication tool when working with the public. • addresses provincial mandates for climate action. • enables climate preparedness and the ability to plan for the future. • could provide incentive for protection, restoration, conservation and stewardship. • habitat protection leads to species protection. • need to know the location of climate refugia as it is worse case scenario.	• it provides a false sense of security that our species will persist with climate change. • analysis of climate change data is ongoing and changing. Therefore, a lot of uncertainty and potential inaccuracies. • mapping needs to occur at a finer scale for urbanized areas. Does TEM miss important refugia when mapping is at a 1:20,000 scale. • is focused on where existing refugia is rather than new areas. • what to do when there isn't refugia for a species? • people might not prioritize without species to relate to as changing ecosystems is difficult to see.
All Opportunities	**All Challenges**
• could be used to look at what may be needed for assisted migration. • LiDAR could be useful for mapping climate micro-refugia. • identifies ecosystems that sustain species while we reduce emissions. • needs to consider the resolution of the mapping e.g. micro-niches at a local scale. • can build the case for green space and ecological reserves. • climate adaptation is simple we need to stop cutting down old growth.	• this approach is new and would need to be integrated into planning. • it would require socialization of the concept of future priorities, as we struggle to protect what we currently have. • what is important now e.g. SAR vs future refugia? • priorities would need to be set for implementation. • who decides on the criteria for the identification of climate refugia? • not all areas will experience the climate shifts predicted.

Top Opportunities	Top Challenges
• could link the refugia mapping to the species models. • mapping of refugia could open conversations when data might exclude people. • its a starting point for strategic conservation planning and getting over analysis paralysis. • could be used in planning for the resilience of culturally significant species.	• could the mapping lead to culturally valuable species being undervalued? • tools need to be viewed in an appropriate manner. • would need additional capacity to understand the mapping and to incorporate into decision making. • local and provincial planners would need to consider how to keep development/harvesting pressure out of a potential refugia? • needs to be verified on the land to check our assumptions.

3.3.4 Question 3- Restoration of Ecosystem Connectivity

How would you use a map that indicates potential ecosystem connectivity corridor restoration areas in your planning and decision-making documents?

Table 7 The opportunities and challenges of mapping potential connectivity corridors.

Top Opportunities	Top Challenges
• could drive better decision making. • could establish links between NGOs and local governments leading to green jobs. • would be useful for forests and resource planning. • could integrate information on existing restoration projects. • would be useful for land use planning and could be incorporated into Official Community Plans. • could galvanize political will for proposed restoration projects. • could prioritize the areas for acquisition / protection and subsequent restoration. • could lead to bylaws to remove wildlife barriers, e.g. wildlife fencing.	• is the practicality for planners to implement them. • is that they would only be useful for urban disturbed areas and in these locations, there are competing resources. • is that it takes lots of resources to identify suitable restoration areas and then implement it. • is how would their establishment be monitored.
All Opportunities	**All Challenges**
• could use maps for outreach, education, planning tools and visualization. • is needed to consider opportunities to reinstate corridors so species can adjust to climate change. • could provide concrete tools for cross jurisdictional conversations. • could provide corridors for wildlife and people.	• how would we keep development pressure out of a potential refugia/connectivity corridor? • the uncertainty around their protection and their value. • the developmental pressure from forestry, let's not grant timber licenses.

3.4 Breakout Group 3- Environmentally Sensitive Areas

3.4.1 Summary of Pilot Mapping Layers

3.4.1.1 What is an Environmentally Sensitive Area (ESA)

Environmentally Sensitive Areas (ESAs) are a tool used by local governments in their planning documents.

The Local Government Act states that a *Regional Growth Strategy should work towards protecting environmentally sensitive areas.* (Part 13, Division 1, 428 (2) (d)).

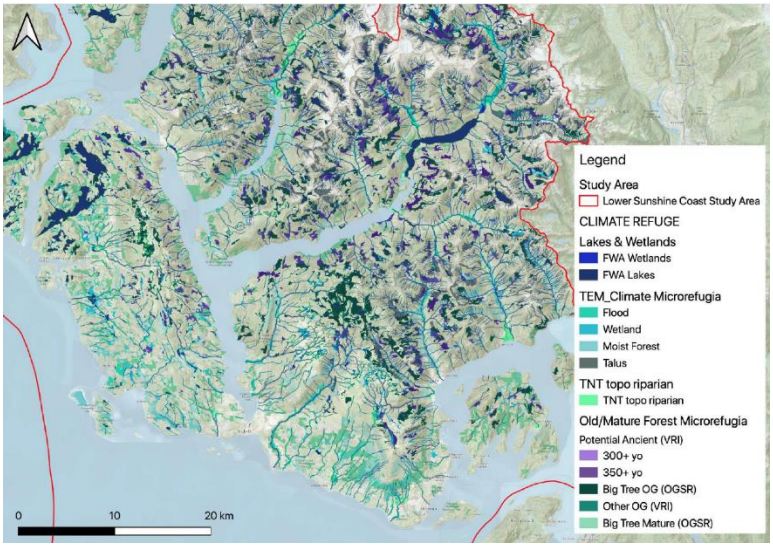
In addition, the Local Government Act states that *an official community plan must include statements and map designations for the area covered by the plan respecting the following;*

(d) restrictions on the use of land that is subject to hazardous conditions or that is environmentally sensitive to development (Part 14, Division 4, 473 (1)).

Therefore, Official Community Plans and Regional Growth Strategies include policy and objectives relating to ESAs which link to maps presenting the known location of terrestrial and aquatic ESAs. The information presented as an ESA by a local government differs as planners consider that there are no guidelines that define what an ESA is. Typically, local governments use Sensitive Ecosystem Inventory (SEI) mapping to identify ESAs. However, this mapping doesn't have complete coverage and can be out of date (>30 years). First Nations have also indicated that they use SEI mapping as a means of identifying ecosystems of high value when undertaking land use planning and referrals.

3.4.1.2 Detecting Change to the SEI Mapping

Erin Crockett, UBC Okanagan – Earth Observation and Spatial Ecology Lab), presented work undertaken by Nadia Clarke (UBC BSc Student), which looked at the area of SEI loss in the Sunshine Coast Regional district since the mapping was completed in 2005 (**Appendix A Map 10**).



3.4.1.3 Extending Ecological Communities at Risk and SEI Mapping

Kelly Chapman (Kwest) and Allison Haney, independent consultants, introduced a pilot Ecological Communities at Risk layer and an extended SEI layer produced by mining information from the Terrestrial Ecosystem Mapping (TEM), Vegetation Resource Inventory (VRI) and the Old Growth Strategic Review Technical Advisory Panel (OGSR TAP) mapping layers.

This process was undertaken as the SEI mapping completed in 2005 within the Sunshine Coast Regional District is restricted to the Coastal Douglas-fir moist maritime Biogeoclimatic subzone (CDFmm). In addition, the CDC has only mined the TEM for Ecological Communities at Risk information in the CDFmm for 13 of the 45 ecological communities at risk known to be present in the area. The Sunshine Coast Regional District has been mapped through 11 separate TEM projects (different years) and the Sunshine Coast SEI. These projects combined provide approximately 90% coverage for the Regional District. The mapping layers presented by Kelly for discussion are listed in **Table 8** below.

Table 8 Pilot mapping of Ecological Communities at Risk and extended SEI layers.

Pilot Layers Shared	Maps, Appendix A
CDC Ecological Communities at Risk.	11
Extended Ecological Communities at Risk – flood and non forested.	12
Extended Ecological Communities at Risk – mature and old forested.	13
Extended Ecological Communities at Risk – 45 ecological communities.	14
SEI mapping – 2005.	15
Extended SEI mapping.	16

The attendees were asked to consider the following three questions based on the pilot mapping layers that had been shared with them.

1. What opportunities and challenges to you do see for your planning and decision making with extending the SEI using other mapping produced by the province?
2. Would you find it useful for Environmentally Sensitive Areas (ESA) to be graded to help decision making?
3. How often would you want the ESA layers updated – 1 year, 3 years or 5 years? Any why that level of update frequency?

3.4.2 Question 1- Extending the Sensitive Ecosystem Inventory (SEI)

What opportunities and challenges to you do see for your planning and decision making with extending the SEI using other mapping produced by the province?

Table 9 The opportunities and challenges of extending SEI mapping.

Top Opportunities	Top Challenges
• will identify gaps in current mapping and identify focus areas. • by using LiDAR, satellite data and AI to fill gaps. • provides the ability to tell more powerful stories with existing data. • increases coverage and is a viable input in regulatory tools (OCPs). • through a standardised workflow that facilitates collaboration. • support First Nations, as the relationship to archaeological layers is important for Nations.	• it can be used as an absolute when it shouldn't. • is how often will it be updated? • is the capacity for local governments and First Nations to apply the methods. • is the province must recognize it can be a proxy for a full field update of the SEI. • is its limited geographic coverage and its age. • is determining accuracy. How would the product / mapping be verified?
All Opportunities	**All Challenges**
• mapping changes due to disturbance e.g. update regularly through automation (LiDAR). • could enable it to be used for biodiversity ranking. • provides an opportunity to link to climate refugia mapping. • means planners and decision makers can look beyond their jurisdiction. • could educate and inform decision makers to support SEI.	• doesn't include indigenous ways of knowing. • the scale of the mapping will impact its value. • can be misused if not backed up by field collection of SEI information. • mapping would need to be done in a way that can be enforced. • mapping needs to include coastal and high elevation ecosystems. • data collection timeframe influences usability.

Top Opportunities	Top Challenges
• opportunities for training of smaller land use planners and First Nations • enables the application of TEM in a manner that can be used in local planning. • could focus restoration efforts. • using multispectral red bands of light to help pick out treed wetlands. • using lidar with existing SEI and TEM to look at connectivity of open (Garry oak) and closed (Douglas-fir) ecosystems. • could inform acquisition of land. • could enable better connectivity mapping. • Provides accessibility without high cost of updating the SEI.	• may require training of land managers and or Nations to understand and use new mapping. • a challenge for decision-makers is balancing values and mapping can lead to negative or positive interactions. • different people can interpret data differently when using TEM; VRI etc. • the government is not as fast as technological development. • opposers will never say mapping is enough. • the existing SEI is not considered authoritative, and planners get pushback. • TEM should be used by planners instead of SEI mapping. • there is a lack of funding to extend the SEI. • update the SEI using a new methodology.

3.4.3 Question 2 – Graded Environmentally Sensitive Areas (ESA)

Would you find it useful for Environmentally Sensitive Areas (ESA) to be graded to help decision making?

Table 10 The opportunity and challenges of grading ESAs.

Top Opportunities	Top Challenges
• it could help with decision making. • could provide maps with easy-to-understand values. • it could be positive as it presents goals, but values change over space and time. • there would need to be a suite of functions. • would need to be linked to policy and be legal and defensible.	• dependent on the desired outcome, e.g. conservation, restoration or equity. • how do we do the grading? • possibly not relevant to cultural keystone species. • there needs to be transparency of criteria. • who chooses the value or scale of an ESA?
All Opportunities	**All Challenges**
• could reflect disturbance on landscapes which is not otherwise captured. • could provide a way to indicate local priorities. • provides a framework of how things could be evaluated. • grading / priorities will change depending on scale – local, regional, provincial, First Nation. • grading is a suitability analysis. • would need to be ground-truthed. • the relationship to level of development is important "look after what is left". • could be aligned with the Official Community Plan updates every 5 years. • it would provide active data to refer to, helpful for development applications. • should include climate refugia as climate change could lead to the loss of ESAs.	• difficult to grade things and in relation to what? • the scale of assessment will impact on the value of an ESA. • value is a challenge as the value of wetlands changes with scale. • how would you bring in everyone's values? • how do you update as more info is available? • You would need to increase the capacity of planners and decision makers to implement this tool. • there are likely to be competing values. • keeping pace with grading with climate change will be difficult. • it would require a high frequency of updates. • subjectivity, hard to get a perfect rating system. • cannot grade across jurisdictions, not all jurisdictions have the same priorities.

3.4.4 Question 3 – Frequency of Environmentally Sensitive Areas Updates

How often would you want the ESA layers updated – 1 year, 3 years or 5 years? Any why that level of update frequency?

Table 11 The opportunities and challenges of updating ESA layers.

Top Opportunities	Top Challenges
• preferable to increase scale on a less frequent update time frame, than a smaller scale on a more frequent timeframe. • we need to do it at least once! • strength in validation so ground truthing is a key part of the updates. • need change detection as a priority. This could be automated every 6 years e.g. Metro Vancouver. • indigenous organization rely on data because they lack manpower. • should be updated to support a planning cycle e.g. 5 years. • with tech, it might become easier to update, 3 years?	• the cost, Metro Vancouver spent $90,000 in the last update. Cycle of every 6 years. • once something is considered sensitive, it should be considered protected, and an update wouldn't be necessary. • we need to be nimble enough to do regular updates. • requires high frequency of updates to feed into planning decisions.
All Opportunities	**All Challenges**
• will be dependent on how its used. • in an ideal world, 2 years but this needs to be paired with provincial financial support. • depends on development, habitat and methodology.	• staff, corporate and political turnover means that you need high frequency updates. • a mix of methodologies is more useful.

3.5 Breakout Group 4 – Presentation and Interpretation of Mapping

3.5.1 Examples of Decision Support Tools

Lyndsey Smith, Program Manager for the CDFCP presented images from two existing mapping products. The first images shared was taken from Maryland Department of Natural Resources (DNR) mapping site called GreenPrint. It was developed to display information for four conservation programs, most notably Program Open Space. Program Open Space accrues 0.5% of state property transfer tax every time a house or land is sold. These funds are invested in the purchase of open space and recreational facilities. Greenprint includes a Parcel Evaluation Tool (**Appendix A Map 17**) that provides an indication of the value of each parcel of land for;

- habitat connectivity;
- rare species and wildlife habitat;
- support for aquatic life;
- forest important for water quality protection;
- targeted ecological area;
- coastal community resiliency;
- future wetland habitat; and
- proximity to protected lands.

The second approach shared was an example of a prioritisation tool called Marxan (Morrell *et al*, 2017). The Marxan tool enable multiple scenarios to be run with the mapping information it holds for variable targets e.g. to protect 17%; 30% or 50% of the landscape. This tool enables habitats of high and low value to be identified. This information could be used for planning and land acquisition (**Appendix A, Map 18**).

The attendees were asked to consider the following two questions based on the mapping tools shared with them.

1. What opportunities and challenges do you see with presenting ecological / environmental information at a land parcel scale?
2. What opportunities and challenges do you see with tools that interpret information for you to indicate high value ecosystems?

3.5.2 Question 1 – Decision Support Tools Focused on a Land Parcel Scale

What opportunities and challenges do you see with presenting ecological / environmental information at a land parcel scale?

Table 12 The opportunities and challenges of mapping on a parcel scale

All Opportunities	All Challenges
• would improve engagement with the community because it is of relevance to them. • opportunity to inform decisions that link ecological conservation data at a local level. • utility at the scale of impact and planning. • it would increase clarity for landowners. • it would create opportunities for conversation assuming data is correct. • it could bring more values to the table at a finer scale. • more useful for planners at a small scale. • simplicity of presenting GIS info. • if scoring is based on mapping and it is updated how will those changes feed into the tool? • a communal tool would decrease duplication of effort. • if it is sub watershed level, people can relate, include other info, water etc. • parcel scale is a manageable size for municipalities. • it could connect to an evaluation framework, providing consistency and transparency. • raises the bar for QEPs knowing the data layers are already known. • improve public image for public organizations who submitted data. • could inform philanthropic acquisitions for land protection. • opportunity to have parcel information for sale of private land.	• from a bylaw perspective, it could be political leading to unexpected consequences e.g. Saanich • could decease land value depending on purchaser, situation and regulation. • it could cost a lot to be accurate to a parcel scale. • it could undervalue parcels if information is limited. • scale, accuracy and age of data could impact on the validity of the tool. • could lead to an oversaturation of data. • there could be privacy challenges / data sovereignty. • updating on a parcel scale would be more challenging. • from an acquisition perspective it could increase land cost for conservation. • the quality of the surrounding landscape would influence the rating of a parcel. • land parcels won't match up with ecological features. • there would need to be standardization to the approach. • at land parcel scale, loose ability to protect ecosystems / connectivity. • the landscape is always changing, so the tool would need monitoring and regular reporting. • you would need to train the user. • there could be territorial challenges when it comes to ancestral territory.

All Opportunities	All Challenges
• Maryland example is awesome.	• politics and science can conflict. • if an environmental feature doesn't score a 5 then it could be undervalued. • how do you include restorative potential? • fine scale from a federal perspective. • may not reflect neighboring parcels connectivity. • validation would be needed for parcel level accuracy.

3.5.3 Question 2 – Tools that Interpret / Prioritise Information

What opportunities and challenges do you see with tools that interpret information for you to indicate high value ecosystems?

Table 13 The opportunities and challenges of using prioritisation tools.

All Opportunities	All Challenges
• can drive the need for better mapping data. • can provide a utopian view which is hopeful. • I love habitat wizard, point data and observations that are not in a model. • can be great for municipalities with data all at the same scale. • can translate complicated mapping into useable products. • it could be useful to prioritize areas. • in theory it could help developers choose areas avoiding those of high value. • would help select parcels to achieve environmental goals. • it would provide the ability to work across spatial scales in a consistent way to facilitate planning across levels of government. • opportunity for provincial leadership for minimum standards, plus tool development hosting. • prioritization allows to inform policies and regulation, locally, regionally and provincially.	• need interpretation and supportive material. • the method would need to have transparency.

4 Conclusions and Next Steps

The Action for Adaptation project has funding for the next two years and one of the outputs for the project is the production of a Biodiversity Atlas for the south-west coast of BC to be used by local governments and First Nations. The goals of the Biodiversity Mapping Workshop 2023 were to;

- share progress on the Biodiversity Atlas and learn how this work could support local governments and First Nations.
- discuss how the pilot mapping layers could connect to decision making that supports biodiversity.
- support planners and decision makers to strengthen the network of knowledge holders on the southwest coast.

The Atlas team will continue to reflect on the information shared during the workshop (**Section 3.2-3.5**). However, some key reflections for the team are presented below.

4.1 Species at Risk and Cultural Value

4.1.1 Citizen Science

The use of citizen science records within the Atlas was identified to be advantageous by workshop attendees as it would increase community engagement; engage with multi generations; provide additional information for decision making and highlight gaps in information. However, attendees also indicated that this data would contain inaccuracies and bias that the Atlas will need to navigate. It was also highlighted that focusing on the presence or absence of species at risk can undervalue high value habitat areas.

Next steps: The Biodiversity Atlas species at risk mapping layers should draw on citizen science records, but the metadata will need to clearly state the source and the level of validation.

4.1.2 Cultural Value

The workshop discussions suggested that further conversations with First Nations would be required to determine the best approach to mapping culturally valuable species. Opportunities relating to reconciliation; species protection; reduced time handling enquiries; weaving western science with indigenous knowledge were identified. However, data sovereignty was highlighted as a key issue for consideration and that the presentation of individual species would be contradictory to the world view expressed by First Nations in the project area.

Next steps: Continue discussions with First Nations to understand how the presentation of species records would be of most use to their decision making.

4.1.3 Habitat Suitability Models

The provincial habitat suitability models were considered advantageous as they provided an indication of habitat suitability when species records were absent. However, it was highlighted that models have been produced for a small number of species; they are only as good as the data they are based on; they express suitability rather than presence which can be difficult to handle in relation to planning.

Next steps: Work with the province to ensure the appropriate use/presentation of existing species models. Use these models, alongside other information, as a means of validating the ecosystem connectivity layer.

4.2 Ecosystem Connectivity

4.2.1 Effect of Scale

It was identified that mapping ecosystem connectivity at a regional scale provides a resource that all jurisdictions can apply, but this approach may not reflect local political priorities; might miss smaller ecosystem features valued locally; may be difficult to implement through policy on private land. It was also highlighted that there is no provincial mandate for the need to protect ecosystem connectivity.

Next steps: Review approaches to regional and local connectivity mapping and consult with the province on methodology / standards. Review current examples of policy implementing ecosystem connectivity at a local government and First Nations level.

4.2.2 Climate-micro-refugia

The idea of mapping climate-micro-refugia was considered advantageous as it could enable climate adaptation. However, the idea is a new one and therefore there are no guidelines defining climate micro refugia. Policy would need to be developed to incorporate it into planning documentation. You would need to increase capacity for local governments and First Nations to respond to it.

Next steps: Consult with the province and academia on methodology/standards. Consider appropriate wording for this layer to be incorporated into policy. Consider building capacity to enable its implementation.

4.2.3 Restoration of Ecosystem Connectivity

It was identified that mapping opportunities for the restoration of ecosystem connectivity would enable these to be taken into consideration during planning and decision making. However, the practicality of implementing these on private land is difficult as there are no legal drivers to do so. It was also identified that the process of restoration is expensive, and we should focus on protection of existing resources first.

Next steps: Focus on identifying existing connectivity corridors but indicate significant barriers / pinch points to key connectivity corridors.

4.3 Environmentally Sensitive Areas

4.3.1 Extending the SEI

The extension of the SEI was welcomed as it provided better coverage but the product was based on the TEM so concerns were expressed in relation to the age of the data, scale and coverage. It was also indicated that the SEI does not reflect Indigenous ways of knowing.

Next steps: Review the methods used to mine TEM with the province and look for ways to automate. The classification should be updated to include coastal ecosystems e.g. Metro Vancouver. The project will also need to verify the mapping layers on the ground. Consult with First Nations on how to incorporate indigenous ways of knowing.

4.3.2 Graded ESAs

Grading ESAs could provide an easy way to present ecosystem value improving discussions with the wider community, but attendees highlighted that a framework would need to be developed to rank their value. This could be difficult as people's perspective on value differ.

Next steps: The grading of ESAs will not be a focus area for the Atlas at present. This may be revisited later in the project.

4.3.3 Frequency of ESA updates

It was highlighted that in many areas ecosystem mapping has not been completed, which impacts on the identification of ESAs, therefore the first step is to ensure mapping is completed once. It was also identified that scale is important, and that the frequency of updates should be reduced if it means that the quality of the mapping is higher. Updates could follow planning cycles (5-6 years).

Next steps: Consult with the province on guidance / standards on mapping ESA's. Consider frequency of mapping change once detailed mapping has been completed.

4.4 Presentation and Interpretation of Mapping

4.4.1 Site Based Tools

It was considered that a site-based approach to the presentation of mapping information would be useful for the engagement of the community and for municipal planners as they work at this scale. However, mapping at a site level may need a high level of accuracy; could have unexpected political outcomes; could impact on property prices.

Next steps: Review the methods used by Maryland and others to describe value. Undertake consultation with local government and First Nations to understand priorities for presentation of mapping data.

4.4.2 Prioritisation Tools

It was considered that prioritisation tools would enable the interpretation of multiple layers of information; identify priority area for protection; provide a consistent approach to planning. However, the methods would need transparency.

Next steps: Review existing prioritisation tools to see if the Atlas layers could be analysed through these.

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3. Hectares BC (2013) query - http://www.hectaresbc.org/app/habc/HaBC.html). Accessed May 2013
4. Madrone Environmental Services (2008) Terrestrial ecosystem mapping of the Coastal Douglas-fir Biogeoclimatic zone – Madrone Environmental Services
5. Pither, R.,O'Brien, P, Brennan, A., Hirsh-Pearson, K. and Bowman, J. (2023) Predicting areas important for ecological connectivity throughout Canada. PLoS One.
6. Smithwick, E., *et al*. (2002). Potential upper bounds of carbon stores in forests of the Pacific Northwest. Ecological Applications, 12(5), 1303-1317.
7. Sothe, C., Gonsam, A, Arabian, J., Werner, K.A., Finkelstein, S.A., Snider, J. (2022) Large soil Carbon Storage In Terrestrial Ecosystems of Canada, https://wwf.ca/carbonmap/.
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9. Morrell, N., Schuster, R. and Arcese, P. (2017) Basin-wide CDFCP Runs of Marxan.

Appendix A- Action for Adaptation Project Descriptions

UBC Botanical Garden

Key Goals of the UBC Botanical Gardens Climate Adaptation project

Goal 1: Adaptation Planning - Accelerate Climate Action for Plants and Landscapes along the Pacific Northwest

An Adaptation Action Team will be established as the Garden's working group. The team will ensure curated collections are resilient to future climates by using databases (e.g. IrisBG – Garden Explorer) to monitor how collections change. Collaborating with established and emerging networks (gardens, universities and local governments), the Garden will develop community-driven solutions for adapting plants and landscapes through:
(1) a regional adaptation plan for the Pacific Northwest; and,
(2) plant-specific case studies for plant groups such crop wild relatives, alpine plants, and native plants.
Climate and conservation planning will enable networks to understand future climate risks, prioritize adaptation options and build on regional strengths to drive climate action and plant conservation.

Goal 2: Biodiversity Atlas Design – Develop a digital tool to monitor, track and manage plants and biodiversity in a changing climate.

Designing a Biodiversity Atlas will engage citizen scientists and researchers to monitor and track how genes, species and ecosystems respond in future climates. This digital resource will integrate datasets (maps, citizen science data, climate science, research data, etc.) to benefit gardens, universities and local governments in making informed decisions.

Goal 3: Climate Education - Deliver inclusive sustainability educational experiences.

Team Building Experience: Guided by a back-to-market strategy, a Climate and Conservation Engagement Coordinator and Field School team will engage businesses, organizations and youth in nature-based education at the Garden. Previous Field School learning modules (established 2015-2020), will be updated to reflect local and global priorities with new experiences added for smaller groups (Table 1). The team will collaborate on new learning modules for adaptation and climate justice. Knowledge gained from the learning modules will inform the design and development of new interpretive signage at the Garden. With support for student jobs and graduate research training, UBC Students will be engaged in all aspects of the Field School.

Interpretative signage: The Garden's interpretive signage installed in 2016 transformed visitor experience at the Garden. Learning from this, a gap exists on signage around climate action and climate justice. The vision is to develop, design and install additional interpretive signs that share diverse community perspectives of sustainability, Indigenous Knowledge and climate action. These additional signs will give guests the opportunity to learn, engage and reflect on sustainability and climate impacts.

Table 1. Field School sustainability learning modules and experiences.

Established Field School Learning Modules	New Learning Modules	Field School Experiences
• Biodiversity & Ecosystem Services • Food Gardens and Agriculture • Green Economy and Green Jobs • Policy Landscapes: SDGs, CBD, UNFCC • Water and Forests • Waste and Regeneration	• Climate Adaptation • Climate Justice • Indigenous Knowledge, Decolonization • Emerging climate topics	• Team building tours at the Garden • Sustainability education workshops • Field trips for local and international conferences • Train-the-trainer workshops • Facilitated meetings • Solution labs

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

Working together to create:

A Regional Framework for Nature Based Climate Solutions in Southwest BC

Why is Southwest BC Important?

Southwest BC's Georgia Basin lowlands host over 75% of BC's population and includes the Coastal Douglas-fir zone (CDF), home to the largest number of species and ecosystems at risk in the province. Per hectare, forests in the Basin have among the highest carbon storage capacity of any forest in BC, with those in old growth being some the highest carbon storing ecosystems in the world[1]. Georgia Basin ecosystems also provide critical ecosystem services, such as supplying water, controlling floods, improving air quality and providing salmon habitat, recreation and climate refuge. As the traditional territory of the Coast Salish and other First Nations, these ecosystems are also important to indigenous food security, and support a multitude of culturally important plants and animals.

Increasing demand for residential development and timber are intensifying pressure on the Basin's natural assets and the ecosystem services they supply. These pressures are compounding as climate change increases the intensity and frequency of heat, droughts, flooding, and wildfires, threatening the well being of BC's south coast communities, and their capacity and long-range options for adapting to climate change.

Nature Based Climate Solutions

Healthy functioning ecosystems are our front line defence against climate change. Nature-based climate solutions (NBS) are policies and actions that conserve and restore natural areas to reduce carbon emissions (climate change mitigation) and buffer climate change impacts (climate change adaptation). They do so by:

- storing and capturing carbon;
- reducing impacts of floods, droughts, erosion, fires and heat waves;
- sustaining biodiversity and culturally important plants and animals;
- providing indigenous food security;
- sustaining economically important fish and wildlife populations and valued recreation areas.

The Issue

BC's Georgia Basin land base is governed by a complex suite of federal, provincial and municipal policies, bylaws, and regulations. Governments, First Nations, industry and ENGOS need improved coordination, policy and science-based decision support to: incentivize nature based solutions, support payments for ecosystem services, and overcome the barriers to conserving biodiversity and natural assets presented by escalating land and timber prices, amidst a complex land ownership and management landscape.

The Project

In February 2022, the CDFCP secured two years of funding from the *Nature Smart Climate Solutions Fund* to help address this issue. The CDFCP will be working with its partners[12] to convene key stakeholders in a collaborative process to develop **a regional framework for aligning and improving nature-based policy and decision support tools**[3], to integrate objectives for:

- biodiversity conservation,
- climate change mitigation (carbon storage and sequestration),
- climate change adaptation (watershed and wildfire resilience),
- culturally important ecosystems (i.e. habitats that support plants and animals important to indigenous communities).

…with a focus on supporting local government, First Nations, and ENGO decision-making in southwest BC. (see study area in **Figure 1**).

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[1] Smithwick, E., *et al.* (2002). Potential upper bounds of carbon stores in forests of the Pacific Northwest. *Ecological Applications*, *12*(5), 1303-1317.

[2] Partners to date include: Ministry of Land, Water and Resource Stewardship, BC Climate Action Secretariat, UBC Botanical Gardens, Transition Salt Spring and Action on Climate Team.

[3] E.g. maps, models, incentives, decision trees, protocols, policy statements, guidance documents, evaluation frameworks, etc.

Proposed Project Schedule for CDFCP *(to be coordinated with partner projects)*

YEAR 1	**(2022/23)**
Identify partners & plan work	
▪ Identify potential partners	Apr–May
▪ Project start-up and work planning	Apr–May
Build relationships & identify needs, barriers and opportunities	
▪ Conduct in-depth interviews	April-Sep
▪ Compile literature and spatial layers	April-Sep
▪ Collate interviews & prepare summary reports	Oct
▪ Design follow-up workshops on key topics	Oct
Share knowledge, build agreement & plan action	
▪ Host workshops to share knowledge, build agreement and plan action	Nov-Dec
▪ Develop and deliver supporting webinar series	Nov-Dec
▪ Prepare workshop summaries & collaborative action plans for Year 2	Nov-Jan

YEAR 2	**(2023/24)**
Mobilize partners/collaborators	
▪ Additional meetings, interviews and workshops, as required	TBD
▪ Mobilize partners to develop regional framework for NBS policy and decision-support tools, based on Year 1 results	

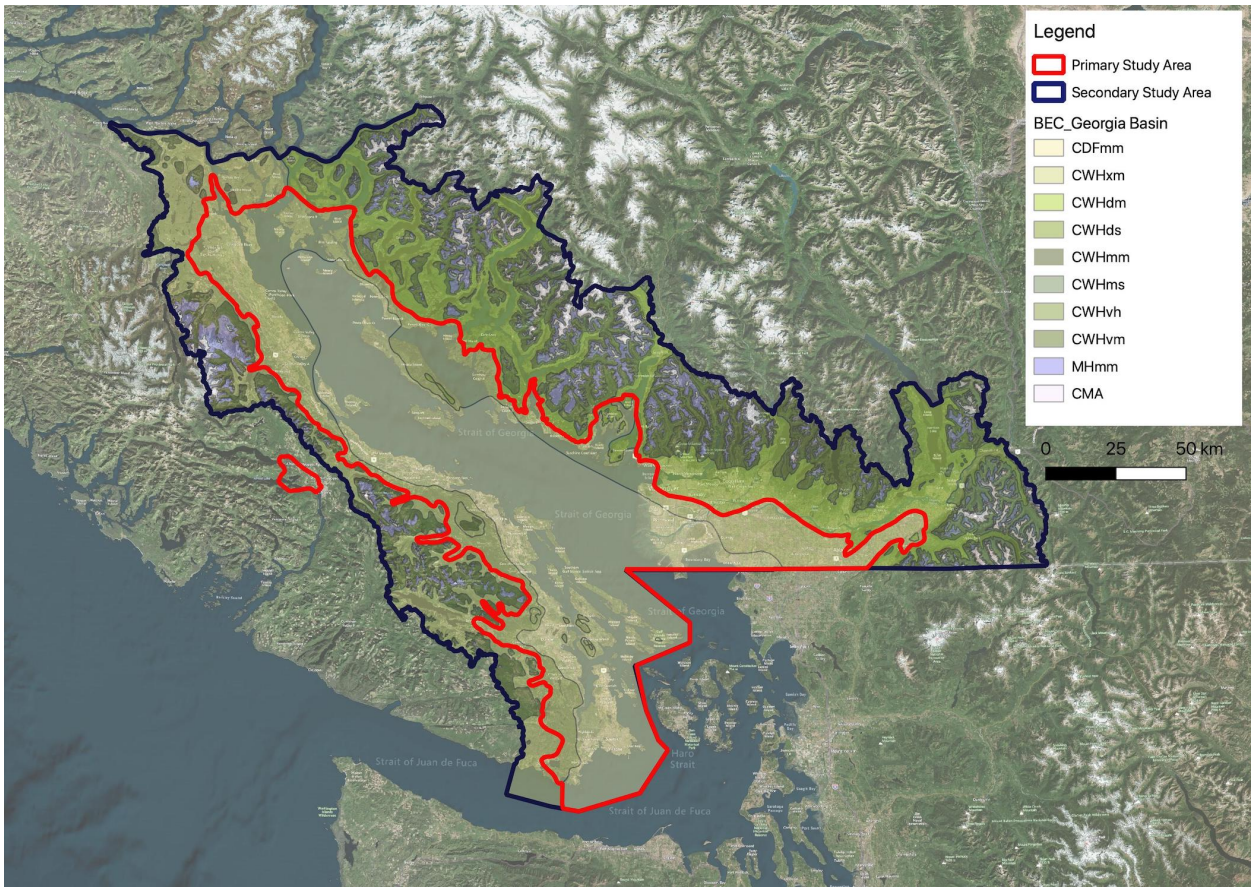


Figure 1. Primary study area outlined in red (Georgia Basin's dry lowlands – CDF and associated ecosystems), and secondary study area outlined in blue (lowlands and adjacent uplands combined).

Working Together to Create a Biodiversity Atlas

Why are the Species and Ecosystems in Southwest British Columbia Important?

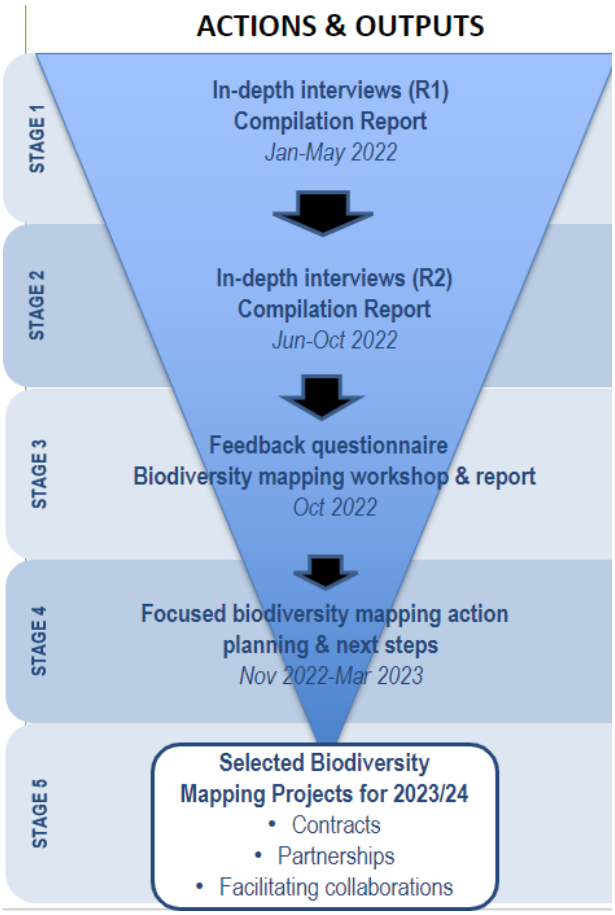
Southwest British Columbia's (BC) Georgia Basin lowlands host over 75% of BC's population and includes the Coastal Douglas-fir zone (CDFmm), home to the largest number of species and ecosystems at risk in the province. The ecosystems present provide critical services, including supplying water, urban cooling flood control, removal of particulates from the air and carbon storage and sequestration. As the traditional territory of the Coast Salish and other First Nations, these ecosystems are important as they provide indigenous food security, and support culturally important plants and animals.

Increasing demand for residential development and timber are intensifying pressure on the area's natural assets and the ecosystem services they provide. These pressures are compounded by climate change threatening the well being of BC's south coast communities, and their capacity for adapting to climate change.

Working Together

In 2022 the Coastal Douglas-fir Conservation Partnership (CDFCP) and UBC Botanical Gardens came together with the combined aspiration of producing a digital Biodiversity Atlas that would provide First Nations, local governments and land managers with the tools they need to make informed decisions in relation to biodiversity in a changing climate. The aim of the biodiversity atlas is to inform policy, decision-making, conservation and climate change adaptation.

Process being Followed



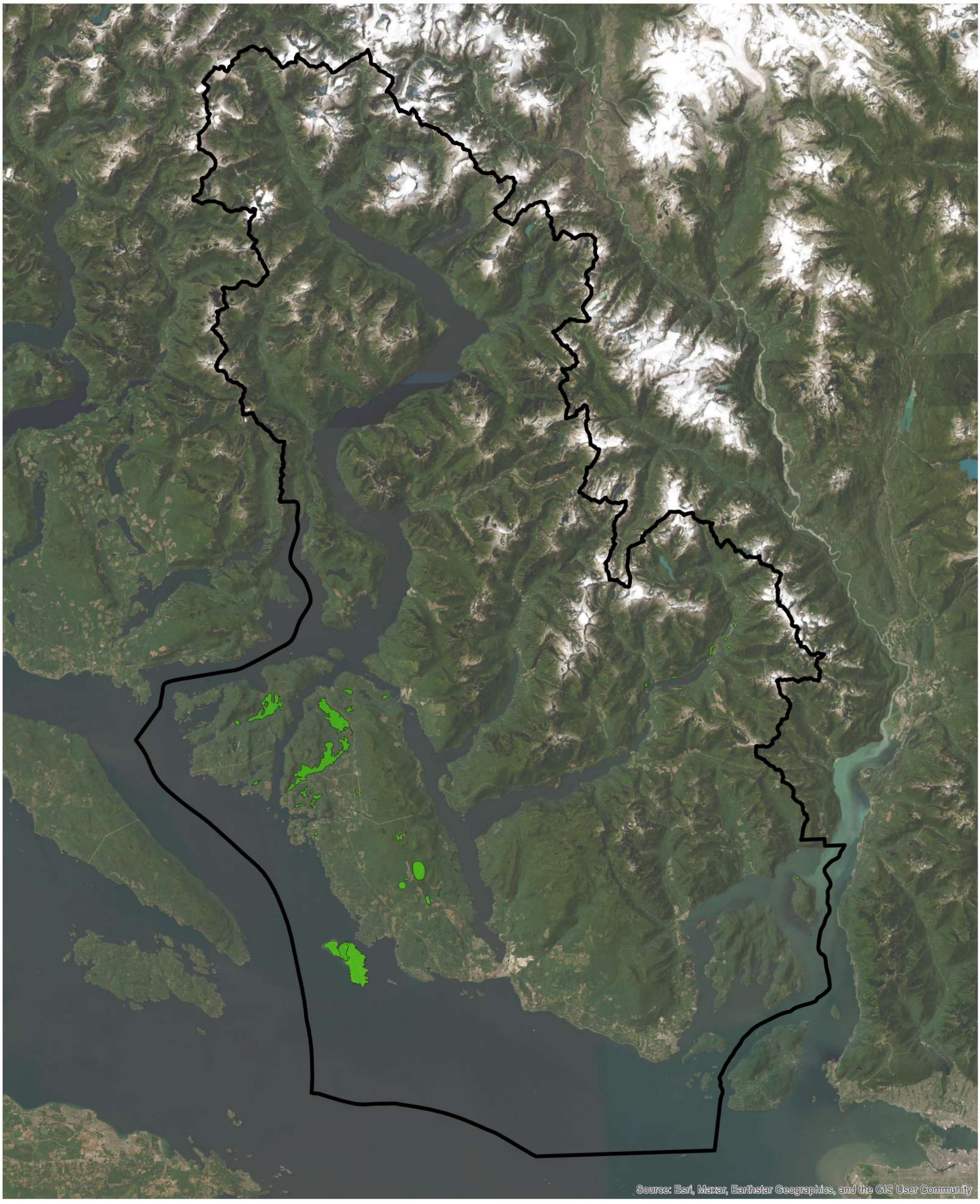
Priority Areas

- Connecting and collaborating with First Nations and local governments.
- Building on existing policy, tools and guidance.
- Identifying a suitable online host platform for the Atlas.
- Establish a framework for the maintenance of the Atlas

https://www.cdfcp.ca/nature-smart-project/ and https://botanicalgarden.ubc.ca/tag/sustainable-communities-field-school/

Appendix B – Pilot Maps used for Breakout Groups

Map 1: CDC Occurrence Records



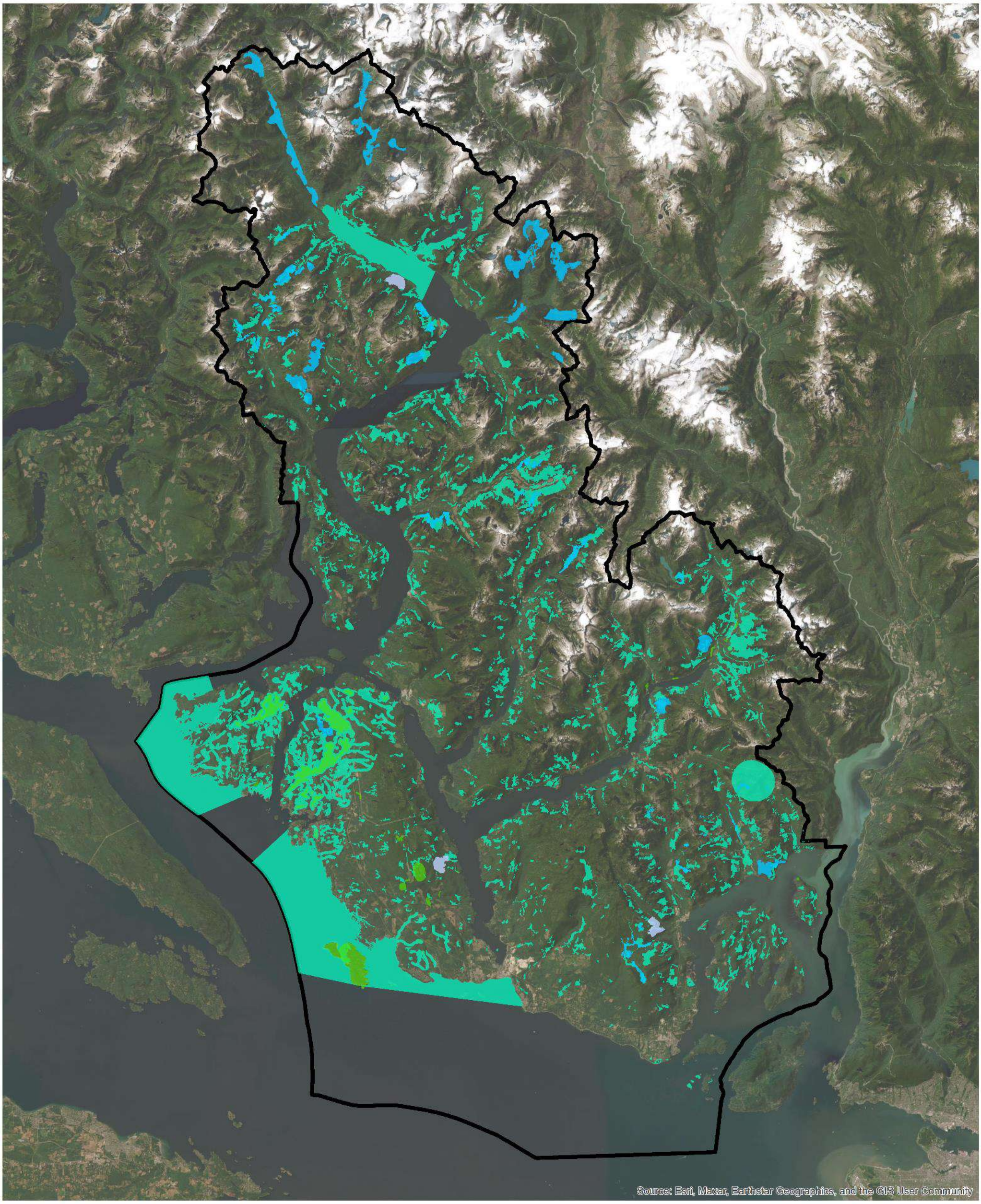
0 4 8 16 24 32 km

N

Legend

- CDC Species Occurrences
- Sunshine Coast Region

Map 2: Wildlife Habitat



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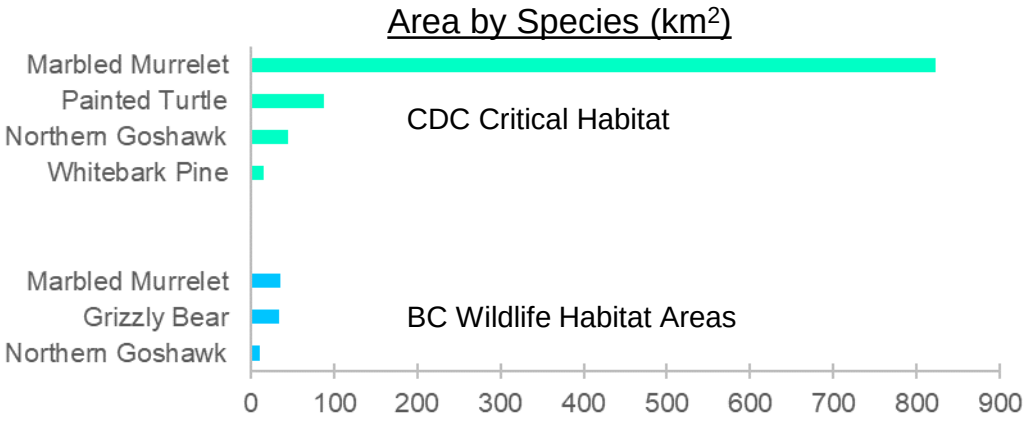
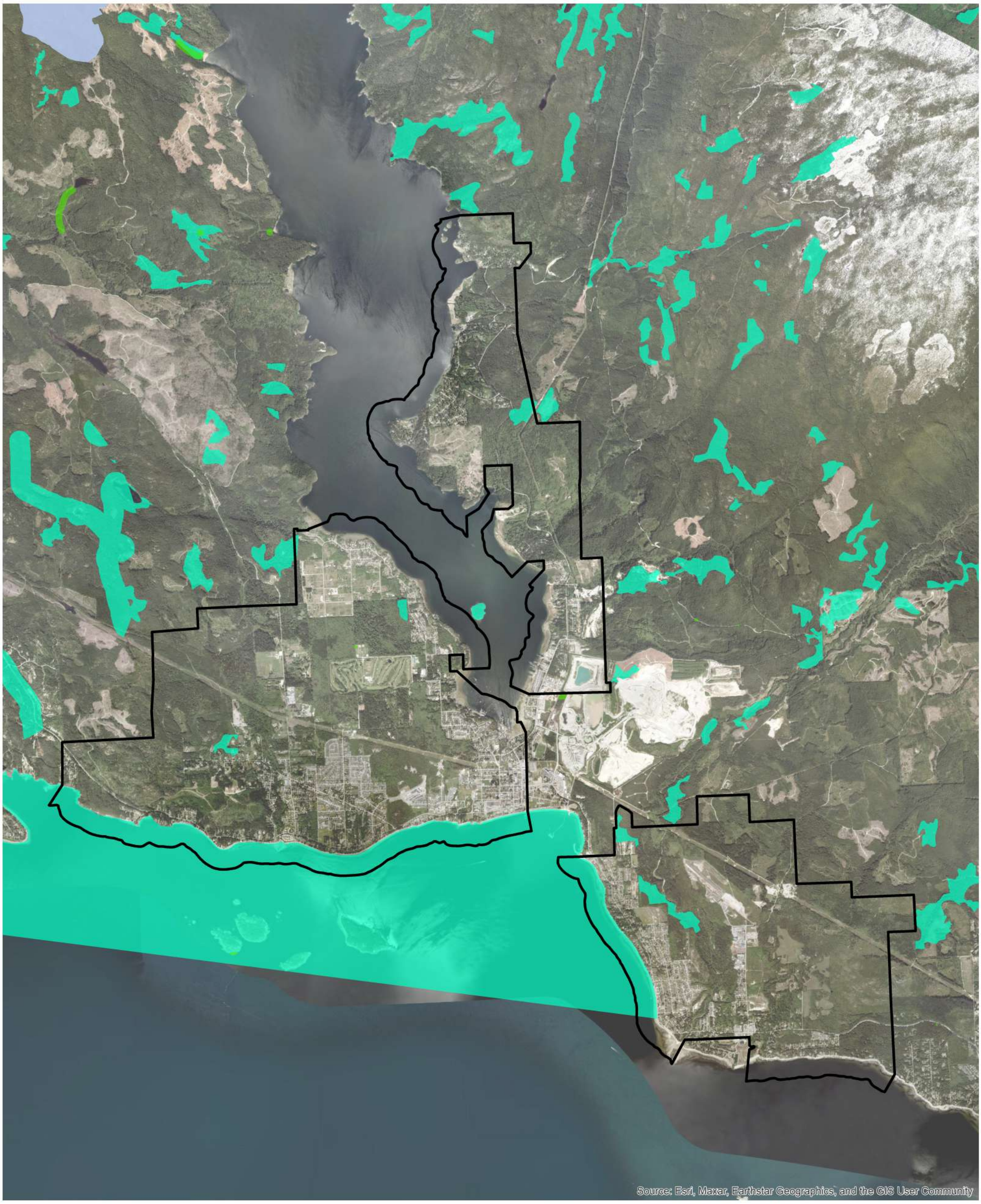
Area by Species (km^2)



Legend

- CDC Species Occurrences
- CDC Critical Habitat
- BC Wildlife Habitat Areas
- BC Wildlife Habitat Areas - Proposed
- Sunshine Coast Region

Map 2: Wildlife Habitat



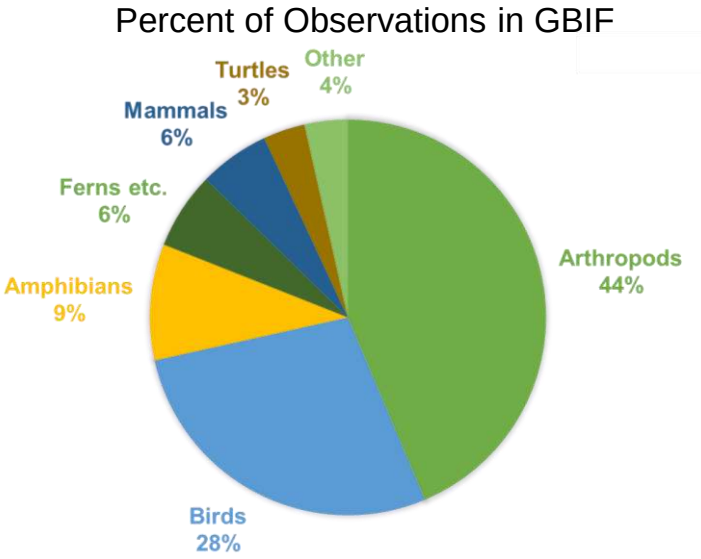
0 0.5 1 2 3 4 km

N

Legend

- Municipal Boundaries
- CDC Species Occurrences
- BC Wildlife Habitat Areas
- BC Wildlife Habitat Areas - Proposed
- CDC Critical Habitat

Map 3: Species at Risk



0 4 8 16 24 32 km

N

Legend

- GBIF - Red Listed Species
- GBIF - Blue Listed Species
- CDC Species Occurrences
- Property Boundaries
- Sunshine Coast Region

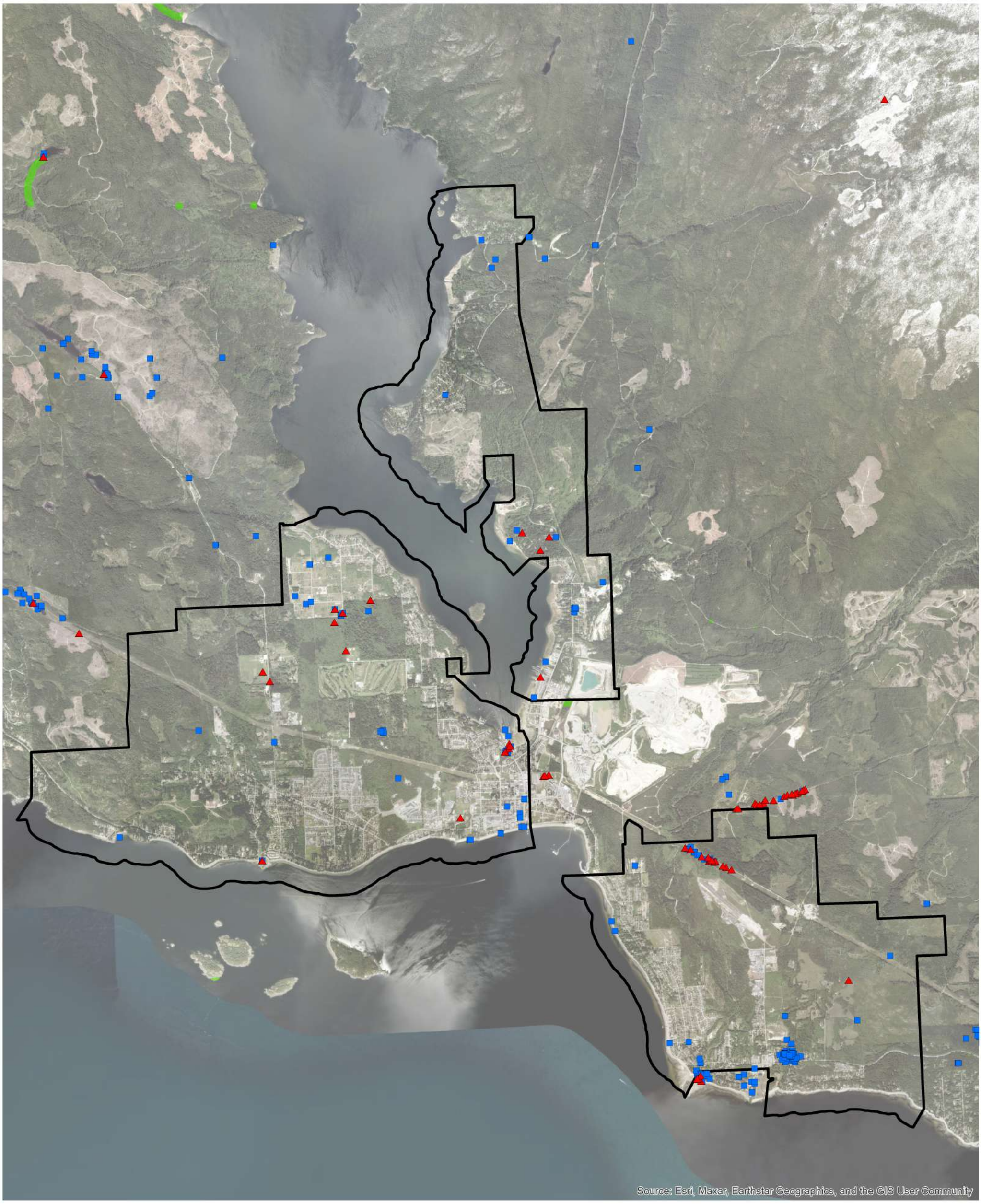
Number of Observations

n = 197

n = 740

Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Map 3: Species at Risk



0 0.5 1 2 3 4 km

N

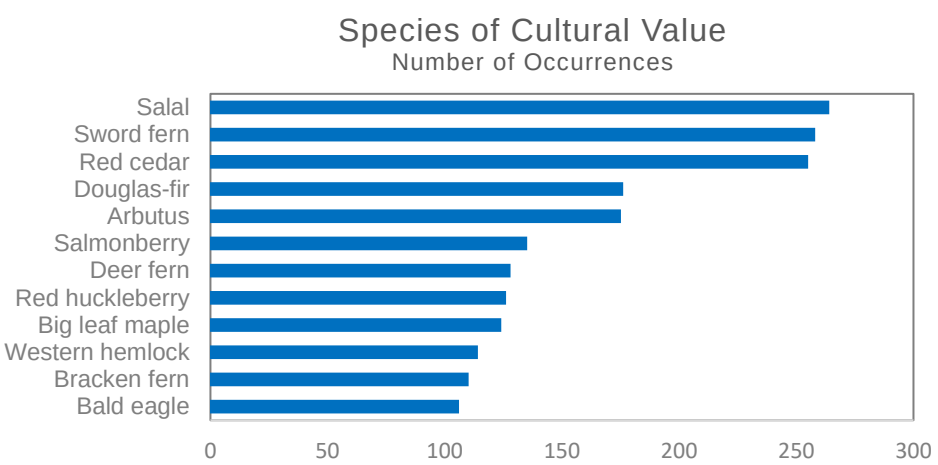
Legend

- GBIF - Red Listed Species
- GBIF - Blue Listed Species
- CDC Species Occurrences
- Municipal Boundaries

Map 4: Species of Cultural Value and Species at Risk

0 4 8 16 24 32 km

N



Legend

	Number of Observations
GBIF - Red Listed Species	n = 197
GBIF - Blue Listed Species	n = 740
GBIF - Species of Cultural Value	n = 5288
CDC Species Occurrences	
Property Boundaries	
Sunshine Coast Region	

Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Map 4: Species of Cultural Value and Species at Risk

0 0.5 1 2 3 4 km

N

Legend

- GBIF - Red Listed Species
- GBIF - Blue Listed Species
- GBIF - Species of Cultural Value
- CDC Species Occurrences
- Municipal Boundaries

Map 5: Marbled Murrelet Habitat

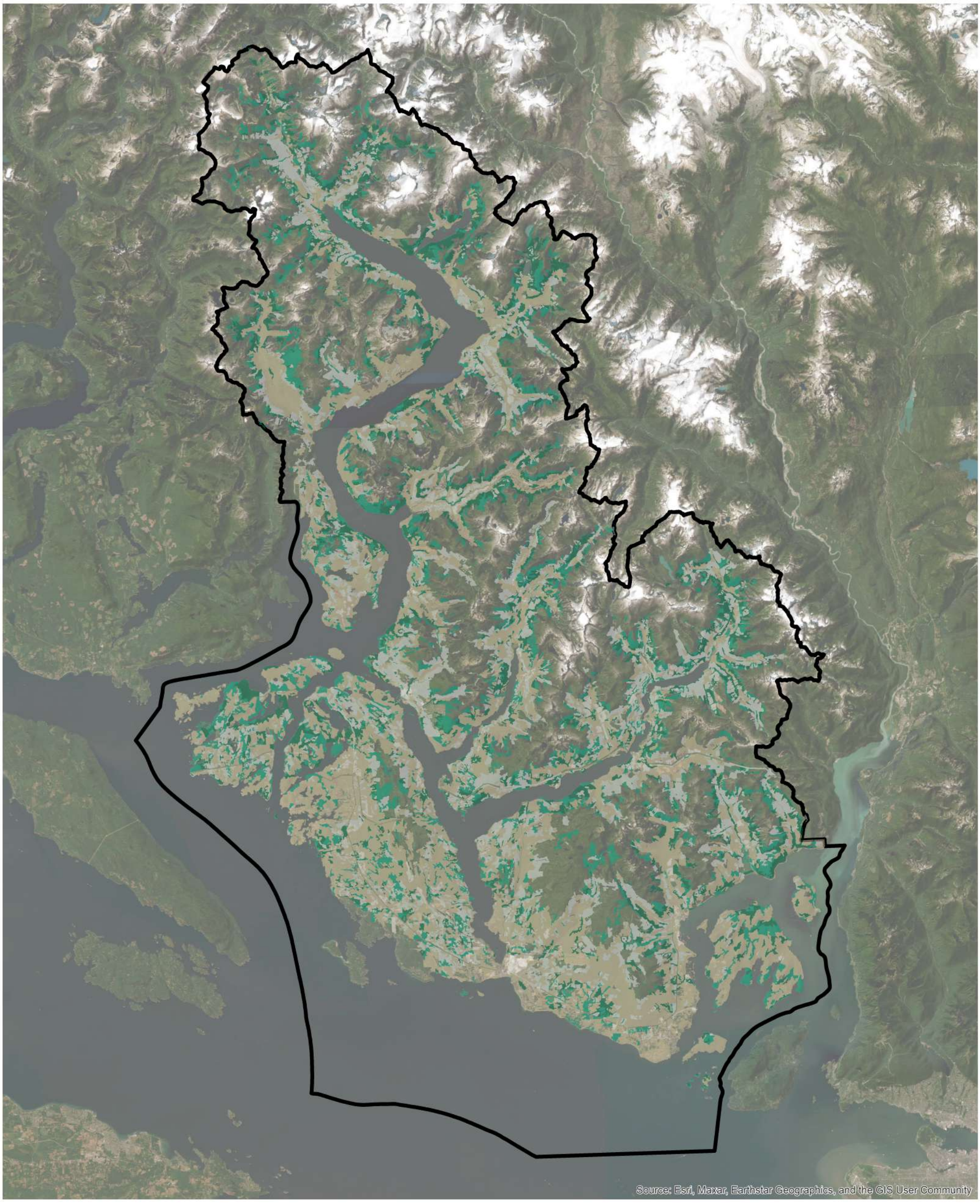
0 4 8 16 24 32 km

N

Legend

- Marbled Murrelet - Suitable Habitat
- CDC - Murrelet Occurrences
- GBIF - Murrelet Occurrences
- Sunshine Coast Region

Map 6: Spotted Owl



0 4 8 16 24 32
km

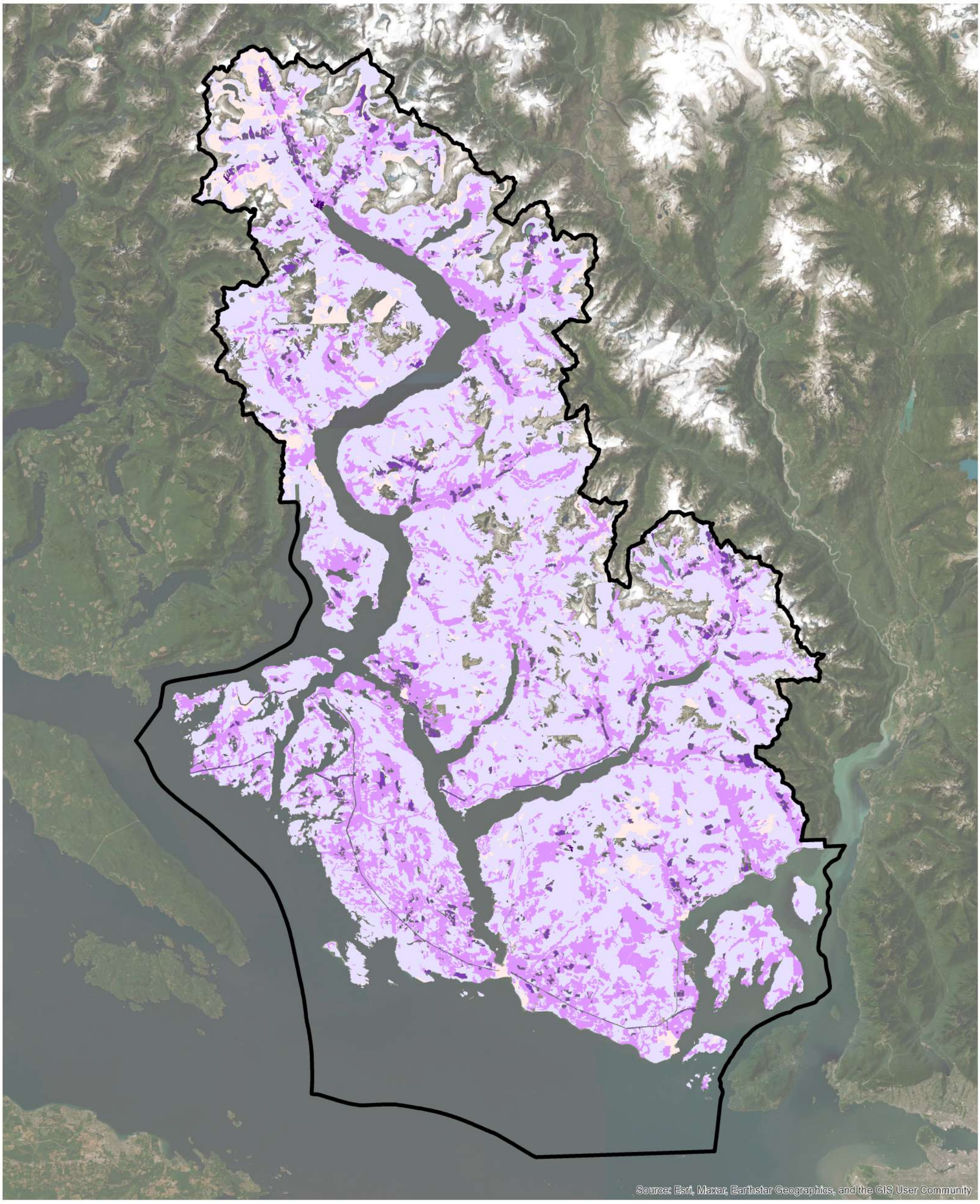
N

Legend

Spotted Owl - Habitat Suitability

- Nesting
- Foraging
- Dispersal
- Capable
- Unrated
- Sunshine Coast Region

Map 7: Elk Habitat



0 4 8 16 24 32
km

N

Legend

Elk - Habitat Suitability

- High
- Moderately High
- Moderate
- Low
- Very Low
- Sunshine Coast Region

Map 8: Connectivity - Landscape

0 4 8 16 24 32 km

N

Legend

Species Movement Ability

High

Low

Sunshine Coast Region

Map 9: Local Connectivity

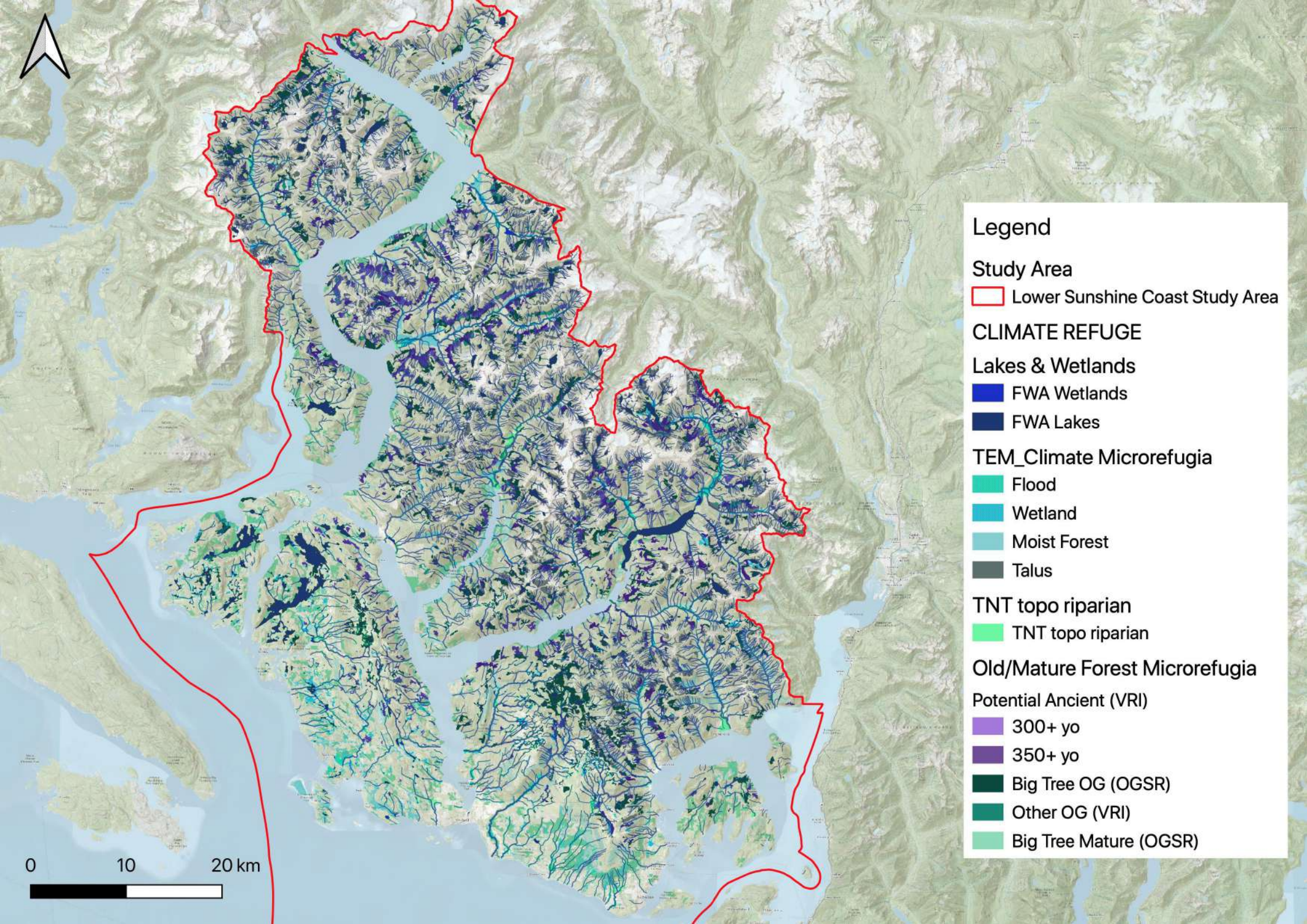
Legend

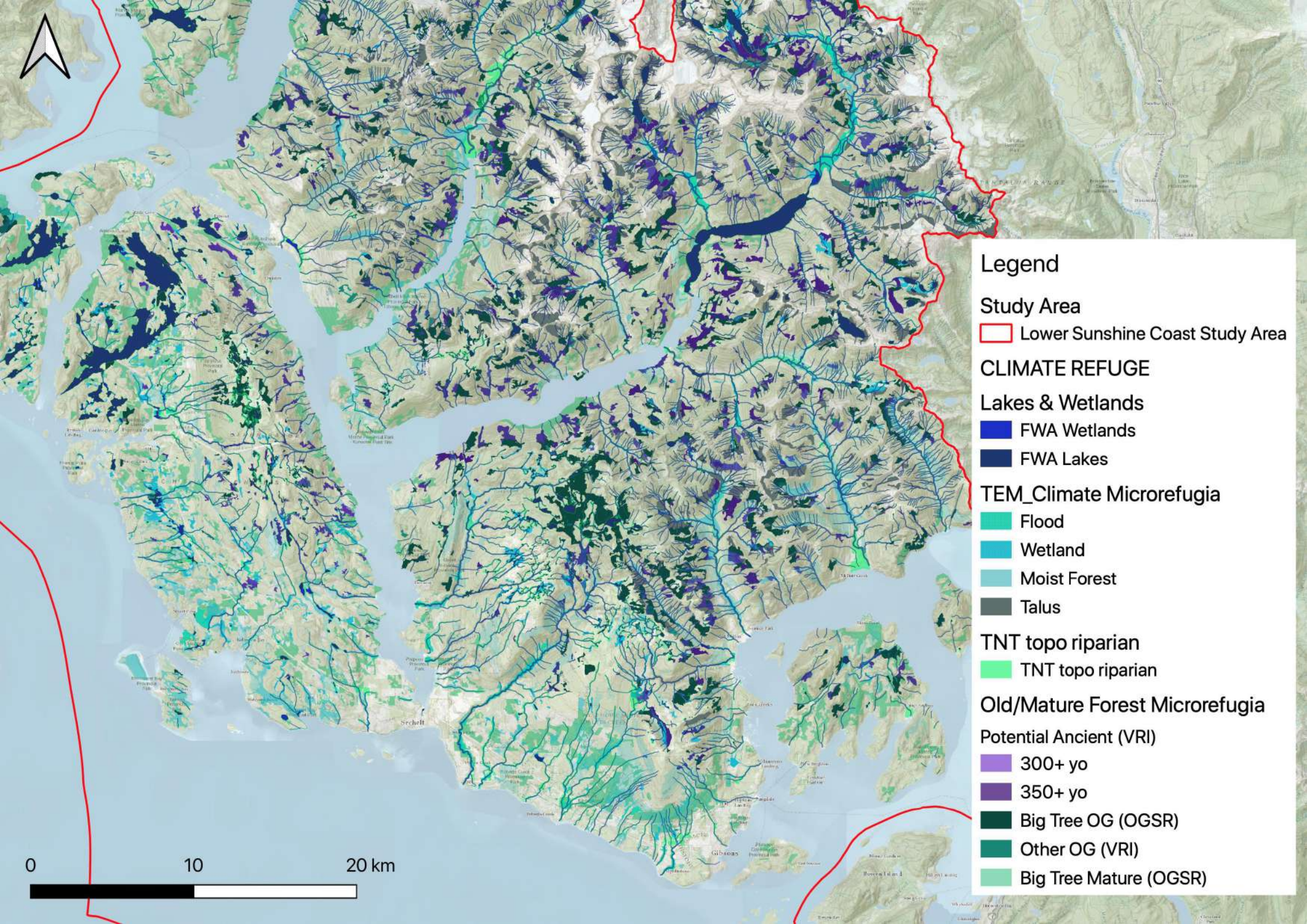
- Corridors - Primary
- Corridors - Secondary
- Corridors - Desirable
- GBIF - Red Listed Species
- GBIF - Blue Listed Species
- GBIF - Species of Cultural Value
- Municipal Boundaries

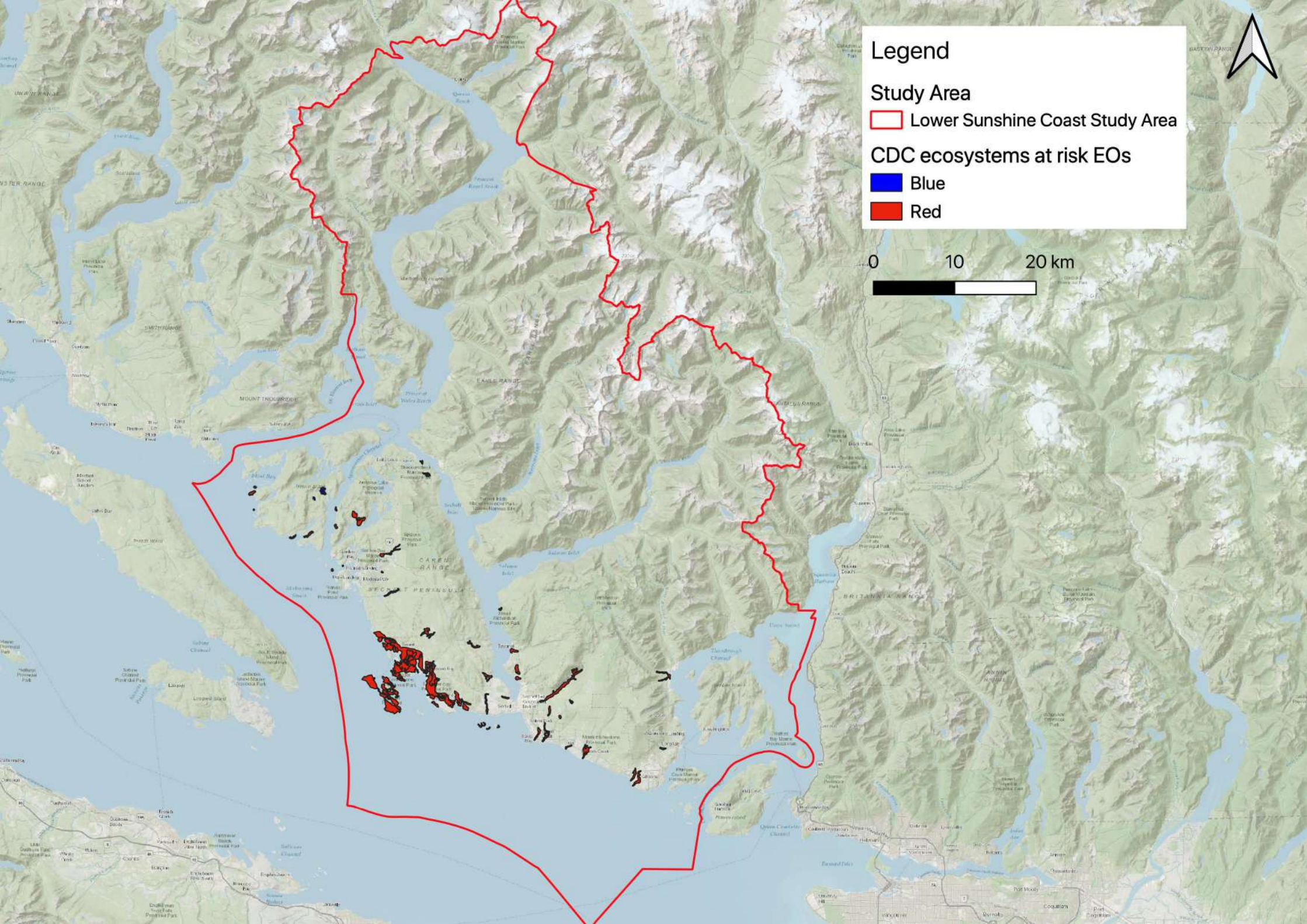
0 0.5 1 2 3 km

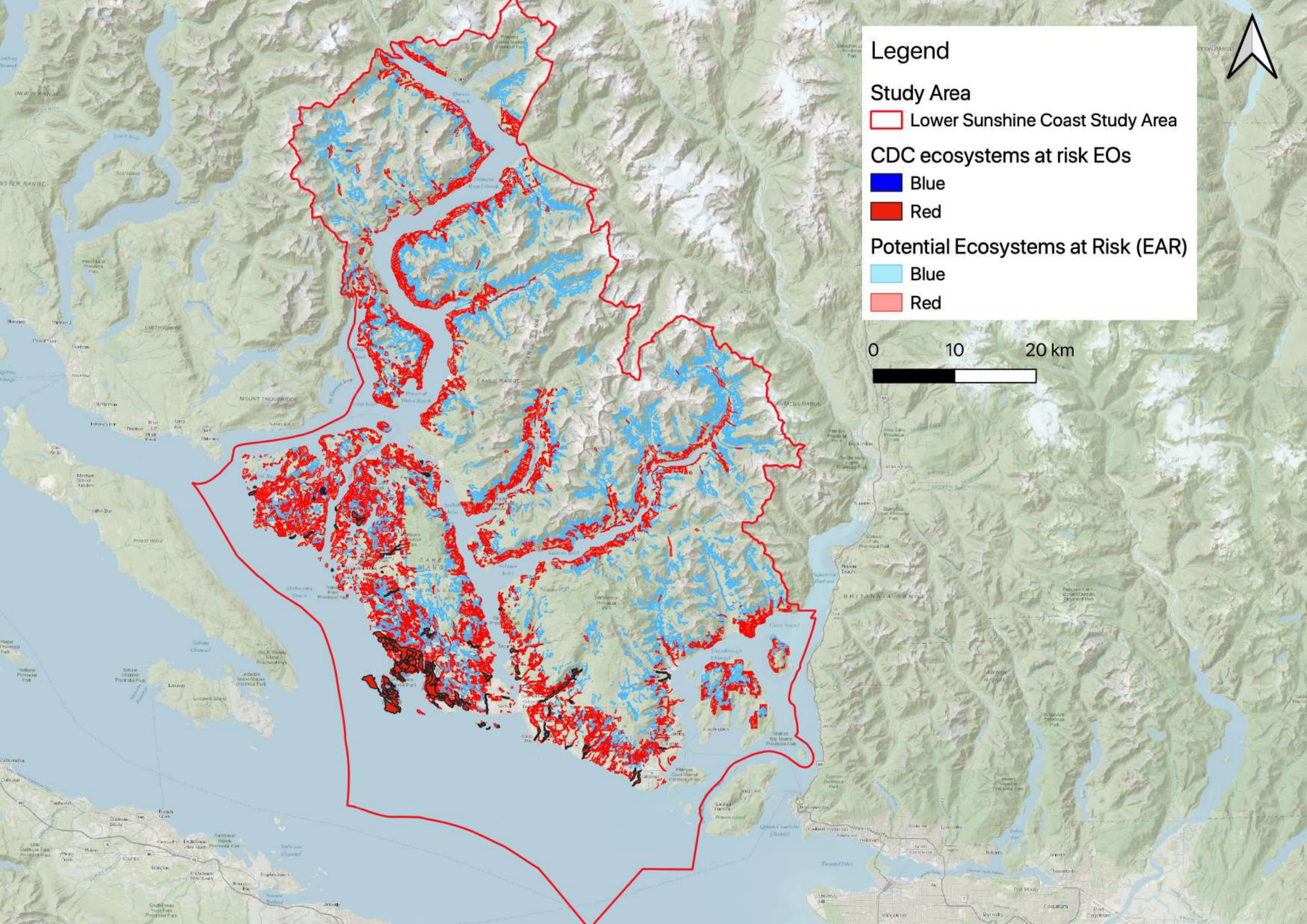
N

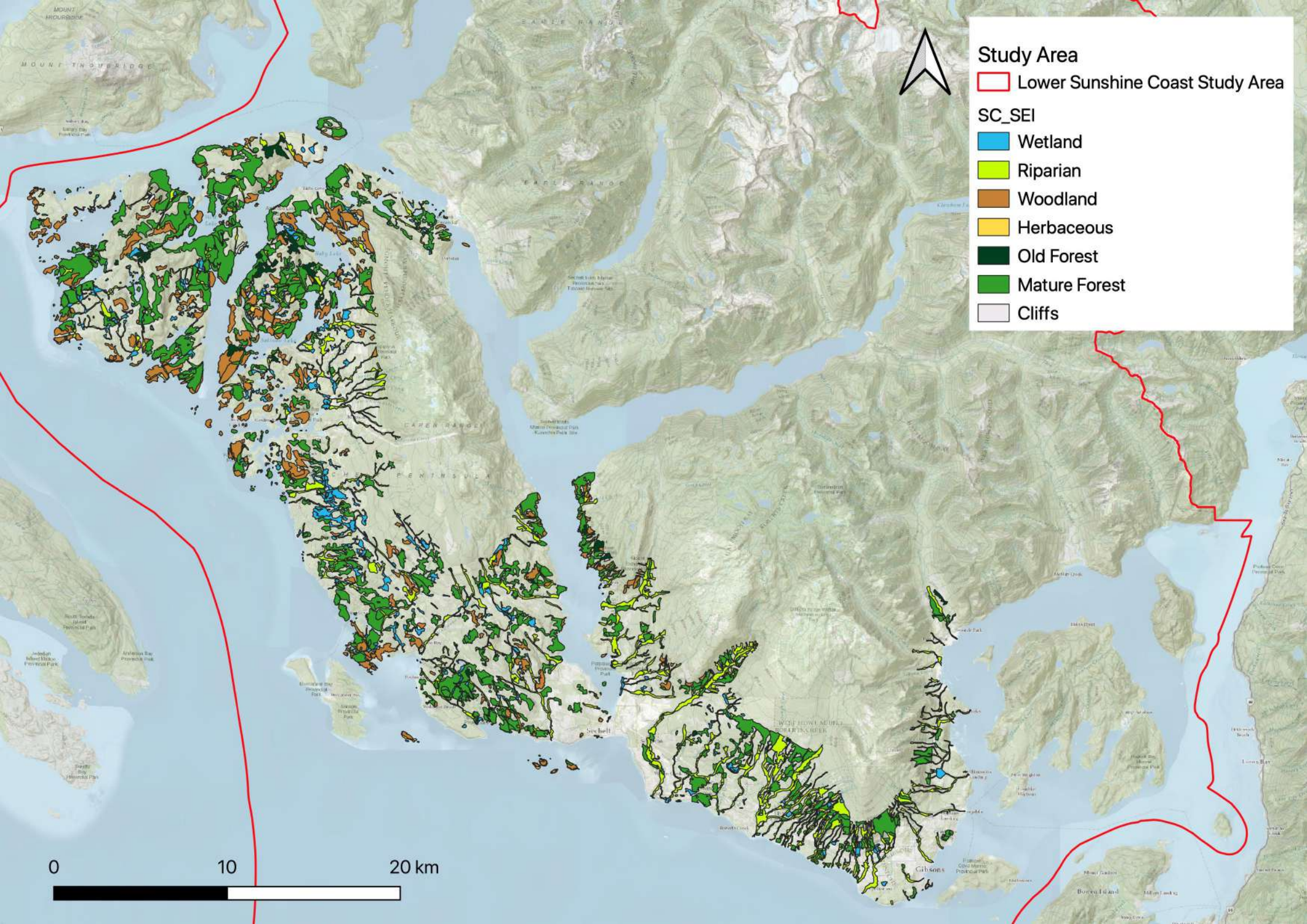
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

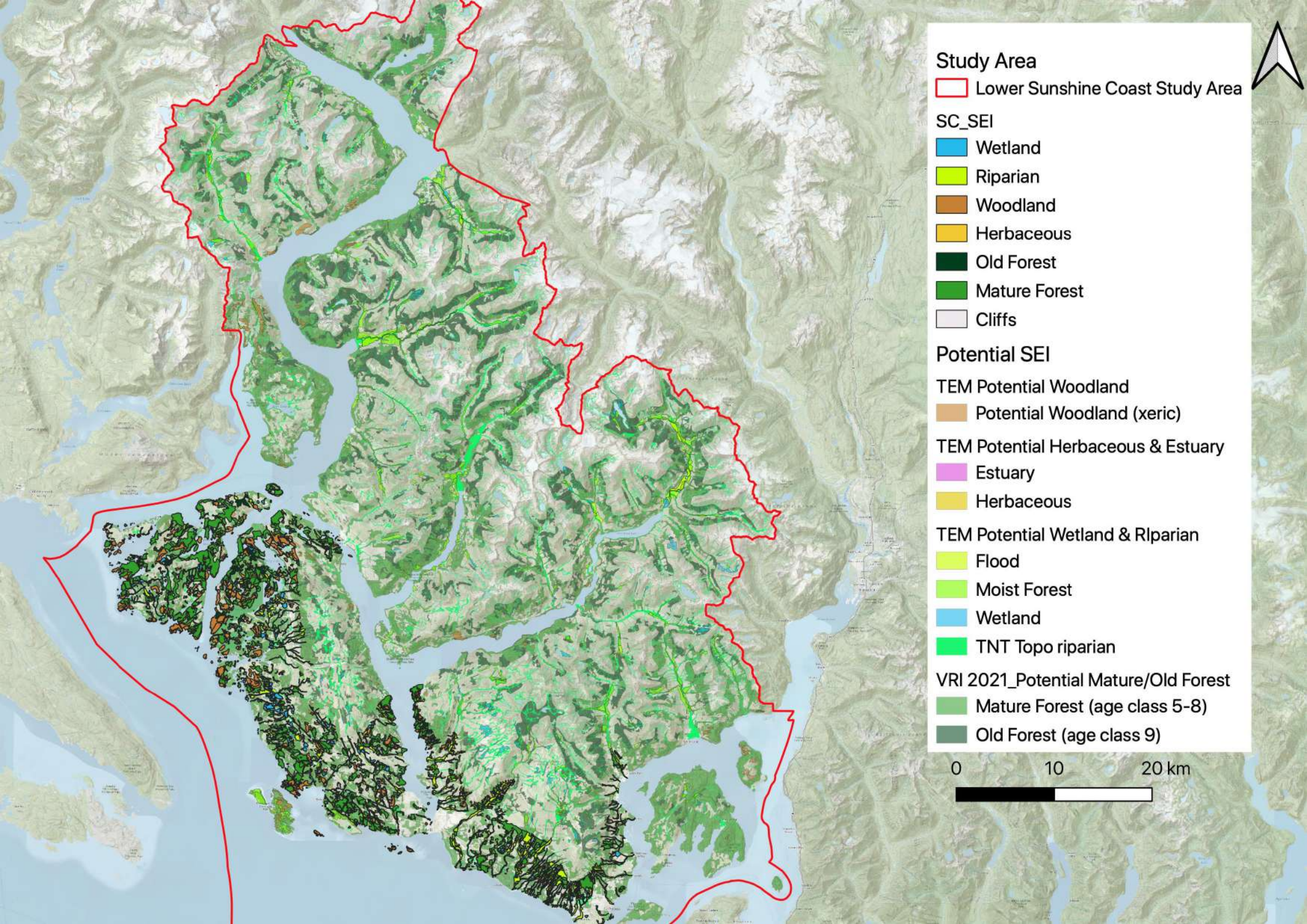

Legend
Study Area
Lower Sunshine Coast Study Area
CLIMATE REFUGE
Lakes & Wetlands
FWA Wetlands
FWA Lakes
TEM_Climate Microrefugia
Flood
Wetland
Moist Forest
Talus
TNT topo riparian
TNT topo riparian
Old/Mature Forest Microrefugia
Potential Ancient (VRI)
300+ yo
350+ yo
Big Tree OG (OGSR)
Other OG (VRI)
Big Tree Mature (OGSR)
0
10
20 km

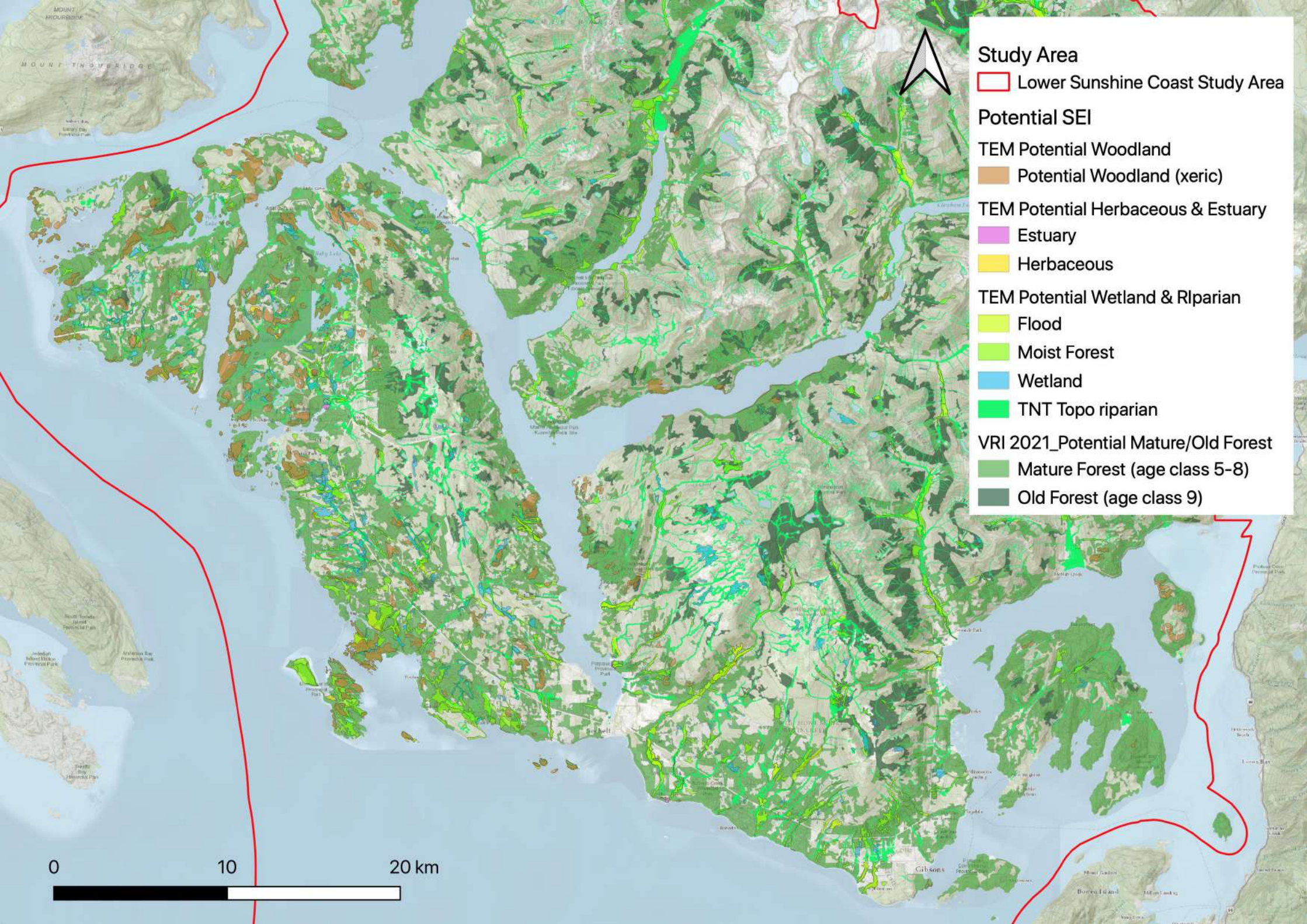

Legend
Study Area
Lower Sunshine Coast Study Area
CLIMATE REFUGE
Lakes & Wetlands
FWA Wetlands
FWA Lakes
TEM_Climate Microrefugia
Flood
Wetland
Moist Forest
Talus
TNT topo riparian
TNT topo riparian
Old/Mature Forest Microrefugia
Potential Ancient (VRI)
300+ yo
350+ yo
Big Tree OG (OGSR)
Other OG (VRI)
Big Tree Mature (OGSR)
0
10
20 km


Legend
Study Area
Lower Sunshine Coast Study Area
CDC ecosystems at risk EOs
Blue
Red
0
10
20 km

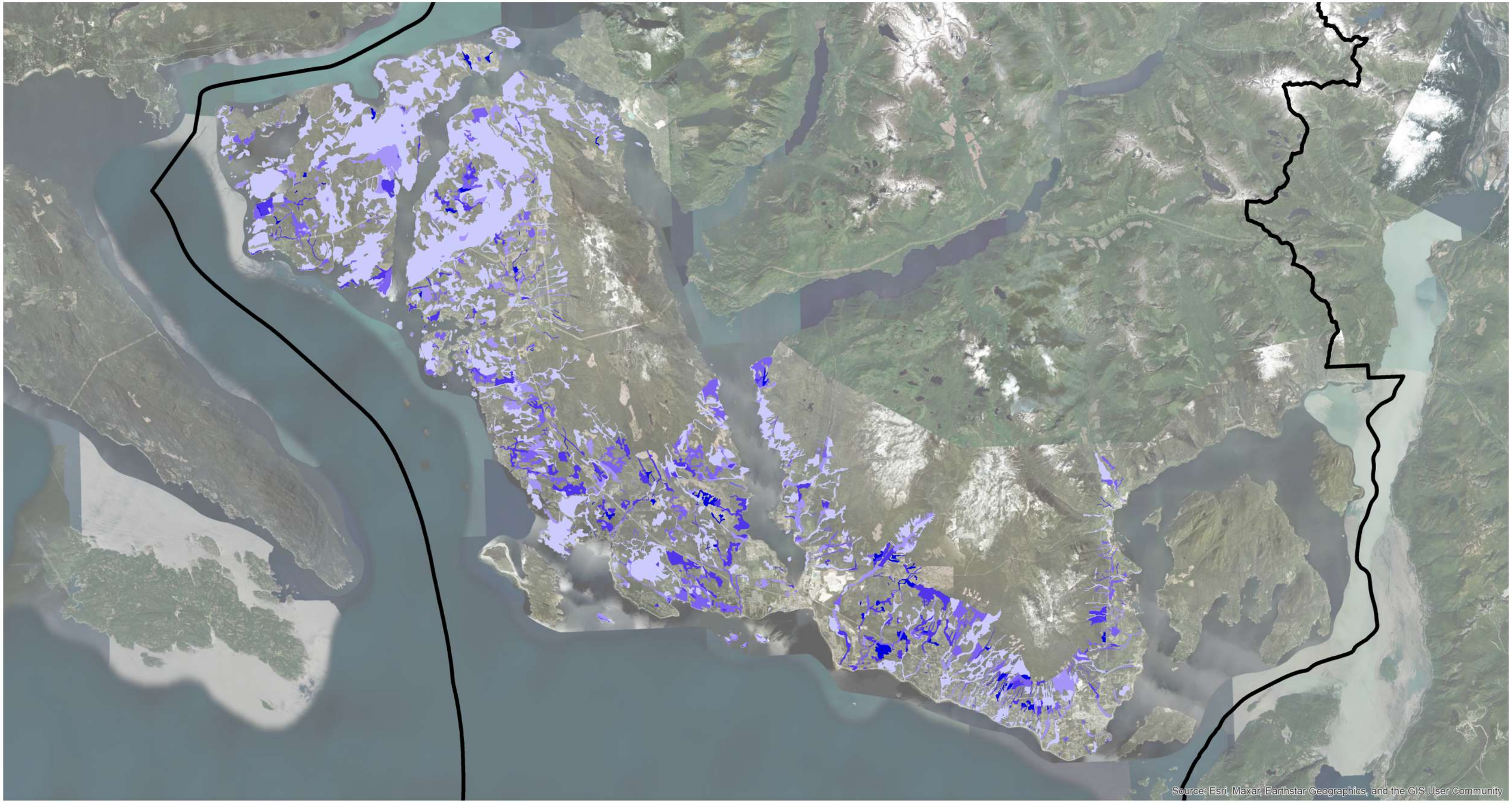

Legend
Study Area
Lower Sunshine Coast Study Area
CDC ecosystems at risk EOs
Blue
Red
Potential Ecosystems at Risk (EAR)
Blue
Red
0
10
20 km


Study Area
Lower Sunshine Coast Study Area
SC_SEI
Wetland
Riparian
Woodland
Herbaceous
Old Forest
Mature Forest
Cliffs
0
10
20 km


Study Area
Lower Sunshine Coast Study Area
SC_SEI
Wetland
Riparian
Woodland
Herbaceous
Old Forest
Mature Forest
Cliffs
Potential SEI
TEM Potential Woodland
Potential Woodland (xeric)
TEM Potential Herbaceous & Estuary
Estuary
Herbaceous
TEM Potential Wetland & RIparian
Flood
Moist Forest
Wetland
TNT Topo riparian
VRI 2021_Potential Mature/Old Forest
Mature Forest (age class 5-8)
Old Forest (age class 9)
0
10
20 km


Study Area
Lower Sunshine Coast Study Area
Potential SEI
TEM Potential Woodland
Potential Woodland (xeric)
TEM Potential Herbaceous & Estuary
Estuary
Herbaceous
TEM Potential Wetland & RIparian
Flood
Moist Forest
Wetland
TNT Topo riparian
VRI 2021_Potential Mature/Old Forest
Mature Forest (age class 5-8)
Old Forest (age class 9)
0
10
20 km

Map: Land Cover Change by SEI Polygons



Legend

- 0 - 5%
- 5 - 10%
- 10 - 20%
- 20 - 50%
- 50 - 100%
- Sunshine Coast Region

0 2.5 5 10 15 20 km

N