RARE, UNIQUE OR DIVERSE ECOSYSTEMS

HIGH CONSERVATION VALUE 3, QUESTIONS 8 & 11

Does the forest contain naturally rare ecosystem types?
Are there nationally/regionally significant diverse or unique forest ecosystems?

BACKGROUND

The HCVF framework contains significant overlap between Questions 8 and 11, dealing respectively with rare ecosystems, and ecosystems that are unique or diverse.

The major point of differentiation between these questions is the scale at which the investigations are aimed, and the subsequent data sources that are applicable. Question 8 is intended to deal more with international and national level rarity and significance. Investigations will tend to rely on list-based resources in the same way that Question 1 is focused on listed Species at Risk (*e.g.* consultation of G-Ranks, *etc*.). Question 11 looks more toward regional level significance and unique or outstanding occurrences of ecosystems. For this question, gathering information from local experts and authorities is a more valuable line of enquiry.

The issues associated with identifying naturally rare ecosystem types are also germane to identifying and locating especially diverse or unique ecosystem types. For this reason, we have combined the discussion of these Questions into a single document.

All ecosystem types result from interrelationships between climate, physiographic features, soil, micro and macro organisms, and vegetation. Naturally rare ecosystems often occur along more narrow moisture, nutrient and microclimate gradients than do more common ecosystem types.

Rare ecosystem types may also occur as remnants following some type of major disturbance. Remnant populations and systems resist extinction due to a pronounced ability to persist without completing a whole life-cycle (*e.g.*, long-lived vegetative life cycle stages). These ecosystems provide resilience to disturbance by enhancing post-disturbance colonization, providing persistent habitat assemblages of animals and micro-organisms, and by reducing variation in nutrient cycling (Eriksson 2000). Therefore, rare ecosystem types may be important elements of a protected areas network (FSC Criterion 6.4) in terms of both ecosystem representation and resilience.

The HCVF framework also recognizes that unique and diverse forest ecosystems are valuable due to their potential vulnerability, species diversity and the significant ecological processes they may include

We have identified three principal issues related to how these questions have been addressed in HCVF assessments to date:

1. Lack of data: Identifying rare ecosystem types within FMAs has proven challenging in many instances due to a lack of readily available data. Classifications of rare and sensitive ecosystems exist for some regions and not for others. Further, the criteria, data and scale used to assess ecosystem types are often not consistent across political boundaries. Here we suggest several approaches to identifying rare ecosystem types by developing proxies using multiple data sources at varied scales.

2. Scale: The definition of 'rare' is scale-dependent; an ecosystem type may be common globally but rare locally, or vise versa. Therefore, the occurrence of ecosystem types should be assessed across local, regional and global landscape scales. Data ranging from coarse to fine filter should be examined.

3. Lack of spatial analysis: To date, maps of rare ecosystem types have commonly been omitted from HCVF assessments. Mapping information about rare ecosystem types at multiple scales - those located in, adjacent to and within the region of the FMA - may assist in determining thresholds of HCVF status. Further, providing maps of all rare ecosystem types, regardless of eventual HCV designation, provides important information for forest management and monitoring, and will help when assessing areas of HCV overlap (Question 19).

DATA SOURCES

The HCVF Framework for Canada lists the following possible data sources:

- Conservation Data Centre G1-G3 community types
- WWF Terrestrial Ecoregions of North America
- Conservation International
- National vegetation surveys and maps
- Local Research institutions
- Authorities on Biodiversity (*e.g.*, NatureServe, Infonatura)

Conservation International (CI) data are not broadly applicable in Canada; CI's focus is on global biodiversity 'hotspots' which are generally clustered in tropical and southern temperate regions. To qualify as a CI hotspot, a region must have lost at least 70 percent of its original vegetation due to the impact of human activities and hold at least 1,500 endemic plant species.

WWF's Terrestrial Ecoregions of North America (Ricketts *et al.* 1999) addresses conservation elements on a broad, continental scale. Similarly, national vegetation surveys and maps are also drawn on a

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Figure 8.1 Ranked areal extent of Enduring Features within the study area, with the rarest quartile highlighted.

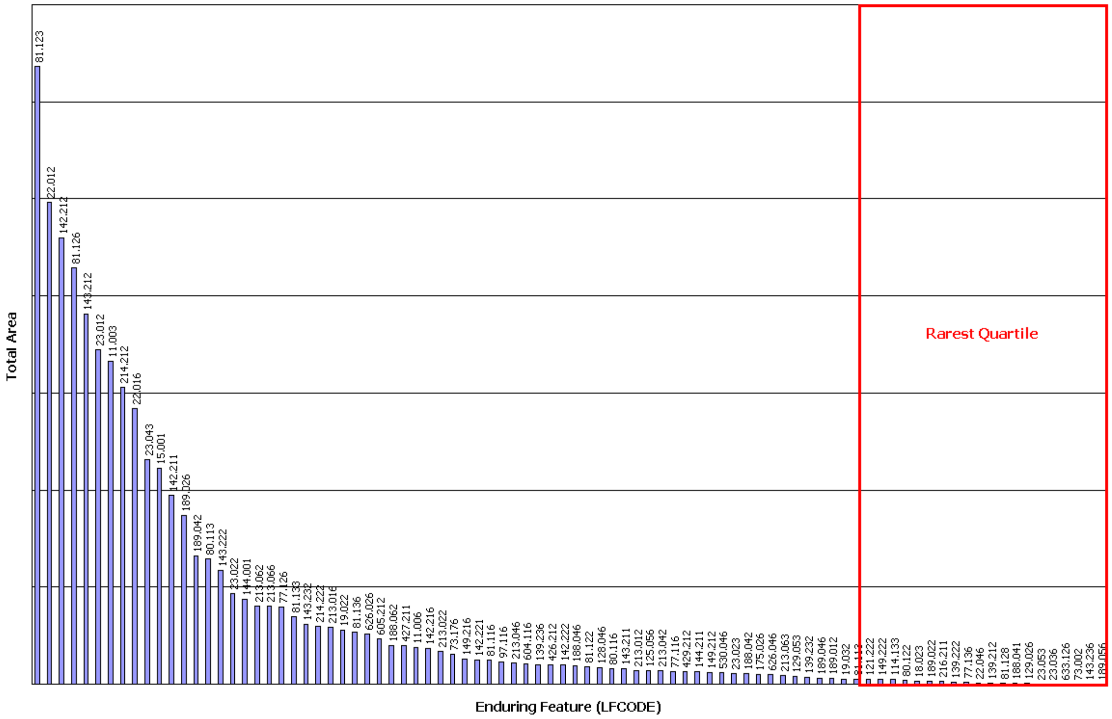
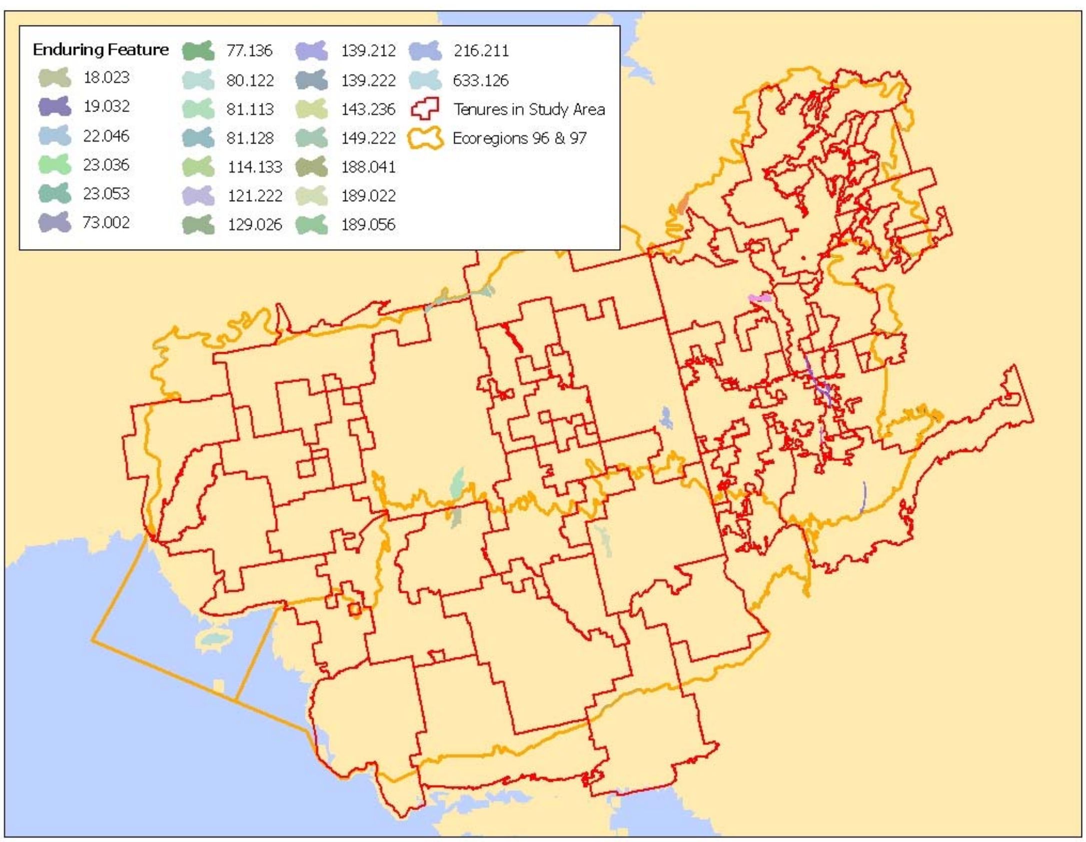


Figure 8.2 Distribution of the rarest quartile as identified in Figure 8.1) of Enduring Features within the study area.



continental scale. We suggest using these documents as part of a first step to flag obvious rare ecosystems.

Authorities on biodiversity, such as NatureServe and Infonatura, coordinate and catalogue regional information from the Conservation Data Centers (CDC), Natural Heritage Information Centers (NHIC) and Natural Heritage Data Centers (NHDC) across Canada. These are all good sources of regional or medium filter information. Fine filter information is most often available through local research institutions and thorough regional studies.

Additional data sources that would be relevant to addressing the issue of rare ecosystems include:

- Provincial ecosite or ecosystem inventories
  - Ontario MNR NEFEC Inventory
  - BC Sensitive Ecosystem Inventories
- Provincial CDC, NHIC, NHDC
- Regional sources:
  - Alberta: Timoney 2003, Archibald *et al.* 1996, Beckingham and Archibald 1996, Beckingham *et al.* 1996, Plant community tracking list (http://www.cd.gov.ab.ca/preserving/parks/anhic/plantcomm.asp)
  - Saskatchewan: Beckingham *et al.* 1999
  - Ontario: OMNR Landform Vegetation dataset, NOEGTS dataset (1:100,000 scale; intended for engineering use, but broad descriptive database may be useful element of a predictive model)
  - Manitoba: Zoladeski *et al.* 1995
- WWF Enduring Features dataset (1:1,000,000 scale; provides information on physiographic features, geology and soils)
- Global Land Cover 2000 or USGS Global Seasonal Land Cover data set (very coarse scale remotely-sensed land cover datasets; USGS dataset contains some erroneous species compositions, such as western Hemlock in Northeastern Ontario, but the data is still of utility to assess the distribution of community types across large geographic areas).

ADDITIONAL GUIDANCE

Are unique physiographic features or rare geologic formations or soils present within the FMA or region?

In areas where a classification of rare ecosystem types is not available or not available at a fine enough scale, identifying what factors contribute to making ecosystem types rare may help with identifying their occurrence on the ground. Species are sometimes rare due to similarly rare ecosystem parameters (Rabinowitz 1981; Rabinowitz *et al.* 1986) therefore identifying occurrences of rare species and/or rare species habitat (HCV 1), if available, may point to rare ecosystems.

Figure 8.3 Distribution of aeolian deposits within the entire study area based on the Northern Ontario Engineering Geology Terrain Studies dataset.

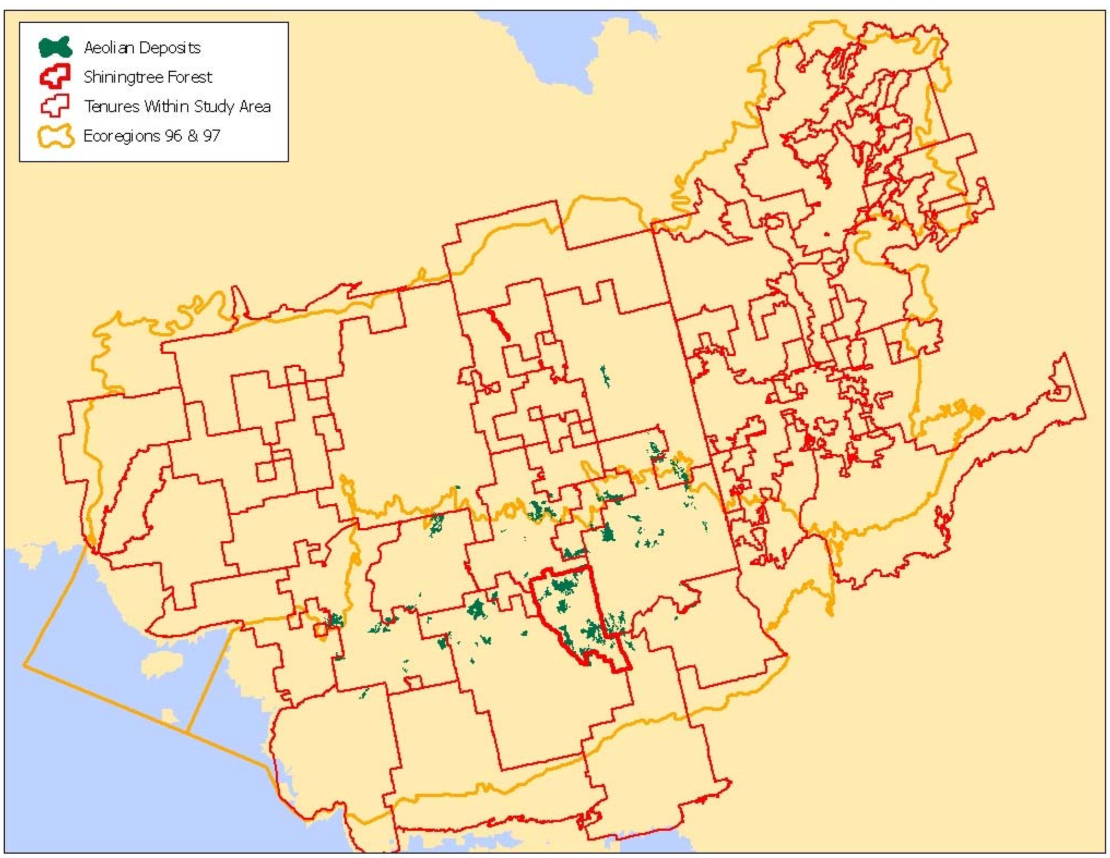


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Figure 8.4 Decision matrix illustratingthe proportion of rare ecosystems to be captured in HCVF zones, based on their regional and local levels of rarity.

		Regional	
		Rare	*Common*
Local	*Rare*	**100 %**	***n*** **%**
	Common	***n*** **%**	**N/A**

Narrow ecosystem parameters, such as small geological formations (*e.g.*, isolated limestone outcrops), unique physiographic features (*e.g.*, sand dunes), or rare soil types (*e.g.*, serpentine soils) often host rare ecosystem types. Therefore, identifying any such parameters may help in locating rare ecosystem types.

One analytical approach to addressing this question is to examine the frequency distributions of various mappable ecological parameters and focus investigations on the "tail", or rarest quartile of the distribution. A related approach is to model or predict ecosites through mapping biotic and abiotic inventory data (for example, by ecodistrict at 1:20,000 to 1:100,000 scales). This mapping can then be used as a base to conduct a similar analysis of rarity.

Figure 8.1 illustrates the ranked abundance of Enduring Features (physiographic features based on 1:1,000,000 scale soils data) in the study area. Mapping the rarest quartile of the distribution creates a coarse filter pass of sites potentially hosting rare ecosystems (Figure 8.2). The rarest quartile was identified in this example simply to select the less common potential community types. Focusing in on these rare physiographic types, finer scale data can then be assessed to determine their distribution more precisely and investigate the potential community types they support.

For example, aeolian deposits fall within the rarest quartile of the Enduring Feature frequency distribution, and are represented by a single occurrence in the Pineland Forest (Figure 8.2). Aeolian deposits have the potential to support rare vegetative communities (the Natural Heritage Information Centre in Ontario tracks several dune communities), and can be highly sensitive to disturbance. Further investigation with a finer scale dataset (NOEGTS, 1:100,000 scale landform and geology data) reveals a somewhat wider, significantly clustered distribution of landforms that are dominated by aeolian deposits (Figure 8.3).

This patchy distribution results in these deposits being locally common in some tenures, but locally rare or absent from others. It is precisely this pattern that a multi-scaled line of investigation can detect. From a tenure-level analysis alone (Figure 8.5), these landforms (and their potentially supported ecosystems) appear to be widespread. Scaling the analysis up to encompass the entire study area, we note the concentration of these deposits in and around the tenure, and the general paucity of this landform in the wider region (Figure 8.3).

Given the patchy distribution throughout the region, it is recommended that all isolated occurrences of aeolian deposits be considered as possible HCVFs. In larger clusters of occurrences however (*e.g.* the Shining Tree forest illustrated in Figure 8.5), some proportion of the aeolian deposits should be identified as possible HCVFs. The subsequent investigation should attempt to determine what proportion and which occurrences.

These questions can be addressed in a general way by a comparison of the distributions at the regional and local scales. This decision matrix is illustrated in Figure 8.4. If the HCV in question is rare at both the regional and local scales, all occurrences of the value should be captured in HCVF zones. If the value is common at both the regional and local scales, the value would not qualify as a HCV and there is no requirement for any of it to be represented in HCVF zones.

The remaining two options, regionally rare but locally common (*e.g.* the aeolian deposit example above) and locally rare but regionally common, both need capture only a proportion (*n*) of the occurrences in HCVF zones. That being said, the functional requirements of many species and communities demand larger areas of clustered habitat. A greater proportion or more

Figure 8.5 Distribution of aeolian deposits within Shiningtree Forest based on the Northern Ontario Engineering Geology Terrain Studies dataset.

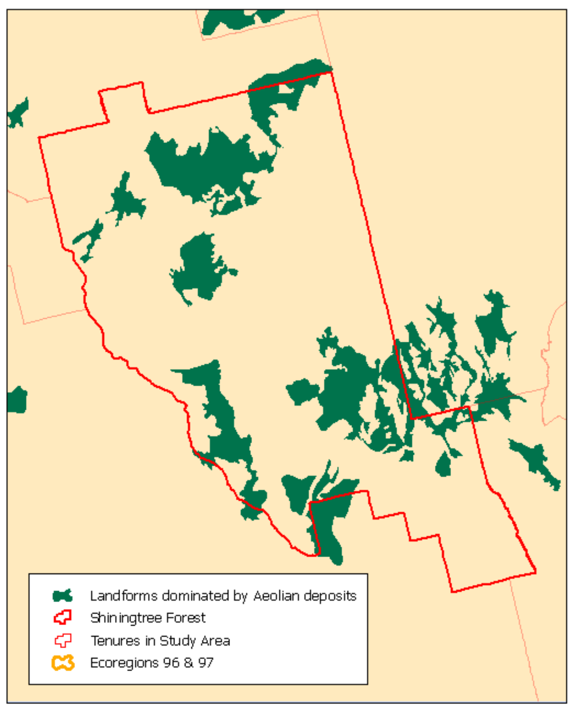
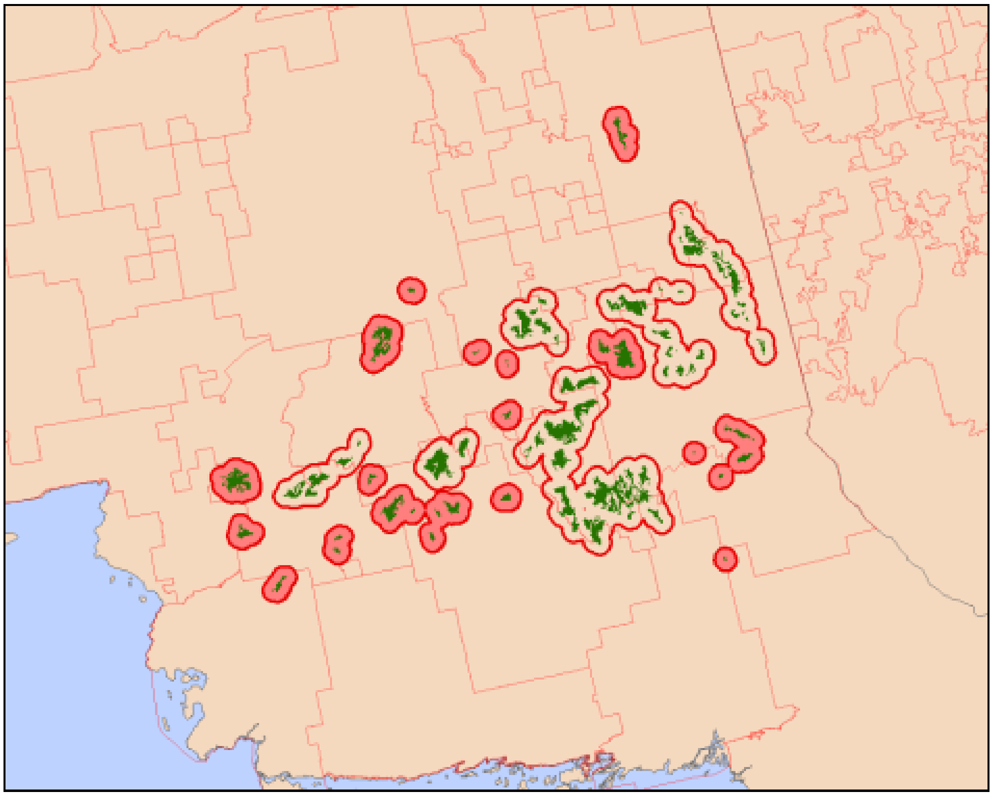


Figure 8.6 Distribution of aeolian deposits shown in green. Clusters of deposits are outlined in red; clusters which constitute "locally rare" occurrences are outlined and shaded red. Individual occurrences were amalgamated into clusters if their nearest neighbouring occurence was less than the average nearest neighbour distance for the entire distribution.



clustered selection of these community types might be identified than others. Furthermore, additional conservation attributes will likely need to be associated with locally rare, but regionally common habitat types to be verified as HCVs.

The delineation of when a value is "locally rare" or "locally common" can be subjective. Figure 8.6 illustrates a potential analysis aimed at making this decision somewhat more objective. In this figure, clusters of deposits were identified by grouping all occurrences that were separated by less than the average nearest-neighbour distance of the entire distribution. The size of these clusters was then assessed against the total size of the distribution. If a cluster was found to contain less than 5% of the area of the total distribution, then it was categorized as locally rare and, as per Figure 8.4, would be targeted for 100% representation in an HCVF zone given that this is a regionally rare HCV. Clusters containing greater than 5% of the area of the total distribution were categorized as locally common, and would be targeted for proportional representation in HCVF zones.

The actual proportion that should be designated as HCVF (denoted as *n* in Figure 8.4) and which individual occurrences should be designated would be determined through consideration of the overall rarity of the value in the landscape, the geographic distribution of the patches, and indicators of patch quality. The spatial clustering of values highlighted by Question 19 can also be helpful in determining which occurrences should be classified as HCV.

Are there ecosystems that have been classified as rare by a relevant regional or provincial organization?

The Conservation Data Centers, Natural Heritage Information Centers and Natural Heritage Data Centers throughout Canada work primarily within provincial boundaries, and in some cases may be the best source of information on rare ecosystem types. Where possible, these communities should be mapped, either directly where relevant data can be brought to bear, or via proxy data.

For example, the Natural Heritage Information Centre in Ontario lists "Dry Red Pine-White Pine Coniferous Forest Type" as S4, G3/G4 can be mapped directly from Forest Resource Inventory data by querying for Pw/Pr Standard Forest Units.

Are rare species or community associations present within the FMA or region?

Clusters of rare species or community types can be indicators of rare, unique or diverse ecosystems. These systems will likely also be flagged through an overlapping values analysis of the type required for Question 19.

Related HCVF Questions and areas of possible overlap

- Question 1 – rare species may occur within rare ecosystem types.
- Question 5 – concentrations of species at the range edge could signify the presence of regionally rare ecosystem types.
- Question 6 – representation in conservation /protected areas network

SUMMARY OF RECOMMENDATIONS

- Identify rare ecosystem types by developing proxies using multiple data sources (*e.g.*, physiographic features, soils, rare geologic formations) at varied scales.
- Spatially assess occurrences of rare ecosystem,
- species and community types across scales.

LITERATURE CITED

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METHODOLOGY

Figure 8.1 and Table 8.1

Sources

- World Wildlife Fund Canada. Enduring Features for Ontario and Quebec. 1:1,000,000.
- Global Forest Watch Canada. Forest Tenures in Canada.
- Environment Canada & Agriculture Canada. Terrestrial Ecoregions of Canada.

Methodology

- The Enduring Features datasets for Ontario and Quebec were merged and clipped to the study area (Terrestrial Ecoregions of Canada 96 and 97)
- The enduring features were grouped by landform code (LFCODE) and were arranged by ranked total area, creating Table 8.1
- The landforms falling in the lowest quartile (22 of 88 unique LFCODEs) with respect to their total area were selected and mapped to created Figure 8.1

Figures 8.2, 8.3

Sources

- Ontario Geological Survey. Digital Northern Ontario Engineering Geology Terrain Studies (NOEGTS). 1:100,000.
- World Wildlife Fund Canada. Enduring Features for Quebec. 1:1,000,000.
- GeoGratis. Surficial Geology of Canada. 1:2,000,000.
- Global Forest Watch Canada. Forest Tenures in Canada.
- Environment Canada & Agriculture Canada. Terrestrial Ecoregions of Canada.

Methodology

- The NOEGTS dataset was clipped to the study area
- All aeolian features were extracted by performing an attribute query to select all landforms coded as "ED"
- As this dataset covers the Ontario portion of the Study Area, the Surficial Geology of Canada and the Enduring Features datasets were used to fill in the Quebec portion. Neither dataset indicated any aeolian features

- Aeolian features were depicted from both a tenure-based perspective, focusing on Shiningtree Forest (Figure 8.3), and a regional perspective, showing the entire Study Area (Figure 8.2)