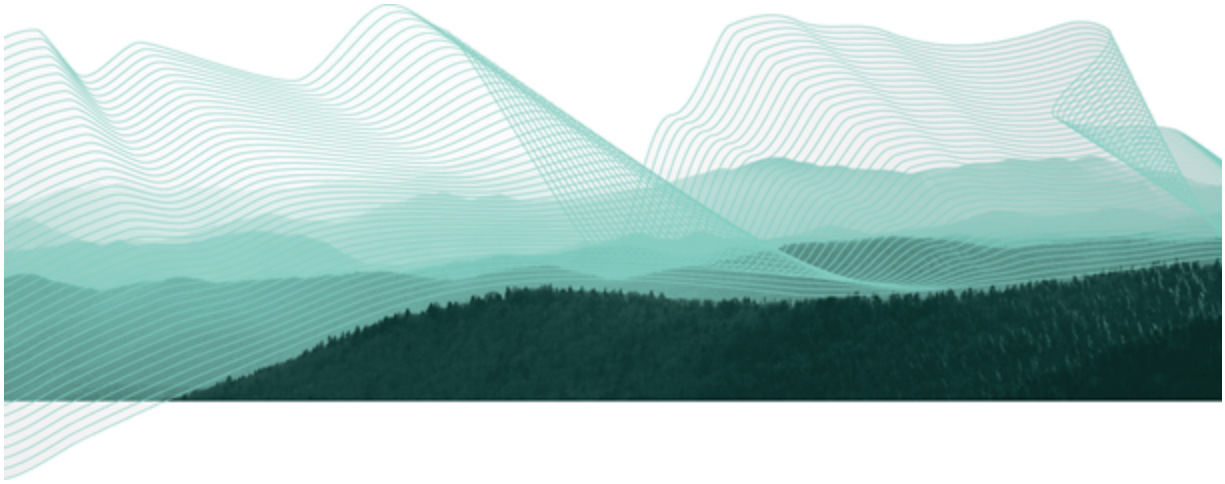

FGP Quality of Service and Experience: Assessment Report

Version 1.1

Date: 2017-01-11

Prepared by: Refractions Research

Prepared for: Federal Geospatial Platform Initiative,
Earth Sciences Sector, Natural Resource Canada

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1 Approach

1.1 Objective

The objective of this report is to assess Federal Geospatial Platform (FGP) web service quality within the current inventory[1] of FGP web services. It also proposes possible solutions and best practices for web service providers to implement, with the goal of improving user experience when viewing, layering or querying a FGP web service. A technical, hands-on workshop with FGP partners on January 11th, 2017 is scheduled to help solidify the conclusions of this project and to work toward deploying solutions across FGP contributing departments.

The FGP is aimed at a broad spectrum of users:

- Light - little to no familiarity with mapping: some Government of Canada policy analysts, economists, and decision-makers with limited to no GIS experience.
- Moderate - some familiarity or expertise with mapping: Government of Canada data managers and data analysts.
- Heavy - expert in geospatial analysis: Government of Canada GIS/geomatics practitioners, other power users.
- Canadian public - via Open Government (which can includes light, moderate and heavy users).

A particular concern, identified by questions and feedback gathered during demonstrations of the FGP to new user communities, is that Government of Canada “light” users, including policy analysts, economists, and decision-makers, sometimes find geospatial web services and their content difficult to use and understand. This report specifically targets how to make FGP services more effective for light users. However, by better meeting the needs of this group, the quality and usability of FGP web services will increase and, consequently, the needs of other groups will be better met as well.

1.2 Methodology

The FGP inventory at the time of this review included 265 publicly accessible web services that are reviewed and assessed in this report. In order to guide the assessment, specific criteria were established (see 1.3). Any issues encountered while examining the data that are considered as unusual or unaccounted for in the specified criteria were noted in a comments column in the assessment spreadsheet.

In order to optimize the assessment process, a spreadsheet was built identifying all of the services and all of the criteria. A script was used to harvest a few key metadata fields from each record in the catalogue, specifically:

[1] Current inventory published to FGP external catalogue as of November 2016.

- UUID
- Title
- Organization
- Topic Category
- WMS URL
- ESRI REST URL

The service UUID was used to create a link directly to the catalog page and a second link to open the service as a layer in the RAMP viewer. For the purposes of this assessment, the RAMP viewer was the primary interface used to view and interact with the web services. Other web service clients, including ESRI ArcMap and QGIS, were also used for a few cases to provide further context.

The assessments have been made by personnel at Refractions who are familiar with a host of services provided by government, NGO, and private sector organizations. So although the assessments are qualitative and subjective in nature, they clearly have merit, as do the recommendations that follow.

1.3 Criteria

The criteria were divided into three sections: Service Description, Service Quality Indicators, and Informed Opinion. This high-level breakdown was defined by the project authority at Natural Resources Canada (NRCan). Refractions and NRCan collaboratively defined the entries in each section listed and defined below. The criteria and their definitions are contained in the tables below.

1.3.1 Service Description

The following six criteria can be used to characterize the service in the context of an inventory of services. They are not used as the basis of establishing service quality.

Service Type	Definition Two web service types are recognized, OGC's WMS and ESRI REST, giving three options: ● WMS ● ESRI REST ● WMS and ESRI REST Rationale To determine the relative commonality of support for the different service types among the FGP services. Note that this criteria was harvested programmatically from the resource listing on the catalog page and required that one of the terms "ESRI REST" or "WMS" was present in either the Resource name, Resource Type, or Format field of the resource. In some cases valid service

<table>
<tr><td></td><td>urls may have been missed due to non-standard categorization of the resource (eg. Format=Other).</td></tr>
<tr><td>Feature Geometry</td><td><u>Definition</u>
The geometry type of the features in the layer, or raster:
Point
Line
Polygon
Mixed vector
Raster
<u>Rationale</u>
To determine the relative commonality of the different types of geometric representations among the FGP services.</td></tr>
<tr><td>Information Level</td><td><u>Definition</u>
Three levels are recognized.
Aggregated - data aggregated from various sources
Processed - generalization or some other form of significant processing carried out
Raw - direct field observations are displayed
<u>Rationale</u>
To determine the relative commonality of different information levels among the FGP services, with the intent being that processed or aggregated data is typically more appropriate for non-expert users.</td></tr>
<tr><td>Dataset Topic Category</td><td><u>Definition</u>
Each service is identified by one or more of the nineteen categories:<table><tr><td>Biota</td><td>Inland Waters</td></tr><tr><td>Boundaries</td><td>Intelligence, Military</td></tr><tr><td>Climatology, Meteorology, Atmosphere</td><td>Location</td></tr><tr><td>Economy</td><td>Oceans</td></tr><tr><td>Elevation</td><td>Planning Cadastre</td></tr><tr><td>Environment</td><td>Society</td></tr><tr><td>Farming</td><td>Structure</td></tr><tr><td>Geoscientific Information</td><td>Transportation</td></tr><tr><td>Health</td><td>Utilities, Communication</td></tr><tr><td>Imagery, Base Maps, Earth Cover</td><td></td></tr></table>Combinations also exist, where a service is placed into two or</td></tr>
</table>

<table>
<tr><td></td><td>more categories.

<u>Rationale</u>
To determine the relative commonality of different topic categories among the FGP services.</td></tr>
<tr><td>Organization</td><td><u>Definition</u>
The web services investigated are provided by the following organizations:

<table><tr><td>Agriculture and Agri-Food Canada</td></tr><tr><td>Canadian Northern Economic Development Agency</td></tr><tr><td>Elections Canada</td></tr><tr><td>Environment and Climate Change Canada</td></tr><tr><td>Fisheries and Oceans Canada</td></tr><tr><td>Indigenous and Northern Affairs Canada</td></tr><tr><td>Natural Resources Canada</td></tr><tr><td>Parks Canada</td></tr><tr><td>Transport Canada</td></tr></table>
<u>Rationale</u>
To determine how many services are provided by each organization.</td></tr>
<tr><td>Series</td><td><u>Definition</u>
A series is defined as a set of two or more services sharing a descriptor in their titles which indicated that the data was describing related features or was produced by the same study or program.

<u>Rationale</u>
An initial survey of the services made it clear that there were many services which were related to each other. In order to understand the scope of these “series” relationships, the service titles were all reviewed and any “series name” was extracted into a separate field, which was used to determine the number and sizes of such series.</td></tr>
</table>

1.3.2 Service Quality Indicators

The fifteen criteria described below are all aimed at assessing the quality of a web service in terms of the degree to which it conveys clearly understood information to the user. As noted

earlier, the user is assumed to be a non-expert, but in most cases the criteria are equally valid for all classes of users.

Title - Standards Conformance	Definition In the document “Data Management and Stewardship Policies and Procedures – Data Structure” standards are specified for “Naming Conventions”. Two assessments of the title are as follows: ● Conforms to FGP naming convention standard ● Does not conform to FGP naming convention standard Rationale To determine the level of conformance to the standard, and also helping to evaluate the effectiveness of the standard itself.
Title - Meaningfulness	Definition How meaningful a title is assessed to be is evaluated against the following categories: ● Meaningful; Informative and clearly indicates content ● Less meaningful; somewhat ambivalent; some use of jargon (overly technical, esoteric or organization-specific terms) or acronyms; could be improved ● Not meaningful; insufficient to convey content; use of jargon (overly technical, esoteric or organization-specific terms) or acronyms; vague; missing information Rationale The title may be the only information a user makes use of in order to determine whether a service is appropriate for their task. It is important to convey as much meaning as possible in a relatively short title.
Consistency between Title and Map Content	Definition This criterion is used to assess the degree to which the title and map content are consistent with one another. A simple three category evaluation is used: ● Map displays what title states ● Some inconsistency between what map displays and what title states ● Mismatch between map and title Rationale To identify services which may have been misnamed in error or otherwise.

Legend Appearance	Definition The appearance of a legend includes the legibility of any symbols used, the legibility of the explanatory text, the three values are as follows: ● Clearly legible ● Poor legibility ● Missing Rationale An initial survey of services identified that some services provided legend images that were difficult to read. The intent was to determine the extent of this problem.
Legend Content	Definition The degree to which the legend conveys meaningful content is assessed against four categories: ● Not applicable, a legend is not provided (in some cases because it is not necessary, eg. satellite imagery) ● Meaningful; provides sufficient detail to allow user to easily and immediately understand map display ● Less meaningful - lacks some context, could be improved by adding units of measure, other information, but still allows for some comprehension of content ● Not meaningful; a user must seek further information to understand content of legend Rationale To evaluate the actual content of the legend, regardless of its legibility (evaluated above). Is there an appropriate number of categories and is it clear what each of them mean?
Feature Attribution	Definition The number and relevance of the attributes provided for each feature. ● Not applicable, no attributes (typically a raster service) ● Sufficient attribution; attributes of essential interest to the dataset are included ● Minimal attribution; sparse information; could be improved ● Excessive attribution; contains unnecessary content Rationale To identify outlying cases of excessive or insufficient attribution.
Feature Attribute Names	Definition The understandability of the attribute names themselves.

	● Not applicable, no attributes (typically a raster service) ● Meaningful; informative and clearly identifies attribute ● Less meaningful; somewhat ambivalent, some use of jargon or acronyms, could be improved ● Not meaningful; insufficient to convey meaning of attribute; use of jargon (overly technical, esoteric or organization-specific terms) or acronyms; vague, missing information Rationale To identify issues with the naming of attributes.
Feature Attribute Completeness	Definition The completeness of attribute values. ● Not applicable, no attributes (typically a raster service) ● Appears complete - data not missing ● Does not appear complete - empty fields; should be examined Rationale To identify cases where a service provides attribute(s) that rarely or never have values, possibly due to an error, or otherwise. Only cases of missing attribute values that were apparent from the assessment of the attribute values themselves have been identified. A thorough review of all features in all services is out of the scope of this assessment.
Feature Attribute Values	Definition The understandability of the attribute values. ● Not applicable, no attributes (typically a raster service) ● Conveys information/meaning effectively ● Does not convey information/meaning effectively (excessive precision, code given but unclear as to what it means, vague); should be examine Rationale To identify issues with understanding the meaning of attribute values, as they are important for analysis of the data.
Map Visualization	Definition An overall measure of the quality and understandability of the map. ● Clearly rendered map; quality of visualization is high, quickly and easily understood at appropriate scale

	● Poorly rendered map; quality of visualization is lacking; not easy to view or understand at appropriate scale Rationale To identify any of various issues that make it difficult to interpret the map. These include potential technical issues to do with re-projection or rendering, as well as issues with the data representation and cartography.
Map Cartography	Definition How well colour and symbols (if used) are used to add information and clarity to the map. ● Use of colour/colour ramp and symbols effective ● Use of colour/symbols less effective, could be improved ● Poor or ineffective use of colour/colour ramp or symbols, should be improved Rationale To identify cases where the use of colour could or should be improved to enhance the usability of the service. While this assessment is somewhat subjective, some colours are objectively poor when displayed against the default basemap provided in the RAMP viewer.
Map Scaling - Consistency	Definition Whether or not the data is consistent at different zoom levels. ● Consistent between scales; no rendering issues when zooming ● Inconsistencies apparent between scales; missing areas, jumbled areas, etc. Rationale To identify services where, due to technical reasons or other, only a semi-random subset of the data is displayed at smaller zoom levels, while displaying more or all of the data at larger zooms. This can cause confusion for a user who doesn't understand why it might be happening.
Map Scaling Visibility	Definition Whether or not the data is scale-dependent, as apparent from viewing the data in the RAMP viewer. ● Can be viewed at all zoom levels ● Cannot be viewed at all zoom levels; i.e., scale dependencies exist Rationale

	To identify layers which have scale dependencies, as they can be more difficult for users to make use of or understand.
Supporting Docs	Definition The availability and understandability of supporting documentation for the service. ● Available; complete and easy to understand ● Available, incomplete or difficult to understand ● Broken link ● No supporting docs Rationale To identify missing or broken links, or a lack of supporting documentation for a service. Note that the supporting document(s) were only given cursory viewing; only in cases of complete jargon or otherwise expert-only readability were they assessed to be difficult to understand. A complete review of the supporting documentation is out of the scope of this assessment.
Service Metadata	Definition The service abstract and other information made available from the “Metadata” link displayed in the ramp viewer. ● Available and easy to understand ● Available, not easily understood or not meaningful ● Does not exist Rationale To determine the extent to which the metadata abstract is used to good effect. The service abstract is the most accessible description of the service’s data. It can provide some explanation of otherwise complex or technical data and/or provide insight into the methodology of the creation or capture of the data.

1.3.3 Informed Opinion

Three high-level criteria are included that provide subjective measures of the overall quality of the web services. These are described in the table below.

Loading / Response Time	Definition This criterion refers to how quickly the service performs. Normal means that it either loaded immediately or quickly by requesting a reload. Frustrating implies that a number of tries were required or that the response time appeared excessive. Failed to load means the service would not load, regardless of multiple attempts and long wait times. ● Normal ● Frustrating ● Failed to load Rationale To identify services where the response time caused problems in using the service. While this might seem to be subjective, the difference in usability between the “slowest” service assessed as normal and the “fastest/best” service assessed as frustrating was quite significant; the frustrating cases were all clear outliers. A complete performance review of the services is not in the scope of this assessment. Additionally it should be noted that performance issues specific to the RAMP viewer and not the services themselves were not intended to affect this assessment.
User Level Suitability	Definition Suitable simply means easy to understand, not-confusing. It does not imply that the service cannot be improved or that it cannot be made easier to use. Users are placed into just two categories, a contraction of the four classes defined in Section 1.1. ● Suitable for a light user, a non-expert ● Suitable only for a moderate to heavy user, an expert Rationale To determine the target audience for the service.
Overall Evaluation of Quality	Definition The services can be compared against one another. Among the best does not mean that it cannot be improved, but it does suggest that it may serve as a worthwhile example. ● Among the best

	• Not among the best Rationale To identify services with little or no usability issues, to potentially serve as positive examples.

2 Assessment

The three subsections that follow describe the findings for six service descriptions, fifteen quality indicators, and three informed opinion criteria. Assessments were made for 265 services. In six cases the service would not load. Consequently most of the assessments were conducted on a sample size of 259.

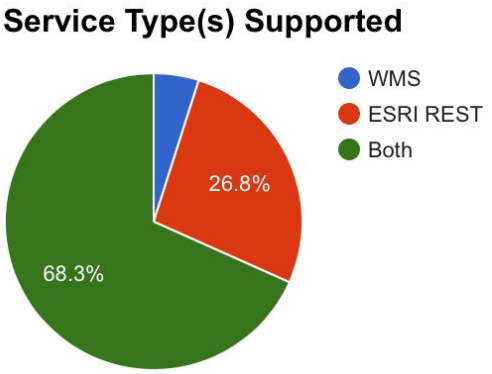
2.1 Examination of Service Descriptions

Basic service descriptions are given in the following four subsections.

2.1.1 Service Type

Sample size: 265

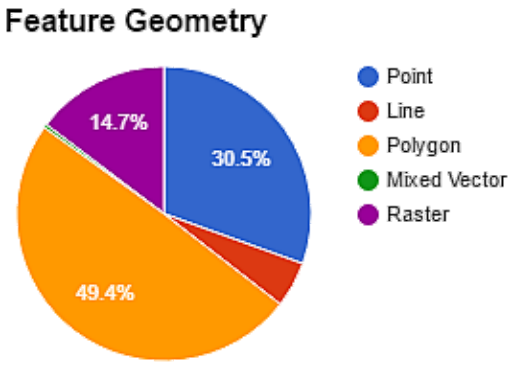
ESRI REST was available for 95% of the services, whereas WMS was offered on 73%. Less than 5% of the services were available only via WMS.



2.1.2 Feature Geometry

Sample size: 259

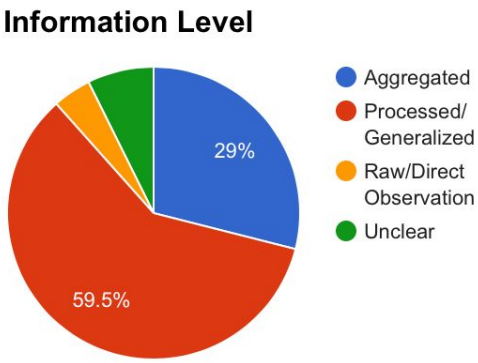
Polygons accounted for nearly half of the services and points a bit less than one-third. Raster was comparatively less common, accounting for roughly one-seventh of the 259 services sampled. The National Hydro Network was the only example showing mixed vector geometry, consisting of polygons and lines.



2.1.3 Information Level

Sample size: 259

The graph shows that only a small percentage (4%) of the services involved raw observations. The survey areas/transects/routes of the various bird surveys account for most of the services assessed as “raw”.



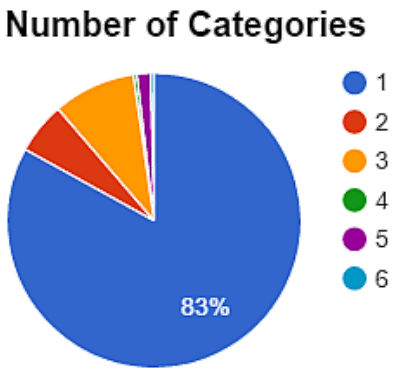
“Polycyclic Aromatic Hydrocarbons - Geographic Distribution of Total Reported ...” is an example of aggregated data, as it is assumed that the data has come from multiple reports. “Spatial Density of Cereals” is an example of processed data; although spatial density is not defined anywhere, the map portrays a generalized set of polygons. Differentiating aggregated from processed/generalized is often not so straightforward. They could be reasonably combined as a single category accounting for nearly 90%.

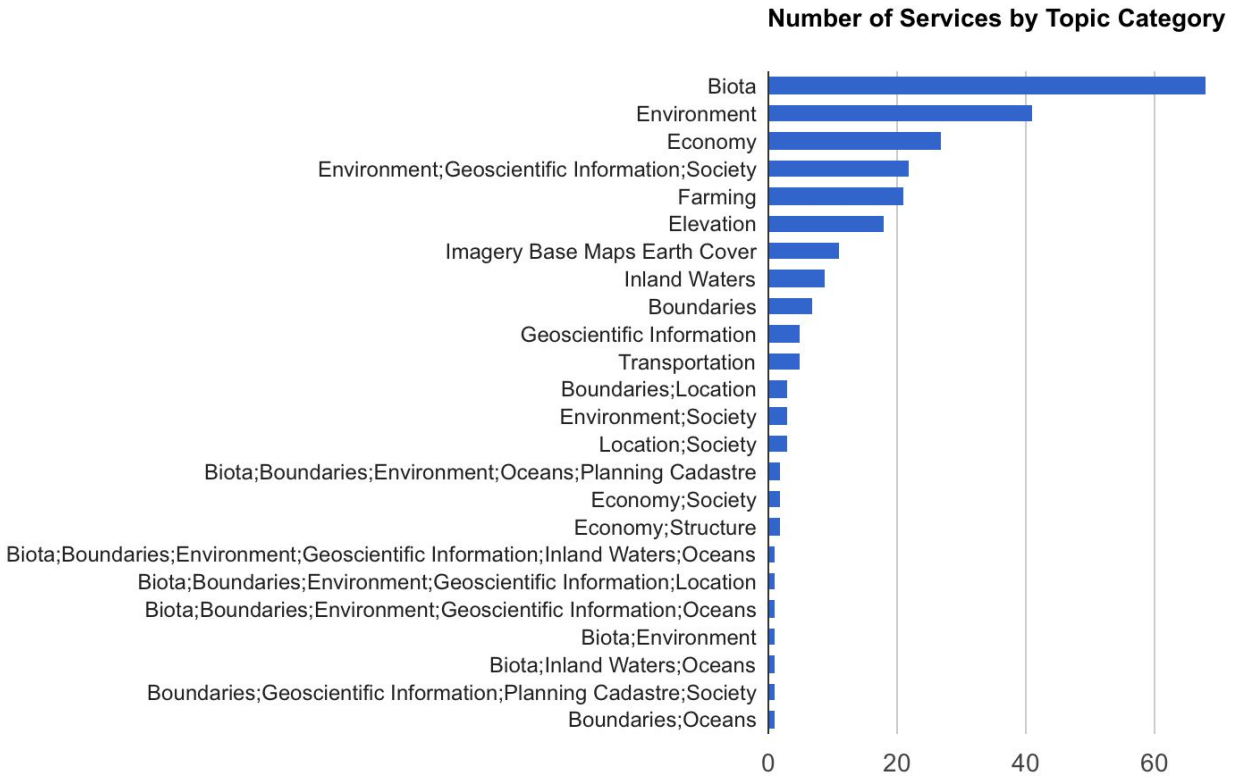
The information level was unclear in about 7% of the cases. However, in most cases it would be reasonable to place the service in either the aggregated or processed/generalized category. “Canadian Road Network - 1:50 000” could be placed in the former, as the data comes from multiple sources, and “Canada’s National Highway System” could fall in the latter, as presumably it is a derivative of the road network. However, the relationship between them is not stated anywhere - neither has a metadata description.

2.1.4 Dataset Topic Category

Sample size: 265

The 19 dataset topic categories found in the study are listed in Section 1.3.1 above. As shown in the pie chart, 83% of the services had only one category listed, whereas 17% were assigned to two to six categories. Biota for example is found in seven groups, one by itself and six others in combination with other categories. This is made clear by looking at the listing on the left side of the bar graph below.The bar graph shows the preponderance of services dealing with biota, environment, and the economy, with geoscientific information, society, farming and elevation being the next best represented categories.

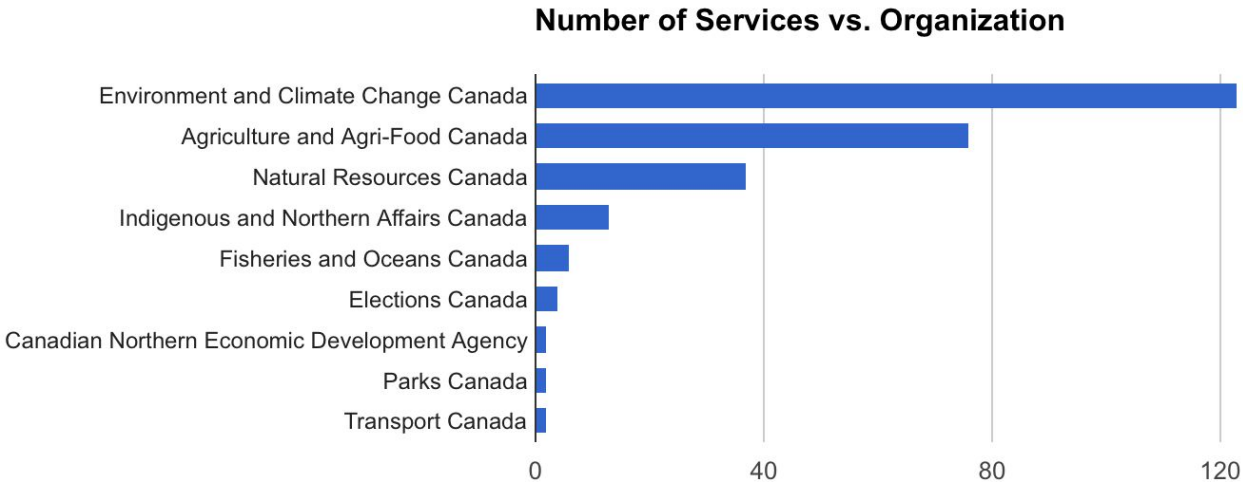




2.1.5 Organization

Sample size: 265

Eight departments and one agency had services included in the study. provided 123, 76 and 37 services, respectively, for a total of 236 out of 265, or 89% of the total number of services

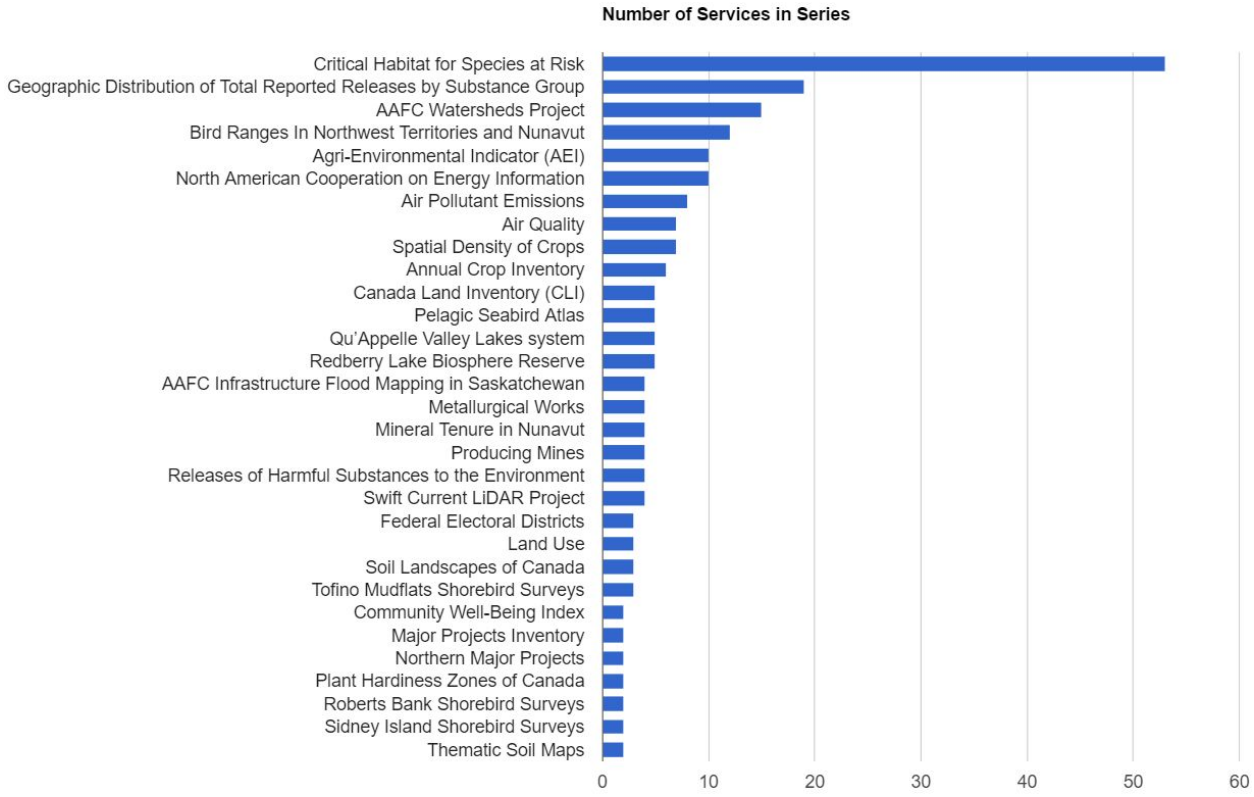


reviewed. The remaining six organizations comprised 11% by comparison.

2.1.6 Series

Sample size: 265

The 31 series found in the study are listed on the side of the bar graph.

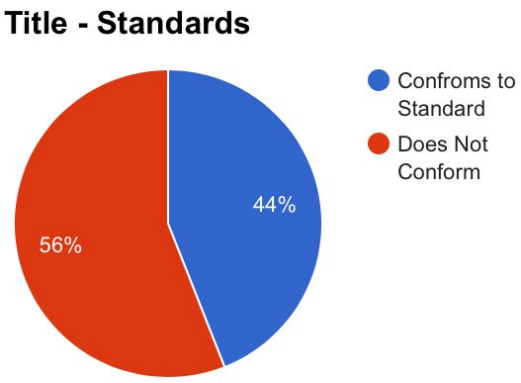


82% of the services fell into the 31 series, whereas 45% of all services were part of the largest six series. The most populous example is the “Critical Habitat for Species at Risk” with 53 members or 20% of all services.

2.2 Examination of Service Quality Indicators

Fifteen service quality indicators were defined. All 259 services that could be accessed were evaluated against these criteria. Details are provided below.

2.2.1 Title - Standards Conformance

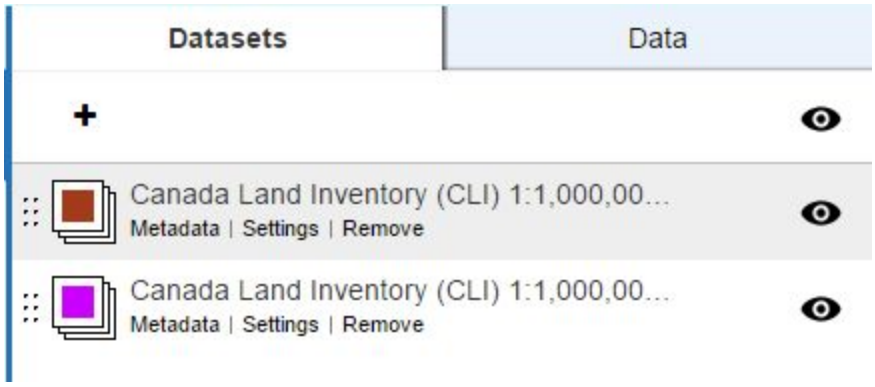


Sample size: 259

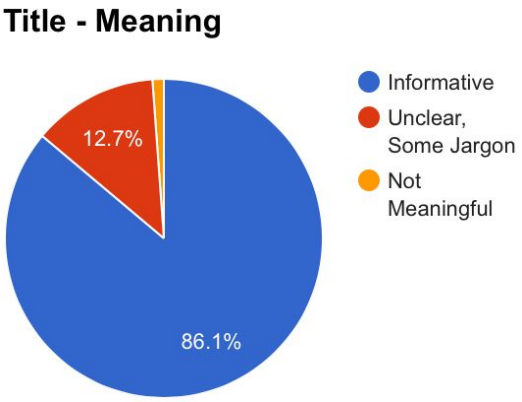
It is clear from the graph that more than half of the titles are not in conformance with the standards as specified by the “Naming Conventions” in the document “Data Management and Stewardship Policies and Procedures – Data Structure”.

An example of a conforming name would be “Greenhouse gas emissions from large facilities, Canada, 2013”. As per the naming conventions, the subject is at the beginning, followed by an optional location, follow by an optional date.

An example of a nonconforming name would be “Canada Land Inventory (CLI) 1:1,000,000 - Land Capability for Agriculture”. In this example, the name of the data series precedes the name of the subject data itself, which can cause the name of the subject to be hidden from view, as in the following example:



2.2.2 Title - Meaning

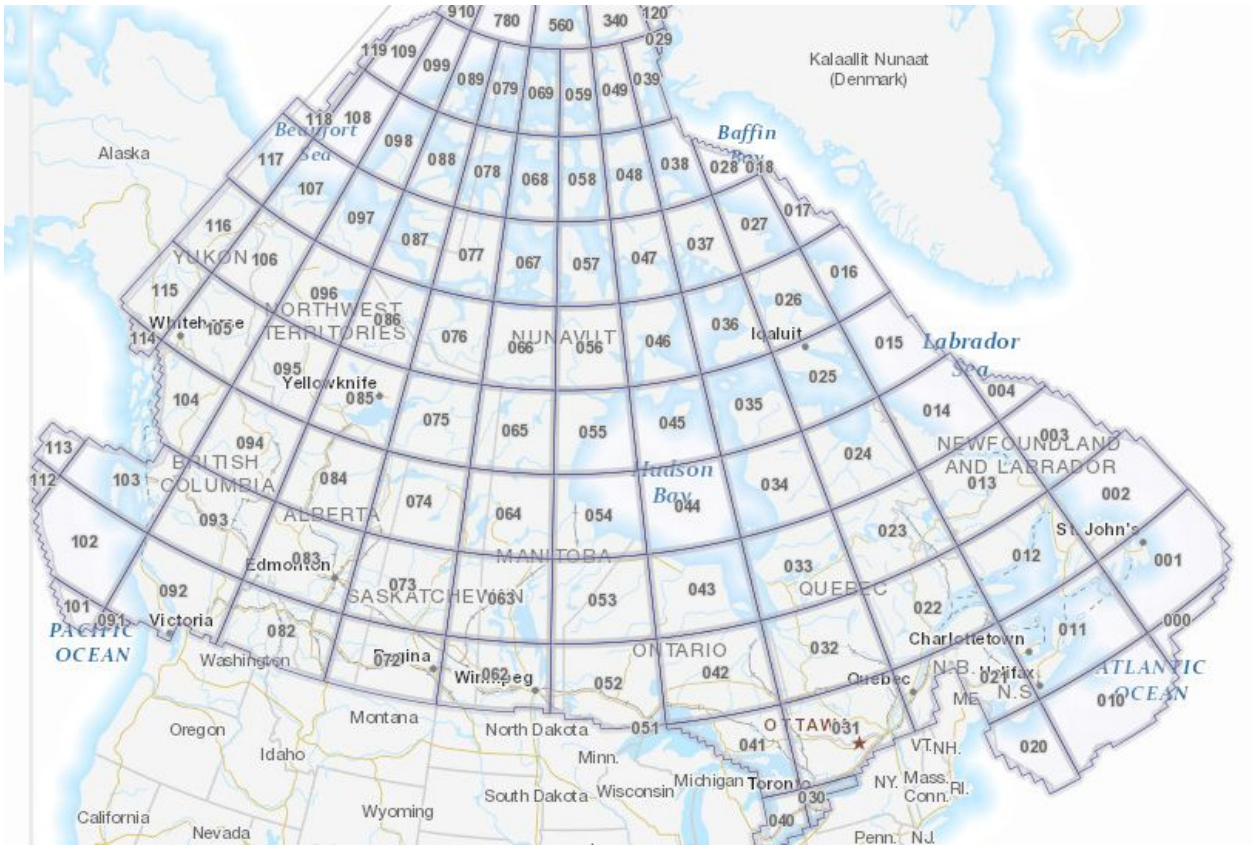


Sample size: 259

Most services were judged to have effective titles. Only three of the titles were assessed as being not meaningful:

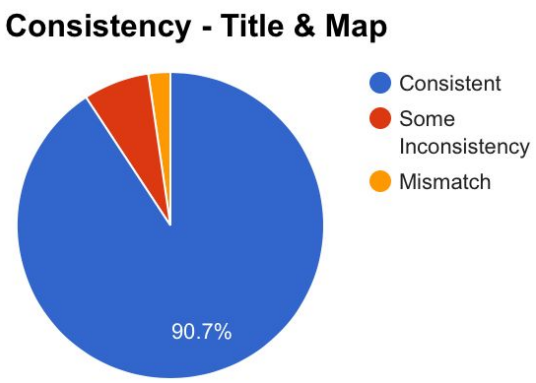
- Critical Habitat of Species at Risk
- Canadian National Topographic System
- Geographic Distribution of NPRI-Reporting Facilities

“Critical Habitat of Species at Risk” is overly general as it is actually a service provided by Fisheries and Oceans Canada that only includes the aquatic species at risk. The “Canadian National Topographic System” service does not need to be identified as Canadian. More importantly the title does not convey that the map (below) shows map indices at three different scales (1:250 000, 1:50 000, and 1:20 000, with the latter two nested separately in the first), but this is evident only if one zooms in. The lack of metadata just adds to the confusion. The current title has insufficient meaning.



The “Geographic Distribution of NPRI-Reporting Facilities” was identified as not meaningful because of the use of the NPRI acronym, with essentially no other information available in the title to help ascertain its meaning. It is explained in the abstract. Nevertheless, the title should be able able to be understood directly.

2.2.3 Consistency between Title and Map Content



Sample size: 259

For more than 90% of the services sampled, the title and the map content were consistent. Of the six services identified as a “mismatch”, four failed to load any data. The remaining two were:

- Canadian Municipal Boundaries
- Canadian National Topographic System

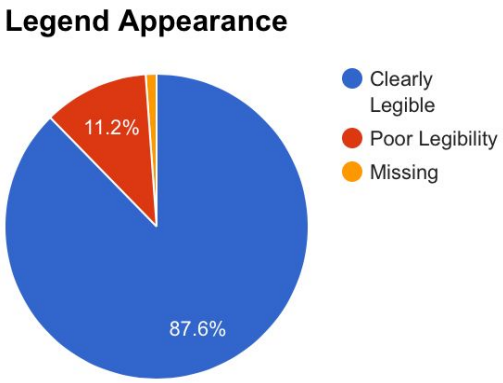
The title “Canadian Municipal Boundaries” is misleading as it is missing four provinces (BC, Alberta, PEI, and Newfoundland and Labrador. As discussed above, the “Canadian National Topographic System” shows the 1:250 000 level index when it opens, but with no indication as to what the system actually entails.

2.2.4 Legend Appearance

Sample size: 259

In most cases the legend was present and clearly legible. Three services provided no legend or had issues with the display of the legend:

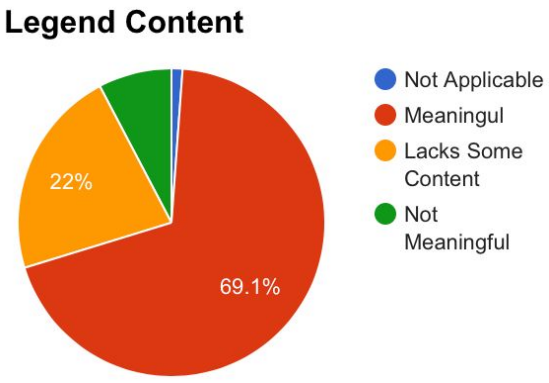
- Canadian National Topographic System
- Geographic Distribution of NPRI-Reporting Facilities
- Landsat 7 Orthorectified Imagery over Canada



The “Canadian National Topographic System” and “Landsat 7 Orthorectified Imagery over Canada” services are raster image services with no need for a legend. The “Geographic Distribution of NPRI-Reporting Facilities” layer does have a legend, but because of its length and a limitation of the RAMP viewer, it is not possible to view the entire legend (the visible portion of which is shown in Section 3.2).

In the more more than 10% of the services where the legend was not clear, the problem was always poor legibility of the text, as shown in the example. As well, some of the colour swatches in the legend are too similar. These colours though reflect what is shown on the map. This issue is considered as part of Map Cartography, which is the subject of Section 2.2.11 below.

2.2.5 Legend Content



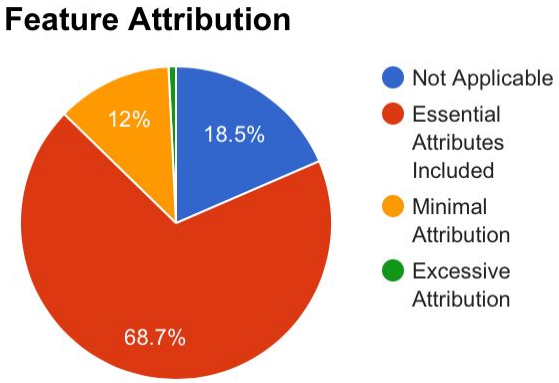
Sample size: 259

In better than two-thirds of the services, the content of the legend was assessed as meaningful. For 20 of them though it was scored as not meaningful and for another 57 it lacked some content.

An example of legend content that was not meaningful is this legend from the “AAFC Infrastructure Flood Mapping in Saskatchewan 20 centimeter colour orthophotos” service:

As an orthophoto service, no legend is really required; there were several other similar examples.

2.2.6 Feature Attribution



Sample size: 259

In about 87% of the cases the feature attribution was either not applicable or considered as including all essential attributes. Two services were identified as having excessive attribution:

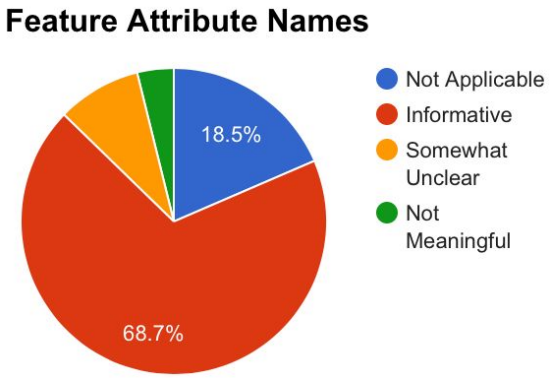
- Liquefied Natural Gas Terminals - North American Cooperation on Energy Information
- Refineries - North American Cooperation on Energy Information

In these services the same information relating to the capacities of the facilities is given in both metric and imperial units. There are several different capacity values given, all duplicated; while this is not really a problem in most cases it could be confusing to an unfamiliar user.

The services assessed to have minimal attribution typically had three to five fields, sometimes duplicated in French, consisting of a numeric identifier, a name, a type, and possibly a single

numeric value. In most cases there are not any particular attributes that are missing or expected - these data are simply intended to have this level of attribution.

2.2.7 Feature Attribute Names



Sample size: 259

For the same 87% of the cases the feature name attributes were either not applicable or assessed as informative. In a small percentage of cases (<4%) the names were assessed as not meaningful.

An example of a service where the feature attribute names were judges to be not meaningful was “Agri-Environmental Indicator (AEI) - Risk of Soil Erosion (SoilERI)”, the result of querying a polygon from this layer can be seen below:

Moderate

OBJECTID	:	1643
RSOILE_CLASS	:	3
RSOILE_CLASS_EN	:	Moderate
RSOILE_CLASS_FR	:	Modéré
YEAR_COLLECTED	:	662688000000
SHAPE_Length	:	96269.76440650193
SHAPE_Area	:	263556999.07472432

On it’s own, “RSOILE_CLASS_EN” is not meaningful to someone not familiar with this data. It is only through the name of service and the value of the attribute that the meaning can be determined.

Several other layers in the “Agri-Environmental Indicator (AEI)” series suffered from similar problems. Another example from the series is discussed in section 2.2.9 below. It includes the attributes names: RWTR_CLFRMRSK_CLASS, RWTR_CLFRMRSK_CLASS_EN and RWTR_CLFRMRSK_CLASS_FR. From the title in this case, it is clear that the middle term is a contraction of Coliform Risk. RWTR is not explained in the title, the metadata, or the data records.

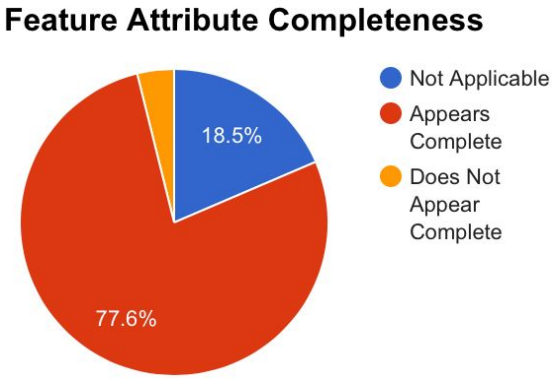
Services assessed as having somewhat unclear attribute names used short words, contractions / abbreviations combined using CamelCase or underscores instead of full words combined with spaces. This reduces the readability to those not familiar with the data and is unnecessary as longer, readable names are supported by the technology and used by the majority of the services. An example of this is the subset of attributes shown to the right, from the “Foothill Sedge (Carex tumulicola) - Critical Habitat for Species at Risk” service.

SciName	:	Carex tumulicola
CommName_E	:	Foothill Sedge
CommName_F	:	Carex tumulicole
Population	:	
SpeciesID	:	1014
SiteID	:	1014_08
SiteName	:	Albert Head
CHApproach	:	
CHMethod	:	
Region	:	
ProvTerr	:	British Columbia
LandTenure	:	
UTMZone	:	10
Easting	:	464458
Northing	:	5359338
Latitude	:	48.386204308
Longitude	:	-123.480057612
Area_ha	:	0.493578011512
Comments	:	
DateEdited	:	
CHStatus	:	Final
CHDetail	:	Detailed Polygon

2.2.8 Feature Attribute Completeness

Sample size: 259

Nearly four out of five of the sampled services included feature attributes that were considered to be complete. For most of the rest the criterion was considered as non applicable. Ten cases warrant examining the attribution to determine if it can be improved.



Metal Shredder

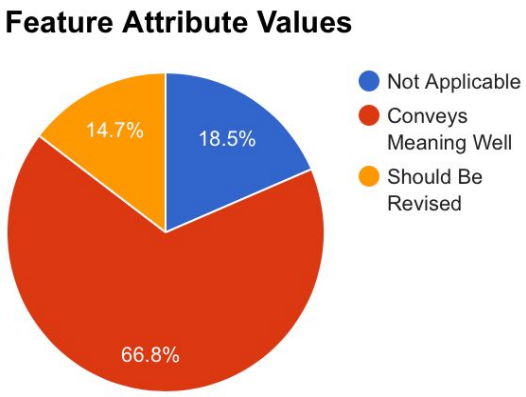
OBJECTID	:	57
OperationType	:	Metal Shredder
Operation_E	:	Kenny/Laval Division
Operator_Owners_E	:	American Iron & Metal Co. Inc.
Facilities_Code_E	:	
Facilities_Code_E_Spelt	:	
City_E	:	Laval
Commodity_Group_E	:	
Commodity_Group_E_Spelt	:	
Commodity_E	:	
Commodity_E_Spelt	:	
Latitude	:	45.6599
Longitude	:	-73.6397
Province_E	:	Quebec

One example of such a case is the “Automobile shredders - Metallurgical Works” service. It has few enough records that it is possible to review all of them and see that a significant number of attributes have no data in any of the records, as can be seen in the one example below:

2.2.9 Feature Attribute Values

Sample size: 259

The vast majority of services had either no attributes or had attribute values that conveyed information effectively. About 15% of the services had some attribute value(s) that could be improved.



An example from the service “Agri-Environmental Indicator (AEI) - Risk of Water Contamination by Coliforms (IROWC-Coliforms)” is given below. In this case, the “YEAR COLLECTED” attribute is given as a Unix epoch timestamp, the number of seconds since January 1, 1970, which will not be meaningful to most people. The values of the “SHAPE_Length” and “SHAPE_Area” attributes are typically automatically created and calculated by software and thus often include without much consideration maximum precision. The long numbers are distracting and difficult to read. The lack of units adds further confusion.

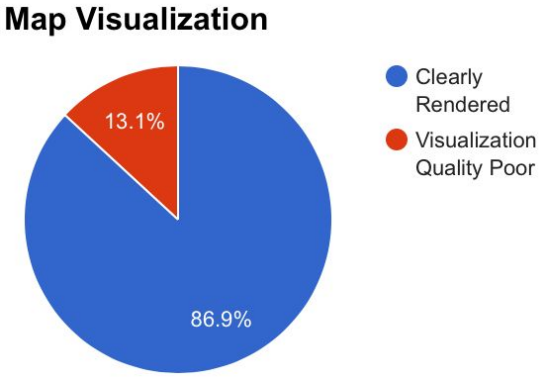
Very High

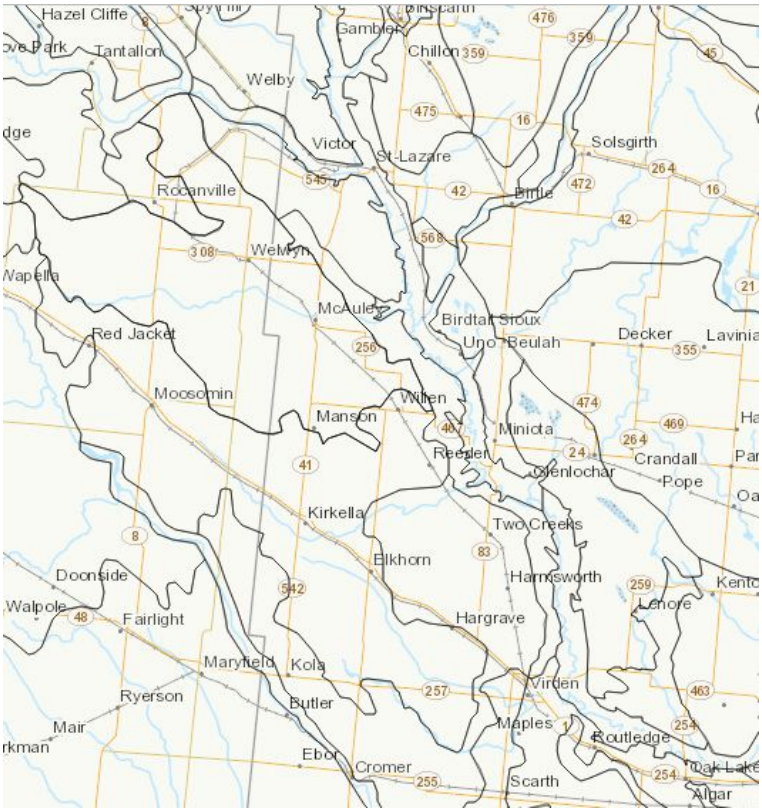
OBJECTID	:	1581
RWTR_CLFRMRSK_CLASS	:	5
RWTR_CLFRMRSK_CLASS_EN	:	Very High
RWTR_CLFRMRSK_CLASS_FR	:	Très élevé
YEAR_COLLECTED	:	1136073600000
SHAPE_Length	:	1080413.5032066654
SHAPE_Area	:	20233561204.327835

2.2.10 Map Visualization

Sample size: 259

87% of services had clear visualization. The remaining thirteen percent could have been better. A common example of poor visualization was complex polygons drawn as outlines only, with no fill, and little or no colour theming.





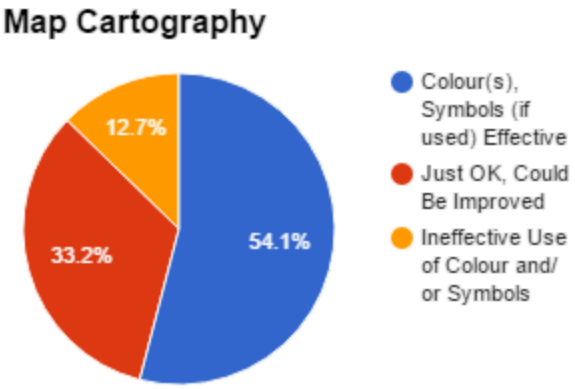
Here is an example from the service “Soil Landscapes of Canada (SLC) derived from V3.1 and V2.2 – Cartographic 1M”:

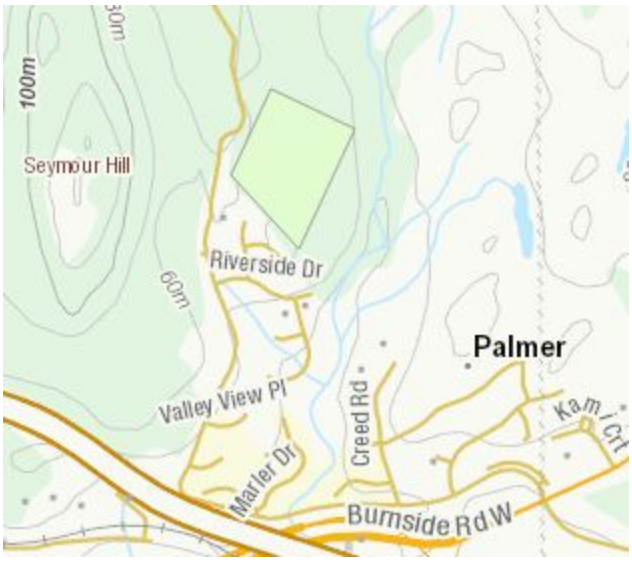
This map could clearly benefit from colour theming based on soil type, or alternatively, polygon labels.

2.2.11 Map Cartography

Sample size: 259

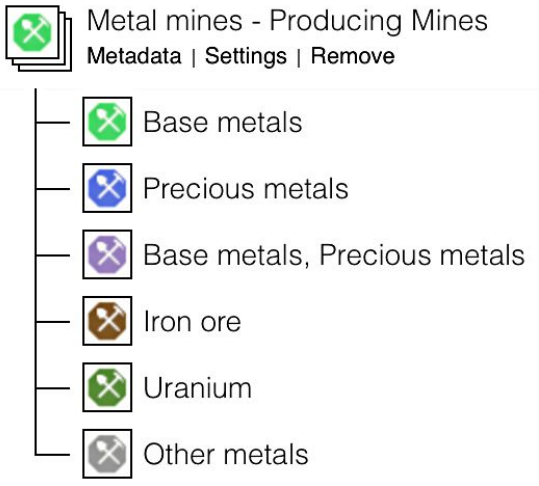
More than half of the services used colour effectively. Nevertheless, that leaves 46% of the services that could or should be improved. One-eighth of the





services were assessed as using colour ineffectively. The simplest and most common problem was using an unsaturated dull or pastel colour that was too similar to the background colours used in the base map. See the example to the left from the service “Brook Spike-primrose (Epilobium torreyi) - Critical Habitat for Species at Risk”:

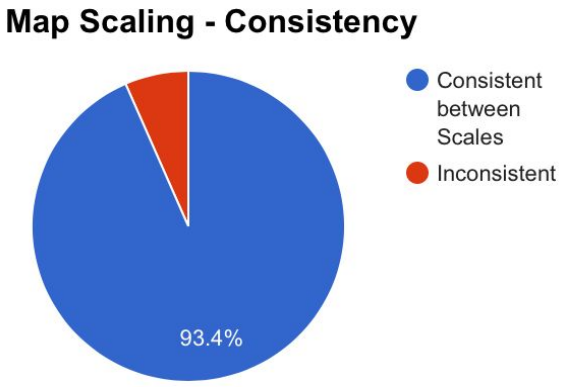
Below is an example of a map with clear symbology (and a clear legend). The symbols contrast well with the background without being overpowering. Arguably though the brown colour used for iron ore is too close to the some of the road colours in the background.



2.2.12 Map Scaling - Consistency

Sample size: 259

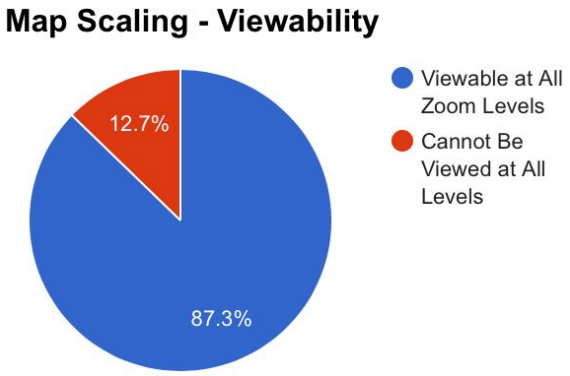
Inconsistent scaling was present in only in 7% of services. The most common reason for this seemed to be that excessive data volumes prevented all of the data from being loaded at lower zoom levels, while at higher zoom levels more or all of the data would load. While this may be caused by technical limitations, there is no explanation given to the user, and it requires significant testing and investigation to understand the nature of the problem.



2.2.13 Map Scaling - Viewability

Sample size: 259

Zooming worked as desired in 87% of the cases. About 13% of the services could not be viewed at some scales. This is typically by intention, and does avoid the problem identified above with inconsistent data at different resolutions, however it does cause difficulty in using the service.



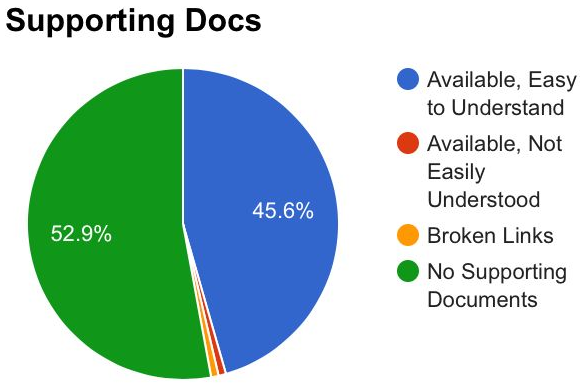
2.2.14 Supporting Docs

Sample size: 259

Broken links were rare, occurring in only two services:

- Oceans Act Marine Protected Areas
- Oceans Act Areas of Interest

These broken links were in the attribute values themselves, apparently intended to link to more information.



There were also two services with supporting docs that were only readable by an expert in the field:

- Protected Areas Indicators – Protected Areas, Canada
- Roberts Bank Shorebird Surveys, British Columbia - Approx. Survey Area

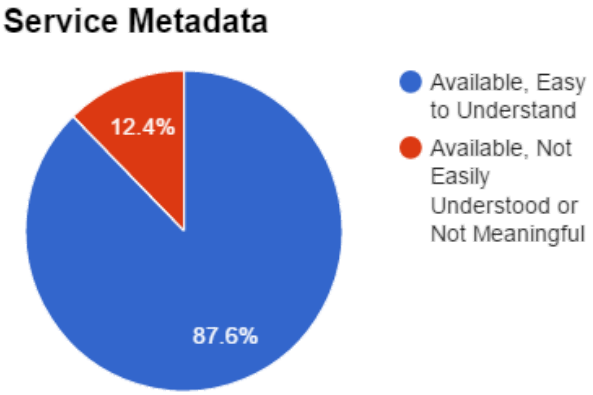
The Data Dictionary file and Data Sources and Methods document provided with these services are filled with technical jargon and would not help a non-expert to understand the data.

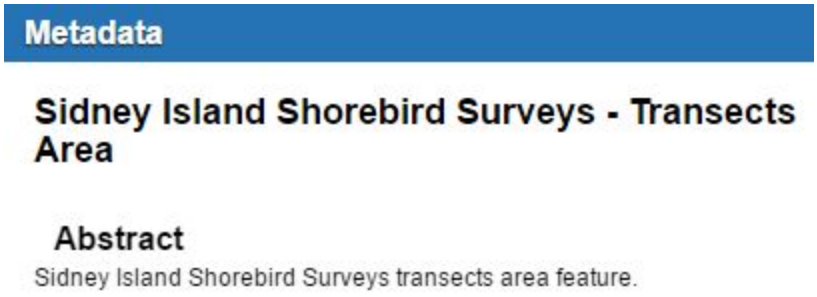
More than half of the services provided no supporting documents at all.

2.2.15 Service Metadata

Sample size: 259

In about 12% of all services the service abstract (as shown when clicking on the “metadata” link in the RAMP viewer) does not provide a meaningful additional description. In some cases the abstract is very short, in others it is full of jargon and disclaimers, and in still others it is overly vague and describes more than the specific dataset. Here is an example of a very short abstract that provides no additional value over the title itself:



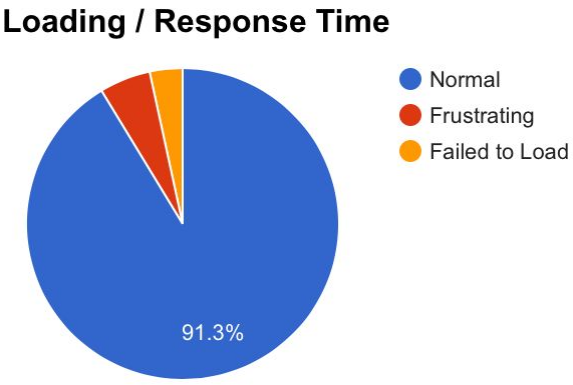


2.3 Examination of Informed Opinion Estimates

Three criteria are included in this section. The first of these is really a performance assessment. The others are particularly meaningful in terms of the overall objectives of this study.

2.3.1 Loading / Response Time

Sample size: 265



More than 90% fell into the normal category. Fourteen cases were judged to be frustrating. In nine cases the service would not load during normal working hours, regardless of multiple attempts and long wait times:

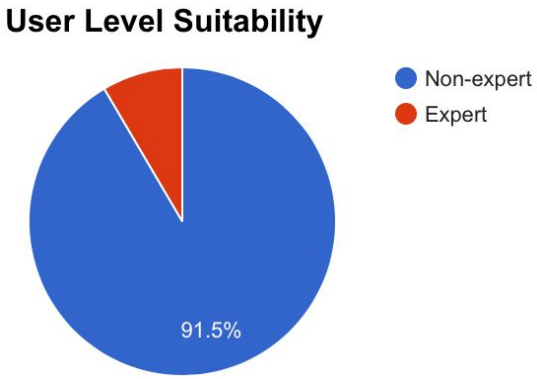
- AAFC Infrastructure Flood Mapping in Saskatchewan - Contours - 50 centimetre
- Redberry Lake Biosphere Reserve – 30 Centimeter Contours
- Swift Current LiDAR Project 2009 – Contours
- Total Gross Drainage Areas of the AAFC Watersheds Project - 2013
- Total Effective Drainage Areas of the AAFC Watersheds Project - 2013
- Areas of Non-Contributing Drainage within Total Gross Drainage Areas of the AAFC Watersheds Project - 2013
- Effective Drainage Area of the AAFC Watersheds Project - 2013
- PFRA Sub-basins of the AAFC Watersheds Project - 2013
- Major Drainage Systems of the AAFC Watersheds Project - 2013

Some of these did load however when attempts were made late at night on another day. “PFRA Sub-basins of the AAFC Watersheds Project - 2013” behaved properly. In the case of “Total Gross Drainage Areas of the AAFC Watersheds Project - 2013” the map eventually displayed but the Data tab never stopped trying to load, while it showed “No data available in table”. With “Total Effective Drainage Areas of the AAFC Watersheds Project - 2013” only the background map showed at night. Some of the services may have trouble loading because of the very large volume of data; however, there may be other explanations.

2.3.2 User Level Suitability

Sample size: 259

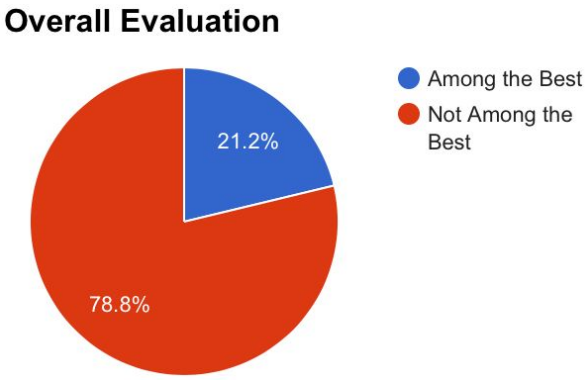
The less than 9% of services which were assessed to require expert knowledge included the highly scientific layers from various bird surveys, as well as some soil and watershed services which were also very scientific and technical in nature.



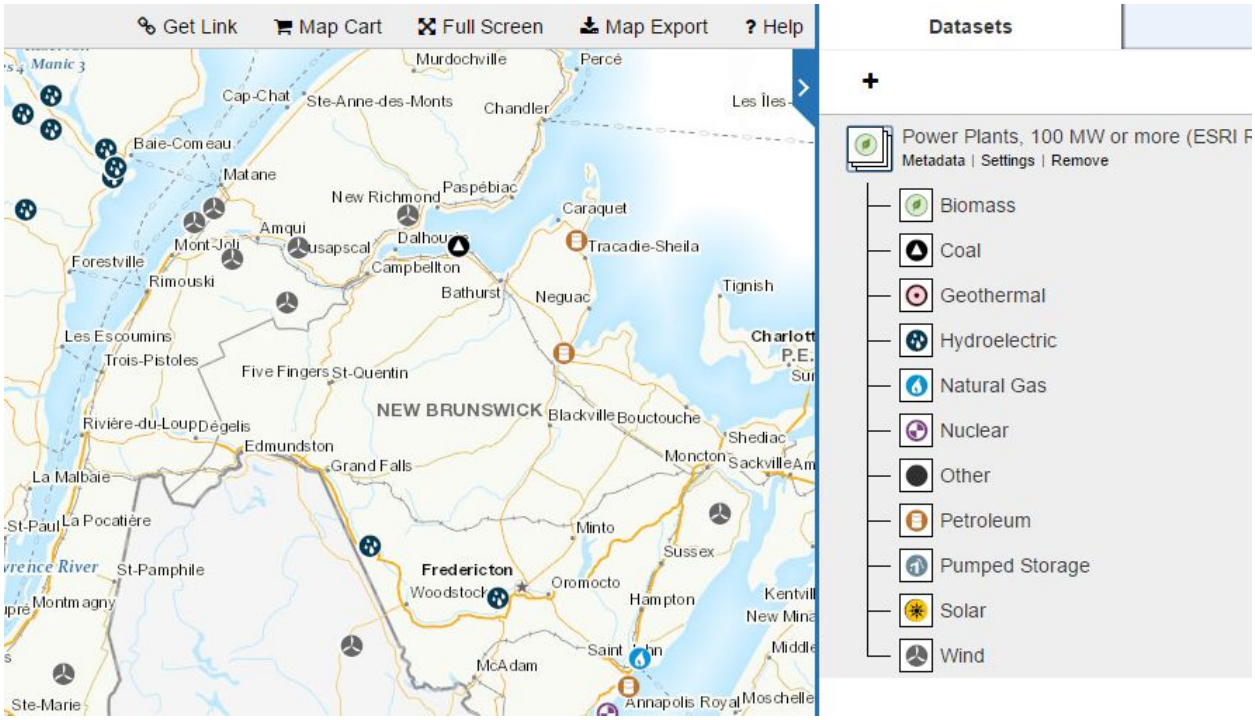
2.3.3 Examples of the Best Services

Sample size: 259

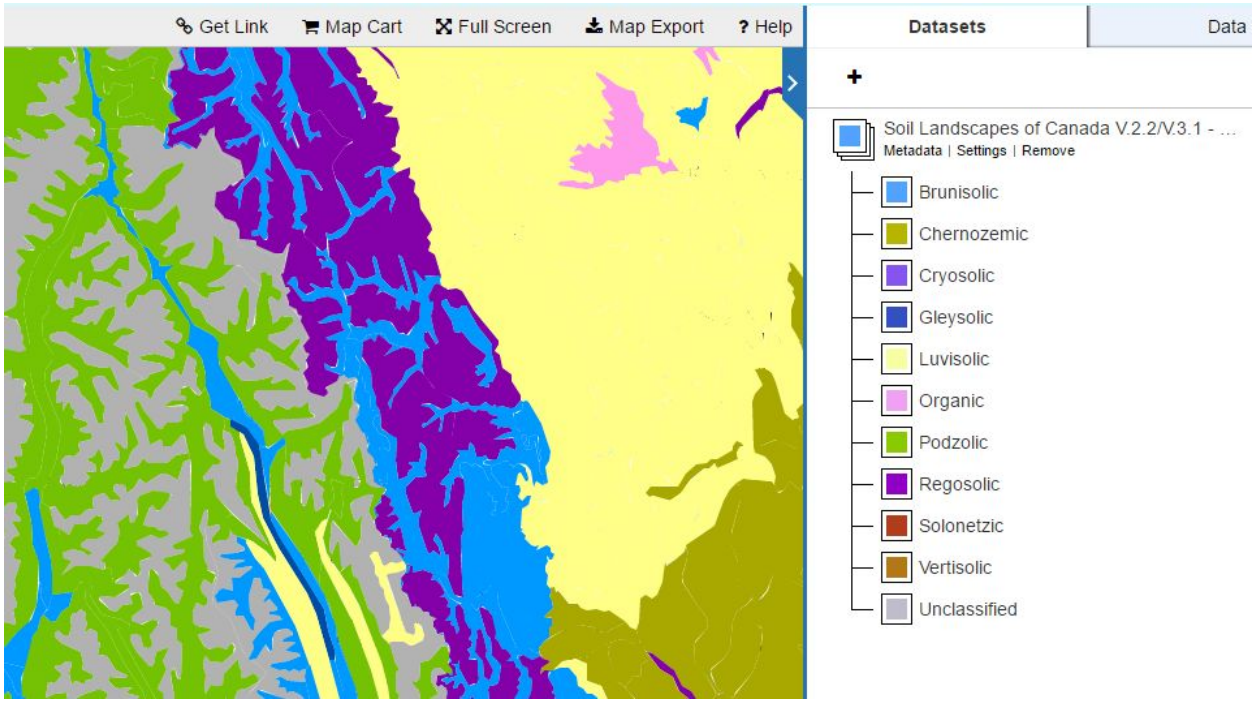
The intent of this criteria was to flag services that had few or no significant usability issues or that otherwise did a particularly good job in at least several of the assessment criteria. A combination of good map visualization and cartography and a good legend was most common among these services.



Below are a couple of examples. The first shows power plants and second displays soil types. Even in these cases though room for improvement is evident. The power plant symbols arguably should be brighter with a stronger differentiation from the background. Also the brown colour for petroleum is very similar to that used for secondary highways. On the other hand, the cartography is still pretty good. The symbol designs are easily distinguished and generally connotative. Other characteristics are excellent. For example, the attribute names for the power plants are clear, with no contracted forms for normal words; “Total Renewable Capacity (MW)” and “Primary Renewable Energy Source” are quite understandable. The first uses MW for megawatts, which is recognized in the International System of Units (SI).



With the soils landscape map below, the colours are all strong. Better colour separation of Cryosolic and Regosolic as shown in the legend is warranted however. As it is, the Regosolic area on the map could easily be mistaken for Crysolic.



3 Discussion and Recommendations

In this section all of the usability issues identified during the assessment are reviewed and and recommended solutions proposed. The issues and solutions are grouped using the associated assessment criteria.

3.1 Title

3.1.1 Discussion

Titles are expected to at least meet the “FGP Naming Conventions” specified in the document “Data Management and Stewardship Policies and Procedures – Data Structure” from the FGP Policies and Standards Suite. However, many services did not meet these minimum requirements.

One common issue with naming was that the name of the study, program, sub-organization, or data series would precede the name of the specific data subject, pushing the main data subject further to the right and making it harder to read in various situations. In other cases this additional name would follow the data subject, making the title excessively long or pushing other information in the title (location, date, scale) further to the right and out of view. Examples of such additional names include:

- Agri-Environmental Indicator (AEI),
- Canada Land Inventory (CLI),
- AAFC Watersheds Project
- Pelagic Seabird Atlas
- Air Quality
- Releases of Harmful Substances to the Environment
- Air Pollutant Emissions
- North American Cooperation on Energy Information

These additional names do have value and could be used in searches; however, they add additional bulk to the title, making it less readable. One approach to dealing with them would be to provide one or more additional metadata fields where this additional name could be placed, such as “sub-organization”, “data group”, or similar.

Another issue was the use of unnecessary words such as “Geographic Distribution” or “Location” - these are generally implied by the fact that the data is being shown on a map. These titles could possibly just drop such words, or could do so with some minor changes.

There are several examples of titles which include “Canada” or “Canadian” as the initial word:

- Canada’s National Highway System

- Canadian Railway Network
- Canadian Road Network
- Canadian National Topographic System
- Canadian Hydro Network
- Canadian Digital Elevation Model

The naming convention suggests that the “place name” should come after the “subject”. In these cases the subject seems to be the name of a program or data package, which includes Canada. While none of these names exceeds the recommended 70 characters, shorter, simpler names with the most specific information at the front can be beneficial in situations where there is not enough room to display the entire title. These layers could have even simpler names, if their current names were moved into the sub-organization/data group field suggested above, eg. just “Highways”.

The naming convention also suggests that the scale of the data could be included in the title where appropriate. While this is important to differentiate between different scales of the same data, for general web-mapping use it is more appropriate to provide a single service which includes all of the scales and automatically switches between them depending on the viewer’s zoom level. For feature-level services the scale should be in the title, and it might be a good idea to have a the scale stored in its own metadata field as well.

Some titles also include a year or similar date, while this is certainly appropriate when multiple years of data are available, it is interesting to note that the date doesn’t always correspond with the metadata fields “date published” or “temporal coverage”. Perhaps the definition of these fields needs to be more clear.

It is also important that the title is not overly general. For example, Fisheries and Oceans Canada provides a service titled “Critical Habitat of Species at Risk”, which by name would appear to be a roll-up of all Critical Habitat layers - but it in fact only represents the critical habitat of aquatic species at risk. This is not clear until the product specification is downloaded and read.This title seems to be dangerously misleading - “Aquatic Species at Risk - Critical Habitat” might be a better choice of title.

3.1.2 Recommendations

Title-1: Amend FGP Naming Conventions to include a definition of “data series”, and recommend including the name of the data series after the name of the specific data product.

Title-2: Consider adding an additional metadata field to the catalogue to store the name of the “data series” to enable better searching and querying options.

Title-3: Amend FGP Naming Conventions to require enough specificity in the subject of the title to not be overly general, suggesting the inclusion of data which is not included.

Title-4: Promote the option to provide different scales of the same data as a single group service, with scale restrictions on each individual layer, so that the user finds it easier to navigate to the data of interest.

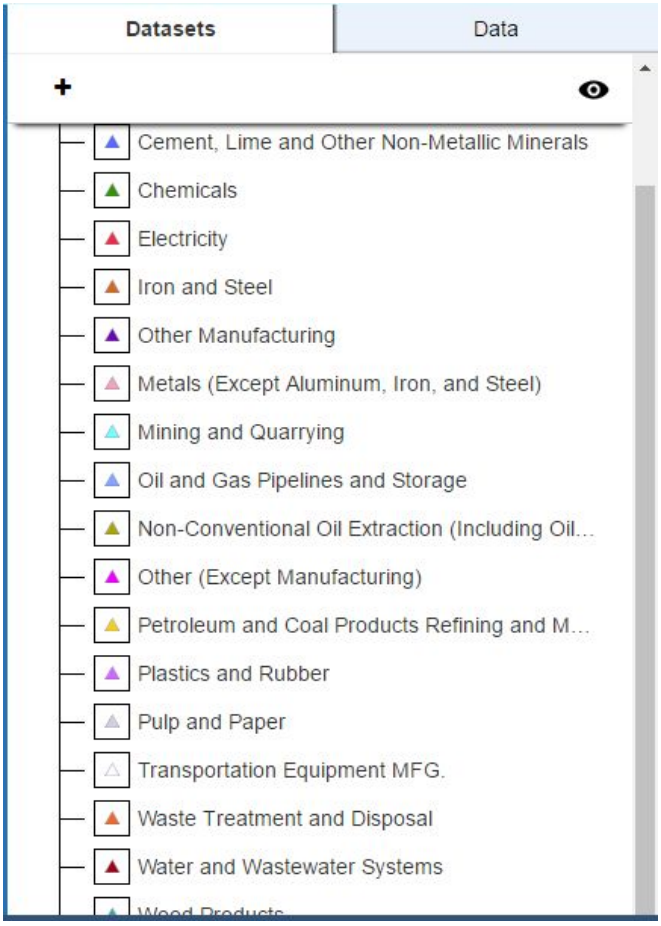
Title-5: Create or amend the metadata standard to require layers that have scale restrictions to include the usable scales in the appropriate metadata field.

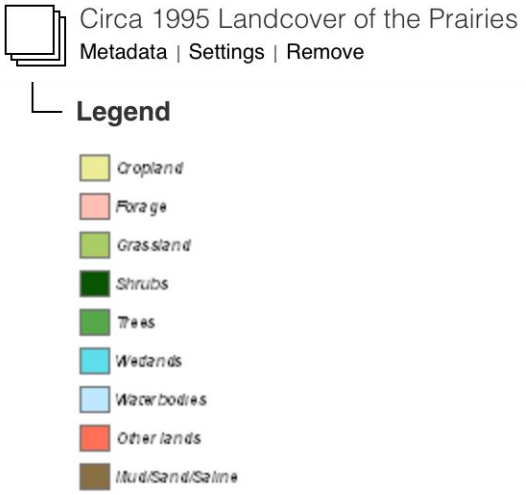
Title-6: Create or amend the metadata standard to require correct “date published” and “temporal coverage” fields which correspond to the date in the title and to the actual capture and publish dates of the data.

3.2 Legend

3.2.1 Discussion

The legend is perhaps the most intuitive way for the service provider to give the user useful information about the layer. There were several issues identified with the usability of the legends.





Depending on the configuration of the service and the type of data being displayed, the legend could be displayed in two different ways: either as a single image including all of the “colour swatches” and all of the text descriptions (above example), or as individual images for each colour swatch accompanied by actual text (example on left). When the legend is displayed as a single image, the text descriptions are often difficult to read. It is suspected that a default setting in the software being used causes an italicized font to be used, which contributes to the problem. In addition, it appears that the legend image has been either resized or re-proportioned at some point in its processing.

Another problem encountered with some of the legends is that they are too large to be displayed in the layer list (example immediately above). This could arguably be attributed to the RAMP viewer, but it actually allocates plenty of space for the layer list. Excessively long legend descriptions could cause the legend to be too wide to be easily viewable. Alternatively, too many different categories displayed in the legend would make it necessary to scroll down, and the RAMP viewer would not scroll to the end of the list in all cases. Realistically even if the user could scroll down, the large number of categories could compromise their understanding of the display, depending upon the details.

When the legend includes numeric values, it should also include the appropriate units in the text description of each legend item. Standard International System of Units (SI) abbreviations (i.e. units) should be used in legend descriptions.

Unexplained codes or jargon are not appropriate for a general audience but may be acceptable for expert use.

3.2.2 Recommendations

Legend-1: The specific cause(s) of the problem with poor legend image quality should be identified, fixed and documented to help other service providers avoid this pitfall in the future.

Legend-2: The maximum supported legend size of the RAMP viewer and/or the next version of the FGP viewer should be documented in terms of pixels for image legends and in terms of characters wide and lines in length for non-image legends, and included in the FGP service implementation guidelines.

Legend-3: The legend should accurately reflect the content of the map.

Legend-4: A legend should not be provided if the content is not categorized or otherwise has no need of a legend.

Legend-5: Units, following SI conventions, should be included in the legend descriptive text when measurements are used.

Legend-6: Codes, contractions or abbreviations should not be used in the legend descriptions if possible, with the exception of SI measurement units and map indexes.

3.3 Feature Attributes

3.3.1 Discussion

The assessment of the feature attributes is mostly about readability and understandability. There were not that many issues to be found in the feature attributes. The most common problem was the use of codes or jargon in either the attribute names or the attribute values.

A minor concern is that floating-point numeric attribute values are often represented at their maximum precision, which can make the numbers difficult to read and falsely represents the actual accuracy of the underlying data.

In some cases point features included the latitude and longitude as attribute values. While this is commonly done as separate attributes, in at least one case the two values were stored in a single attribute as text, separated by a space, which is not as readable for humans or computers. If the data is already being supplied with point geometry, provision of coordinates as attributes really is not necessary.

3.3.2 Recommendations

FeatureAttributes-1: The use of space-separated words or short phrases for feature attribute names should be used, as opposed to contractions, camelCase or underscores.

FeatureAttributes-2: The unit of measure in the feature attribute name for measured values should be specified using SI recognized units. The units used should relate to accuracy and common usage (e.g., the value for the area of a wetlands polygon of 2.34 km^2 should not be given as 2,338,062 m^2).

FeatureAttributes-3: Numerical precision (i.e., the number of digits) should be given to correspond to accuracy and not to the maximum, machine generated values.

FeatureAttributes-4: Feature attributes not be included unless they normally have values.

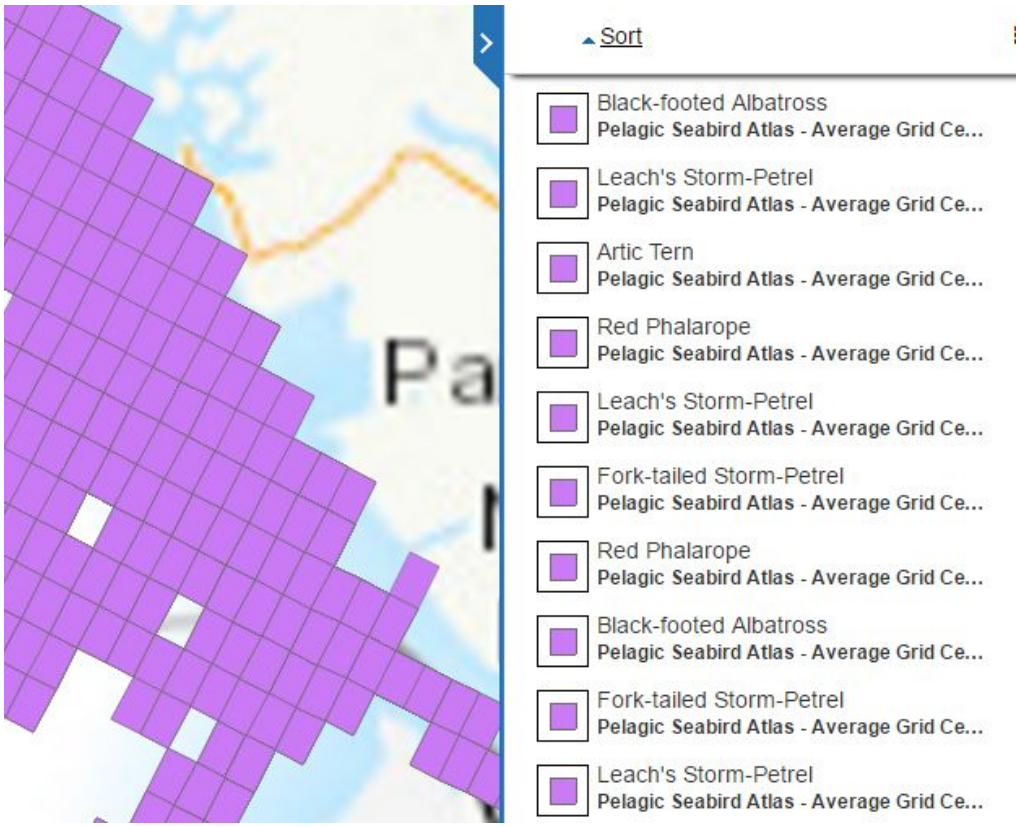
FeatureAttributes-5: Longitude and latitude should not be given as feature attributes of point data, since equivalent information is contained in the geometry.

3.4 Cartographic Representation

3.4.1 Discussion

In the example below from the Pelagic Seabird Atlas - Average Grid Cell Density layer, each grid location may have multiple “stacked” polygons in the same location, each storing observation data for a different species. The user has no way to control which species or which

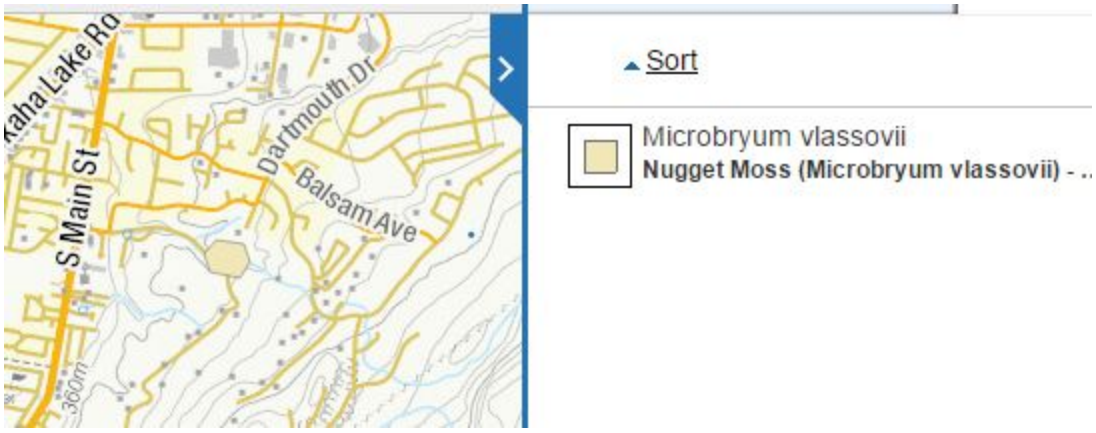
polygon's attributes are displayed when clicking on any grid cell, so making use of this data is difficult.



This sort of data is really only appropriate for use in a sophisticated client such as ArcMap or QGIS where feature-based analysis can be performed. Alternatively or additionally, a single heat map could be produced showing the number of species found in each grid cell. For many casual users this might be much more useful.

3.4.1.1 Colour

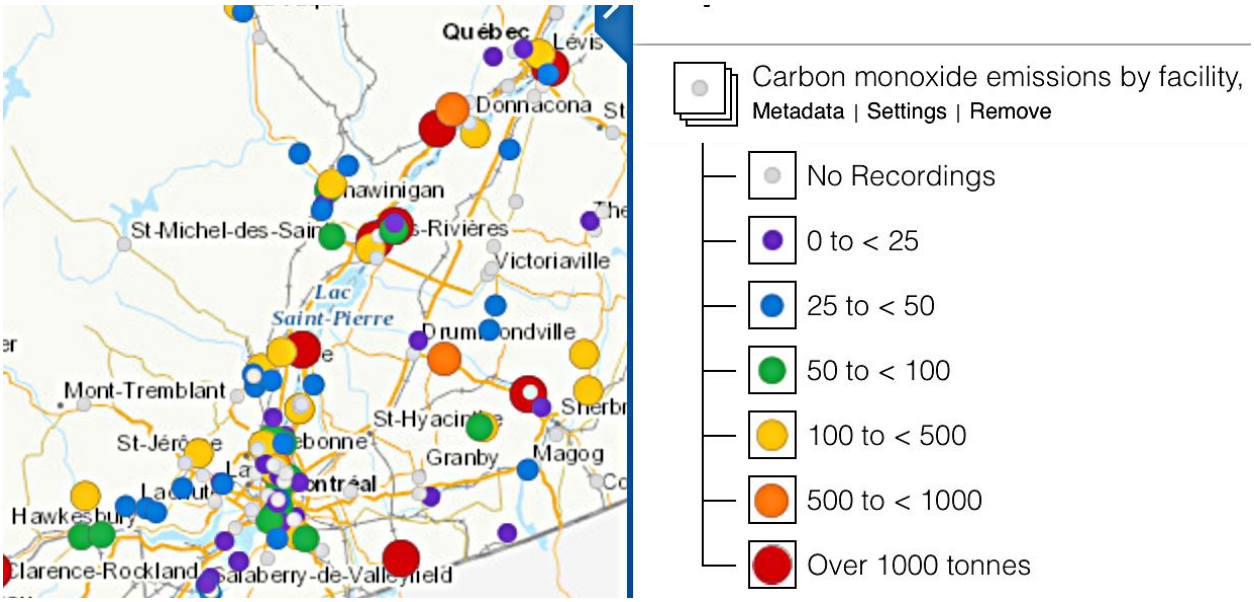
Here is an example of a layer from the Critical Habitat for Species at Risk series of data. It is initially difficult to recognize any of the subject features on the map because of the small size of the polygons. Even after zooming in on a specific polygon, it remains difficult to see due to the use of a muted yellowish colour that is similar to both the yellow background and the yellow used for the streets. This colour may have been chosen to differentiate this species from the other species in the series or perhaps simply to avoid garish colours; however, against the default basemap in the RAMP viewer the contrast is much too low.



While the opportunity for colour clashes always exists, one approach might be to use less saturated colours for the basemap, and more saturated colours for the layers of interest. This should at least help increase the visibility a single data layer shown over the basemap. What if the same layer might be used as part of a different basemap? This approach also increases the likelihood of interlayer colour conflicts, because it reduces the colour space available to the non-basemap data layers. These issues will be discussed further in the Service Interoperability section.

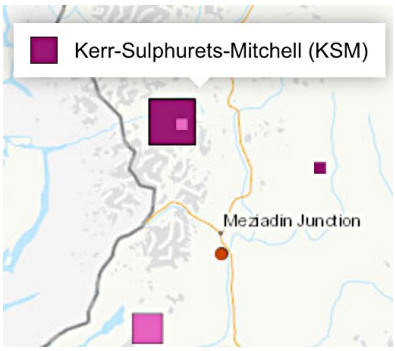
3.4.1.2 Symbology

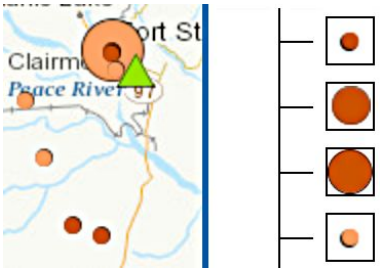
“Carbon monoxide emissions by facility” displays very effective symbology. The colours are very clear and meaning is enhanced by the different sizes employed. The colours on the legend and map are of different hues, which helps with the user experience. As well, no confusion exists with the background colours or basemap details, although a brighter yellow for 100 to <500



would provide greater contrast with the background. The one real deficiency is the of gray for No Recordings; it is difficult to see. If No Recordings were symbolized by a gray circle with a heavy black boundary it would work better. The legend could be improved by specifying the time period to which the number of tonnes applies.

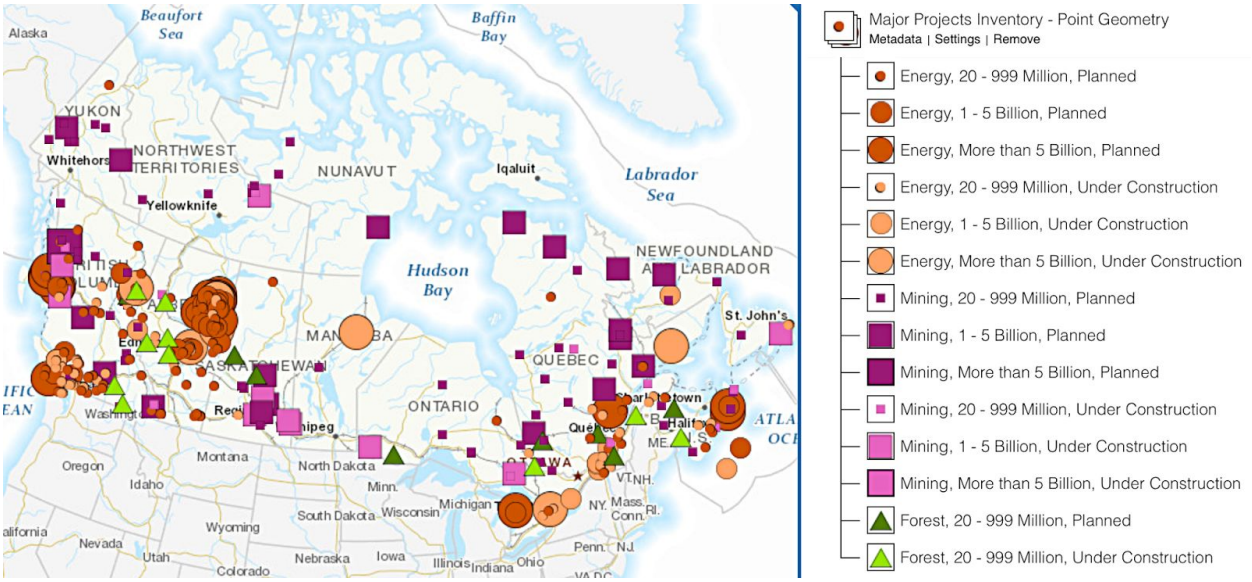
“The Major Projects Inventory - Point Geometry” below uses circles, squares, and triangles for different kinds of projects, as shown in the large image below. The colours are sufficiently different to aid recognition as are the different sizes of the symbols. Also note that the darker tones in all three cases are used for Planned, whereas lighter tones are employed for Under Construction. The black boundary used to indicate the largest planned and under construction sites is used on only a single site across the country (shown on the map snippet on the left). This raises the question of whether the legend should contain symbols that cannot be found anywhere in the country, as is the case with Mining, More than 5 billion, Under





Construction. On the other hand, by including the category it is clear in this case that nothing has been forgotten.

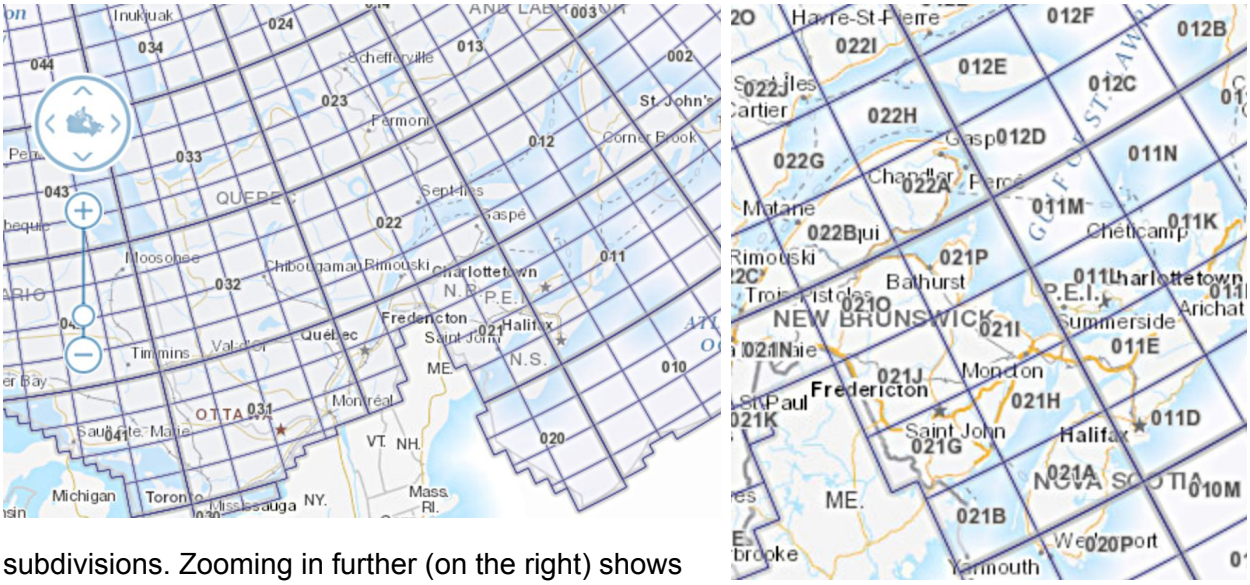
A very minor inconsistency is that the shadow effect used on the two smallest energy symbols is on the lower left in the legend but the upper right on the map, as shown in the second small image above. The legend should also indicate the units used, which will differ depending upon the subject.



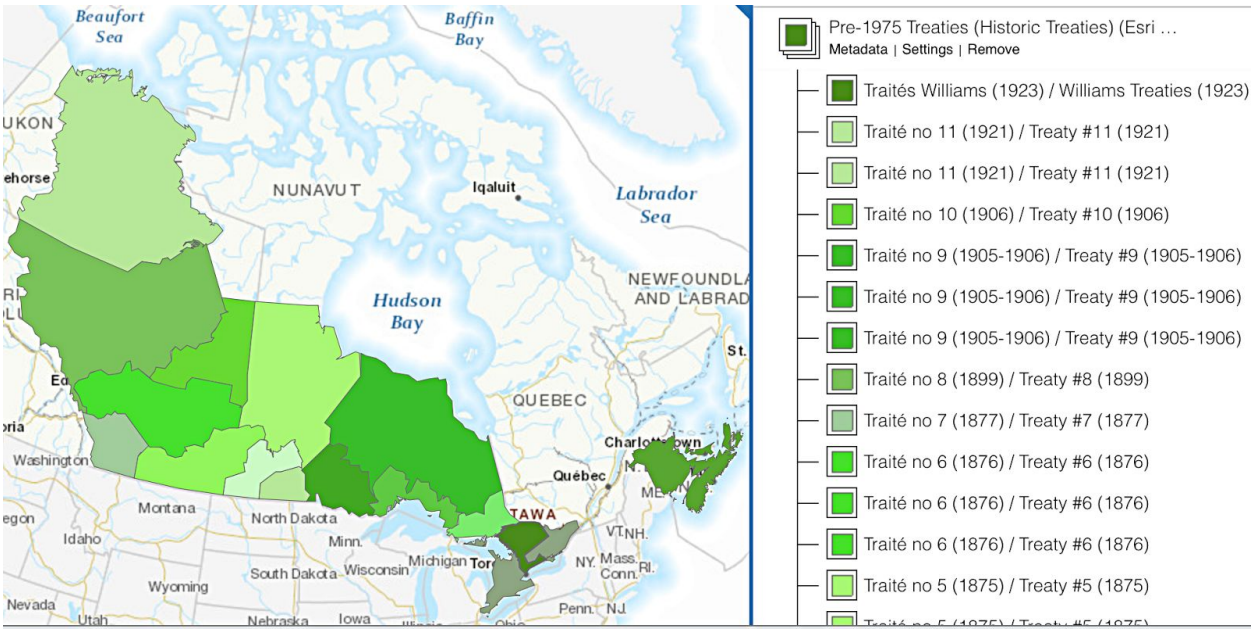
The “Metal Mines - Producing Mines” map shown in 2.2.11 and the “Power Plants - 100 MW or more” both show symbols with a flat design, characterized by no use of gradients, textures or drop shadows. Not only is this in line with modern design, as used on smartphones for example, but it also makes displaying the symbols more compatible with different map rendering technologies.

3.4.1.3 Labelling

Relatively few layers had any labelling of features. Below is an example of a good use of labelling. On the left are the NTS 1:250 000 blocks shown with labels and 1:50 000



subdivisions. Zooming in further (on the right) shows the labels for the 1:50 0000 mapsheets. The labels are clear and the overlay against the basemap is quite well done in both cases. Zooming further (not shown) shows the blocks and the labels for the 1:20 000 NTS grid.



In the case of feature level services, the RAMP viewer displays the feature “name” when a feature is hovered-over with the mouse cursor. In cases where click-to-identify was possible, labels were not required, but could still be of benefit. This is the case with the Historic Treaties map above. Labels and different colours would do much to improve the useful information content of this map. The various green colours are difficult to identify with certainty with the listing in the legend. So this service has issues with labels, colours, legend content, and legend length.

In some cases the “name” displayed when hovering is a code of some sort, where a long-form name is actually available in the data. Since this form of labeling does not take up permanent space on the map image, it seems there is no reason not to use the most descriptive name.

3.4.1.4 Scaling

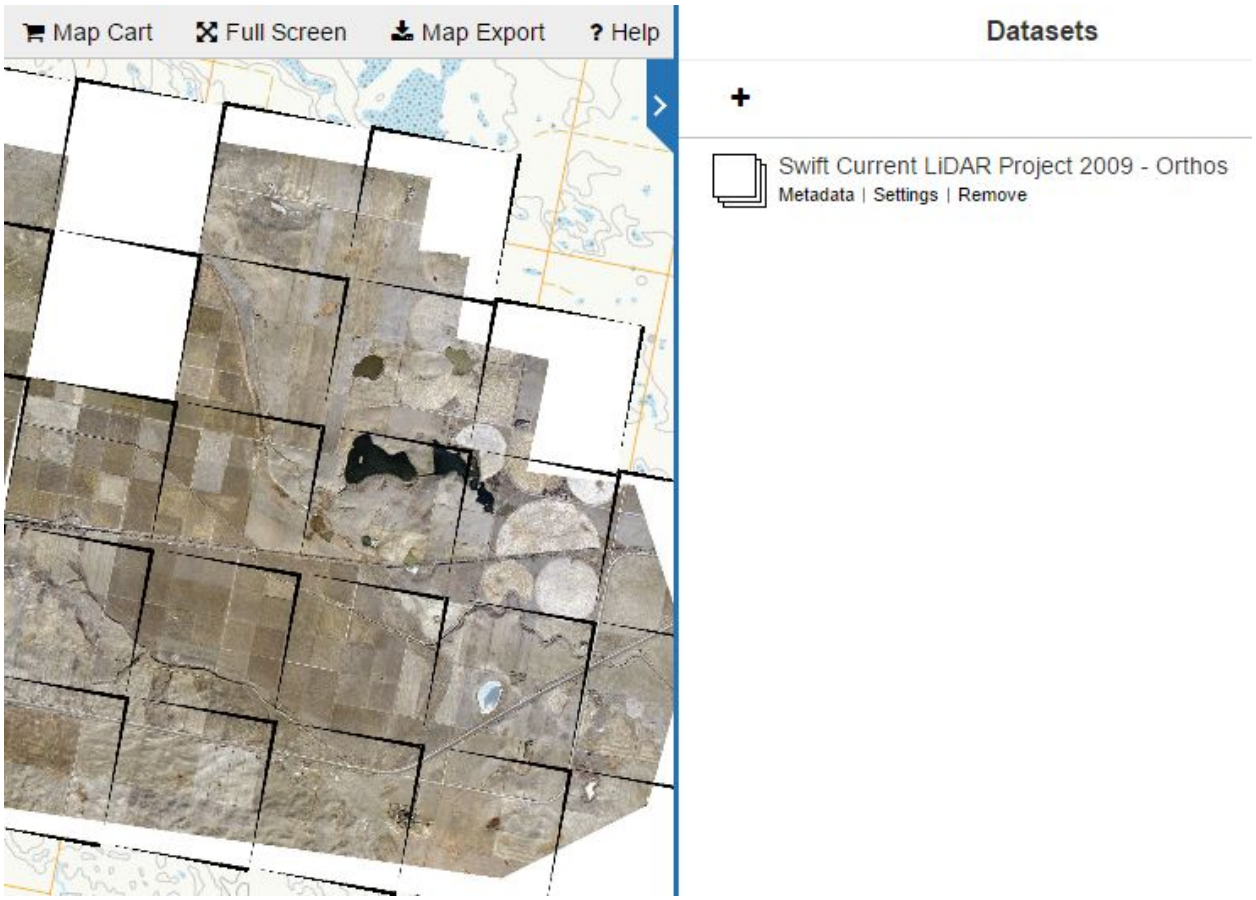
For a general use web service, it is important that something be clearly visible on the map at all resolutions. In the case of small polygon data, or small raster areas, it is often invisible on the map at a national or provincial zoom level, and would better be represented as point symbols or a polygon area to help a user navigate to where the data is and zoom in on it.

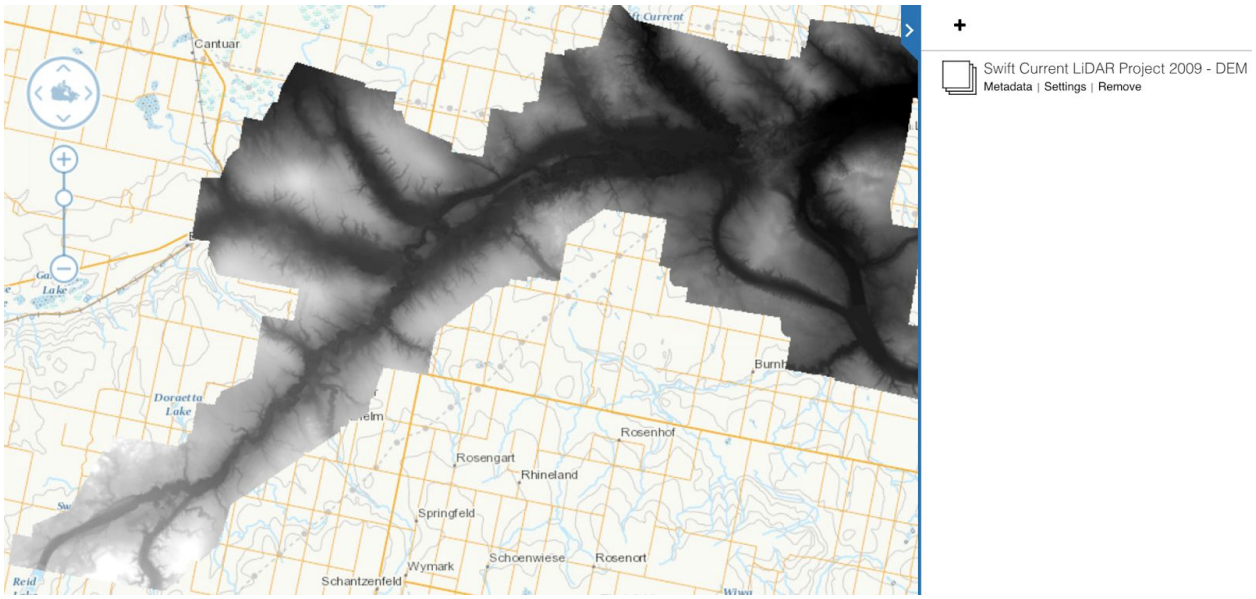
Conversely, it should not be possible to request more data than can be returned in a reasonable period of time; when zoomed out, either more general data should be displayed or a point symbol used. For feature-level services, expert users should still be able to access the full detail data.

3.4.1.5 Imagery

This example from the “Swift Current LiDAR Project 2009 - Orthos” layer (next page) shows some edge artifacts likely caused by re-tiling or re-projecting the ortho image tiles. This sort of problem may affect the usability of the data from an analytical perspective. Of more importance here is that it is an assault on the viewer’s sensibilities and should be easily avoidable with due care taken in processing the data.

Another point about lidar imagery (next page) concerns their meaning to the typical user. Such imagery is often shown as shades of gray with the darker sections showing lower elevations and the lighter sections displaying higher elevations. This should be indicated through the legend preferably and otherwise by the metadata. Even more useful would be to show the range of elevation in the area of question. The experienced user may realize that the the dark shades represent lower areas, but will not necessarily know if the difference between these lower areas and the higher elevation areas is centimetres, metres, tens of metres, etc.


Map Cart
Full Screen
Map Export
? Help
Datasets
+
Swift Current LiDAR Project 2009 - Orthos
Metadata | Settings | Remove


Cantuar
Rosenhof
Rosengart
Rhineland
Springfeld
Wymark
Schoenwiese
Rosenort
Schantzenfeld
+
Swift Current LiDAR Project 2009 - DEM
Metadata | Settings | Remove

3.4.2 Recommendations

CartographyColour-1: Colours for features/layers should be chosen that are brighter than and in clear contrast with those on the basemap.

CartographyColour-2: Colours appearing on individual layers should be readily distinguishable from one another, unless by intention they are of the same colour.

CartographyColour-3: If it is known that certain layers are likely to be used in combination with one another, then care should be taken to ensure that similar colours are not used on the different layers.

CartographySymbology-1: Symbols should have colours that contrast sufficiently with the basemap details and with one another. Subdued or pastel colours should be avoided.

CartographySymbology-2: If the symbols include contrasting boundaries used to distinguish symbols from one another, then the boundaries should be comparatively thick so that they are easily discerned on different devices and screens of differing qualities.

CartographySymbology-3: The use of different sizes and colours in combination is recommended for rendering different numeric categories.

CartographySymbology-4: The use of different shapes, such as triangles, squares, and circles, is recommended for portraying different series on the same map.

CartographySymbology-5: Connotative symbols with varying shapes or internal icons can be used so long as colour is also used to distinguish them.

CartographySymbology-6: All symbols should have a flat design, without the use of gradients, textures, or drop shadows.

CartographyLabelling-1: If used, labels should be short and readily understood directly or from the legend, with the exception of the label as a map index, in which case it is acceptable if the explanation is found in the metadata.

CartographyLabelling-2: Where large polygonal features are displayed, labels are recommended if practical to implement. For small features on the map, care must be taken that the label does not conflict with other labels or with boundaries.

CartographyScaling-1: Services should not allow requests for excessive amounts of data that would cause the server or connection to timeout. If a service provides only high-resolution data, it should only be available at large scales.

CartographyScaling-2: Wherever possible, lower resolution data or alternative representations (e.g. a point symbol instead of a set of lines or polygons) should be provided at smaller scales to enable the user to navigate the map to the data of interest.

CartographyImagery-1: Quality assurance should be carried out so that a proper orthomosaic is available, without obvious artifacts.

CartographyImagery-2: When a color gradient is used to visualize the data, such as a greyscale map of elevation data, the legend should indicate the values associated with key colors in the gradient, eg. that the lighter and darker areas represent higher and lower elevations, respectively.

3.5 Metadata, Series and Supporting Documents

3.5.1 Discussion

The service “abstract” should contain at least a paragraph overview describing the dataset. In some cases, the provided abstract provides no more information than the title of service. Ideally a link to a “product specification” or similar document should be provided if one exists. It may be appropriate for FGP to determine a standard for the minimum information that should be provided in such a document, in particular such information as:

- A data dictionary for codes or terminology
- Description of the methodology for the creation/capture of the data
- Reference to any related laws or standards

The name of the “data series” that a service belongs to should be recorded in the service metadata, searchable and displayed to the user through the map viewer interface. The map viewer’s “metadata” display should include the name of the data series, links to view the metadata of the other layers in the same series, and links to add some or all of those other layers to the map.

3.5.2 Recommendation

MetadataSeries&SupportingDocs-1: Every service should include an abstract with meaningful content. The content should include more detail than the title, so that in a few sentences the reader has a pretty good idea as to what the service provides.

MetadataSeries&SupportingDocs-2: Any documents intended for a general audience should minimize the use of jargon and abbreviations. If such terms are commonplace or judged to be unavoidable, they should be briefly defined nonetheless.

MetadataSeries&SupportingDocs-3: FGP should strongly encourage every service to include a link to a “product specification” or similar document. Such document(s) should include as a minimum a data dictionary, a description of the creation/capture methodology, and references to any related laws or standards.

MetadataSeries&SupportingDocs-4: Add support for the concept of “data series” to the metadata records, catalog, and map viewer. Support service providers in providing this information for their services.

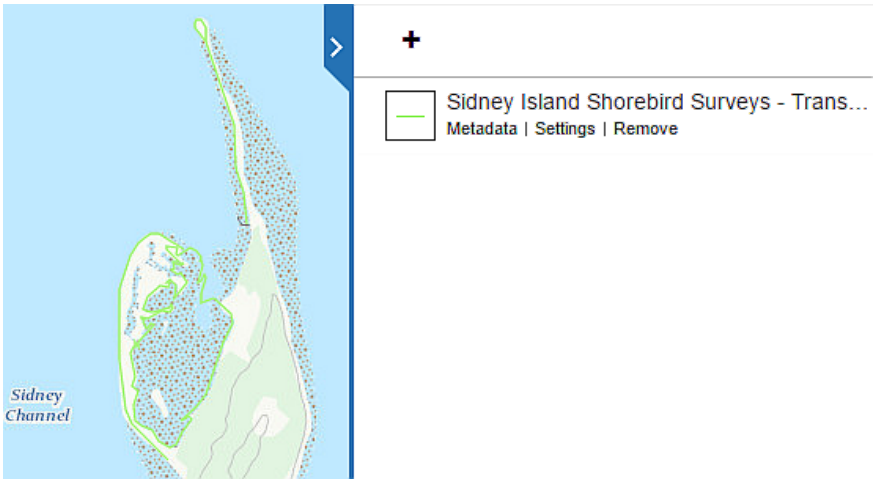
3.6 Service Interoperability

3.6.1 Discussion

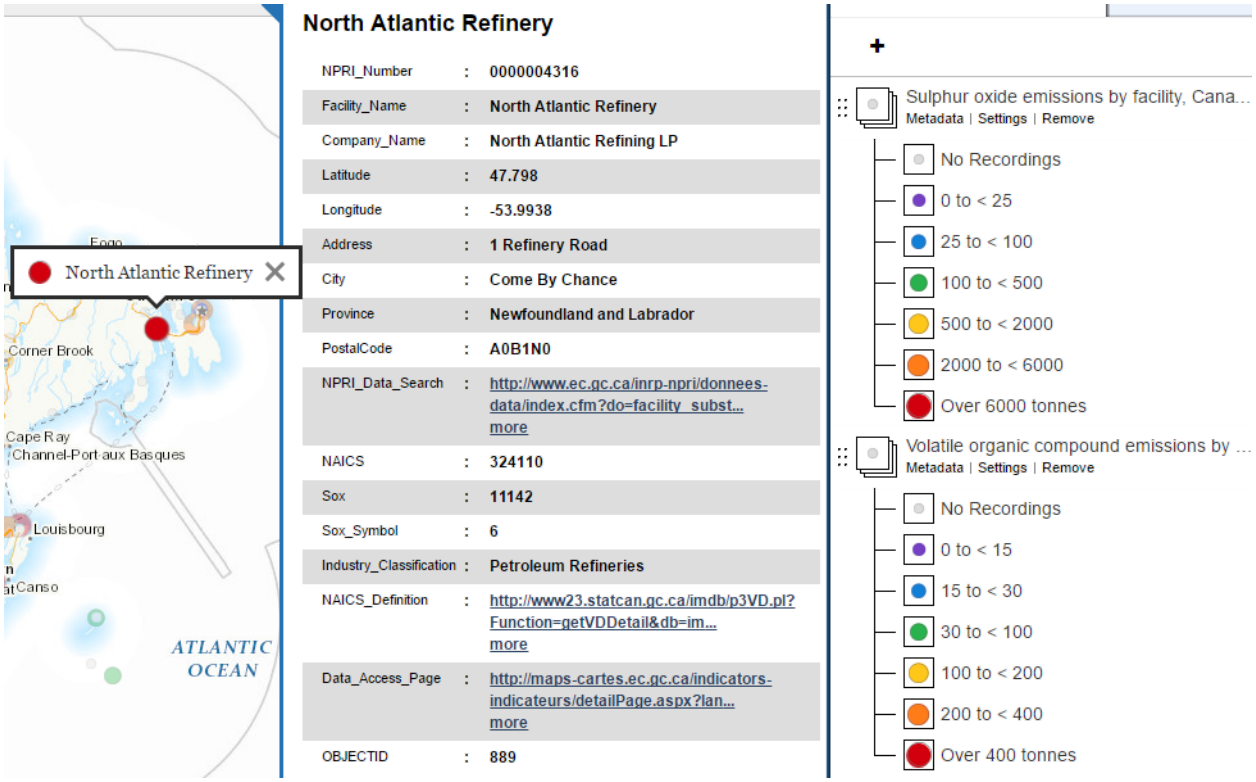
Through reviewing the services, various issues involving service interoperability have been identified. In particular, there are difficulties with:

- Visualization of a service displayed over a basemap
- Visualization of multiple services when displayed together
- Querying two similar services

An example of poor visualization of a service over a basemap is to the right, from the service “Sidney Island Shorebird Surveys - Transects Line”. The thin light green line is almost invisible against the background. Visibility would be improved with a thicker line of a more contrasting colour. With so much green on the basemap, the colour of the line should have a different hue altogether. In the current case the line is so thin and light that even against a different coloured basemap, such as RAMP’s shaded relief option, its rendering needs improvement.



The following example shows the difficulty in visualizing and querying two services together. In this case, several layers in a related series of data (Canadian Environmental Sustainability Indicators (CESI)) were displayed on the map together. These layers use the same symbology of coloured points: increasing in size and tending toward red as they get larger (worse). This results in a very readable map, individually. However, when multiple CESI layers are loaded at the same time, it is impossible to determine which symbol relates to which dataset, just by viewing the map. Furthermore, querying the map shows that the two data sets have nearly identical attributes. It is difficult to recognize which layer’s feature has been selected, because the RAMP UI does not identify from which layer the results were returned. Looking carefully at the attributes of the feature helps in this case because the attribute name “Sox” corresponds to the name of the pollutant. In a worse case, it is possible that multiple datasets could share identical attribution and styling, and be indifferentiable when queried.



The way around these problems is to be able change the styling of a service (colors, linetypes, and/or symbols) dynamically, depending on the situation. Three relevant solutions to this problem are recognized:

- WMS Named styles
- WMS Styled Layer Descriptor (SLD) support
- Client-side style definition and rendering of ESRI REST layers

The WMS specification (all versions since 1.0.0) allows for each layer to support zero or more named styles, with the names of the styles (and other descriptive information) specified in the layer's capabilities in the WMS server's capabilities document. This allows the service provider to provide more than one style for a given layer, and requires only minimal support on the client side (allowing the user to select from a list of style names).

The WMS specification also provides for optional support of the SLD specification, which includes the ability for the client to provide an SLD document describing how to style the layer, with a getMap request. This allows the client to specify the style information in the SLD, and have the server render the map according to that SLD. This implies a sophisticated client application, which provides a user interface to define the style, generates the appropriate SLD XML, and makes use of an XML-based HTTP POST getMap request to send the SLD to the server (instead of the typical HTTP GET getMap request). While this provides excellent flexibility and configurability, supporting it on the server side allows the user to specify arbitrarily complex styling that could cause excessive workload for the server. To reduce the level of sophistication

required in the client, another approach is for the service provider to provide additionally, alternate SLDs. These alternate SLDs would work similarly to named styles, except instead of being defined in the server configuration, and referenced by name, they would be defined by a separate SLD file and reference using a URL. It is even possible for a third party to define and provide the SLD, a job that could be filled potentially by an FGP styling team. This requires some basic support in the client and a way to communicate the availability of the alternate SLDs to the client, likely through some sort of metadata.

The ESRI REST interface sends feature-level data, not map images, and the client renders them to a map image using the styling suggested by the service. ArcMap (ArcGIS for Desktop) supports complete restyling of the data on the client-side, and so could a sufficiently sophisticated web-map client. This provides the greatest flexibility, but requires that both the server and the client handle the individual features and coordinates being rendered on the map, which in some cases is a significant overhead, even preventing some layers from loading or displaying properly because of the volume of data.

3.6.2 Recommendations

ServiceInteroperability-1: FGP should implement support in their web-mapping client for WMS named styles, and recommend that WMS services offer more than one named style. In the case of data series, one style should be visually distinguishable from other data in the series, and another style should be similar or identical to other data in the series.

ServiceInteroperability-2: FGP should investigate the compatibility of different services with SLD. It should be determined if a single SLD can be published and used correctly by WMS servers from different vendors (Mapserver, Geoserver, ArcGIS Server). Further investigation will be required to determine who should be responsible for producing and maintaining such SLDs, and how they can be discovered and used.

3.7 Technical Considerations

3.7.1 Discussion

During the period of this assessment, some technical issues related to web service quality but outside of the scope of the formal assessment have been identified.

One such issue is the viewer failing to display legend images for WMS services, caused by server software not fully conforming with the WMS 1.3.0 specification. After a group discussion the recommendation put forward was to enforce conformance with the WMS 1.3.0 specification, requiring the server to provide a LegendURL for the service, and not requiring the viewer to fall-back to using the optional alternative getLegendGraphic call as defined by the SLD standard.

3.7.2 Recommendations

TechnicalConsiderations-1: If Data Contributors would like to have a legend provided through the viewer for WMS v1.3 Web Services, they must ensure there is a working LegendURL style definition within the services GetCapabilities document for the specific named layer being registered in the catalogue.

Endnote

This report was prepared by Mark Sondheim and Chris Hodgson of Refractions Research for Cindy Mitchell and Joost Van Ulden of the Federal Geospatial Platform Initiative, Canada Centre for Remote Sensing and Earth Observation, Earth Sciences Sector, Natural Resource Canada.