# Conservation Opportunity Framework Data Viewer User Guide

This guide serves as an overview to assist new users of the Conservation Opportunity Framework (COF) Data Viewer. Here we discuss how the data viewer was developed and summarize the capabilities of this tool. This guide will ultimately show how anyone with a modest background in ArcGIS will be able operate the data viewer. Users of the COF data viewer will quickly be able to find valuable information which will undoubtedly aid in planning for local conservation projects throughout Washington.

## Introduction to the COF data viewer

The COF data viewer was developed by the Washington Department of Fish and Wildlife (WDFW) at the request of the Washington Biodiversity Council. This data viewer fulfills a need expressed by many that were interested in viewing the underlying data from Washington's Ecoregional Assessments (EA).[1] The **Ecoregional Assessments** were a collaborative partnership led by The Nature Conservancy, WDFW, and Washington's Natural Heritage Program to identify areas of conservation priority at an ecoregional scale. By 2004, these assessments were completed for all of Washington's nine terrestrial **ecoregions**.[2] A large amount of data was gathered and analyzed as part of this effort, including data showing the locations of many species of conservation priority.

Maps produced through these EAs have proved useful in guiding local and regional conservation efforts. A number of products came out of the EAs, but until now there has not been an easy way for the public to see the original data used in these assessments. To address this need, WDFW developed the COF data viewer. With this tool, interested individuals can now get a better sense of the information that went into each of the EAs.

This guide will help you get a better understanding of the capabilities of the COF data viewer by describing:

- how the EA data is spatially organized.
- what the underlying data looks like.
- how to use the data viewer so you can get the most out of it.

## How is the data organized?

Most mapping efforts require that large areas be divided into smaller, more manageable units (e.g., counties, watersheds). Given that the purpose of the EAs was to identify ecologically significant areas, a system was needed to organize the data into ecologically meaningful units. Since species and habitats are rarely influenced by political boundaries, data was organized and managed by ecoregion. An ecoregion is made up of areas of similar vegetation, wildlife, soils, geology, and climate, which make it a suitable choice for managing biodiversity data.

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[1] The data viewer uses only data from the Terrestrial Ecoregional Assessments and does not contain data for aquatic species.

[2] In 2011 an update of the Columbia Plateau EA was completed since there was a need to incorporate new data into this analysis.

Although the primary focus of the EAs was to identify areas of ecoregional significance, data were also evaluated at the **ecosection** scale. The ecosection provides a finer scale framework more conducive for organizing and assessing information for projects covering smaller areas. In contrast to the ecoregions, many of Washington's ecosections do not cross state or provincial lines.

Each ecosection contains numerous analysis units developed (Figure 1) as part of the EAs. Because each EA was conducted independently and at different times, different sized **analysis units** (AU) were selected to summarize the data. In some ecoregions the AUs are represented with hexagons, while in others the AUs coincided with watershed boundaries. Analysis units ranged in size from 300 to 2,740 hectares (741 - 6,772 acres).

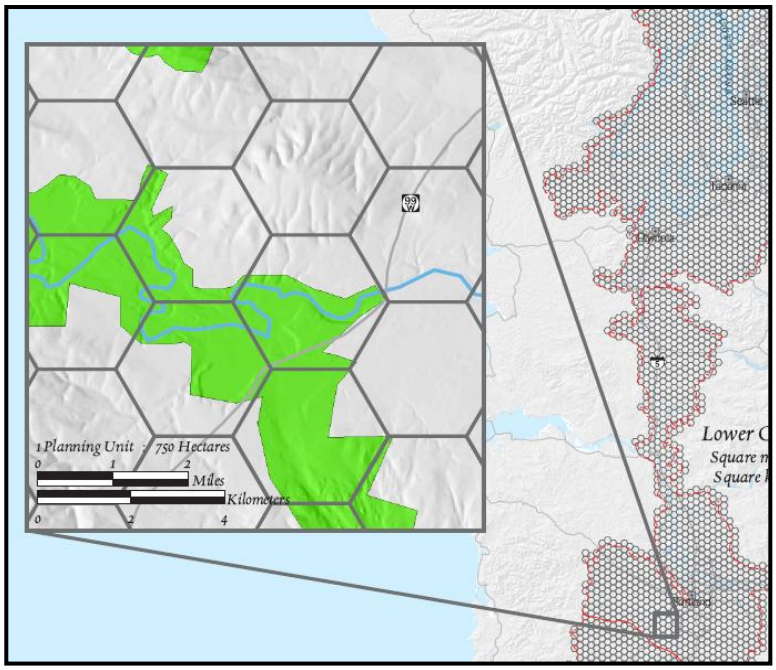


**Figure 1**. An illustration showing COF data viewer analysis units. These hexagons are the smallest planning units in the Willamette Valley - Puget Trough - Georgia Basin Ecoregion.

Analysis units are the smallest of the three planning units used in the data viewer (ecoregion, ecosection, AU). They are also the finest scale for which you will be able to view the underlying species and habitat data.

Each ecoregion contains a wall-to-wall layer of AUs, laid out across the entire state. By clicking on an AU in the data viewer, users can determine what underlying data are at a given location.

**The underlying data**

Every location contains a unique combination of flora, fauna, and habitats. To characterize this mix, data was gathered from a variety of sources including state and federal agencies, nonprofit conservation organizations, and universities. Species data were collected for plants and animals that were selected as ecoregional **targets**.

While some targets are well represented in the data viewer, many others lack data. Some species lack data because there are few individuals left in the wild (e.g., Pygmy Rabbit), while most are underrepresented because they have been poorly surveyed. Some data may also have been inadvertently missed when it was collected during the early stages of the EAs. Species that have received greater attention such as the Northern Spotted Owl tend to be represented by a greater share of the data in the data viewer. Although numerous AUs contain at least one occurrence of a target species, many lack target data altogether.

In addition to the individual species data, the data viewer also contains habitat information for each AU. Unlike the individual species data, we have considerable habitat information for much of the state. NatureServe's **ecological systems** were used to represent habitat types in most of the state's ecoregions (see http://www1.dnr.wa.gov/nhp/refdesk/communities/ecol_systems.html). Coarser scale data was used to represent habitats in some of eastern Washington's ecoregions.

*Conservation opportunity data* – Using the underlying data from the EAs, the Washington Biodiversity Council helped to identify areas of conservation opportunity as part of the Washington Biodiversity Conservation Strategy. The **conservation opportunity maps** and data are useful for identifying where investments in conservation might provide the greatest return in terms of biodiversity protection (see http://www.rco.wa.gov/biodiversity/projects_cof_maps.shtml).

The Council developed criteria for biodiversity significance and risk to construct the conservation opportunity maps. Ecological information (i.e., important wildlife, plants, and systems). was evaluated against human population trends[2] to determine areas of conservation opportunity. By means of this analysis, AUs[3, 4] were categorized by looking at the interplay between future risk and biodiversity significance (Figure 2).

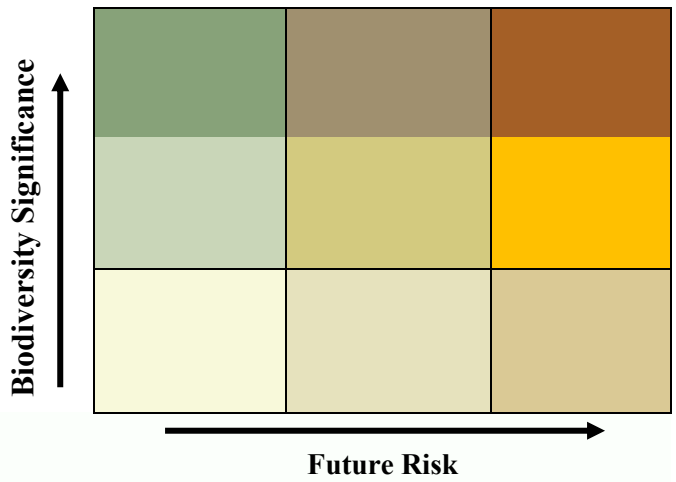


**Figure 2**. Each AU found in the COF data viewer[2] has been classified into one of the nine categories shown here.

This layer is represented in a geodatabase named EA_Data_Final.gdb that accompanies the data viewer and uses the same color scheme depicted in Figure 2.
A fact sheet published by the Washington Biodiversity Council explains how to approach conserving biodiversity using this same color scheme. The fact sheet is available online at http://www.rco.wa.gov/documents/biodiversity/COF_FACTSHEET_6pp.pdf.

*Irreplaceability data* – **Irreplaceability** is an index of the relative conservation value of a place based on the rarity and number of targets in a given AU. The data viewer allows users to identify the irreplacability of any AU[4] on a scale from 0 to 1. A score close to zero means that the AU has either a low number of targets and/or few rare targets. An increased score signals either a high number of targets and/or many rare targets. These highest scoring areas are considered to have the greatest level of irreplaceability. Since slightly different operations were used to determine irreplaceability among different EAs, these scores should never be compared across ecoregional boundaries.

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[2] Human population trends data derived from modeled data (see http://www.centerwest.org/futures/archive/development/)

[3] Although the AUs used to in conservation opportunity maps are similar to the AUs found in the COF Data Viewer, they do not have a 1 to 1 spatial correspondence.

[4] With the exception of AUs in the Middle Rockies - Blue Mountain and the Canadian Rocky Mountain EAs.

*Species and habitat data* – In addition to the conservation opportunity and irreplaceability data, the data viewer also gives users access to the underlying species and habitat data from each EA. As with all the data in the viewer, this information is contained within the AUs. For every species or habitat found in an AU, useful attributes are provided for added detail. For species data, the user is provided with each species' state and federal status (e.g., threatened, endangered) as well as its global, national, and state rank. Another attribute explains what proportion of a species' total ecoregional, ecosection, and statewide abundance is within each AU. Table 1 shows how this attribute is represented in the data viewer at the scale of an ecosection.

**Table 1**. A list of all plant and animal targets occurring in a given AU. The last column shows the percentage of the ecosection's abundance of each species that is found within the AU (e.g., two bald eagles in unit ÷ ten bald eagles in ecosection = 20%).

| **Target Species** | **Species abundance (ecosection)** | **Species abundance (analysis unit)** | **Percect of ecosection abundance in AU**[1] |
|---|---|---|---|
| Wenatchee Larkspur | 11 | 3 | 27.2727 |
| Bald Eagle | 10 | 2 | 20.00 |
| Western Toad | 75 | 3 | 4.00 |
| Northern Spotted Owl | 64 | 2 | 3.125 |
| Long-sepal Globemallow | 50 | 1 | 2.00 |
| Northern Goshawk | 73 | 1 | 1.36986 |

[1] Directly corresponds to the *Target Ecosection Abundance Percent* attribute found in the attribute table of the AU_FeatureClass layer.

In addition to species data, the data viewer identifies what habitats (i.e., ecological systems) may occur in each AU. Since the underlying habitat data is coarse, its accuracy is not perfect. However, it provides a valuable appraisal of what habitats are likely to occur . The amount of habitat (i.e., abundance) found in any given unit is represented in hectares, which can be found in the table of attributes (described later).

In the example below (Table 2), seven different ecological systems are shown to occur in an AU. The aggregate lower elevation forest is the most abundant in this example. However, the amount of this system represented in this AU only makes up a small fraction of the system's ecosection-wide abundance (0.03%). In this example, all seven systems seem to be common given the low percentages shown in the last column.

**Table 2**. A list of all ecological systems occurring in a given AU.

| Ecological Systems | Target Abundance (hectares) | Percent of ecosection abundance in AU[1] |
|---|---|---|
| North Pacific Montane Massive Bedrock, Cliff and Talus | 3 | 0.01 |
| North Pacific Maritime Dry-Mesic Douglas-Fir Western Hemlock Forest | 37 | 0.02 |
| North Pacific Maritime Mesic-Wet Douglas-Fir Western Hemlock Forest | 34 | 0.131313 |
| North Pacific Lowland Riparian Forest and Shrubland | 17 | 0.05 |
| Montane composite [2] | 6 | 0.01 |
| Aggregate lower elevation forest [3] | 358 | 0.03 |

1. Directly corresponds to the *Target Ecosection Abundance Percent* attribute found in the attribute table of the AU_FeatureClass layer.
2. Composed of a group of non-forested montane ecological systems.
3. Composed of a group of lower elevation forested ecological systems.

With these species and habitat data, users can carry out a variety of useful analyses using the data viewer. These analyses can help individuals get a handle on a site's biodiversity or its ability to harbor rare species or communities. Using these data, one can determine the following for any location in Washington:

- number of target species or ecological communities,
- presence of state or federally listed species,
- presence of species ranked as imperiled or rare (G1-G3, N1-N3, S1-S3),
- occurrence of endemic species or species restricted to a small number of AUs in an ecosection, and
- presence of rare ecological communities.

These simple analyses, combined with the information on irreplaceability and the conservation opportunity data (see Figure 2) can aid conservation planning. Although this tool will not answer every question, it can help prioritize sites for conservation-oriented acquisition or to determine what sites might benefit from habitat enhancement.

## How to use the data viewer

To use the data viewer you need to have access to an Environmental Systems Research Institute (ESRI) ArcGIS platform (version 9.3.1 or higher) and optionally Microsoft Excel (tested with Office 2007). The data viewer is installed directly into ArcGIS as a command button that the user places directly onto the toolbar (see installation instructions). Once the command is installed and the file geodatabase objects (AU_FeatureClass and AU_Table) are added to your map document (i.e., .mxd), you can use this tool to evalute areas of interest.

To begin an evaluation, you should pan and zoom in on a site. Figure 3 shows a snapshot of an ArcGIS data frame where the operator has zoomed in on a piece of property. A number of data layers (shown on left side of the figure in the ArcGIS Table of Contents) have been selected by the user to aid in this analysis. To use the data viewer the AU_FeatureClass data layer needs to be added to the map document and turned on so that it is visible (don't forget to add the AU_Table too!). Once visible this data layer provides the user with the abiliity to evaluate an area of interest.

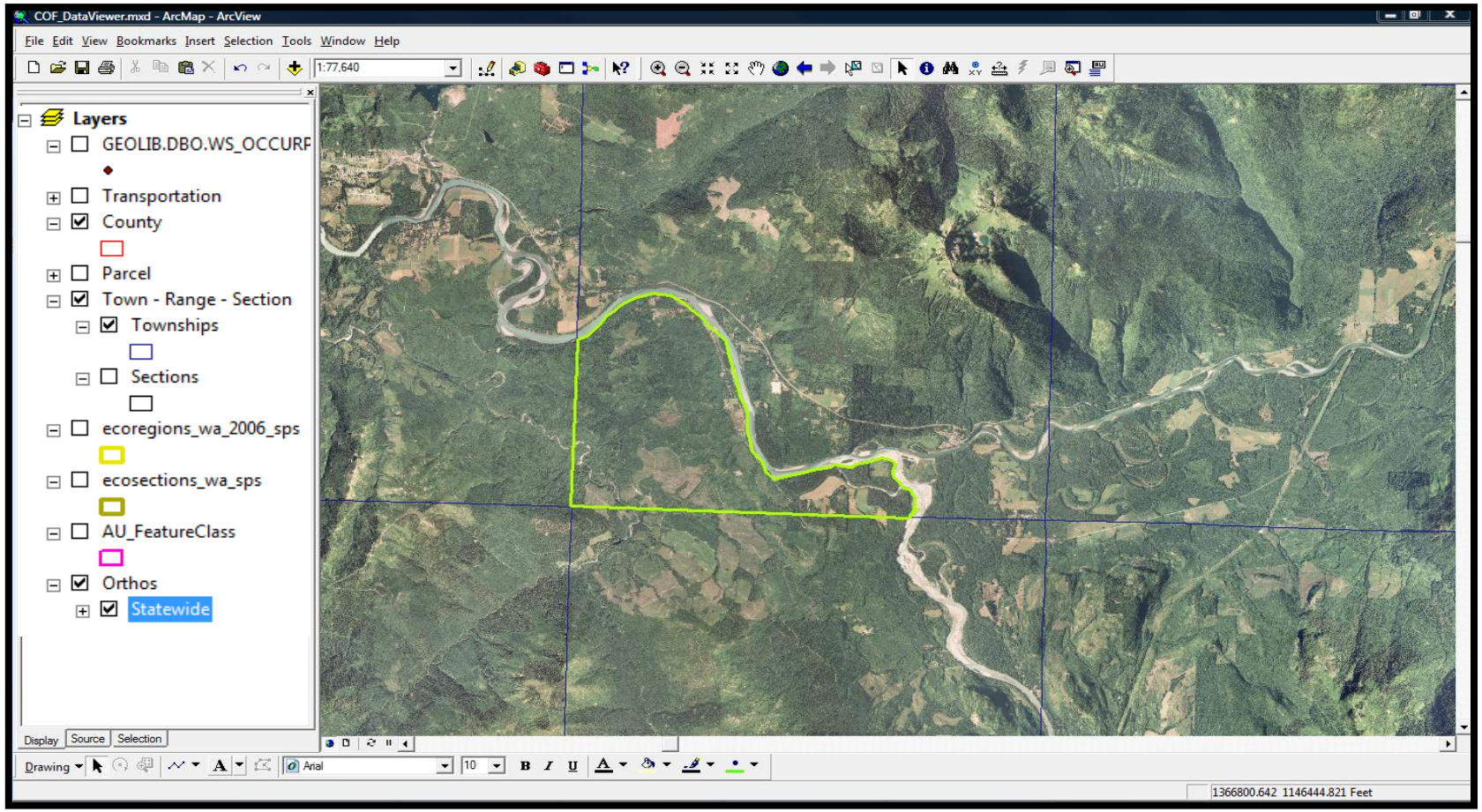


**Figure 3**. ArcGIS data frame of a location with a piece of property outlined in green.

Using the select features tool, AUs can be selected to determine what information they contain. In Figure 4 the AU_FeatureClass layer is visible and the user has selected nine hexagonal AUs encompassing the highlighted property as well as surrounding lands. These selected AUs can now be evaluated by simply clicking on the data viewer tool, which can be found by looking for this icon located on the tool bar.

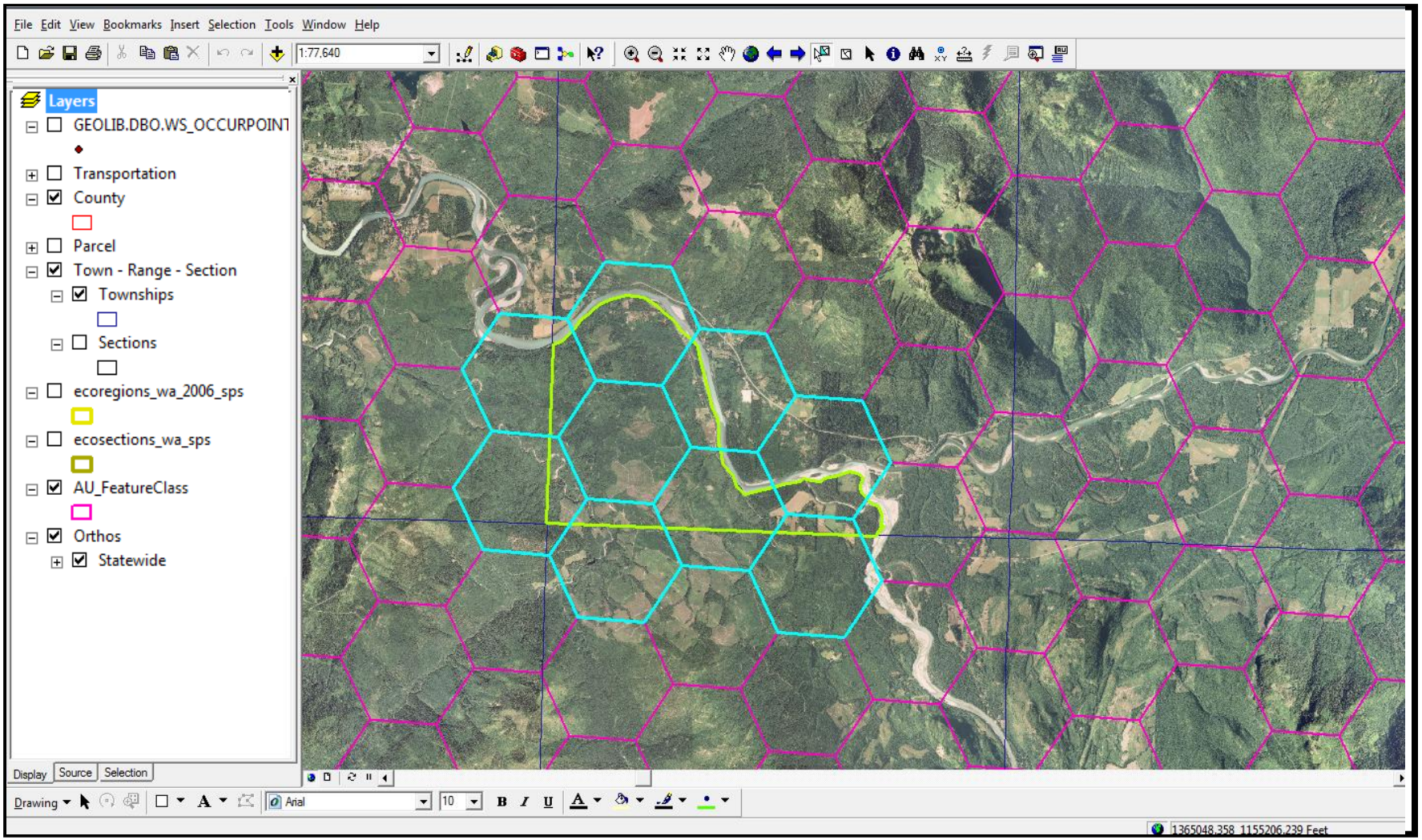


**Figure 4**. Data view after AU_FeatureClass data field has been turned on. The nine blue hexagons were selected by the user.

An attribute table showing numerous data fields will appear once the user clicks on this data viewer icon (Figure 5). This table provides basic information about the selected AUs such as the ecoregion and ecosection where the AU is located. A unique nine digit AU identification number (i.e., Analysis unit ID) is also given as an attribute. The "Normalized Irreplaceability" attribute provides a value between zero and one for each hexagon (described earlier).

Information about target species and ecological systems can be viewed by scrolling further through this table. Such information includes the common and scientific names of each of the target species. Abundance estimates are also given for species and ecological systems. This measure of abundance gives values such as the number of hectares of each of the ecological systems found in any given AU. The "Target Ecosection Abundance Percent" gives a measure of the percentage of an ecosection's abundance for species or ecological systems found within a single AU.

TNC EDMT Ecoregion Assessment and Conservation Opportunity Framework Data

| Ecoregion Abbreviation | Ecoregion Name | Ecosection Name | Analysis Unit ID | Analysis Unit Nor |
|---|---|---|---|---|
| NC | North Cascades | Northwestern Cascade Ranges | 100308178 | 0.28 |
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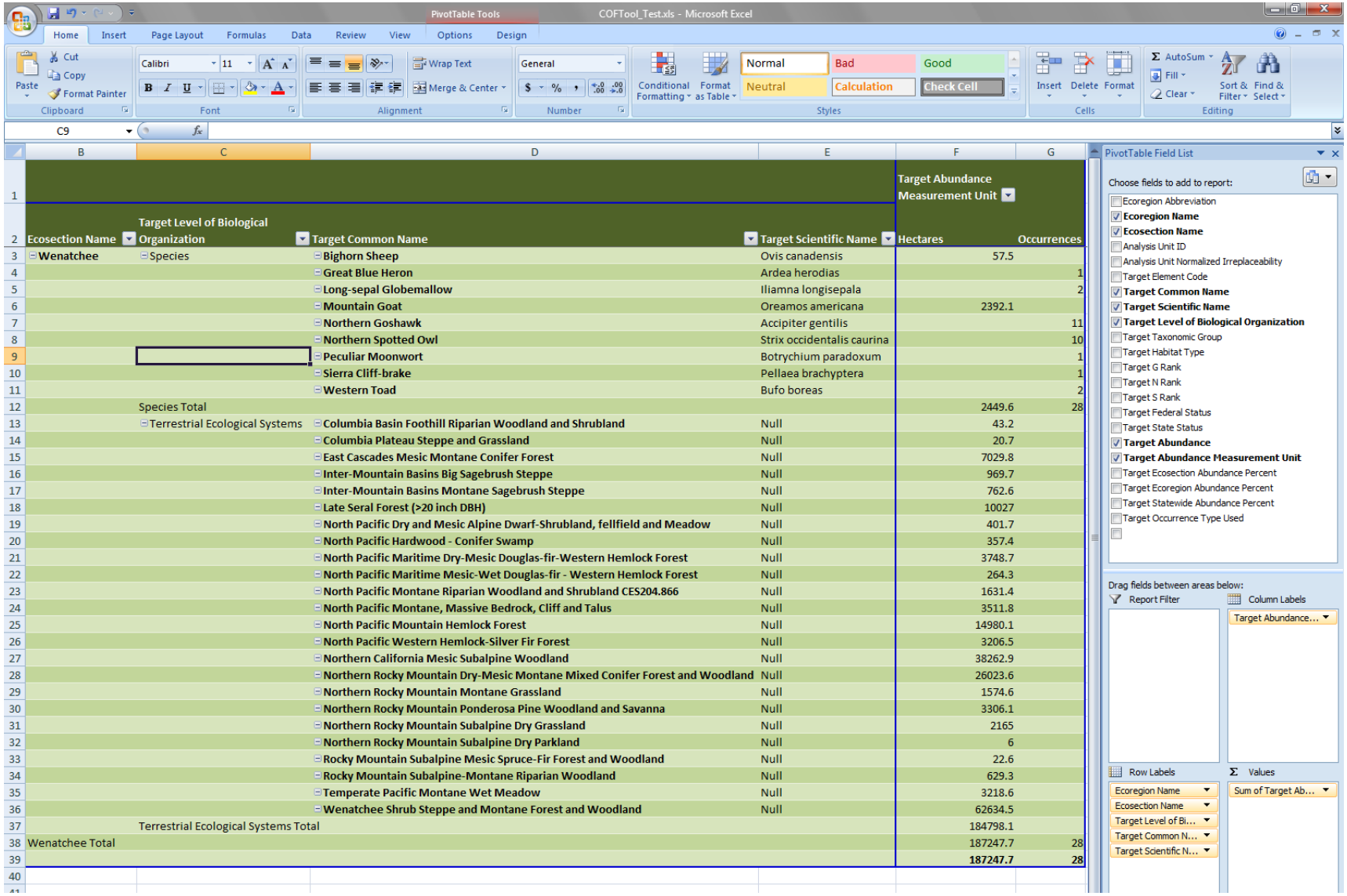
| NC | North Cascades | Northwestern Cascade Ranges | 100308179 | 0.248 |

Number of AUs selected: 50 Export Excel Pivot Report Export CSV Table Dismiss

**Figure 5.** The pop-up data grid from which users can export comma separated text files and Microsoft Excel pivot reports.

At the bottom of Table 5 are buttons that allow users to export the table into formats better suited for analysis and reporting. The export to CSV table command button converts all the data into a simple comma separated text file (for users who do not have Microsoft Excel). The other export option creates an excel spreadsheet and additionally creates a report in pivot table form (Figure 6). When this file is opened the user can view the data either as a report or in its raw data form. Each of these different view options are represented as their own excel worksheet.



| Ecosection Name | Target Level of Biological Organization | Target Common Name | Target Scientific Name | Target Abundance Measurement Unit: Hectares | Occurrences |
|---|---|---|---|---|---|
| Wenatchee | Species | Bighorn Sheep | Ovis canadensis | 57.5 | |
| | | Great Blue Heron | Ardea herodias | | 1 |
| | | Long-sepal Globemallow | Iliamna longisepala | | 2 |
| | | Mountain Goat | Oreamos americana | 2392.1 | |
| | | Northern Goshawk | Accipiter gentilis | | 11 |
| | | Northern Spotted Owl | Strix occidentalis caurina | | 10 |
| | | Peculiar Moonwort | Botrychium paradoxum | | 1 |
| | | Sierra Cliff-brake | Pellaea brachyptera | | 1 |
| | | Western Toad | Bufo boreas | | 2 |
| | Species Total | | | 2449.6 | 28 |
| | Terrestrial Ecological Systems | Columbia Basin Foothill Riparian Woodland and Shrubland | Null | 43.2 | |
| | | Columbia Plateau Steppe and Grassland | Null | 20.7 | |
| | | East Cascades Mesic Montane Conifer Forest | Null | 7029.8 | |
| | | Inter-Mountain Basins Big Sagebrush Steppe | Null | 969.7 | |
| | | Inter-Mountain Basins Montane Sagebrush Steppe | Null | 762.6 | |
| | | Late Seral Forest (>20 inch DBH) | Null | 10027 | |
| | | North Pacific Dry and Mesic Alpine Dwarf-Shrubland, fellfield and Meadow | Null | 401.7 | |
| | | North Pacific Hardwood - Conifer Swamp | Null | 357.4 | |
| | | North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest | Null | 3748.7 | |
| | | North Pacific Maritime Mesic-Wet Douglas-fir - Western Hemlock Forest | Null | 264.3 | |
| | | North Pacific Montane Riparian Woodland and Shrubland CES204.866 | Null | 1631.4 | |
| | | North Pacific Montane, Massive Bedrock, Cliff and Talus | Null | 3511.8 | |
| | | North Pacific Mountain Hemlock Forest | Null | 14980.1 | |
| | | North Pacific Western Hemlock-Silver Fir Forest | Null | 3206.5 | |
| | | Northern California Mesic Subalpine Woodland | Null | 38262.9 | |
| | | Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland | Null | 26023.6 | |
| | | Northern Rocky Mountain Montane Grassland | Null | 1574.6 | |
| | | Northern Rocky Mountain Ponderosa Pine Woodland and Savanna | Null | 3306.1 | |
| | | Northern Rocky Mountain Subalpine Dry Grassland | Null | 2165 | |
| | | Northern Rocky Mountain Subalpine Dry Parkland | Null | 6 | |
| | | Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland | Null | 22.6 | |
| | | Rocky Mountain Subalpine-Montane Riparian Woodland | Null | 629.3 | |
| | | Temperate Pacific Montane Wet Meadow | Null | 3218.6 | |
| | | Wenatchee Shrub Steppe and Montane Forest and Woodland | Null | 62634.5 | |
| | Terrestrial Ecological Systems Total | | | 184798.1 | |
| Wenatchee Total | | | | 187247.7 | 28 |
| | | | | 187247.7 | 28 |

**Figure 6.** An example report produced with the COF data viewer tool.

The report format allows the user to select and unselect fields (i.e., attributes) and summarizes the targets within an AU or a selected group of units. The raw data format lists out each of the individual target species and ecological systems for every selected unit. In this format, each column heading has a dropdown menu that lets the operator make more targeted selections. Users that are familiar with excel will be able to sort data and perform mathematical operations in the raw data form.

Although a lot is possible with pivot tables, it is essential to understand and adhere to the inherent relationships of the data. Keep in mind that the ecoregion and ecosection percentages have been calculated for targets found in the corresponding AUs. Actions like removing the names of ecoregions from row labels in a pivot report can lead to erroneous results when improperly manipulated information is then used to perform mathematical operations.

**Final considerations**

Now that you have a basic understanding of the data, you can use the data viewer to report on the ecological value of places throughout Washington. Although the data viewer can help in evaluating various types of conservation planning projects, the limitations of this tool also need to be understood.

Probably the most significant limitation of the data viewer is that it is operating with a static data set. As mentioned earlier, the data comes directly from EAs that were completed between 1999 and 2004. For each EA, a 20 year cutoff was used to determine the maximum age of data that could be used. That means that data from a report published in 1999 might include some data that is now over 30 years old. Although much of the data is still current and valid, some of it may be already considered historical.

Because of this limitation, users should consider using other sources of ecological data in conjunction with the data viewer. In Washington, WDFW and DNR maintain databases containing relevant sources of species and habitat information that are continuously maintained and updated (Table 3). These sources can complement the information in the data viewer. Other sources of local data should also be sought after to further enhance the ability to evaluate a site.

**Table 3**. Sources of frequently updated data that provides the locations of important species and habitats throughout Washington.

| Information Source [1] | Purpose | How to obtain |
|---|---|---|
| WDFW's PHS data | To determine if WDFW has identified locations of priority species or habitats. | http://wdfw.wa.gov/mapping/phs/ |
| DNR's Rare Plants and High Quality Ecosystem data | To determine if DNR's Natural Heritage Program (NHP) has identified rare plants or high quality ecosystems. | http://fortress.wa.gov/dnr/app1/dataweb/dmmatrix.html |

1. Some databases contain some data that cannot be distributed to the general public due to issues of data sensitivity.

Another limitation is that species and habitat information can only be viewed within the extent of the AUs. That means that users are not able to see the exact locations of species or habitats. We kept these locations inexact because some organizations and agencies that contributed the data requested their data not be given to the public as exact locations. Other contributors also made it clear that some of their data was protected under a formal sensitive data policy. To address these conditions we were required to

present the data at a scale that would not divulge precise locations. Although this may not be much of an issue for many users, it certainly presents some limitations on what the type of questions can be answered using the data viewer.

The final major limitation of the data viewer is the absence of data from the aquatic EAs. Although the viewer is powerful in its ability to share information about plants and plant communities as well as key species of birds, mammals, reptiles, and amphibian, users will have to look elsewhere for aquatic species and habitat data.

Although the data viewer has its limitations, those using it will find a lot useful information to help in evaluating sites across the state. And, now that you have a basic understanding of how to use the data viewer, we invite you to test it out to see how it can aid in project planning. We hope that by getting a closer look at the data, the COF Data Viewer can begin to help shed some new light on the biodiversity of sites that are of interest to groups involved in conservation planning.