Behind the Portal: Use of GOS Map and Data Services

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The Coeur d'Alene Tribe, North Carolina Department of Environmental and Natural Resources, and US Environmental Protection Agency GOS Integration Project

Final Report

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Executive Summary

The Coeur d'Alene (CDA) Tribe, North Carolina Department of Environment and Natural Resources (NCDENR), and U.S. Environmental Protection Agency (EPA) Geospatial One-Stop (GOS) Integration Project provided software, resources, training, and assistance to allow partners to more easily leverage GOS (and other metadata) services for their needs. A key feature of this project was the development of a web-service based reusable application programming interface (API) that supports numerous geospatial metadata catalog implementations and provides content to users in a variety of output formats. The application, called GeoFinder for the Environment (GFE) extends GOS capabilities by allowing users to connect to a number of different catalogs (including GOS) and enact searches simultaneously. The user then has the option to format and customize output results in a number of ways, including GeoRSS, HTML, and KML. These outputs can be combined with a number of other tools to make the content accessed through the GFE readily available to a wide range of uses.

A major goal of the project was providing partners with the ability to interface with the GFE API directly in order to integrate the software within their systems. The Innovate team worked with the partnering agencies to describe the GFE capabilities, and then partner groups utilized the API to implement their own solutions. This approach realized the goal of creating a reusable service that others can access and manipulate for their own needs. Our partner agencies were able to work with the GFE API to integrate the tools within their organizations. The implementation chosen by each group illustrates a different aspect of the application's capabilities.

A final step in the project was providing training to the general public on the use of GFE and GOS resources. The session made use of examples provided by partner agencies in order to provide attendees with an understanding of how to use GFE components and GOS API features in their own applications. The training session was attended by a total of 45 persons, including individuals from state, federal, and private entities. Additional detail on the training sessions is provided below.

Project Narrative

The goal of the CDA Tribe, NCDENR, and EPA GOS Integration Project was to provide resources that could allow partner agencies to effectively implement the GFE within different partner environments in order to more easily find and access geospatial resources. When this project was initiated in April 2009, the GFE was a pre-existing application that allowed EPA and a group of selected partners to share metadata through a web-based user interface. GFE was extended through this effort in numerous ways. First, the GFE was made into a web-service based reusable API that users can easily utilize to query the application and output results. Second, GFE was extended to support additional implementations of the Catalog Service for the Web (CSW) specification and Z 39.50. The project made use of existing partner metadata catalogs and enabled users to optimize GFE services for use within their own environments. Third, a number of new metadata providers were added to the list of GFE sources and existing catalog providers were updated to reflect enhancements at target source sites (e.g., the GOS CSW interface). Fourth, a number of additional enhancements were made to improve and streamline GFE functionality for optimizing its usability for the project team. Search results can be output to Google Maps, the Google Earth Plug-in, Microsoft Bing, DHTML, HTML, GeoRSS, and KML. The application is currently available at http://dev.innovateteam.com/GFE/.

Key project activities included enhancing the existing GFE application and customizing it to meet the needs of partners, providing new output formats for our partners to use in their various environments,

exposing a URL-based API, collaborating with partners to help them implement the application in their own environments, and providing general training so that other users can access the resources provided through this project for their own needs. These activities (described in greater detail below) are categorized into the following five areas:

1. Enhancements to Core GFE functionality
2. Providing new output formats
3. Expose a URL-based API to allow GFE to be used by partners
4. Partner Collaboration
5. Training and Outreach

1. Enhancements to Core GFE Functionality

Numerous enhancements were made to GFE's underlying search infrastructure. Enhancements began with upgrades to the GFE code base to Java 5 and Dojo 1.3.1. The new version of Dojo includes a fix for a bug affecting the display of metadata records that was discovered and fixed previously by Innovate personnel (http://trac.dojotoolkit.org/ticket/8045). The GFE code base upgrade was followed by updates to core GFE functionality that included:

- Enhancements to support ESRI CSW 2.0.0 implementation:
    o Support spatial search
    o OGC filter tree-pruning to avoid crashing the server
    o Detect connector inserted metadata linkages
- Support for ESRI CSW 2.0.2 implementation
- Support for GOS CSW 2.3.1. Permitted the extended syntax of the keywords parameter for GOS searches
- Included support for the "isPartOf" and "contributor" (affiliation) filters for GOS CSW interface.
- Support for GOS source identifier
- Improved IE rendering
- Improve consistency of search experience across providers, protocols (Z39.50 and CSW), implementations (Isite, ESRI, GeoNetwork) and metadata record formats (CSDGM, ISO, DC).
- Extract all linkages from metadata records
- Server-side XML pretty-printing to achieve consistent viewing of XML metadata across browsers.
- Implement mechanism to retrieve XML metadata from sources that support a unique identifier
- Implement mechanism to retrieve readable (HTML) metadata from sources that support a unique identifier
- Support dynamic HTML output
- Support static HTML output
- Support KML output
- Support GeoRSS output
- Demonstrative use of static and dynamic HTML outputs in browser
- Demonstrative use of KML output in Google Earth browser plug-in, Microsoft Bing and desktop tool.
- Demonstrative use of GeoRSS output in Google Maps and desktop/browser RSS viewer.
- XSL and CSS parameters added to control appearance and extraction of metadata
- Added training and outreach materials to "About" section of GFE website

2. Providing New Output Formats

The GFE application may be accessed using the GFE web interface (http://dev.innovateteam.com/GFE/). The GFE web interface allows users to search for information and view results. In addition to viewing results within the standard GFE user interface, users can now request output in several different formats:

- Google Maps
- Google Earth Plug-in
- Microsoft Bing
- Static HTML
- Dynamic HTML
- GeoRSS
- KML

Several output formats are illustrated below. Figure 1 shows metadata search results output in the GFE web interface. This is the simplest view of results and is intended as a starting point for users to discovery how to customize parameters and results output from the API. Figure 2 shows an example of GFE output in Google Maps, which utilizes the GFE's GeoRSS output format. If the metadata record provides bounding box information, bounding boxes will be displayed visually on the map. Clicking on a box displays the abstract from the metadata. Figure 3 illustrates metadata results (bounding boxes) shown in the Google Earth plug-in, which uses the KML format. Figure 4 illustrates the use of GFE's add to map capability, which allows a user to dynamically add KML or WMS content discovered and viewed in Google Earth (KML) format to the user's Google Earth viewer. Figure 5 shows GFE's DHTML output, which takes advantage of Dojo and javascript on the user's browser. Clicking on any row of in the results list will open a window in the foreground, displaying the detailed data. Figure 6 shows the GFE's web-based map viewer that allows users to visualize WMS data dynamically in a web-based map. Figure 7 shows the Coeur d'Alene Tribe's implementation of GFE's DHTML output embedded directly within their existing GIS data web page. Figure 8 shows EPA's implementation of the GFE KML output in their EPA Earth Application.
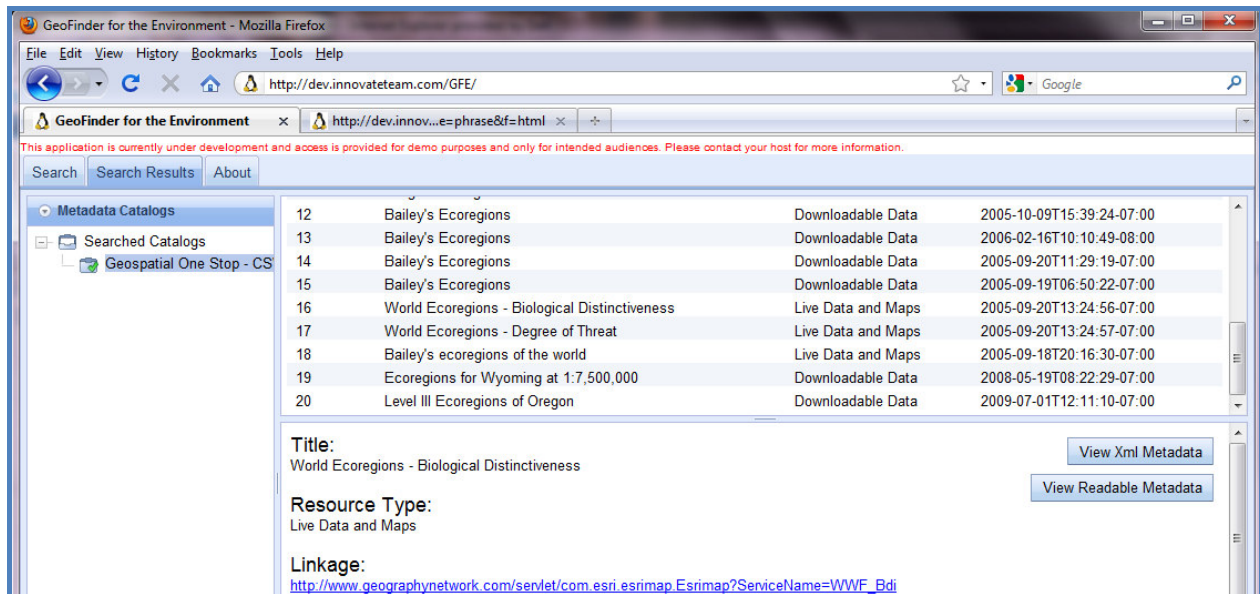

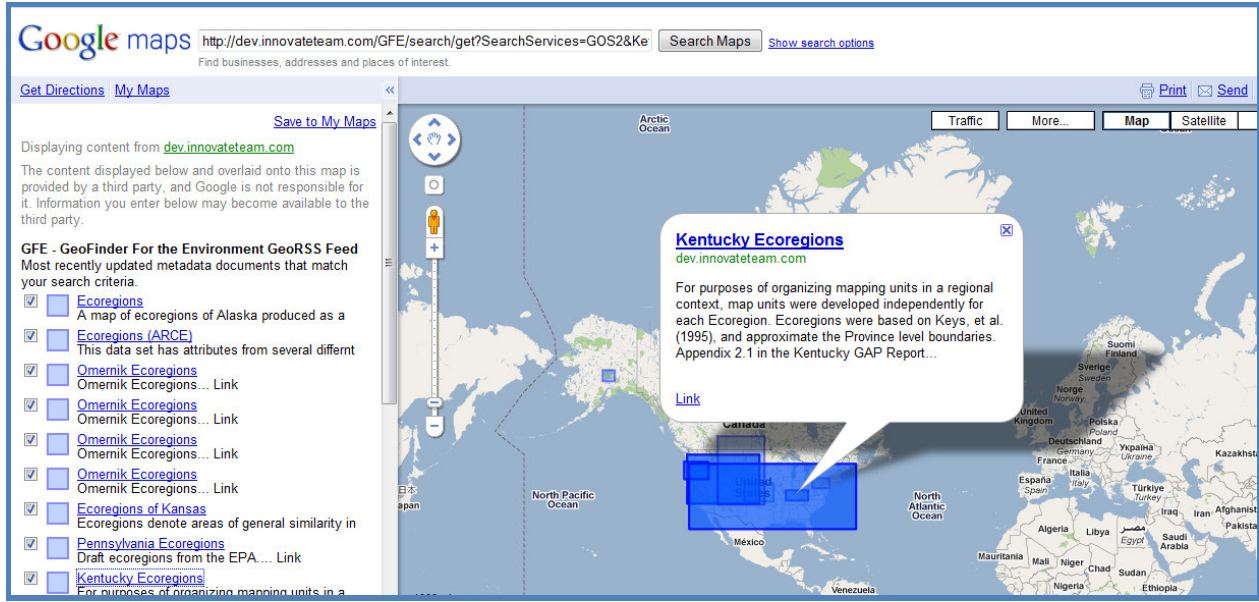**Figure 1 – GFE Output Shown in GFE Interface**
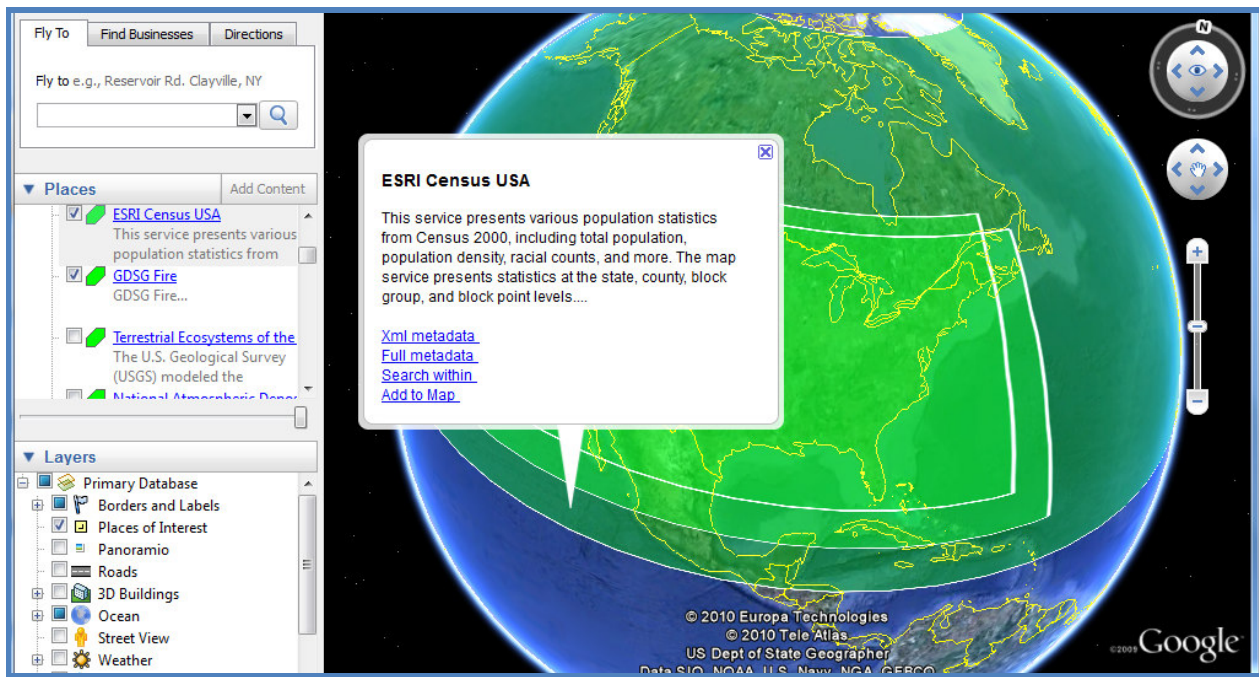
Figure 2 - GeoRSS Output in Google Maps

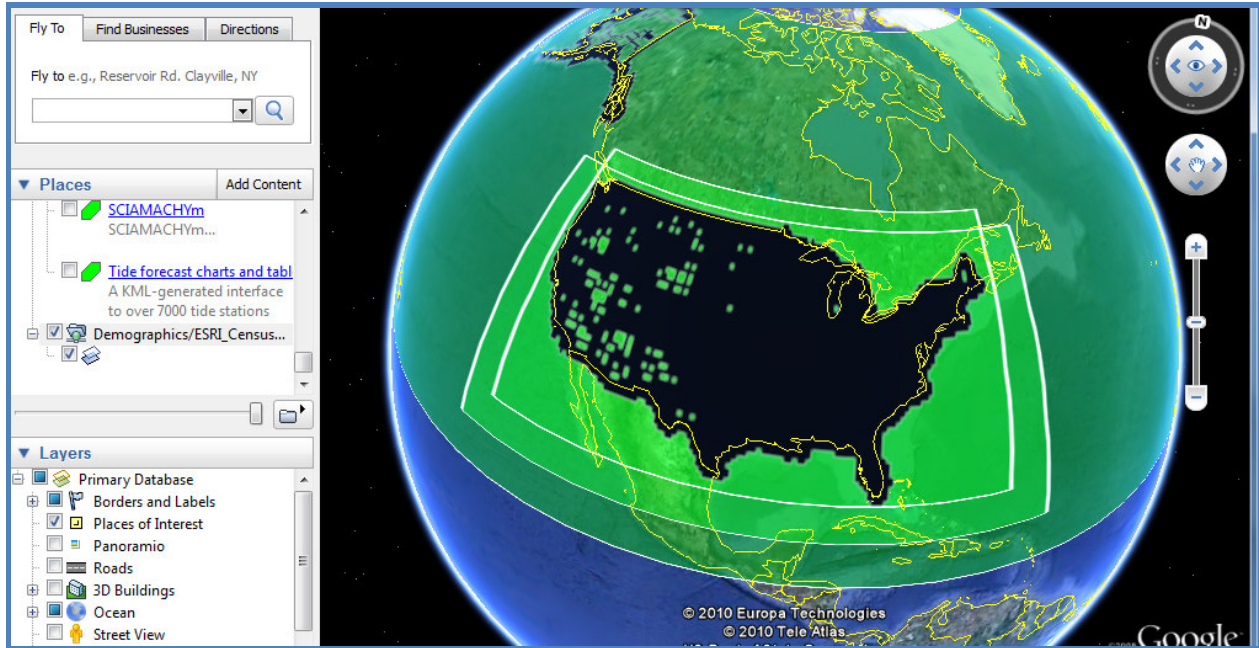**Figure 3 - KML Output in Google Earth**

Figure 4 - KML Output in Google Earth with Add to Map Functionality for KML and WMS resources
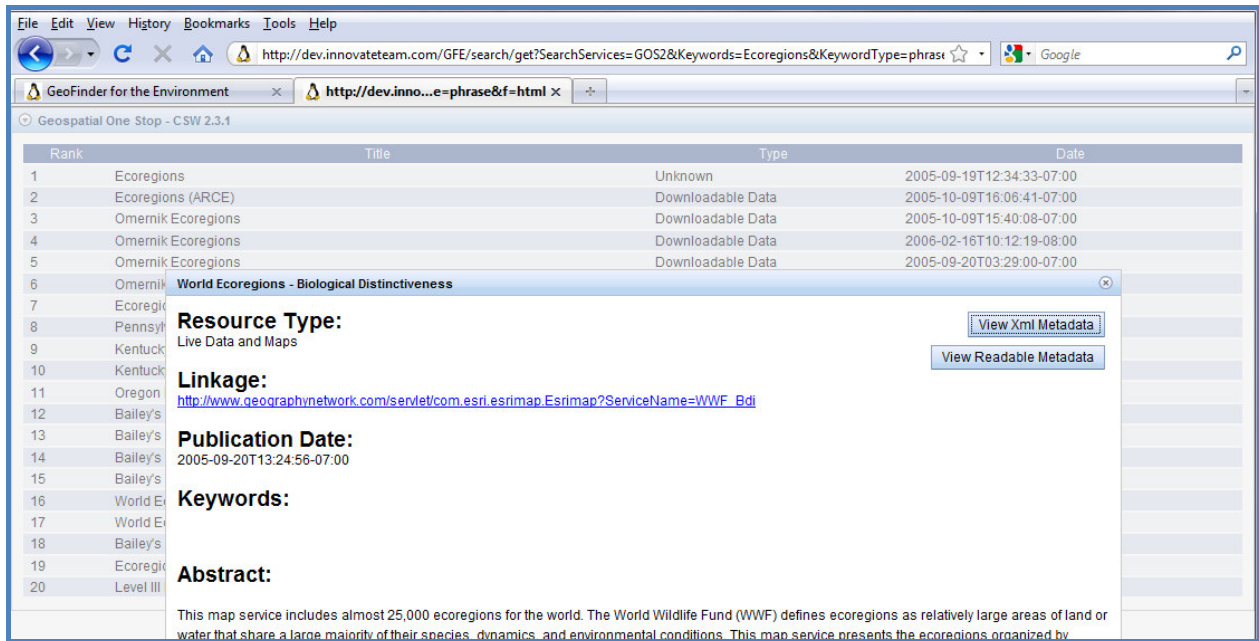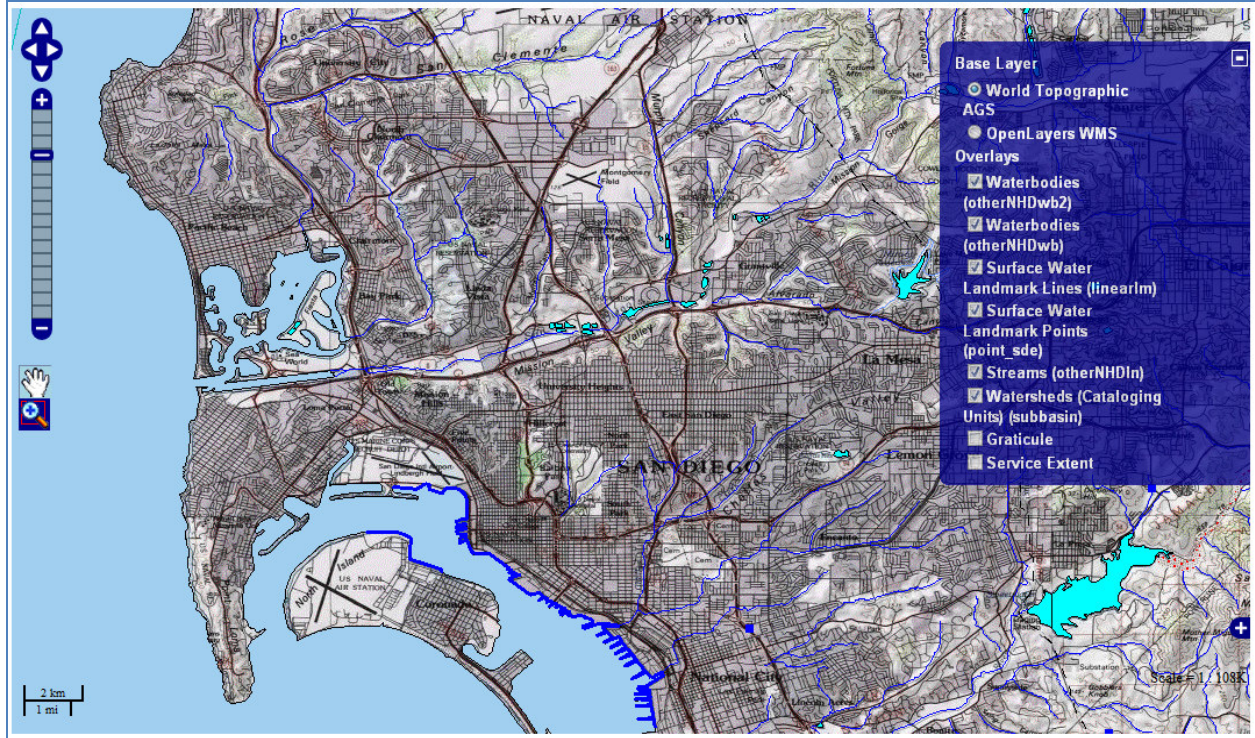

Figure 5 - Dynamic HTML

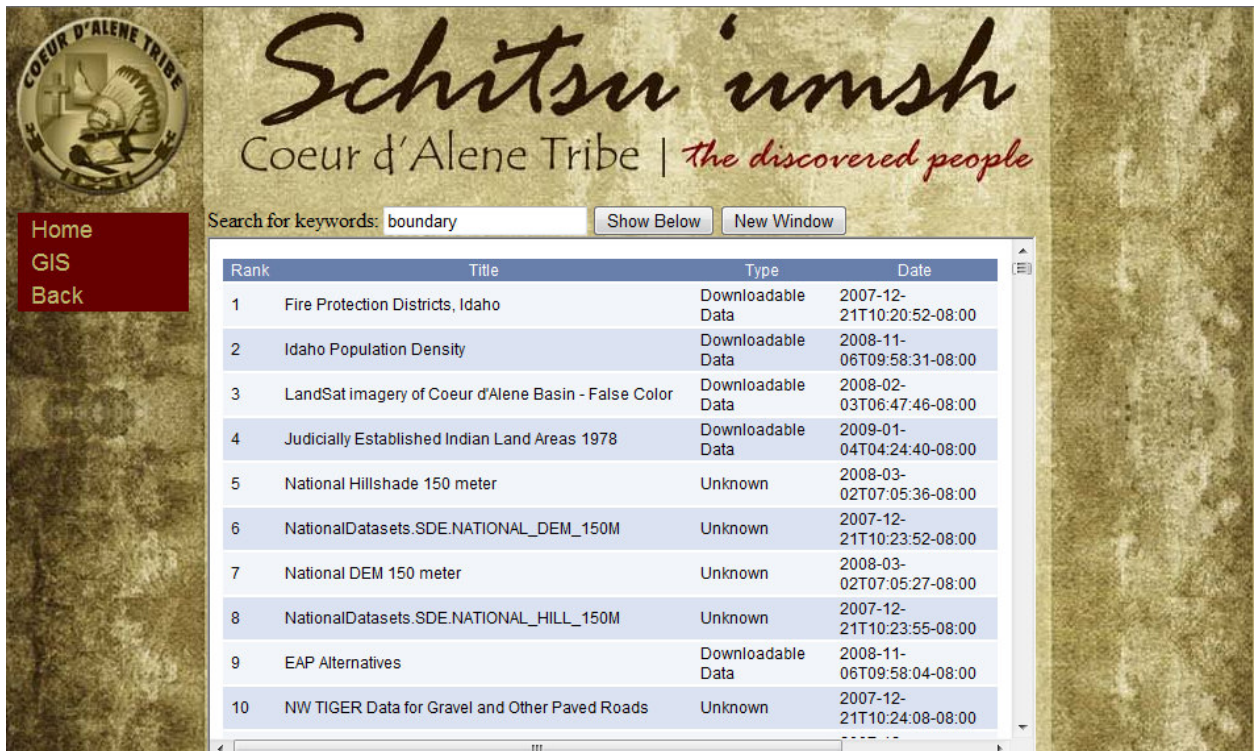**Figure 6 – GFE Web-based Mapping Interface Showing Overlay of WMS Service**

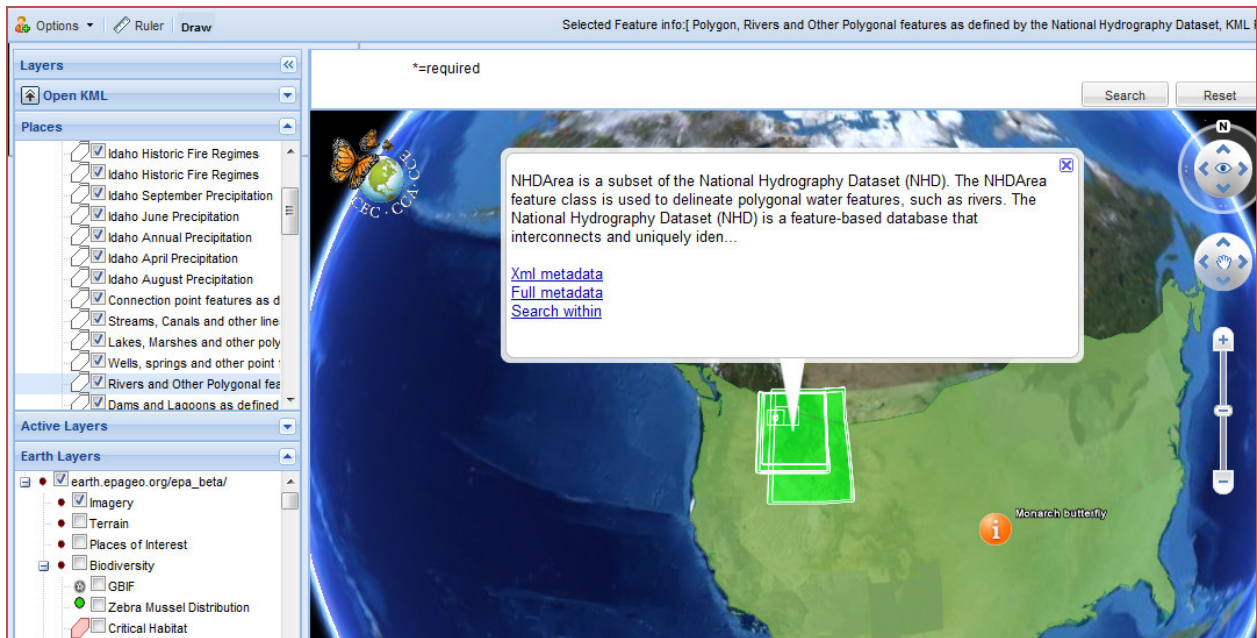**Figure 7 – GFE DHTML Output in Coeur d'Alene Web Page**

Figure 8 – EPA Earth Implementation of GFE Output (KML Output Format)

3. Expose a URL-based REST API to allow GFE to be used by partners

Another major area in which work was done was the development and exposure of a URL-based API. This simple API allows access to all of the features of GFE that are available via the user interface. Parameters select search service providers and search criteria, such as bounding boxes and keywords. Another parameter selects the output format. The API was designed to be easy to use, yet it gives access to all of the features of GFE. All of the illustrations above were produced using the API. Some examples of the API are shown below.

API Parameters:

    Base URL String: http://dev.innovateteam.com/GFE/search/get?

- Keywords
- Keyword type (all, any, phrase)
- Bounding coordinates (180 to -180; 90 to -90)
    - Eastbc
    - Westbc
    - Southbc
    - Northbc
- Output format (kml, georss, html, html_static)
- SearchServices (GOS2, EPA_GDG_PUB)
- Source (10787, 3667): 10787=EPA; 3667=CDA

Examples:

- EPA Records Shown in Google Earth Plugin:
  http://dev.innovateteam.com/GFE/GEPlugin.html?searchUrl=http://dev.innovateteam.com/G
  FE%2Fsearch%2Fget%3FSearchServices%3DGOS2%26Keywords%3DIdaho%26Keyword
  Type%3Dall%26f%3Dkml%26source%3D10787

- CDA Records in GeoRSS Output:
  http://dev.innovateteam.com/GFE/search/get?SearchServices=GOS2&Keywords=boundary&
  KeywordType=all&source=3667&f=georss

- CDA Records shown in Google Maps:
  http://maps.google.com/maps?f=q&source=s_q&hl=en&q=http://dev.innovateteam.com/GFE
  %2Fsearch%2Fget%3FSearchServices%3DGOS2%26Keywords%3DCDA%26KeywordTyp
  e%3Dall%26f%3Dgeorss%26source%3D3667

4. Partner Collaboration

A key aspect of this project is enabling partner organizations to effectively reuse resources within their own environments. As such, considerable effort was put into defining how the GFE could be used to meet the needs of our partners. Our team developed a "Requirements, Use Cases and Design" document and reviewed this with partners. We coordinated across teams to understand how best to customize the use of the GFE application to best meet user needs. The implementations chosen by each organization are described in more detail below.

The EPA implementation utilizes the KML output from the GFE API within its custom Enterprise Google Earth implementation (called EPA Earth). This implementation allows users to search for and access geospatial information from EPA's geospatial catalog and from the GOS catalog directly from the EPA Earth application. Users can display the search results directly within EPA Earth using the KML output option returned by the GFE application. The KML file displays the footprint of the bounding box of the data set described by the metadata and allows the user to view additional details about the metadata (title, abstract, link to full metadata, link to geospatial content where applicable). EPA Earth programmers were interested in the spatial search aspects of GFE. Initially the team was concerned about the approach that required that data returned be completely within the search coordinates. The EPA Earth team was initially interested in having spatial search function using "overlap" rather than "completely within". The rationale for this approach was explained by the need to eliminate returning records that have national or global coordinates (which can often be the case for many records).

The CDA tribe implementation utilizes the DHTML output from the GFE API. The DHTML output is embedded into an internal web page to allow users to view updated information about environmental data within their tribal area. The search has been configured to point to CDA tribe data specifically as well as to data from other organizations that falls within the geographic extent of the tribe (or greater region around the tribal area). Users are able to view the metadata record's title, abstract, online linkage (where available), and a link to the full metadata record. Because of feedback from the tribe, we have also added support for CSS style sheets in the DHTML and HTML output formats. Additionally, at the request of the CDA tribe, the team augmented the GFE to provide additional flexibility for users to specify their own XSL style sheets in order to control which metadata elements are presented to the user from the search results. The CDA application is currently available at http://gis.cdatribe.com/SearchGISData.aspx.

As part of this effort, the CDA tribe was able to take advantage of SDE metadata harvesting capabilities that had originally been developed for EPA. Although this feature was not originally planned, the functionality provided through this inter-agency collaboration is a good example of how CAP grant activities enhance geospatial application and code reuse across organizations. The SDE harvesting

feature was originally developed as a component for EPA to use internally to support users in harvesting metadata directly to EPA's internal metadata catalog from an SDE database. The CDA tribe was hoping to retire their ArcIMS metadata service as they moved toward ArcGIS Server and was also interested in ensuring that the information provided to GOS was up to date with the content in their local database. This dynamic "SDE to WAF" capability creates a dynamic web accessible folder (WAF) from a local database that can then be directly harvested by GOS. A user can choose to configure the application to point to their entire metadata table, or they can choose to point to a view of their records that allows them to harvest only records that they are interested in having harvested to GOS. Because CDA tribe individuals can use GFE to allow users to search for and browse their metadata catalog, they can effectively retire the ArcIMS metadata explorer and still provide the functionality for contributing to GOS and allowing for user access to records.

NCDENR was planning to implement a metadata catalog as part of this effort. The project team worked with NCDENR to discuss options for reusing the GFE resources once their catalog is in place and made available to the GFE application. NCDENR implemented a GeoNetwork catalog that supports CSW 2.0.2, however, as of the writing of this document, the catalog developed by NCDENR is still not available to the GFE application due to firewall restrictions. NCDENR has been planning to utilize the dynamic HTML output from the GFE REST API to allow users to search their Geo Network Catalog and display the results within a departmental web page.

5. Training and Outreach

The project team also completed a general training session as part of this project. The training was conducted on March 31, 2010 from 3:00 to 4:00 PM Eastern. The session was made available via web-cast to any interested party and covered the following topics:

- Getting started
    - o Basic metadata catalog concepts

- GOS catalog interfaces
    - o What is available?
    - o How do you use it?

- GFE capabilities
    - o What is the GFE?
    - o Accessing the GFE
    - o GFE partner implementations
    - o How can you leverage the GFE?

- Steps for getting started with catalog services in your organization

- Additional tools that may help

- Questions

Forty-five (45) individuals attended the training sessions. Attendees ranged from state, to federal, to local government, and private industry affiliations. Feedback from the sessions indicates that attendees felt the training was useful. Some specific responses included:

"I thought the training was good and it gave me a few ideas of things we could take advantage of. I would like a copy of the presentation."

"We found your presentation very informative and will be meeting today to discuss how we might put your techniques to good use. No questions for now but a copy of the slide presentation would be helpful."

Training materials are currently available at the GFE website for general access. They will continue to be available at the following URL: http://dev.innovateteam.com/CAP2009/CAP2009-10_Training.pptx.

Next Steps

As the CAP project comes to a close, the resources developed through this effort will continue to be used. The GFE application will remain available to interested users at http://dev.innovateteam.com/GFE/. The training information is also available to the public at the URL shown above, and the Innovate team is considering holding future web-casts related to metadata catalog service topics due to the response and interest received in follow-up from the sessions. GFE is already being used as a key component in a high profile project involving federal-state partnerships that is expected to go nation-wide and our project team has been approached by others to explore the possibility of expanding the use of the GFE technology within other applications. Moving forward, the software developed for this CAP project will be utilized beyond the scope of this effort to enhance organizations' ability to discover, access, and reuse each other's resources for their own needs.

Feedback on the CAP Program

Overall, our team found the CAP program to be an effective program for allowing our team to carry out the goals of this project. We feel that our team and our partner agencies were able to gain knowledge and tools from this effort. Working with a group of 4 awardees was beneficial for obtaining a larger view of related efforts and for sharing knowledge and resources. The use of regular check-ins with the project management team was also effective for establishing progress and viewing other partner results and implementations. I believe that something that might be useful for future CAP consideration is how to address follow-on activities. Our team was approached by a number of individuals who are interested in receiving additional training. We are discussing options for completing this internally, but some sort of option year extension for valuable follow-on activities might be nice for providing individuals with a way to continue the work developed and provide resources to interested parties. Overall, we were very happy with the way the CAP program was operated and look forward to working on future CAP projects.