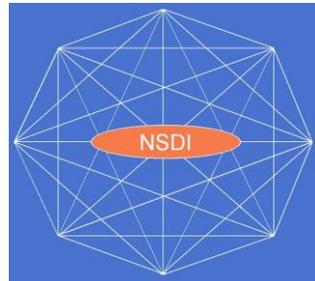


# 2012 NSDI CAP Final Report

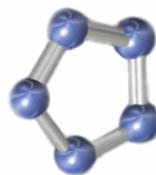
## 2012 NSDI Cooperative Agreement Program Proposal Category 5: FGDC-endorsed Standards Implementation Training and Outreach

**Project Title:  
Implementation Model Development for FGDC-Standard  
Cadastral Data - Enabling Seamless Parcel Data  
Exchange**

**Presented To:**



**Submitted By:**



**The Carbon Project**

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**Executive Summary**

Land ownership has been critical to the economic development of the United States. Land parcel databases, also known as cadastres, describe the rights, interests, and value of property. These databases represent the distribution of the real property assets of a community and its ownership, form the basis for land use and zoning decisions, and represent the location of residences, businesses, and public lands. In other words, almost every aspect of government and business can be associated with a land parcel. Given the importance of this data there is growing interest in creating 'seamless' statewide and federal parcel data sets that can be shared among local, state, tribal and federal organizations. To support such 'seamless' parcel data sharing this project assisted in the deployment of the FGDC-endorsed standard for Cadastral Data Content by developing a draft implementation model in Extensible Markup Language/Geographic Markup Language (XML/GML) for parcel data. The intent of this XML/GML Implementation Model is to help enable 'seamless' parcel data exchange among local, state, tribal and federal organizations. This effort builds on a survey commissioned in early 2008 by the North Carolina Working Group for Seamless Parcels (WGSP) to determine most commonly needed cadastral data attributes. The XML/GML Implementation Model for Parcel Data and associated technical guidance is freely available and designed to help promote uptake of the FGDC-endorsed Cadastral Data Content Standard across the United States National Spatial Data Infrastructure (NSDI).

## Project Narrative

### Overview

Land ownership has been critical to the economic development of the United States. Land parcel databases, also known as cadastres, describe the rights, interests, and value of property. These databases represent the distribution of the real property assets of a community and its ownership, form the basis for all land use and zoning decisions, and represent the location of residences, businesses, and public lands. In other words, almost every aspect of government and business can be associated with a land parcel.<sup>1</sup>

Given the importance of this data there is growing interest in creating 'seamless' statewide and federal parcel data sets that can be shared among local, state, tribal and federal organizations – and the objective of this project is to assist in the implementation of the FGDC-endorsed standard for Cadastral Data Content.

To achieve this objective the project developed a draft implementation model in Extensible Markup Language/Geographic Markup Language (XML/GML) for Cadastral Data with the intent of enabling 'seamless' parcel data sharing among local, state, tribal and federal organizations. The XML/GML Implementation Model for Parcel Data and associated technical guidance is freely available<sup>2</sup> and designed to help promote uptake of the FGDC-endorsed Cadastral Data Content Standard across the United States National Spatial Data Infrastructure (NSDI).

This effort was coordinated with the Integrated Cadastral Data Exchange platform for sharing North Carolina parcel data. Integrated Cadastral Data Exchange approach will improve statewide decision-making, reduce costs and serve as a model for next-generation seamless parcel data sharing – and has the potential to engage partners throughout the state that can help validate and refine XML/GML model development. This experience will be valuable in refining the implementation model in XML/GML for Cadastral Data with the intent of enabling 'seamless' parcel data sharing among local, state, tribal and federal organizations.

### Technical Approach

This project built on a survey commissioned in early 2008 by the North Carolina Working Group for Seamless Parcels (WGSP) to determine the most commonly needed cadastral data attributes. This survey identified multiple business cases that require seamless parcel data and a proposed list of standardized information elements that most county property mapping offices are able to

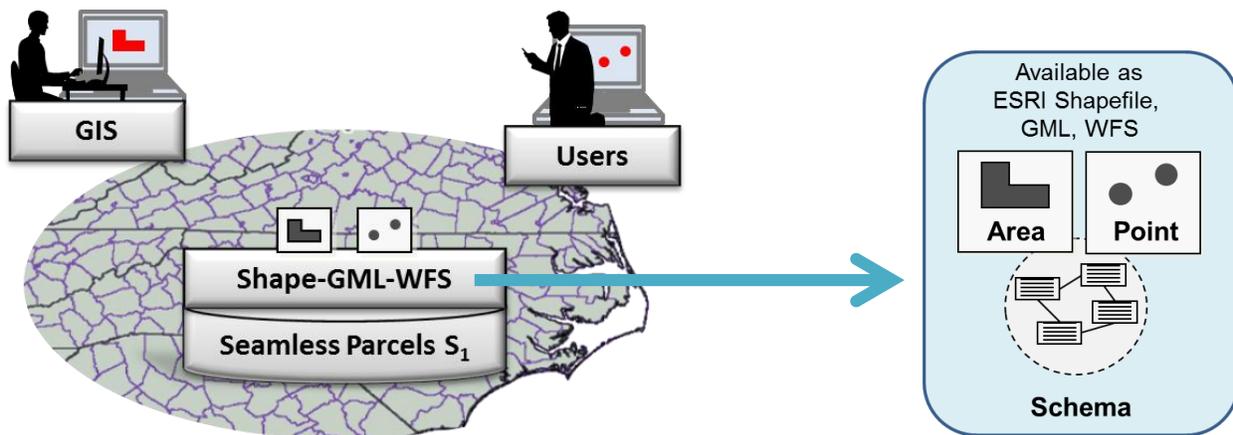
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<sup>1</sup> From "National Land Parcel Data (A Vision for the Future)", National Academies Press, 2007

<sup>2</sup> <http://nationalcad.org/2013/04/parcel-gml-project-review-report/>

support. The final attribute list is also fully conformant with the Federal Geographic Data Committee (FGDC) Cadastral Subcommittee standards for published parcel data. The WGSP also examined a number of options for standardizing and sharing Local Government cadastral and land use data.

For this project, these *identified parcel attributes were modeled as both Area (Polygon) and Point data in a 'Cadastral Data Content Schema'* (Figure 1). The architecture of this model supports a Geography Markup Language for Simple Features (GMLsf) schema usable in Esri GIS and other open GIS systems. This approach was designed to ensure full compatibility with existing GIS implementations in North Carolina and at the Federal level, and to provide a convenient connection to national networks for information exchange such as the EPA Exchange Network.



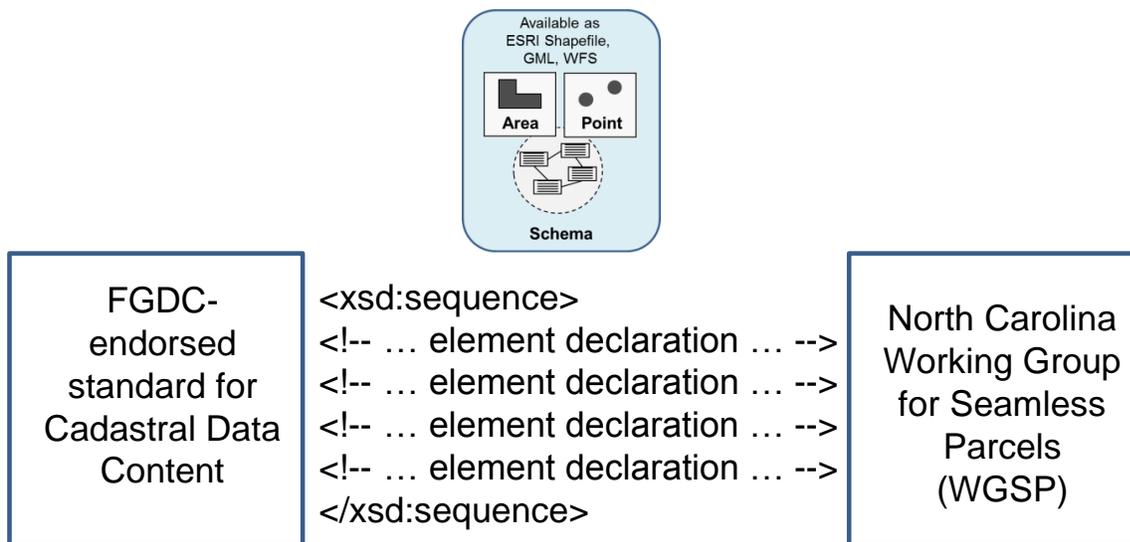
**Figure 1 - To develop the Implementation Model parcel information was modeled as both Areas (Polygons) and Points in GML. The use of GML and the addition of parcel point data to the seamless model will greatly enhance usefulness to many decision support applications (such the planned InCLUDE project in North Carolina).**

Development of the GML Implementation Model was conducted as series of collaborative tasks among project participants that:

- Verified core set of data elements that support business needs for parcel data among agencies,
- Converted core data elements to a Geography Markup Language for Simple Features

- (GMLsf) Exchange Schema to support NSDI interoperability<sup>3</sup>,
- Leveraged new cloud-based tools to develop and deploy the first draft schema encoding,
- Deployed prototype WFS cloud services with test data to assist in verifying the GML Implementation Model.

To support development of the GML Implementation Model the project team reviewed the FGDC-endorsed standard for Cadastral Data Content and the NC standard (North Carolina Working Group for Seamless Parcels) described above. A crosswalk was conducted between the two and examples developed using data from North Carolina counties. This crosswalk helped verify the core set of data elements that will support business needs for parcel data among multiple agencies. A summary of the crosswalk process for the draft GML Implementation Model is provided below.



**Figure 2 – Parcel GML Implementation Model development ‘crosswalk’ process**

Core data elements identified were then converted to a Geography Markup Language for Simple Features (GMLsf) Exchange Schema by uploading sets of test data from Fairview Industries into new cloud-based tools from The Carbon Project called CarbonCloud Plus+. The XML schemas generated by CarbonCloud Plus+ were then documented in a draft “Geography Markup Language

<sup>3</sup> GMLsf was selected as the starting point since it is designed to lower the “implementation bar” of time and resources needed to implement model of standard for published parcel data.

(GML) Implementation Model for FGDC-endorsed standard for Cadastral Data Content”. This draft was distributed to members of the project team and the FGDC Cadastral Subcommittee in late October 2012 for review. The draft GML Implementation Model is also being forwarded to the NC Center for Geographic Information and Analysis (CGIA), the NC Department of Transportation (NC DOT), the North Carolina Working Group for Seamless Parcels (WGSP), the North Carolina Property Mappers Association (NCPMA) and other organizations for review and comment.

As described in the draft schema, parcel data exchange compliant with this Implementation Model provides Geographic Features as *CoreParcelPts\_Type* for Point data or *CoreParcelShape\_Type* for Polygon data. These types are defined in the model and in XML schemas (*ParcelDataGML.xml*).

```

<?xml version="1.0"?>
<xs:schema version="0.1" elementFormDefault="qualified"
xmlns:gml="http://www.opengis.net/gml"
xmlns:cp="http://www.thecarbonproject.com"
targetNamespace="http://www.thecarbonproject.com"
xmlns="http://www.thecarbonproject.com"
xmlns:xs="http://www.w3.org/2001/XMLSchema">

<xs:import schemaLocation="http://schemas.opengis.net/gml/3.1.1/base/gml.xsd" namespace="http://www.opengis.net/gml"/>

<xs:element substitutionGroup="gml:_Feature"
type="cp:CoreParcelPts_Type" name="CoreParcelPts"/>
<xs:element substitutionGroup="gml:_Feature"
type="cp:CoreParcelShape_Type" name="CoreParcelShape"/>

<xs:complexType name="CoreParcelPts_Type">
...

```

Available as  
ESRI Shapefile,  
GML, WFS



Area



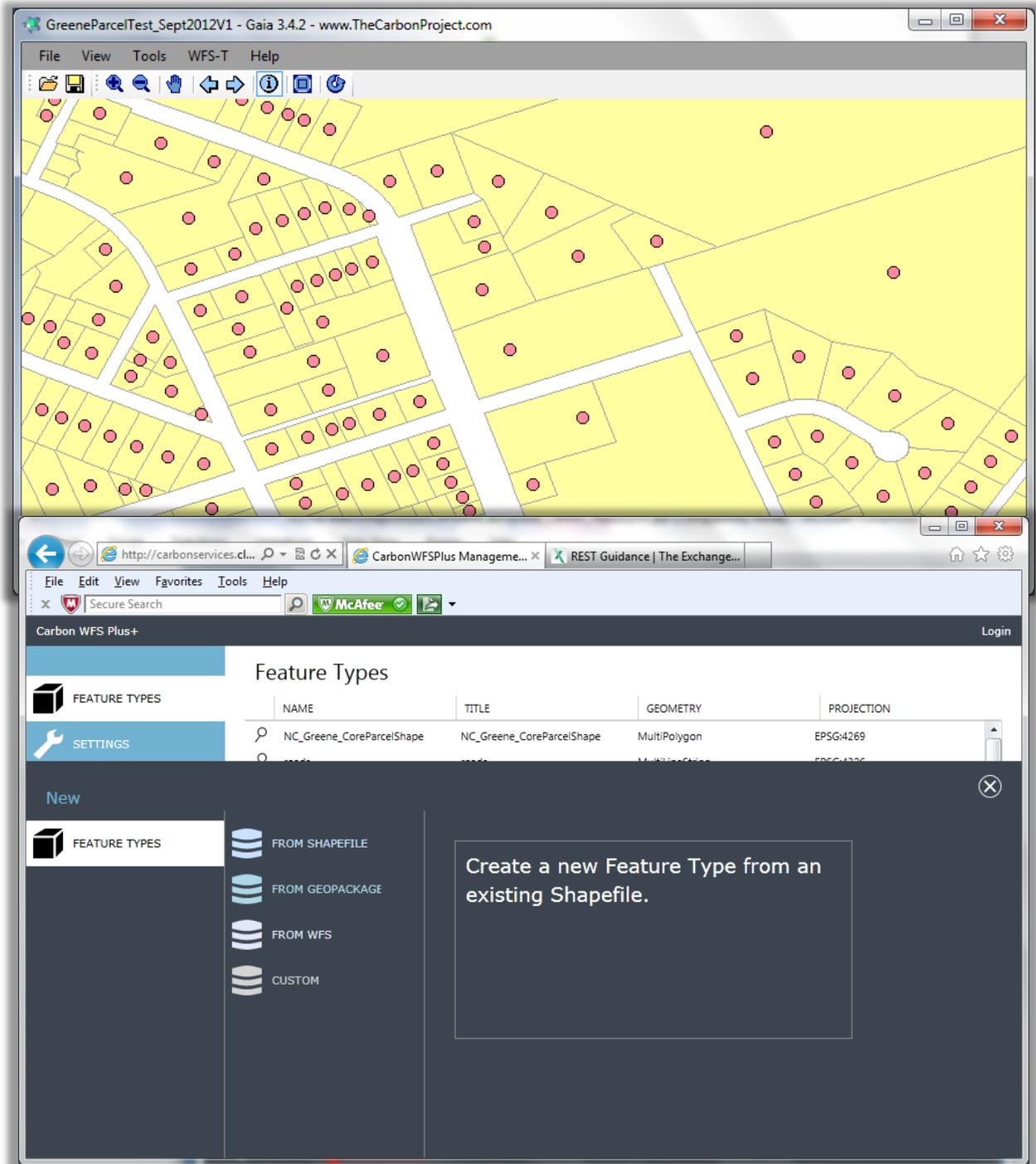
Point



Schema

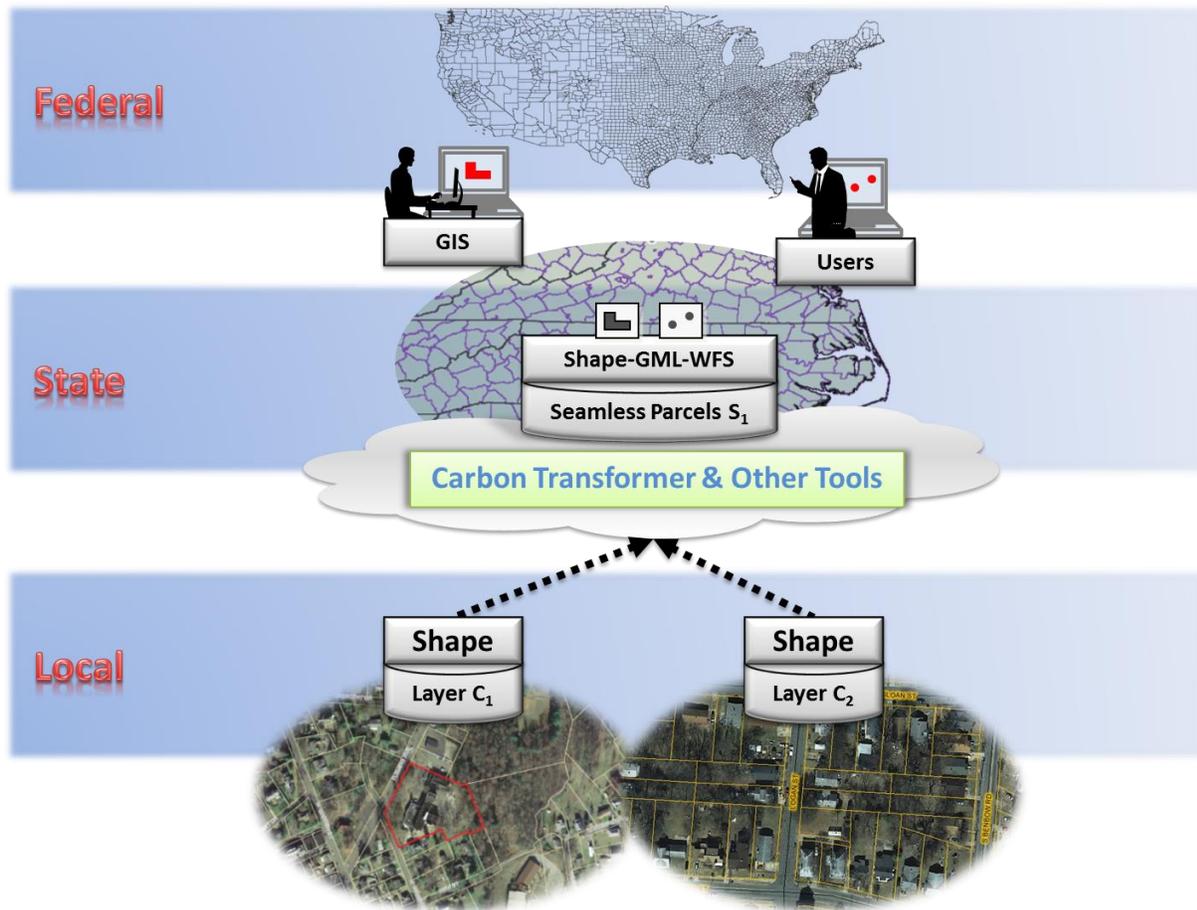
**Figure 3 - Core data elements identified were converted to a GMLsf Exchange Schema using test data from Fairview Industries and cloud-based tools from The Carbon Project**

In addition to developing the XML/GML Implementation Model schema, test data with core information elements was deployed in a prototype cloud-based Parcel Web Feature Service (Parcel WFS). Links to the prototype Parcel WFS were distributed to members of the project team in late October 2012 to support review and testing. The project team conducted tests of the schema using the open standards-based collaboration platform from The Carbon Project called CarbonCloud Plus+ and client applications from The Carbon Project (Gaia) and Esri (ArcGIS desktop). All tests were able to successfully access the prototype ‘Parcel WFS’ service.



**Figure 4 - Parcel data as Shapefiles were uploaded and deployed in the XML/GML Implementation Model schema using the cloud-based CarbonCloud® Plus+ WFS**

In addition, the prototype ‘Parcel WFS’ was successfully tested for its ability to support transactional updates, including updates from mobile apps on the Android platform.

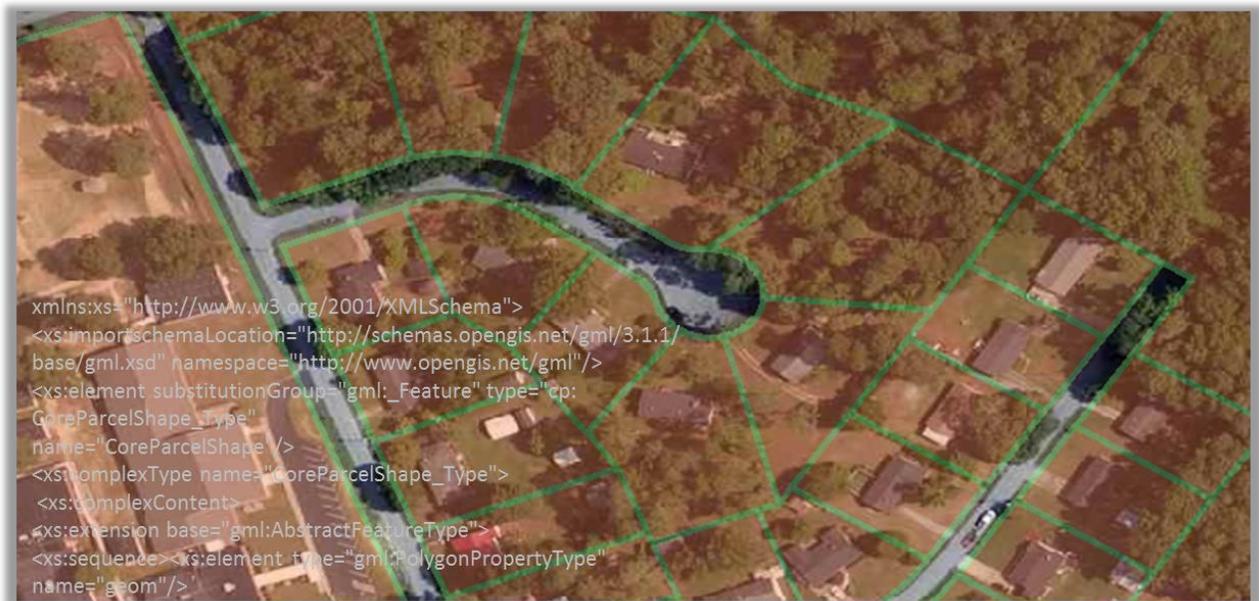


**Figure 5 – Testing during the project showed that local parcel data as Shapefiles could be uploaded, deployed in the XML/GML Implementation Model schema using The Carbon Project’s CarbonCloud Plus+ WFS, and accessed by many applications.**

It should be noted that the addition of ‘parcel point data’ to the Implementation Model will greatly enhance the usefulness of parcel data for many decision support applications including geocoding, land management, engineering, environmental assessment and emergency and disaster response. Parcel points provide an overview of the parcel information making data retrieval, navigation and query much faster than the polygon layers. Some applications, such as Rapid Assessment of Values at Risk (RAVAR) that supports the Wildland Fire Decision Support System (WFDSS), rely on the parcel points. The points are also useful for cartographic applications, such as polygon labeling, and selecting subsets of

information such as spatial distance or attribute criteria filtering. For example, if a GIS user in North Carolina requires easy access to seamless parcel data for a rapid disaster response analysis they can connect to CarbonCloud Plus+ Parcel WFS and get the data as GML parcel points.

As part of ongoing efforts the project team will continue gathering community comments from multiple organizations in North Carolina and the across the NSDI, refining the draft “Geography Markup Language (GML) Implementation Model for FGDC-endorsed standard for Cadastral Data Content”, testing prototype cloud-based ‘Parcel WFS’ deployment for point and polygon data and documenting sample NSDI Use Cases.



**Figure 6 - Data with core information elements was deployed in a cloud-based Web Feature Service (WFS) to support testing of ‘Parcel GML’. Polygon data, overlaid on aerial imagery, accessed using the Gaia application from The Carbon Project.**

## Next Steps

This project's activities will continue beyond the performance period through the Integrated Cadastral Data Exchange effort. The project, funded by a grant from the US Environmental Protection Agency (EPA), will feature tools to transform North Carolina county parcel boundaries into standard, integrated datasets, and share online data services with EPA’s Environmental Information Exchange Network and with users of the NC OneMap Geospatial Portal.



As of January 2014, this project has developed and deployed a cloud-based solution for ingesting cadastral datasets, translating fields to a common standard schema, exchanging data via the US EPA Environmental Exchange Network, and providing access to published datasets to GIS users (not part of the Exchange Network) through Parcel WFS implementing the draft Parcel GML model outlined in this report. Updates to the model will be published as they become available on [www.nationalcad.org](http://www.nationalcad.org).<sup>4</sup> These updates will include links to schema reference implementations.

The North Carolina Center for Geographic Information and Analysis (CGIA) is managing the Integrated Cadastral Data Exchange project in partnership with Eastern Band of Cherokee Indians, the NC Working Group for Seamless Parcels, NC Department of Transportation, NC Department of the Secretary of State, NC Department of Public Safety, with participation by 25 North Carolina counties and guidance from the NC Geographic Information Coordinating Council and the Statewide Mapping Advisory Committee.

## Feedback on Cooperative Agreements Program

*What are the program strengths and weaknesses?*

Strengths - Great management, very easy to understand the process and get engaged.

Weaknesses - None. The NSDI CAP is a very efficient use of resources.

*Where does the program make a difference?*

The program helps develop key elements of the US geospatial community. It delivers key components for real-world interoperability.

*Was the assistance you received sufficient or effective?*

Yes

*What would you recommend doing differently? Are there factors that are missing or need to consider that were missed?*

None

*Are there program management concerns that need to be addressed? Time frame?*

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<sup>4</sup> <http://nationalcad.org/2013/04/parcel-gml-project-review-report/>



No

*If you were to do this again, what would you do differently?*

The program functioned very well for this project. This project has fostered and promoted significant advances for Parcel Data exchange, especially in North Carolina where new online services using the Parcel GML standards have been developed and deployed.