

USDA Certifies Conservation Practices using Geospatial Web Services.

Steven Ekblad, Eric Strand, and Tom Barclay

The USDA Natural Resources Conservation Service provides long-term, conservation cost share incentives to land owners and operators in the United States. Previously, agency personnel used traditional survey and documentation processes to certify areas or lengths of conservation treatments. ProTracts - a new USDA-NRCS n-tier, Internet enabled system - supports the use of GPS, laptops, and wireless networking, and Microsoft TerraService provided images for in-situ data collection and conservation practice certification. ProTracts implements geospatial web services that consume point, line, and polygon shapefiles; invoke TerraService to display feature data over digital-ortho imagery; and transact these data into ArcSDE for conservation practice certification, reporting, and mapping. ProTracts is the newest agency tool that enables rapid delivery of conservation assistance to NRCS customers.

The Information Technology Center in Fort Collins, Colorado is the center of excellence for developing cutting-edge information technology applications to enhance the value of mission critical business processes of the USDA Natural Resources Conservation Service. In conjunction with its partner Service Center agencies, Farm Service Agency and Rural Development, the NRCS is developing fast, efficient e-government solutions for delivering technical assistance and financial incentives to agricultural producers in response to recent Farm Bill initiatives for conservation programs. The conservation program contracts project is the next major cornerstone in building the necessary web-enabled infrastructure needed to enable the Service Center agencies to rapidly deliver on the promise of e-government to service agricultural and rural communities.

Program Contracts (ProTracts) integrates conservation contract, funds allocation, and geospatial data sources within a Web-based software application that provides tools for managing NRCS conservation cost share and conservation incentive contracts at all levels of the Agency. ProTracts successfully completed its pilot use by NRCS employees in ten Texas field offices to manage Environmental Quality Incentives Program (EQIP) applications and contracts. Protracts is planned for national implementation during the spring of 2003 to be used by thousands of agency users supporting EQIP.

The ProTracts application supports these NRCS business goals:

- Eliminates the dependence on other agencies for administrative support.
- Produces error-free contract documents.
- Manages conservation program applications.
- Manages conservation program contracts from the start date through completion.
- Reduces the time required to pay customers.
- Distributes program allowances and tracks obligations.

ProTracts implements the ***National Database for Conservation Contracts*** by establishing a secure, central database that is accessed only from the USDA Intranet, and only by authorized employees. User permissions are based on an employee's position, geographic location, and service area. Program managers have real-time access to contract summary data at local, state, and national levels.

The pilot version of the ProTracts software provides these features:

- Tools to manage conservation program applications including signup, approval, cancellation, and deferment.
- Methods to develop contracts either on-line or by uploading contracts developed with the Customer Service Toolkit.
- Tools to manage cost-share agreements including modifications, minor revisions, contracts that need status reviews, practice certification, and payment approval.
- Tools for program managers to distribute program funds to states and to counties, and redistribute un-obligated funds as needed.
- Methods to track contract obligations and payments by viewing detailed or summarized information.
- Maximum use of electronic signatures to certify practices, sign letters to customers, and approve payments.
- A security system to grant permissions to employees based on their program responsibilities and geographic location.

ProTracts enables rapid delivery of conservation assistance to NRCS customers. Previously, agency personnel used traditional survey and documentation processes to develop conservation plans and certify areas or lengths of conservation treatments.

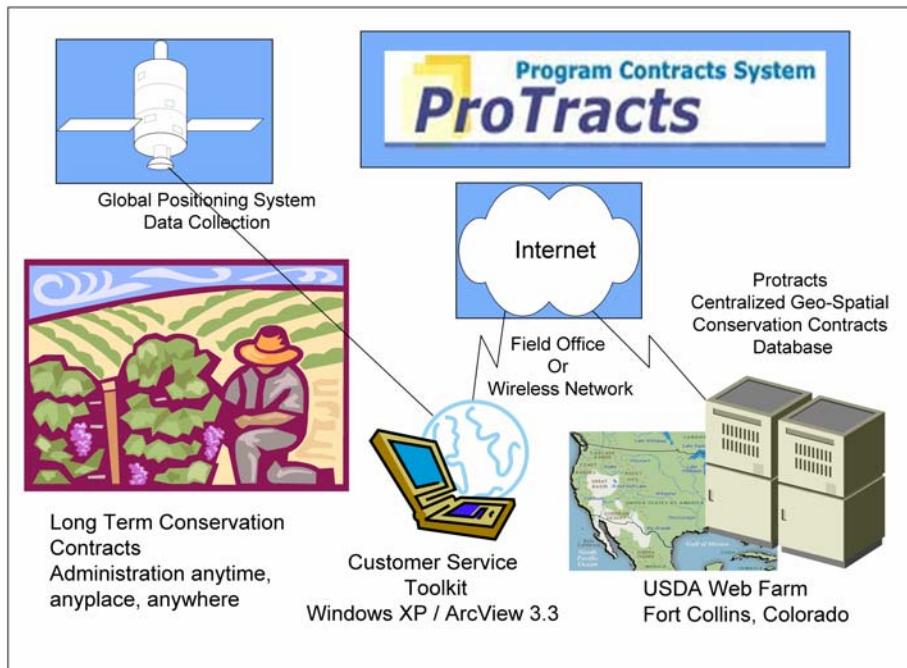


Figure 1 On-site access to Program Contracts System

NRCS field conservationists now use Customer Service Toolkit [Ekblad] to develop conservation plans and contract support documents and use their internet browser to upload the contract items into the ProTracts database. ProTracts is then used to enter additional data needed for the contract management tools.

ProTracts supports the use of GPS units, laptop computers, and wireless networking for in-situ data collection and conservation practice certification. Using these new tools, agency personnel save time and improve the quality of conservation practice certification, reporting, and mapping.

Geospatial Web Services

When certifying conservation practices in the field, geospatial data is collected from GPS units and custom ArcView Tools. These data are complimented by Customer Toolkit contract data and ArcView mapping of the practices to prepare conservation assistance products that are delivered “on-the-spot” to the customer. To further enable immediate delivery of technical assistance, the USDA Service Center Agencies are evaluating VPN connections over wireless networks to access web-based applications while visiting the customer’s site. To use this to the fullest, ProTracts implements geospatial web services that consume point, line, and polygon shapefiles and stores these data in ERSI’s Arc Spatial Data Engine ArcSDE [ArcSDE] and Microsoft SQL Server.

The geospatial data processing requirements include identifying the location for a conservation program application or contract, recording the conservation practice, calculating the extent or area of the conservation practice, and producing quick maps of the conservation practices and the customer locations serviced by the conservation program.

A location map is produced by presenting prepared maps for the county and then using an ArcIMS image service respond to zoom in requests from the user’s web browser. Once the general area is located from the displayed county boundaries, cities, and roads depicted in the map the user points to a location and drops a map pin to designate the location being serviced. (The county and state is recorded as part of the location information.)

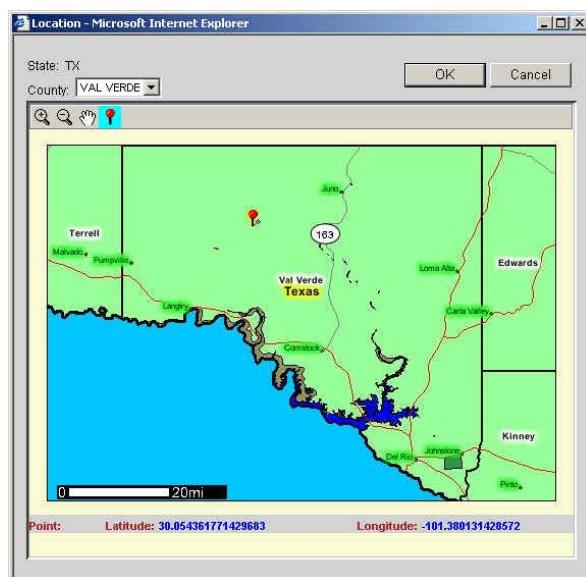


Figure 2 Location Map of Contract

After a conservation program practice has been implemented, field office personnel visit the customer’s site to certify that the practice complies with requisite policies and

guidelines so that cost share payments can be authorized. The ProTracts system enables field office personnel to quickly collect the necessary information and, where connected via wireless networking, immediately complete the certification and authorization on-site with the customer. This removes the delays of returning to the field office.

Protracts uses custom geospatial web methods to re-project geospatial data, create and update attribute information associated with a spatial record, create a new spatial record, and generate XML. Geospatial feature data is stored in Microsoft SQL Server 2000 utilizing ArcSDE. Geospatial data management and re-projection services to the Protracts web service is implemented through the ArcSDE C-API and the Microsoft .Net 1.1 Framework. Geography Markup Language 2.0 (GML) [OGC] was selected as the standard for describing the polygons. The XML returned by the web service was extended to contain the parameters that enable the web browser to directly access TerraService.NET [Barclay] and retrieve the digital orthophoto backdrop for the polygons.



Figure 3 Conservation practice polygon against TerraService ortho image

The automated ProTracts tools ensure that accurate calculations and consistent information is used to complete the business process. This is a major efficiency benefit compared to previous manual processes which varied in consistency and were susceptible to errors and rework delays.

NRCS Web Farm

The centralized databases for ProTracts geospatial and business data are located in the ITC web farm at Fort Collins, Colorado which is one of three USDA Service Center agency web farms. The TerraServer database is located in Redmond, Washington.

ProTracts accesses a web service and obtains current customer information from the Service Center Information Management System (SCIMS) located in the Kansas City,

Missouri web farm. ProTracts also accesses data from the Office Information Profile (OIP) system

The ProTracts web application runs on two web servers (IIS 6.0, .NET v1.1, Windows Server 2003, Dell 2650 Xeon 2x2.4GHz with 2GB RAM) and one database server (ArcSDE 8.2, SQL Server 2000, Windows 2000, Dell computer). This configuration was performance tested and is anticipated that it will support the initial user community of 2,000 to 5,000 users. The system will be scaled-out to support the larger e-government user community in the future.

Protracts National Implementation and Deployment

Protracts has been placed in production in the state of Texas with 400 users to implement Environmental Quality Incentive Program (EQIP). Expected number of EQIP applications / contracts is expected to reach 12,000 in the first year. Protracts is planned for a national implementation in October 2003 and is to be used by thousands of agency users supporting EQIP. ProTracts will be enhanced to a national version that incorporates the business rules and processes required for conservation programs such as Agricultural Management Assistance (AMA), Conservation Security Program (CSP), Wildlife Habitat Incentive Program (WHIP), and Wetland Restoration Program (WRP) long term cost-share contract agreements. The ProTracts national version will support program accountability because data is collected in a national database and it incorporates fund tracking, program managers could access information for reports on program activities and funds at any time. Information no longer would need to be summarized and forwarded manually from office to office. Managers would have access to detail or summary information at all time and all application and contract agreements will be geospatially referenced. Information will always be current, available, and reliable without redundant data entry.

The national version of ProTracts will also include an e-Government Web site for customers. Customers would use their e-Government login and password to access their contracts. They would be able to review the plan of operations, request payment for practices, and sign status reviews electronically. The features implemented in Protracts will provide greater efficiency in agency program delivery translating to more application of conservation practices for the conservation of natural resources in the United States.

[ArcSDE] ESRI Arc Spatial Data Engine

<http://www.esri.com/software/arcinfo/arcsde/index.html>

[Ekblad] "Customer Service Toolkit: USDA Looks to the Future of Desktop GIS in a Mobile Computing Environment," Ekblad S., Strand E., and Carlson J., ESRI International User Conference, 1999.

[GeoML] Geography Markup Language 2.0 Specification, OGC Document Number: 01-029,

[Barclay] "TerraService.NET: An Introduction to Web Services," Barclay T., Gray, J., Strand E., Ekblad S., and Richter J., Technical Report MS-TR-2002-53 Microsoft Research Advanced Technology Division, June 2002

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Authors

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Eric Strand is Vice President of Synergetics Incorporated and is the contractor project manager for the Customer Service Toolkit project team. For the last 20 years he has led information technology development projects emphasizing GIS for federal government and private industry applications. He is contributing editor to GEOWORLD magazine.

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Tom Barclay is a researcher in Microsoft's Bay Area Research Center. He is responsible for the development of the TerraServer project (<http://terraserver.microsoft.com>), which is pioneering the use of large-scale databases as a store for spatial data. TerraServer is a cooperative effort between Microsoft Research, the USGS, USDA, Compaq Corporation, ADIC, Veritas, Brocade, and Extreme Networks. Currently the TerraServer project is focused on exploring the use of Web Service technology to provide on-line, programmable access via the web to the TerraServer databases (<http://terraservice.net>). Web Services enable cross-organization and true wide-area distributed applications.

Tom joined Microsoft in 1994 as a program manager in the Developer Division as a member of the Visual SourceSafe product team. In 1996 Tom joined the Scalable Servers Group of the Bay Area Research Center led by Dr. James Gray. Prior to joining Microsoft, Tom worked for Digital Equipment Corporation for 18 years. Tom received a B.S. in commerce from Rider University.

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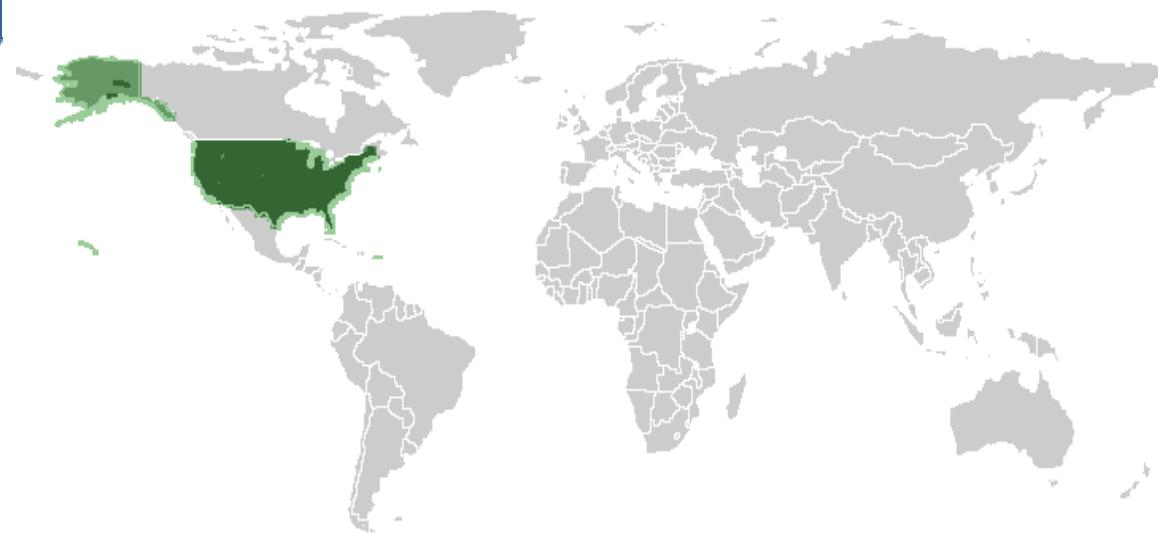
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TerraServer

Click the green areas to zoom-in on the map.

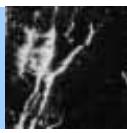


TerraServer contains 3.3 tera-bytes of high resolution **USGS aerial imagery** and **USGS topographic maps**. You can locate imagery by clicking on the map above, **entering a city or town name** in the "Search TerraServer" form at the top of the page, or **entering a U.S. street address**. Click on **Advanced Find** to see other methods for searching our imagery database.

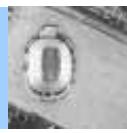
Below are sample thumb-nail images of famous places contained in the TerraServer database. Click on a thumb-nail image to see a famous place or click on **more famous places** to see a complete the complete list images of famous sites.



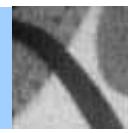
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I've been with Microsoft since 1994 and in Microsoft Research since 1996. My research interests are in large, scalable database systems.

Projects

- [Microsoft TerraServer](#): I was the lead on the development of a large (3+ TB) geo-spatial database containing high resolution imagery of the United States provided by the US Geological Survey and running on a four-node, high availability Compaq ProLiant 8500, Windows 2000 Data Center cluster. Click [Microsoft TerraServer](#) to visit the TerraServer web site.
- [TerraService.NET Web Service](#): This past year, with help from [Jeffrey Richter](#) and George Brother, we added a programmable [Web Service](#) to the TerraServer database. The <http://TerraService.net> web site describes the capabilities of the TerraServer Web Service and provides examples of how to use it in your applications.
- Currently, I am working with the Yukon project team on investigating spatial support for SQL Server.

Papers

- [Microsoft TerraServer Technical Report - MS-TR-99-29](#): a 618 kb MS Word Document that describes the motivation and design of the TerraServer database and web application.
- [TerraServer White Paper](#): a "marketing oriented" description of the technologies used to build the first version of the TerraServer database and web application. (Self-extracting Word document 3,078 KB)

Presentations

- [TerraServer PowerPoint](#) presentation: contains a complete overview of TerraServer including the architecture of the SQL Server database, the web site, and an overview of the Web Service application.
- [Microsoft TerraServer SIGMOD 2000 Presentation](#): presented at the June 2000 SIGMOD conference in Dallas, Texas

Affiliations

- Committee member on the [National Academy of Science](#) Computer Science and TeleCommunications Board Committee on "[Workshop on Intersections Between Geospatial Information and Information Technology](#)".
- Microsoft representative on the OpenGIS Consortia Technical Committee.

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Power Outage Darkens Northeast

Aug. 15 -- A sudden, massive power surge late yesterday afternoon shut down much of the power grid serving northeastern North America, stranding travelers at airports and train stations, shutting down cash machines and hampering cellular telephone service throughout the region. A 2002 National Academies report discusses the current state of the U.S. energy infrastructure and outlines new approaches to making power grids more resilient and adaptive.
[\[more\]](#)

Southeast Asia Suffers Rapid Species Loss

July 31 -- Southeast Asia may be faced with an overall extinction rate as high as 40 percent in the next 100 years due to rapid, large-scale deforestation, according to a report in a recent issue of *Nature*. Several National Academies reports examine how to preserve biodiversity and encourage sustainable development. [\[more\]](#)

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Top News

Suminoe Oysters Are Not a Quick Fix for

Chesapeake Bay

Aug. 14 -- Proposals to offset the dramatic decline of the Chesapeake Bay's native oysters by introducing disease-resistant, reproductive Suminoe oysters from Asia should be delayed until more is known about the environmental risks, says a new report from the National Academies' Ocean Studies Board. However, carefully regulated cultivation of sterile Asian oysters in contained areas could help the local industry and researchers. Oysters also eat the excess algae caused by pollution, but it could take decades before there are enough of them to improve water quality.

[Press Release](#)

[Opening Statement](#)

[Report Brief \(43 KB PDF, requires free Adobe Acrobat Reader\)](#)

[Full Report](#)

Vaccinating Public Against Smallpox Requires Stringent Controls

Aug. 12 -- The general public should receive smallpox vaccinations only as part of a research study or other arrangement with stringent medical and ethical controls given the risk of adverse health reactions to the people being vaccinated and those with whom they come into contact, says a new report from the Institute of Medicine. Registries of vaccinated health care workers and other responders also should be created to mobilize and coordinate them quickly if an outbreak occurs.

[Press Release](#)

[Full Report](#)

Report Evaluates State of Supercomputing in the United States

Aug. 12 -- A new report from the National Academies' Computer Science and Telecommunications Board identifies factors the federal government should examine before making policy to further research and development of high-performance computing. Supercomputers solve complex problems in areas ranging from weather science and biology to national security.

[Full Report](#)

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