AGRICULTURAL SITE ASSESSMENT TOOL: AUTOMATING AND ENHANCING DELIVERY OF MULTIPLE SITE-SPECIFIC DATABASES

Sub-theme: Knowledge and Information

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Abstract:

Various government agencies maintain numerous georeferenced databases valuable for agricultural business management. Accessing these databases is oftentimes consuming and frustrating. Reducing the transaction cost of accessing these databases increases their value. Providing visual, educational and regulatory pages associated with the data also increases their value to potential users. Agricultural Site Assessment Tool was developed to allow agricultural producers, bankers and appraisers to quickly access and view information pertaining to a parcel of ground from multiple databases. Outlining a field on an aerial map and pressing a submission request button generates a report containing multiple tables of site specific information for the outlined land. Current reports contain information on location parameters; nearby communities and population estimates; soils; streams; wetlands; watersheds; floodplains; karst geology; threatened and endangered species; land use within 3 miles for past three years; crop productivity indices; temperature, precipitation and wind climatology; and aerial photography. All tables have hyperlinks to maps that identify the location of relevant land features. All tables also contain hyperlinks to educational information, regulatory considerations and possible resource assistance.

Keywords: *site-specific, big data, environmental, land analysis*

Introduction

Landowners, land managers and crop consultants often need detailed information about individual pieces of land. Much of the information can be found in multiple databases, maintained by U.S. government agencies and residing on the internet. However, several factors diminish the use of these databases. First, many potential users do not know that the

data exist. For those that do know of the existence of the data, they may not be able to locate the database. Finally, each database has its own interface protocol that requires a learning curve for users to adequately use them. Diminishing these hurdles reduces the transactional costs of valuable resources, enhancing the demand for and value of the data.

The Ag Site Assessment Tool (AgSite), found at AgSite.missouri.edu, overcomes many of the hurdles to accessing relevant data. AgSite references multiple national geo-referenced data layers in a single tool to develop a comprehensive report for any piece of land in the contiguous United States. Each AgSite report outlines the physical, cultural and environmental characteristics of a selected land parcel and its immediate surroundings. This report contains hyperlinks to interactive maps that allow the user to identify the precise location of relevant features.

The initial objective of AgSite was to help land managers understand the environmental sensitivities associated with an individual parcel of land. As users provided feedback, additional databases were added that met specific requests of decision makers such as real estate appraisers and bankers meeting due diligence.

Methods

The first section of the report summarizes the geography of the parcel – its size in acres, county and state location, legal description and latitude and longitude in both degrees and decimal format. This information guarantees that the AgSite report is providing information on the correct parcel of land. Some of the data, such as the latitude and longitude in decimal format, may be information on the land which users were unaware existed but which assists them in managing the land.

The Demographic section of the report summarizes the population within 1 and 5 miles (US Census Bureau, 2011) and lists all communities within 5 miles (US Census Bureau, 2013). Information reported in the demographic section is targeted towards decision makers that may be affected by proximity to people and communities. For example, an animal feeding operation might prefer an isolated location; a farmer who does direct sales to consumers might prefer a location close to population centers.

The Hydrologic Summary section of the AgSite report lists the streams that cross the property, waterbodies on the property (US Geological Survey, 2016) and wetlands on the property (US Fish and Wildlife Service, 2014). This section also reports the USGS

Watershed Boundary Dataset declaration of the 12-digit hydrologic unit(s) where the property is located (US Geological Survey, 2015). The hydrologic summary information is critical to understanding what production limitations the land may have. Particular concerns for land managers include regulations on land use by the US Environmental Protection Agency, US Department of Agriculture and the US Army Corp of Engineers.

The Soils and Productivity section of the AgSite report provides a detailed list of the soil types on the property. For each soil type listed, the report specifies the acreage and percent of that soil type in the property (US Department of Agriculture, 2016a), the hydrologic group and the USDA productivity index of each soil type (US Department of Agriculture, 2016b). Clicking on any soil Map Unit Symbol in the table will connect the user to that soil's Soil Data Map Unit Interpretation Report. The average weighted crop productivity index for the entire parcel can be used to compare two different parcels to see which would most productive for the amount paid.

The Environmental Concerns section begins by listing threatened and endangered species *for the county* where the property is located (US Fish and Wildlife Service, 2015). This information can alert users to possible critical habitat designations so purchasers and users can make informed decisions before modifying habitat or purchasing land that may have endangered species limitations. This data is not specific to the parcel but rather to the county where the parcel is located. The US Fish and Wildlife Service releases endangered species data on by county to protect the species. By clicking on any endangered species name, users are brought to webpages providing information on a particular specie and federal regulations dealing with managing that species.

The Environmental Concerns section also presents estimates of acres in floodway and acres in the 100- and 500-year floodplains (Federal Emergency Management Agency). This data layer is intended to help users understand limitations to land use due to flooding and limitations to accessing certain programs such as insurance that might have floodplain exclusions.

Lastly, the Environmental Concerns section identifies karst geology associated with the parcel (Weary and Doctor, 2014). Not all areas of the United States have karst geology data. Where it is found, karst geology affects ground water resources and risk of hazards such as sink holes.

The Climate Summary section of the report presents monthly and annual 30-year average estimates of precipitation and temperature (PRISM Climate Group). Information from NOAA Atlas 14 (US National Oceanic and Atmospheric Administration, 2015) is used to report 24-hour, 25-year storm events and 24-hour, 100-year storm events. These storm event estimates are used by engineers to design structures that can withstand specified storm parameters.

Additionally, the Climate Summary section uses hourly wind information from airports and maintained by NOAA to create an interactive wind rose (US National Oceanic and Atmospheric Administration, 2016). The appearance of the wind rose can be changed to report wind information by multiple month periods and for different wind speeds. The wind information is intended to be used by decision makers considering the risks of chemical drift or animal odor.

Any person can access AgSite free of charge and without providing any personal information. However, if a user chooses to become a member of the site, they are provided a username and password that allows them to access additional features, such as measurement tools, and databases, such as topography, EPA designated impaired waters, or tribal and native land status. Registered members can save shape files so that they can return to the same field more easily. They can save reports generated in their personal library. They can also access additional data layers that reside in the Community Commons library of databases and use special tools that measure distance, area and elevation.

Results

A soils table, illustrating one of the 16 data tables on each AgSite report, is below (figure 1). This soils table illustrates the type of information accessible to users who generate an AgSite report for their land. The Map Unit Symbol in the extreme left column is hyperlinked to that soil's Soil Data Map Unit Interpretation Report. This Interpretation Report contains detailed information for land managers interested in evaluating soils for various uses ranging from agricultural production to construction of buildings and waste storage structures.

The word "Map" on the right top portion of the table is hyperlinked to a map (figure 2) displaying the locations of the individual soils types within the field. This allows farmers to understand where soil difference may occur that have impact on such things as precision agriculture decisions.

The word “Page” on the right top portion of the table is hyperlinked to a webpage that contains educational, regulatory and assistance information. Theses webpages are intended to help land managers understand the soils, their composition, how they might be regulated by the US government agencies, and which agencies have technical and financial assistance programs.

At the bottom of the table is a hyperlink to the SSURGO website that gives a description of the soils and provides access to the original database. Supplying this metadata has been found important if the report is used in any legal proceedings.

Soils and Productivity

Soils Map | Page

Map Unit Symbol	Map Unit Name	Acres	Percent of Area	Hydrologic Group	Maximum Productivity Index	Productivity Index Method
56008	Zook silty clay loam, overwash, 0 to 2 percent slopes, occasionally flooded	70.0	43.9	C/D	0.800	Corn/Soybeans
66081	Dockery and Tice silt loams, 0 to 2 percent slopes, occasionally flooded	44.2	27.6	C	0.732	Unspecified
36042	Vesser silt loam, 0 to 2 percent slopes, occasionally flooded	43.2	27.0	C/D	0.803	Corn/Soybeans
36064	Floris silt loam, 0 to 2 percent slopes, occasionally flooded	2.4	1.5	B	0.760	Corn/Soybeans
--	Report Area	159.7	100	--	0.781	Average

Source: USDA NRCS SSURGO Database, accessed June 2016 via the Geospatial Data Gateway

Figure 1. Sample soils table from an AgSite report.

The data accessed by AgSite is the most recent available data. Each database has peculiar characteristics that affect it accuracy. For example, the SSURGO soils database is continually updated by the USDA. Some fields may have had their soils mapped recently, while other fields in the same state may have soil maps that are decades old. This anomaly has been observed also on the hydrologic survey where waterways abruptly end because the mapping protocol changed and one location has a more recent survey. Errors in the national databases have been discovered by AgSite users who have then requested corrections by the appropriate database curators.

During 2016, over 10,000 unique users accessed AgSite.missouri.edu. Almost 5,000 reports were generated. Users indicated that the reports were used for the following activities: appraisal of land; due diligence by lending officers prior to approving loan

applications; evaluation of land for animal feeding operations placement and general crop production management.

Many users reported that they clicked on the map button at the top right hand corner of specific tables. These maps specified where the feature of interest, such as soils or wetlands were located, so that the user could pursue management options and communicate with others involved in the decision.

Figure 2. Sample soil map from an AgSite report.

Conclusion

AgSite has become a popular website for decision makers in the agricultural sector. It has reduced the transactions costs of accessing multiple datasets containing data pertinent managerial decision making. It also has introduced decision makers to information they may not have thought about when considering different alternatives. Users have increased the value of business reports and record keeping by including information and maps accessed through AgSite.

The data reported in AgSite come from national databases. Interest in some state and regional databases, such as private well locations and plat ownership, has been requested. However these databases have not been included due to the multitude of formats, difficulty in maintaining connections and the discontinuity of coverage across the U.S.

All measurements on AgSite reports are in imperial measurements (acres, feet, degrees Fahrenheit) because they are used by U.S. decision makers. The imperial units could be converted to metric units by the computer if users began requesting such conversions.

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