

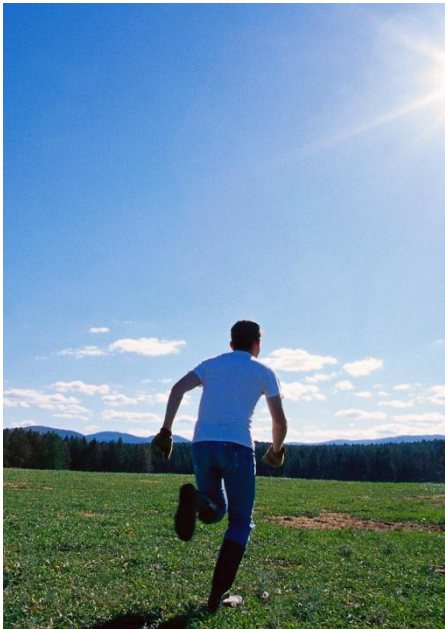
The GreenLeaf Project - Building a Google-like Infrastructure for Climate Data

The GreenLeaf Project is a revolutionary collection of decision-support tools and methodologies linked to provide dramatically new and unique views of the data critical to supporting producers, decision makers and researchers in analyzing climate-associated risk events and mitigating their effects.

Climate is a complicated force that significantly impacts every aspect of our lives. Few people experience these impacts more than agriculture and livestock producers. Mitigating the risk associated with the occurrence of destructive climate like drought or early freeze is critical to the success of any farming or ranching operation. With the impacts of drought effecting nearly every region in the United States, the availability of tools to help producers assess the severity and duration of climate events is imperative as they develop risk mitigation strategies. In 2005 a partnership between the USDA Risk Management Agency (RMA), the National Drought Mitigation Center (NDMC) and the University of Nebraska - Lincoln Department of Computer Science and Engineering was started. The goal of this partnership is to provide producers with tools and data that will allow them to more effectively plan for and mitigate the effects of climate. Together these organizations are using years of risk management experience, climate expertise and the latest internet technologies to develop tools and information systems that will help producers develop and maintain risk management plans.

For the past three years we have been rethinking the way that decision support tools work. We have rebuilt are tool offerings from the ground up with a single focus: *simplicity*. Good decision support requires that data be available when it is needed every time. We have found that the only way for technology to empower the decision making processes of our users is to always be there just under the surface and never get in the way. With this understanding we have been able to streamline just about every one of our processes all while significantly upgrading our technology base. The result: a robust set of tools providing producers with access to over 1 billion historical climate records, dynamic maps and the latest in drought assessment and reporting tools. A system that is both familiar and new at the same time. A system that puts a world of information a mouse click away.

What follows is a brief discussion of our tools. Everything you see here can be found at <http://greenleaf.unl.edu>.



The freedom to work

The GreenLeaf Project is a collection of decision support tools designed to be different. With The GreenLeaf Project, users can find a myriad of data all in a single place - all easily accessible. The primary goal of the project is to bring large data-sets together and allow users to customize data in order to generate a unique view of risk that is relevant to them and the unique decisions they make.

In order to accomplish the goals of The GreenLeaf Project, significant investment in a robust technology infrastructure has been made. At the same time we've implemented the technology in such a way as to remain hidden - our technology stays out of the way of our users, freeing them to focus on the important decisions they need to make every day.

Advanced visualizations

The GreenLeaf Project integrates the latest in web mapping technology from Google. This allows complex data visualizations to be streamlined and included in an interface that is not only familiar, but is fast and responsive. Waiting while a map is generated as part of a complex report is a thing of the past. With the new data visualizations included in The GreenLeaf Project looking at a map becomes as easy as, well, looking!

The GreenLeaf Project utilizes a core framework to link disparate data-sets,

which means maps can be easily and quickly customized to suit your individual needs. Whether it be viewing drought impacts reported in the local media near your farm or getting a quick look at rainfall estimates for the pacific northwest - building customized visualizations couldn't be easier.

Advanced search made easy

The GreenLeaf Project includes a one-of-a-kind search engine for locating climate data. We once heard a producer comment that finding out about celebrities on the internet was so easy but that finding needed climate data was nearly impossible. That comment rang true to us and so we've developed the first true search engine for climate data. Using The GreenLeaf Project search engine users are able to locate climate related data simply by searching for it like they would with popular search engines like Google. For more advanced searching needs The GreenLeaf Project now includes a query builder. Using the query builder users can select weather stations which meet very specific and limited criteria.

A world of data on a page

We recognize that the best decision support tool is the one that never gets in the way. We've designed The GreenLeaf Project to do just that - never get in the way. Our advanced search capabilities allow you to pull up a snapshot of climate, soil, and drought conditions as easily as you look up a name in the

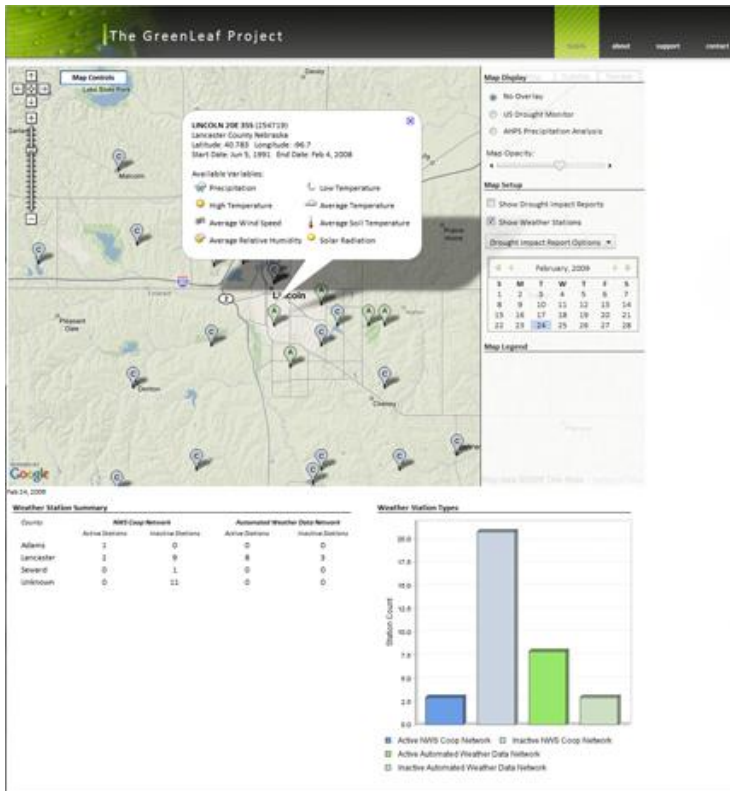
phonebook. All the information is in one place: data-tables, quick-view charts, and drought impact reports. Finding climate data has never been easier or more accessible.

For users with more advanced needs, searches can be refined to highly granular conditions allowing you to find exactly what you want, when you want. The technology will never get in the way.

Playing well with others

The GreenLeaf Project is built around the concept of interoperability. Everyone makes decisions a little bit differently, and confining our data to a web-page would fail to recognize the unique needs of users. Viewing data with The GreenLeaf Project is just one way to support strong decision making processes. Are you a GIS expert with an existing system in place? No problem, our data visualizations can stream using standard web services. Have you been successfully managing your data with an existing spreadsheet? Again, not a problem. All of the data you find on The GreenLeaf Project can be saved on your machine in the standard Microsoft Excel format.

The GreenLeaf Project utilizes many open-source software components and interoperability was one of our major design goals. Other development projects can leverage our open components to create entirely new sets of tools, allowing The GreenLeaf Project to support your decisions in ways unimaginable.



Integrated data-sets with GIS.

The GreenLeaf Project gives users the ability to access all of the data in the system spatially. Building off a powerful GIS engine driven by ESRI components, The GreenLeaf Project integrates open technology provided by Google to display data plots. Spatial data is accessed from a single point - The GreenLeaf Project SmartMap. This control presents users with a single, and familiar, Google map object. We've extended Google maps to provide users with a new map control, allowing them to plot the following data-sets:

- Weekly US Drought Monitor
- Advanced Hydrologic Prediction Rainfall Estimates
- Drought Impact Reports
- Weather station networks

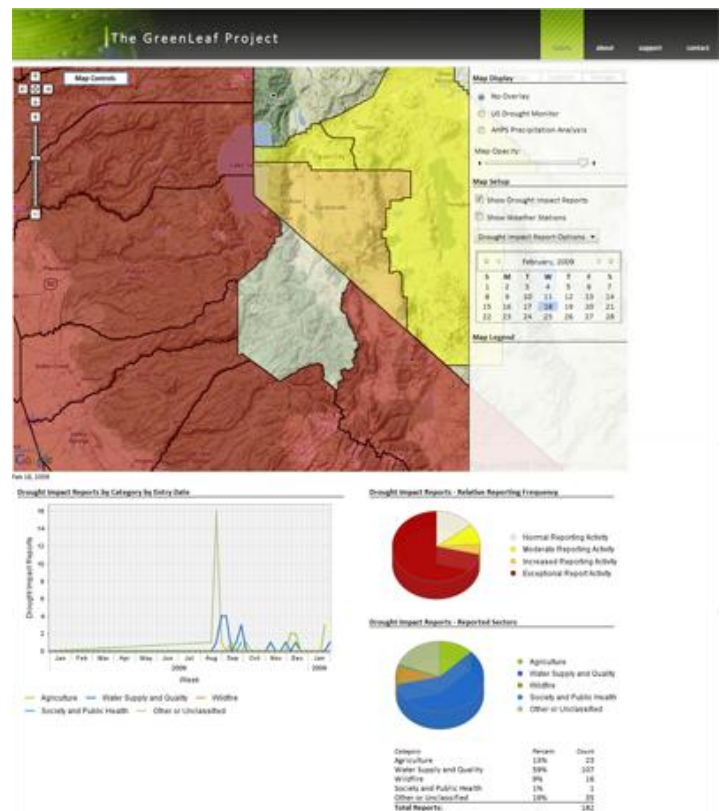
Data-sets can be overlaid on the map to provide a US-wide depiction of climate and can be adjusted across space to provide down to a sub-county view of risk. The map can also be adjusted across time to provide a historical view of the data. The map control features an intuitive calendar component that allows the user to control the date range over which data is being viewed. As a new date is selected the map will automatically update to reflect conditions on that date, giving users easy access to a better historical understanding of how climate has affected their region. Each of the data-sets function as independent map components, allowing disparate data-sets to be combined to give a tailored view of risk across both space and time.

Analytical data views

Because The GreenLeaf Project is built on the Framework for Integrated Risk Management, data-sets are neither point-based nor spatial - they are both. This means that data displayed spatially can be easily queried to provide statistical data for the current view. At a US-view data can have a very different meaning than at the sub-county level. The data views in The GreenLeaf Project accommodate this by providing view-specific information to accompany the spatial presentation. This allows for more complete analysis to be performed without the need to go to multiple sources and tools. GreenLeaf SmartMap technology makes spatial access both easy and robust, blending the best of both worlds to bring the greatest value to the decision making process.

The map on the left is a sample of a SmartMap displaying weather stations in and around Lincoln, NE. The stations are displayed on the map based on which network they belong to and indicate if they are active or inactive by the intensity of their color. Each of the stations provides information detailing the variables reported by the station. Also in this view is a summary of all weather stations for this region on the map.

Below is a SmartMap displaying the a summary of drought impact reports for the six-week period leading to February 18, 2009. These reports are gathered from users and local media outlets - an example of how composite data-sets can give a view of drought conditions. In this case, the map shows areas of increased severe drought over the time interval.



The GreenLeaf Project - Data Dashboard

Weather station data queries made easy

Unique to The GreenLeaf Project is the Weather Station Dashboard (WSD) - a tool that provides a snapshot of climate conditions at a local level. The WSD contains a collection of dynamic components that work together to provide a single view of data at a weather station over time. The WSD aggregates content from multiple disparate sources including:

- Drought Impact Reports from the NDMC Drought Impact Reporter
- NWS COOP and AWDN weather station values from the NCDC ACIS system
- Drought data computed for the Standardized Precipitation and Palmer Drought Severity Indices
- Soil taxonomy data computed using the Newhall Simulation Model

A quick view component allows users to quickly navigate the dashboard to adjust the data display to match the desired historical view. As the quick view data visualization updates so do the rest of the components on the page, giving the user a historical perspective of climate at a specific location.

The GreenLeaf Project WSD also includes a Planting Date Guide that can be used by producers to support decisions regarding which seed hybrid to plant and when to plant it. The user chooses planting and maturity dates and the Planting Date Guide will compute the number of heat units, risk of freeze, precipitation to maturity and emergence as well as growing degree days for that location based on 30-year data normals. By combining data-sets at the weather station level The GreenLeaf Project offers users a powerful analysis tool that works at thousands of locations in the US - or anywhere data is available.

To the right is an example of the GreenLeaf Project WSD in action. The image shows the WSD for the 'ASHLAND 2' weather station in Ashland Nebraska. The quick look view is set to display 10 years of data from 1997. Below is an example of the query builder, a tool that allows users to locate weather stations based on a variety of custom inputs.

The GreenLeaf Project

tools about support contact

ASHLAND 2 (250375)

County: Saunders Variable: Precipitation Starting: Jan 1, 1893 Ending: Dec 1, 2007 Reporting: 97%

State: Nebraska Variable: High Temperature Starting: Jan 1, 1893 Ending: Dec 1, 2007 Reporting: 96%

Start Date: Jan 1, 1893 Variable: Average Temperature Starting: Jan 1, 1893 Ending: Dec 1, 2007 Reporting: 96%

End Date: Nov 30, 2007 Variable: Low Temperature Starting: Jan 1, 1893 Ending: Dec 1, 2007 Reporting: 97%

Latitude: 41.04 Longitude: -96.38

Data Quick Look

Climate Report - Precip Jan 1, 2002 to Nov 30, 2007 Zoom - 6 months 1 year 5 years 10 years

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002	0.61	0.68	1.20	2.44	4.60	1.43	0.78	9.06	1.14	3.66	0.33	0.00
2003	0.51	1.46	0.83	2.59	3.56	3.42	0.98	1.46	2.57	1.47	2.68	1.09
2004	1.70	0.94	3.74	1.20	3.45	3.35	3.72	1.55	4.30	0.43	2.71	0.28
2005	1.28	2.65	0.65	4.46	2.21	3.51	6.15	0.55	0.35	1.79	1.14	0.86
2006	1.05	0.17	1.92	3.93	1.26	0.88	1.77	8.41	4.14	0.68	0.02	2.25
2007	1.08	1.73	3.27	5.06	5.24	2.23	1.51	8.37	2.66	4.96	0.08	

Planting Guide

Soil Regime Summary

Soil Moisture Regime	Years	Frequency
ARIDIC	0	0%
XERIC	1	17%
USTIC	1	17%
PERUDIC	0	0%
UDIC	3	50%
UNDEFINED	1	17%

Soil Regime Distribution

Year	PREC	PET	AWB	MSD	Dry Days	Medium Days	Moist Days	BIO8	Regime
2002	0	0	0	0	0	0	0	0	UNDEFINED
2003	574	761	-187	-320	92	42	120	123	TYPIC_XERIC
2004	695	755	-60	-186	0	2	258	230	TYPIC_UDIC
2005	650	821	-170	-234	0	108	152	232	WET_TEMPUSTIC
2006	675	799	-126	-207	0	41	243	246	DRY_TEMPUDIC
2007	919	830	90	-180	0	19	103	122	DRY_TEMPUDIC
Averages	702	798	-91	-225	18	42	175	190	UDIC

Query Builder

Find Stations: with all words, located in a state, located in a county, without the words, located outside of a state, located outside of a county

Meeting Criteria: reporting normal temperature in the range, reporting high temperature in the range, reporting low temperature in the range, reporting precipitation in the range, with all variables in the range

Full Data Search: Use meta data (faster), Examine data record (more accurate)

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