

DSS IN THE WICKED & WILD WORLD

Recent lessons from data- and model-driven decision support in participatory settings



PLANET TEXAS 2050

A UT Austin Grand Challenge

Making Texas resilient is our
grand challenge.

Today, Texas' population is nearly 28 million. By 2050, that number is expected to **double**.

Climate change will bring more floods, more droughts, and more heat.

Are we prepared for our future?

People – Not (just) CS but people with different backgrounds

Systems and Services
(That's often the easier part)

Capacity & Services

- Large scale modeling, data storage, visualization, networks, cloud computing, code optimization
- Consulting, Curation and analysis, Portals and Gateways, Web service APIs, Training and Outreach



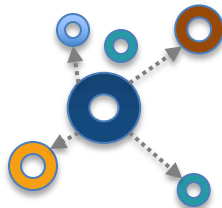
**Adaptive
Sensing**



**DataX Science
Gateway**



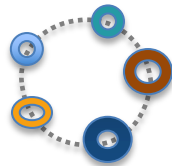
**Model
Integration**



**Digital Objects
of Research**

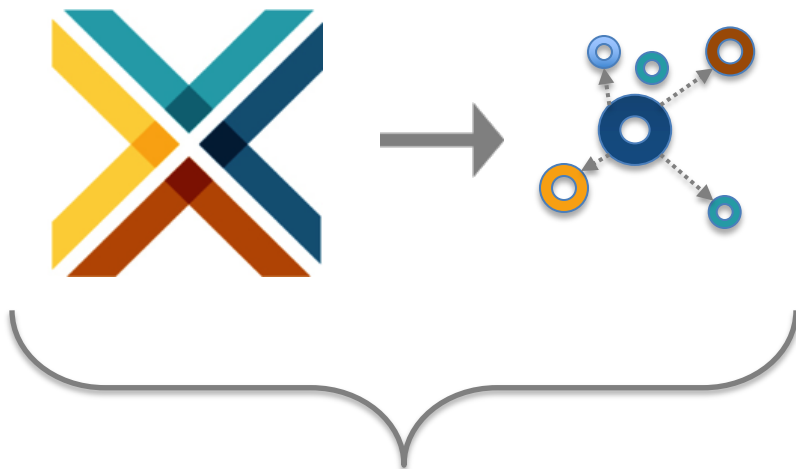


**Participatory
Interfaces**




**DataX Science
Gateway**

**Model
Integration**



**Data and Models
are the building blocks for Knowledge**

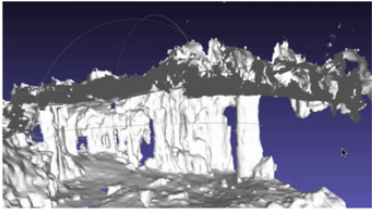
DATA 

Welcome to DataX


DataX is a next generation integrated data analytics platform designed by experts and powered by the supercomputers at the Texas Advanced Computing Center. It provides the computational tools necessary for researchers to understand, manage, and examine critical data from around the state.

Existing data – from water availability to flood plain mapping to urban growth models and more – are integrated into one portal and will be added to continuously as new data become available, both from Planet Texas 2050 researchers and from organizations around Texas.


These data can be used to create simulations and projections that help policymakers, educators, and citizens better understand the challenges their communities are facing today as well as the challenges their towns could face in 30 years.




Optimal Averaging of Water Resources




Texas Metro Observatory




Population Dynamics in Premodern Societies




Texas Water Stories: Local Narratives of Hydrologic Change and Adaptation




Artist-in-Residence: Lorenz Graybelt




Urban Watershed Evolution



Transportation-Related Air Pollutants and Health



Blue Index



Dashboard

Data Files

Applications

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Add

My Data

My Projects

Community Data

Google Drive

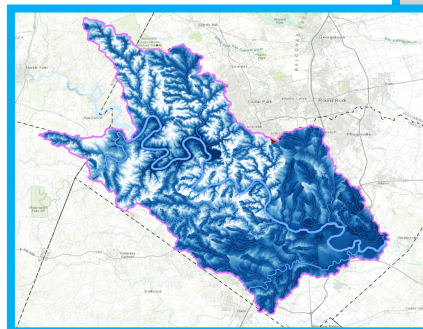
Floodplain Modeling

Description Research and development to generate floodplain contours and depth grids, at 1' depth intervals on network for Texas statewide.

PI Arctur, David (arcturdk)

Co-PIs Hardesty Lewis, Daniel (dhl) Maidment, David (maidment) Passalacqua, Paola (paolap)

Name	Size	Last Modified	Permissions
Colorado	4.0 kB	4/2/20 5:40 PM	All
Concho	4.0 kB	4/2/20 5:41 PM	All
Harris	4.0 kB	4/2/20 5:42 PM	All
Hays	4.0 kB	4/2/20 5:43 PM	All
Jefferson	4.0 kB	4/2/20 5:44 PM	All
Mitchell	4.0 kB	4/2/20 5:45 PM	All
Uvalde	4.0 kB	4/2/20 5:46 PM	All
Young	4.0 kB	4/2/20 5:48 PM	All



*Work with TACC,
Jeaine Powell, Anna Dabrowski, Daniel Hardesty Lewis,
Lissa Pearson, Joon Yeh Chuah, Vera Belcher, Nathan
Franklin, Sarah Gray, Tracy Brown, Smruti Padhy,
Anagha Jamthe, Joe Stubbs, (and many others)*

Data Workbench

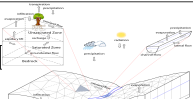
Select a region by hovering over it and clicking.



A platform for using artificial intelligence to accelerate:

- Connecting data to models
- Composing sophisticated high-fidelity models
- Guiding analysts through easy to follow phases and steps via a user interface that simplifies the complexity.


Model-engine for decision support



The Soil & Water Assessment Tool (SWAT)

The Soil & Water Assessment Tool (SWAT) is a small watershed to river basin-scale model used to simulate the quality and quantity of surface and ground water and predict the environmental impact of land use, land management practices and climate change (<https://swat.tamu.edu/> 2019)

Keywords: Soil, watershed, surface water, ground water, en... [More details](#)




2 versions

Cycles

Cycles simulates the productivity and the water-carbon and nitrogen balance of soil-crop systems subject to climate conditions and a large array of management constraints

Category: Agriculture
Type: Theory-

Keywords: agriculture, cycles, crop growth, weather, soil, cr... [More details](#)



4 versions

Economic aggregate crop supply response model (EACS)

The Aggregate crop supply response model (EACS) describes the aggregate crop supply response model for the country of South Sudan. This is a regional-scale aggregate model of agricultural supply for a specified set of crops (cassava; groundnuts; maize; sesame seed; and sorghum).

Category: Economy
Type: Theory-

Keywords: economy, land use, crop production, fertilizer c... [More details](#)

Data formats

Name	Description	Value on setup	Format
cycles_weather	Cycles weather file	-	weather

Physical variables

- Parameters: 8**
- FERTILIZER RATE**
Cycles configuration (version 0.9.4) exposing additional parameters such as weeds fraction and fertilizer rate
Authors: Rafael Silva
- Time interval: 1 day
 - Grid details:
 - Type: PointBasedGrid
 - Dimensions: 100
 - Spatial resolution: Point
 - Processes: Respiration, Nitrogen mineralization and immobilization, Biomass growth, Humification, Transpiration, Nitrogen uptake, Precipitation, Solar radiation, Management, Nitrogen transport
 - Download: cycles-0.9.4-linux-ubuntu.exe

Constraints

Name	Description	Value on setup
crop_name	Name of the crop to run the simulation for	Maize (default)
start_planting_day	Day of the year when the planting started The range is from 1 to 365	100 (default)
end_planting_day	Day of the year when the planting ended	149 (default)

Adjustable parameters

Label	Long Name	Description	Standard Name
RHn	relative humidity minimum	relative humidity minimum	atmosphere_air_vapor_min_of_relative_s
Solar	solar radiation of the day	Shortwave incoming radiation on a horizontal surface at elevation of the location	land_surface-horizontal_radiation-incoming-sho
Wind	wind speed	Wind speed at 15 m	land_surface_wind_speed

- Identify variables of interest
- Identify variables of interest
- Compare models
- Set up and run model
- Adjust model to explore interventions, identify problem areas
- Prepare modeling products for analyst

What feeding is expected in the Pango Basin for the next five years?

Processing: Investigate food security in South Sudan for August 2017

Model: Pango Basin Configuration

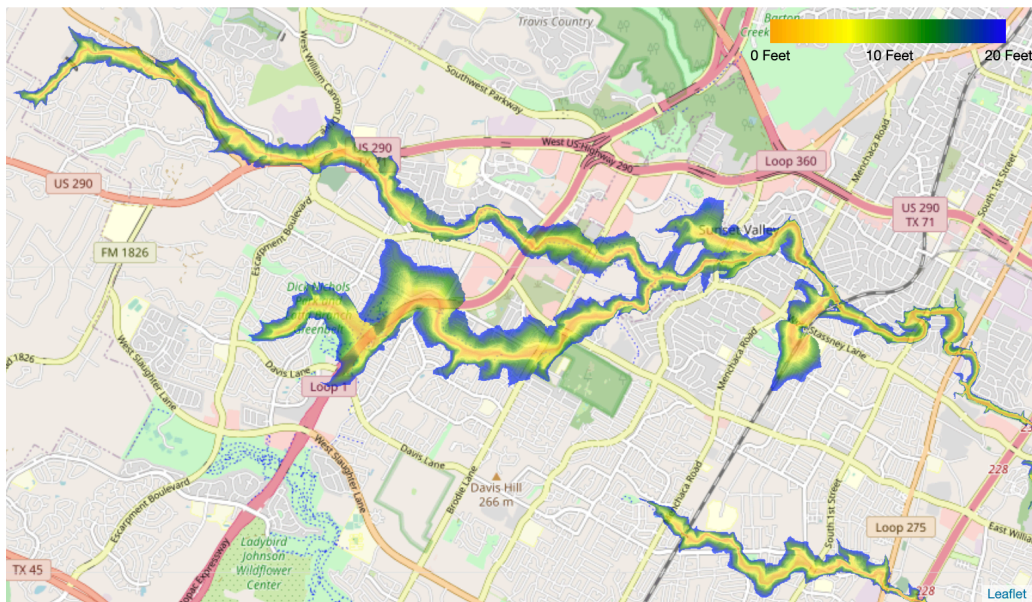
Variables: Crop Production, Fertilizer Use, Water Use, etc.

Results: Bar charts showing crop production and fertilizer use over time.

Work with Yolanda Gil, Daniel Garijo, Maximiliano Osorio, Hernan Vargas, Deborah Khider (USC), Anna Dabrowski and Lissa Pearson(UT)



Visualization of Indicator HAND Model Results ready <10 minutes

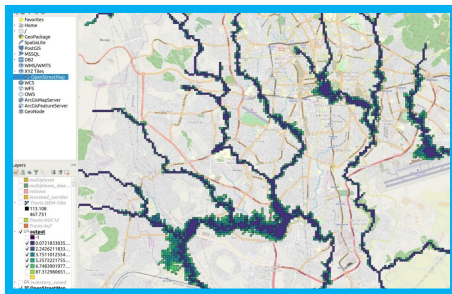
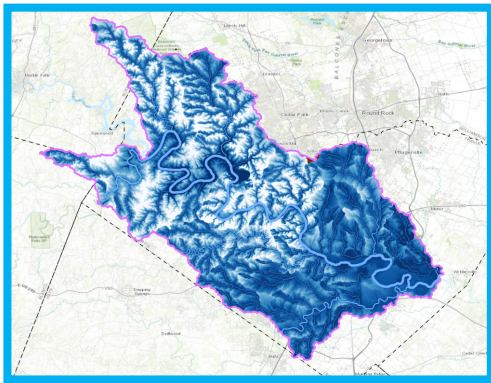


Data and Models are
The best tools we have to understand
our critical Earth resources

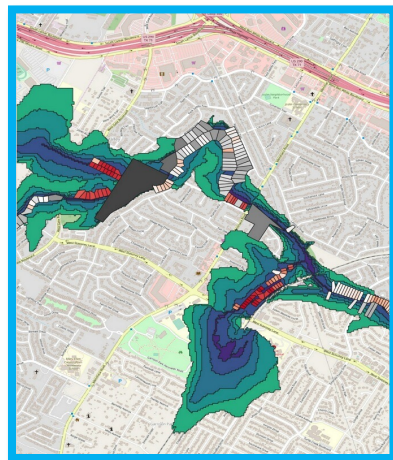
However, information contained within
data and models is often
misunderstood or misinterpreted by
people who need to use it to make
group decisions.

Data Fusion to Refine and Build Insight

Automating assessment using portable flood model workflow with higher resolution base data

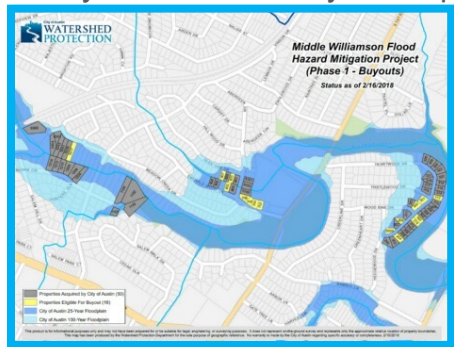


Travis County



Comparison Williamson County

Manually Constructed Buyout Map



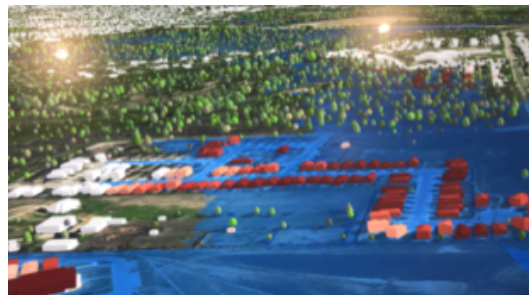
MINT Generated Vulnerability Map



Combining

- Terrain (10 m, 1 meter next)
- Population
- Urban Land Use

Work with Daniel Hardesty Lewis, David Arctur and Paola Passalacqua (UT)



Creating dynamic user interfaces to help understand & share it

Disaster usually strikes fast and without tolerance for deliberation. At the very moment response needs to be nimble, frontline communities can be overwhelmed by the complexity of impending impacts and limited in their collective action by the **“speed of trust.”**



https://tpwmagazine.com/archive/2017/apr/ed_3_hornsbybend/

“Austin’s Hornsby Bend does double duty as a sewage plant and wildlife mecca.”
- Camille Wheeler

Success depends on both **access to trustworthy knowledge resources** and **existence of robust relationships** among affected communities.

Aspect	Research	IRL = In Real Life
Combinatorial	Must be capable of fast and powerful computations	Candidate solutions that are “Good Enough” to support insightful dialogue and deliberation
Expertise	Crucial, precise, high caliber science-driven	Frame the problem with people Diagnose to context
Accessibility	Need to be flexible and easy to use	Could be as simple as a conversation drawing on your knowledge or driven by media cycles
Uncertainty (particularly with models)	Carefully delineate the limitations and evaluate performance with best precision, detailed metadata	Modelers need to define the limitations and constraints for other users. Can someone else use your model ‘safely’
Timely	Careers are made and dedicated for years, exploratory analyses	Commit to the pace of the event and focus on the problem structure at hand
Integration	Look for and define frameworks,	Various knowledge areas <u>will</u> be combined and used

Thank You!

Social Process is as Important
as the Cyberecosystems, Data, and Models

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Planet Texas 2050, Bridging Barriers Initiative, UT Austin
MINT/DARPA, Award W911NF-18-10027
IS-GEO/NSF, EarthCube Award #1632211

