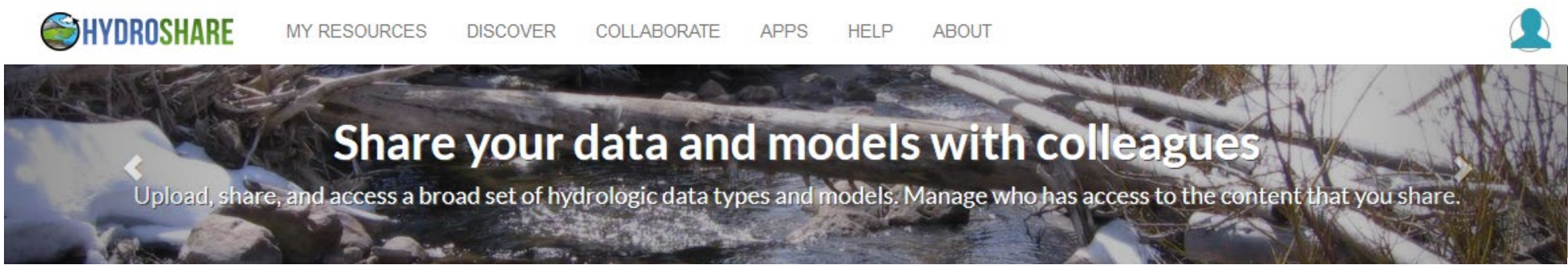Award #: 1664061

HYDROSHARE

CSSI Framework: HydroShare: Cyberinfrastructure for Advancing Hydrologic Knowledge through Collaborative Integration of Data Science, Modeling and Analysis

David Tarboton[a], Ray Idaszak[b], Shaowen Wang[c], Jeffery Horsburgh[a], Dan Ames[d], Jon Goodall[f], Alva Couch[e], Hong Yi[b]
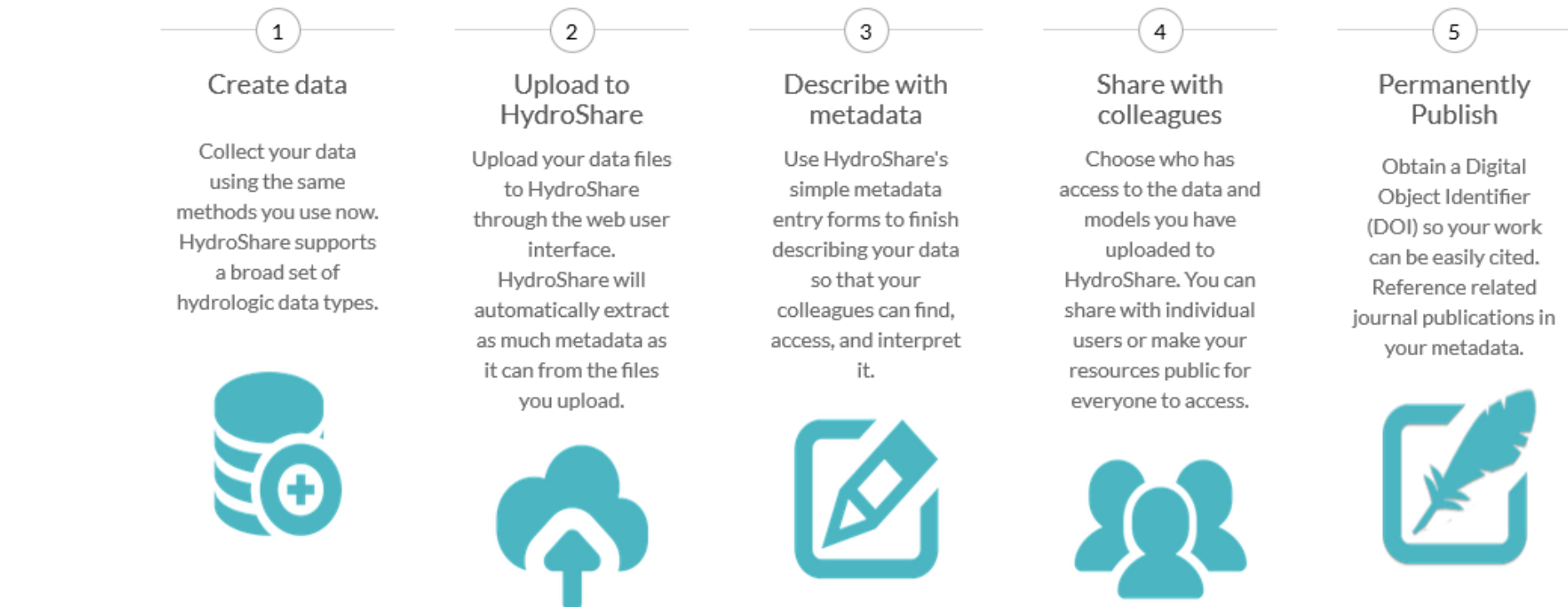
[a]Utah State University, [b]RENCI University of North Carolina, [c]University of Illinois, [d]Brigham Young University, [e]Tufts University, [f]University of Virginia

What is HydroShare ?

An online hydrologic information system for sharing data, models and code to enable more rapid advances in hydrologic understanding through collaborative research, analysis and modeling.

HYDROSHARE — MY RESOURCES   DISCOVER   COLLABORATE   APPS   HELP   ABOUT

Share your data and models with colleagues
Upload, share, and access a broad set of hydrologic data types and models. Manage who has access to the content that you share.

How it works

1. **Create data** — Collect your data using the same methods you use now. HydroShare supports a broad set of hydrologic data types.
2. **Upload to HydroShare** — Upload your data files to HydroShare through the web user interface. HydroShare will automatically extract as much metadata as it can from the files you upload.
3. **Describe with metadata** — Use HydroShare's simple metadata entry forms to finish describing your data so that your colleagues can find, access, and interpret it.
4. **Share with colleagues** — Choose who has access to the data and models you have uploaded to HydroShare. You can share with individual users or make your resources public for everyone to access.
5. **Permanently Publish** — Obtain a Digital Object Identifier (DOI) so your work can be easily cited. Reference related journal publications in your metadata.

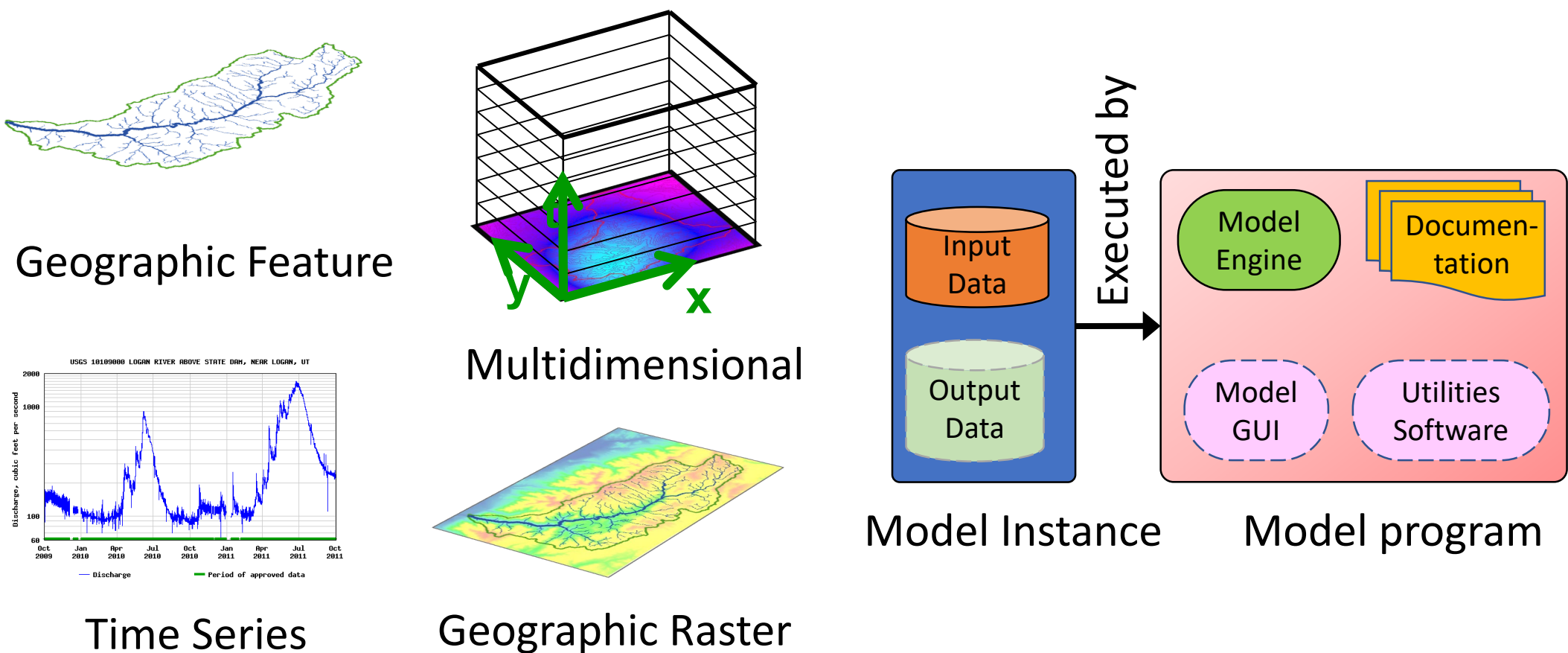### What you can do with HydroShare

- Share your data and models with colleagues
- Manage who has access to the content that you share
- Share, access, visualize and manipulate a broad set of hydrologic data types and models
- Use the web services API to program automated and client access
- Publish data and models to meet the requirements of your data management plan
- Discover and access data and models published by others
- Use web apps to visualize, analyze and run models on data in HydroShare

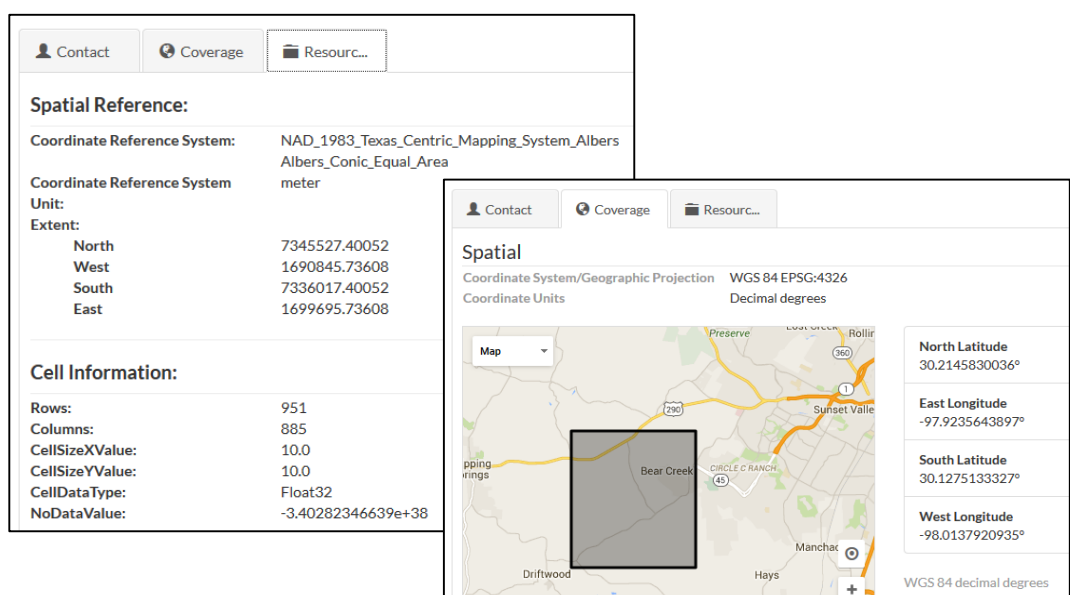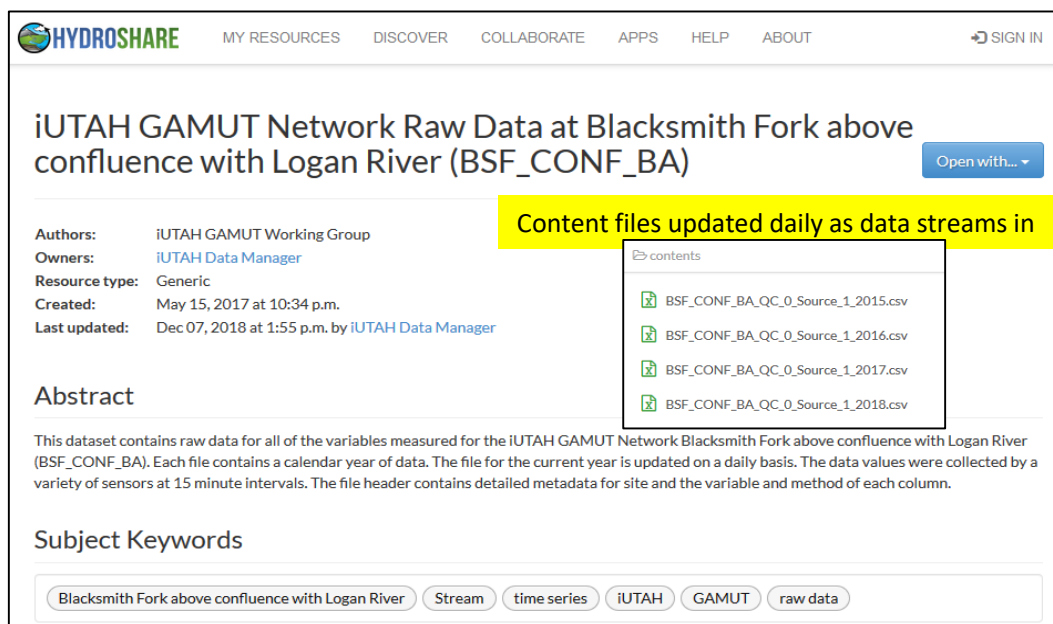## www.hydroshare.org

What can you store in HydroShare ?

1. In HydroShare, data and model files are stored as **resources**.
2. HydroShare supports any file, including several specific data formats.
3. Content "aggregations" hold data formats common in hydrology and support description with additional content specific metadata. Apps can act on specific content types.
4. Collections group together multiple resources related to a project or study.
5. Model Programs and Model Instances hold specific hydrologic models and associated data for application at a location.
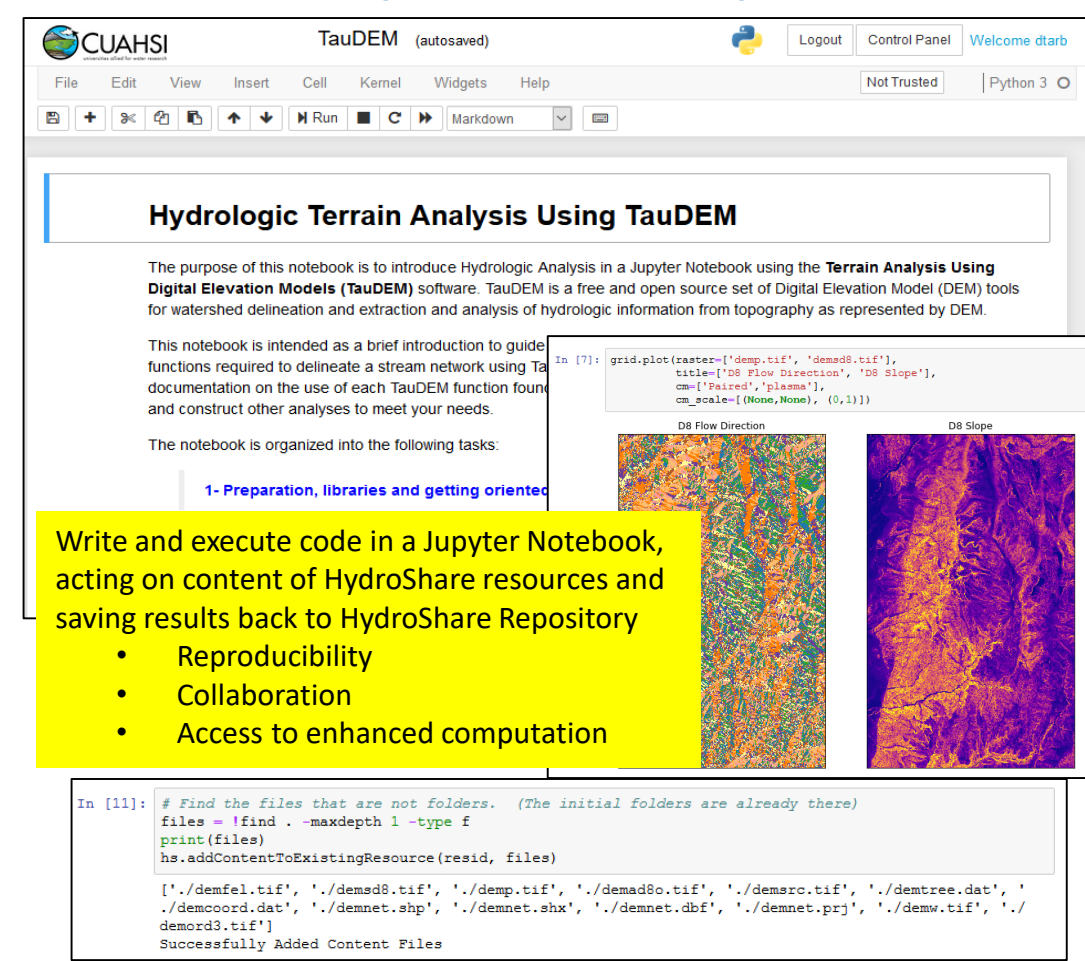
Geographic Feature
Multidimensional
Time Series
Geographic Raster

Input Data → Output Data — Executed by → Model Engine, Documentation, Model GUI, Utilities Software
Model Instance
Model program

Key Functionality

Data streamed into HydroShare as soon as it is collected

HYDROSHARE — MY RESOURCES   DISCOVER   COLLABORATE   APPS   HELP   SIGN IN

iUTAH GAMUT Network Raw Data at Blacksmith Fork above confluence with Logan River (BSF_CONF_BA)

Authors: iUTAH-GAMUT Working Group
Owners: iUTAH Data Manager
Resource type: Generic
Created: May 15, 2017 at 10:34 p.m.
Last updated: Dec 07, 2018 at 5:14 p.m. by iUTAH Data Manager

Content files updated daily as data streams in

Abstract
This dataset contains raw data for all of the variables measured for the iUTAH GAMUT Network Blacksmith Fork above confluence with Logan River (BSF_CONF_BA). Each file contains a calendar year of data. The file for the current year is updated on a daily basis. The data values were collected by a variety of sensors at 15 minute intervals. The file header contains detailed metadata for site and the variable and method of each column.

Subject Keywords
Blacksmith Fork above confluence with Logan River | Stream | time series | iUTAH | GAMUT | raw data

Metadata harvested automatically or captured via simple web page editing

Spatial Reference:
Coordinate Reference System: NAD_1983_Texas_Centric_Mapping_System_Albers
Albers_Conic_Equal_Area
Coordinate Reference System Unit: meter

Cell Information:
Rows: 951
Columns: 885
CellSizeXValue: 10.0
CellSizeYValue: 10.0
CellDataType: Float
NoDataValue: -3.402822664e+38

Groups

JupyterHub App Analysis

CUAHSI   TauDEM (adosxend)

Hydrologic Terrain Analysis Using TauDEM

The purpose of this notebook is to introduce Hydrologic Analysis in a Jupyter Notebook using the **Terrain Analysis Using Digital Elevation Models (TauDEM)** software. TauDEM is a free and open source set of Digital Elevation Model (DEM) tools for watershed delineation and extraction and analyses of hydrologic information from topography as represented by DEM.

This notebook is intended as a brief introduction to guide functions required to delineate a stream network using TauDEM and construct other analyses to meet your needs.

The notebook is organized into the following tasks:
1 - Preparation, libraries and getting oriented

Write and execute code in a Jupyter Notebook, acting on content of HydroShare resources and saving results back to HydroShare Repository
- Reproducibility
- Collaboration
- Access to enhanced computation

Freshwater
Freshwater is led by the University of Washington with support of the Mountain to Sea Strategic Research Initiative for advancing freshwater research in the Pacific Northwest and beyond. (http://freshwater.uw.edu/)
Freshwater researchers create positive change through scientific discovery and technological innovation. This is community resource for education, data and tool sharing for overcoming the global challenges in water quality, resource management, and access.

Landlab
Landlab is a Python-based modeling environment that allows scientists and students to build numerical landscape models. Designed for disciplines that quantify surface dynamics such as geomorphology, hydrology, glaciology, and stratigraphy, it can also be used in related fields.

Why HydroShare ?

Collaboration: Share your data and model files; integrate information from multiple sources; organize individual, team, and group work.
Reproducibility, transparency and trust: Publish your work in any format, including data and models with a citable digital object identifier (DOI).
Do Science: Run Apps and models from a browser without installing software; access computational services for your big data and model analysis.
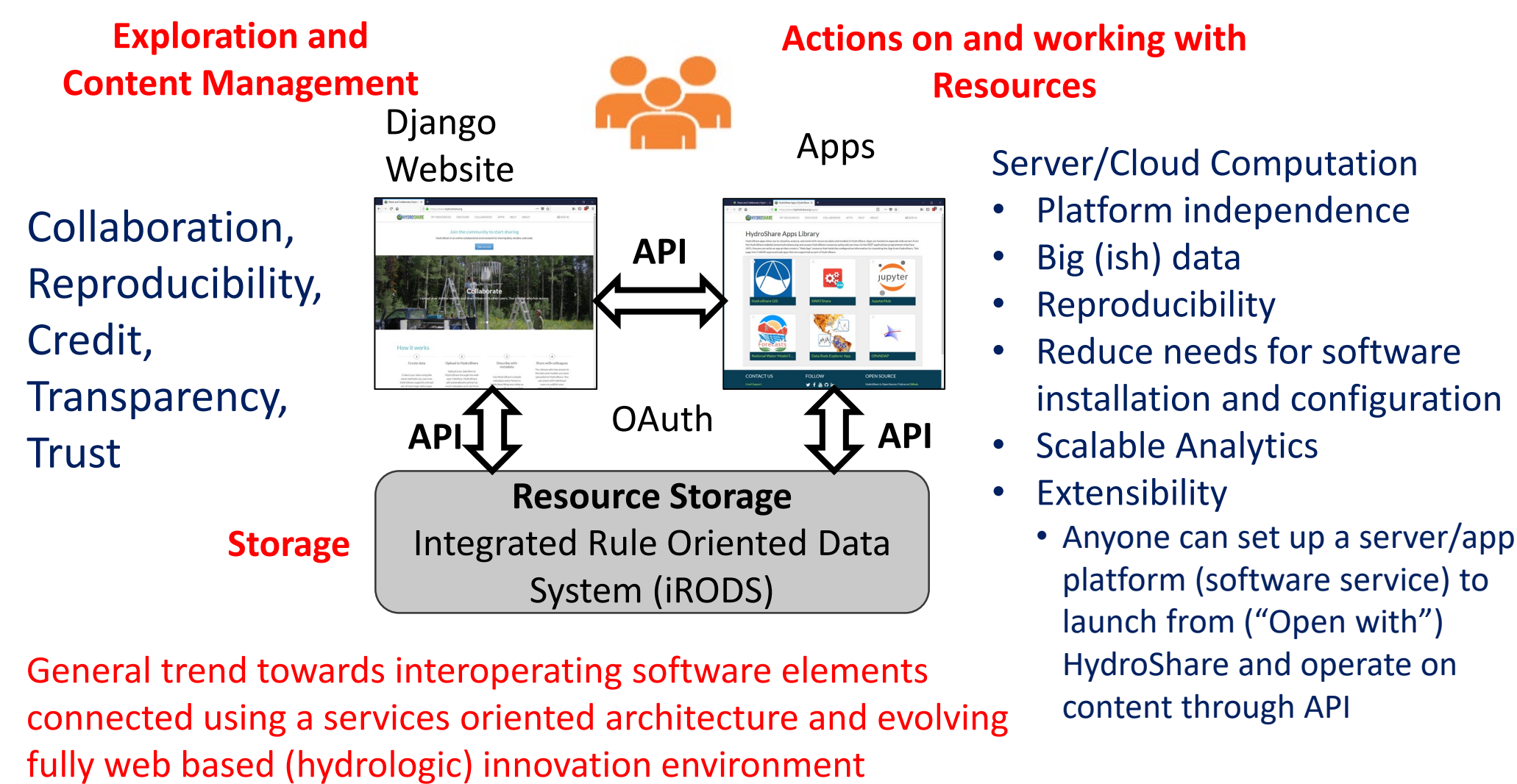**Learning:** Use a platform where all students have access to the same functionality regardless of their computer.

HydroShare is a system to advance hydrologic science by enabling the community to more easily and freely share products resulting from their research, not just the scientific publication summarizing a study, but also the data and models used to create the scientific publication.
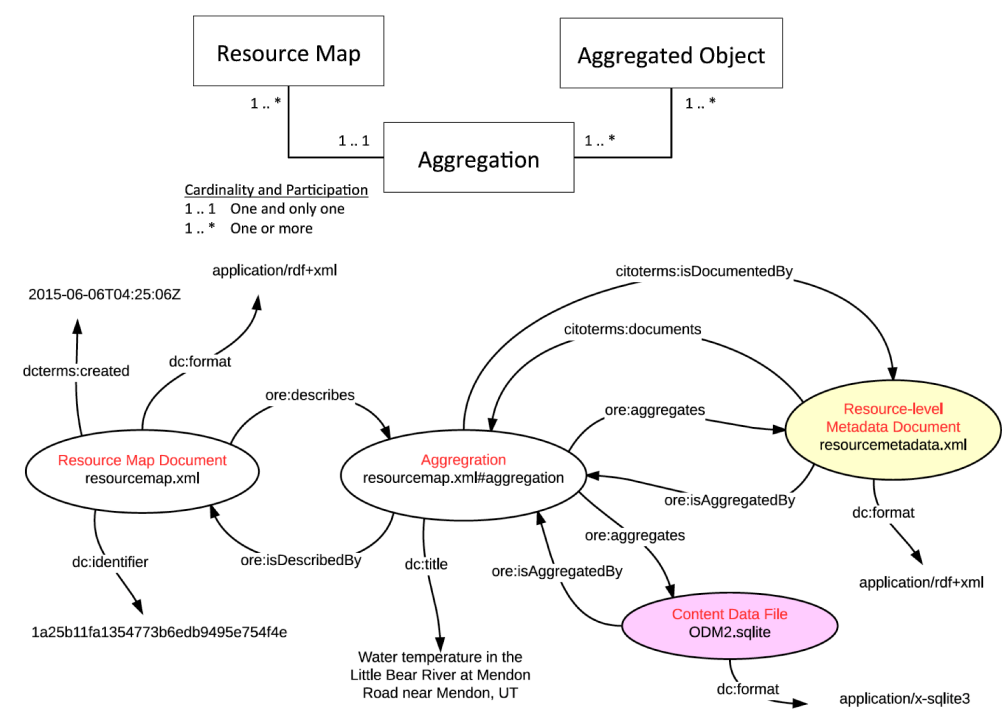
- **F**indable
- **A**ccessible
- **I**nteroperable
- **R**eusable

Make Data FAIR @AGU

Design

Exploration and Content Management
Actions on and working with Resources

Django Website — API — Apps

Collaboration, Reproducibility, Credit, Transparency, Trust

API — OAuth — API

Storage — Resource Storage: Integrated Rule Oriented Data System (iRODS)

Server/Cloud Computation
- Platform independence
- Big (ish) data
- Reproducibility
- Reduce needs for software installation and configuration
- Scalable Analytics
- Extensibility
  - Anyone can set up a server/app platform (software service) to launch from ("Open with") HydroShare and operate on content through API

General trend towards interoperating software elements connected using a services oriented architecture and evolving fully web based (hydrologic) innovation environment

OAI-ORE standard based Resource Data Model

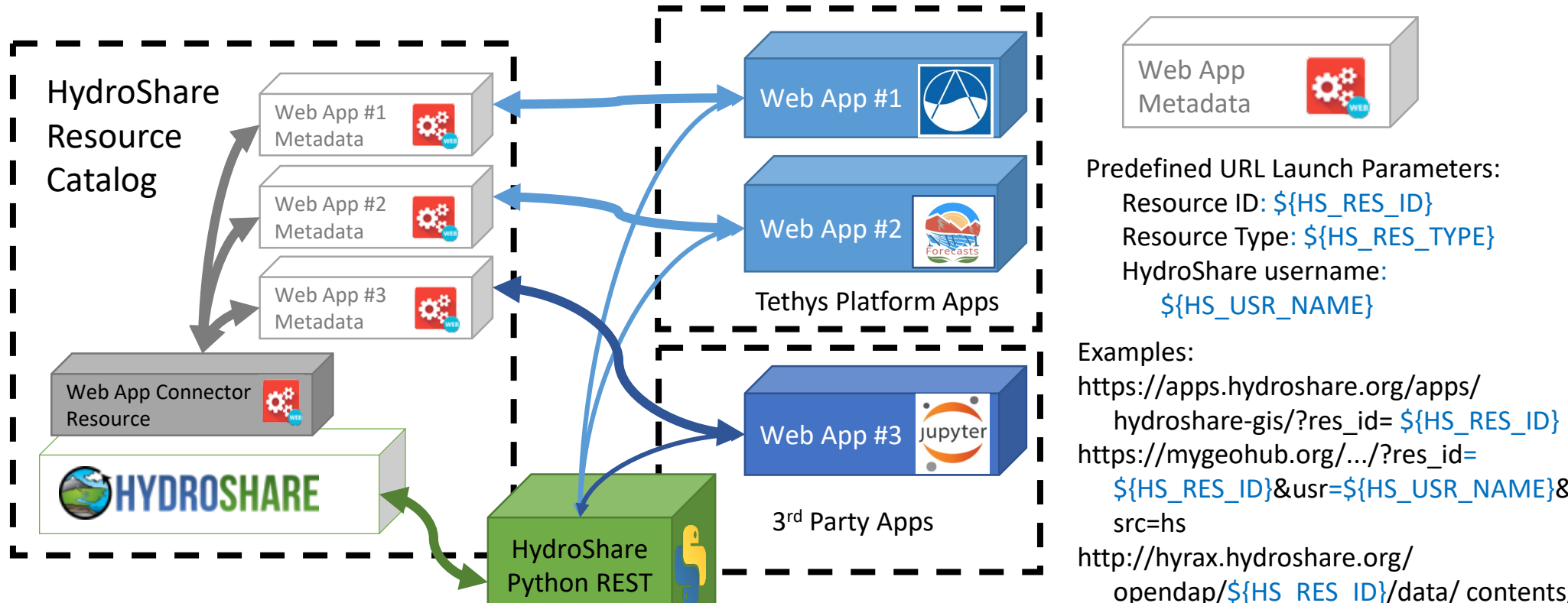Resource Map — Aggregated Object — Aggregation

Dublin Core machine readable metadata and data model to make data in HydroShare, **F**indable, **A**ccessible, **I**nteroperable, **R**eusable

Resources, comprised of data and models, are framed as social objects, the basis for collaboration and interaction

Horsburgh, J. S., et al. (2016), "Hydroshare: Sharing Diverse Environmental Data Types and Models as Social Objects with Application to the Hydrology Domain," JAWRA, http://dx.doi.org/10.1111/1752-1688.12363.

Web App Connector

Anybody can create a web app on any web server and configure a web app Connector for it to be launched from HydroShare

HydroShare Resource Catalog — Web App #1 Metadata, Web App #2 Metadata, Web App #3 Metadata

Web App Connector Resource

HYDROSHARE

HydroShare Python REST API

Web App #1, Web App #2 — Tethys Platform Apps
Web App #3 — 3rd Party Apps

Web App Metadata

Predefined URL Launch Parameters:
Resource ID: ${HS_RES_ID}
Resource Type: ${HS_RES_TYPE}
HydroShare username: ${HS_USR_NAME}

Examples:
https://apps.hydroshare.org/apps/hydroshare-gis/?res_id=${HS_RES_ID}
https://mygeohub.org/.../?res_id=${HS_RES_ID}&usr=${HS_USR_NAME}&src=hs
http://hyrax.hydroshare.org/opendap/${HS_RES_ID}/data/ contents/

Publishing data and models

Publication with Citable Digital Object Identifier (DOI)

HYDROSHARE — MY RESOURCES   DISCOVER   COLLABORATE   APPS   HELP   ABOUT

TW Daniels Experimental Forest (TWDEF) Lidar

Authors: Michaela Tesch, David G. Tarboton
Owners: Michaela Tesch
Resource type: Generic
Created: Dec 08, 2016
Last updated: Dec 09, 2016 at midnight by Michaela Tesch

Abstract
This resource contains lidar data, collected at the TW Daniels Experimental Forest (TWDEF) on six separate flights in 2008 and 2009 measuring surface and canopy properties during snow on and snow off conditions. It was collected for the purposes of obtaining a digital elevation model (DEM) to characterize the area for snowmelt modeling, and by differencing between snow on and snow off observations to characterize the spatial distribution of snow depth. Canopy lidar returns also characterize the vegetation. The data was collected as a project of USU shortly after collection and additionally processed by the Space Dynamics Laboratory (SDL) in support of Utah lidar efforts in 2016.

The topographic data (set 10-15m) grid green details about the hardware used for data collection, the flight plans and resulting data, the data processing steps, and a brief version.

Subject
TW Daniels Experimental Forest | TWDEF | Lidar | DEM | Snow Depth

How to cite
Tesch, M., D. G. Tarboton (2016), TW Daniels Experimental Forest (TWDEF) Lidar, HydroShare, http://doi.org/10.4211...

This resource is shared under the Creative Commons Attribution CC BY.

Link publications to their supporting data

ELSEVIER — Journal of Hydrology
journal homepage: www.elsevier.com/locate/jhydrol

Research papers
Modeling urban coastal flood severity from crowd-sourced flood reports using Poisson regression and Random Forest
J.M. Sadler, J.L. Goodall, M.M. Morsy, S. Spencer

Sadler, J., 2018a. Input data for flood severity modeling in Norfolk, VA, HydroShare. https://doi.org/10.4211/hs.ff89e5aea3224c15b2626666d5fb6031.
Sadler, J., 2018b. Output from data-driven model of flood severity in Norfolk, VA. https://doi.org/10.4211/hs.5d8f0bb15d2045868583e96f22f2ecc7b.
Sadler, J., 2018c. Data-driven model script for flood severity modeling in Norfolk, VA. https://doi.org/10.4211/hs.712cd2a50f604e3f82464036be16b53.

- Paper cites HydroShare resources
- HydroShare resources link back to paper

Sources
Derived From: https://www.hydroshare.org/resource/ff89e5aea3224c15b2626666d5fb6031/
isCreatedBy: https://www.hydroshare.org/resource/...
cites: https://doi.org/10.1016/j.jhydrol.2018.01.044