# The ABoVE Spectral Library (ASTRAL) – A Web-mapping Application to Enhance the Discovery, Visualization, and Sharing of Hyperspectral Reflectance Data

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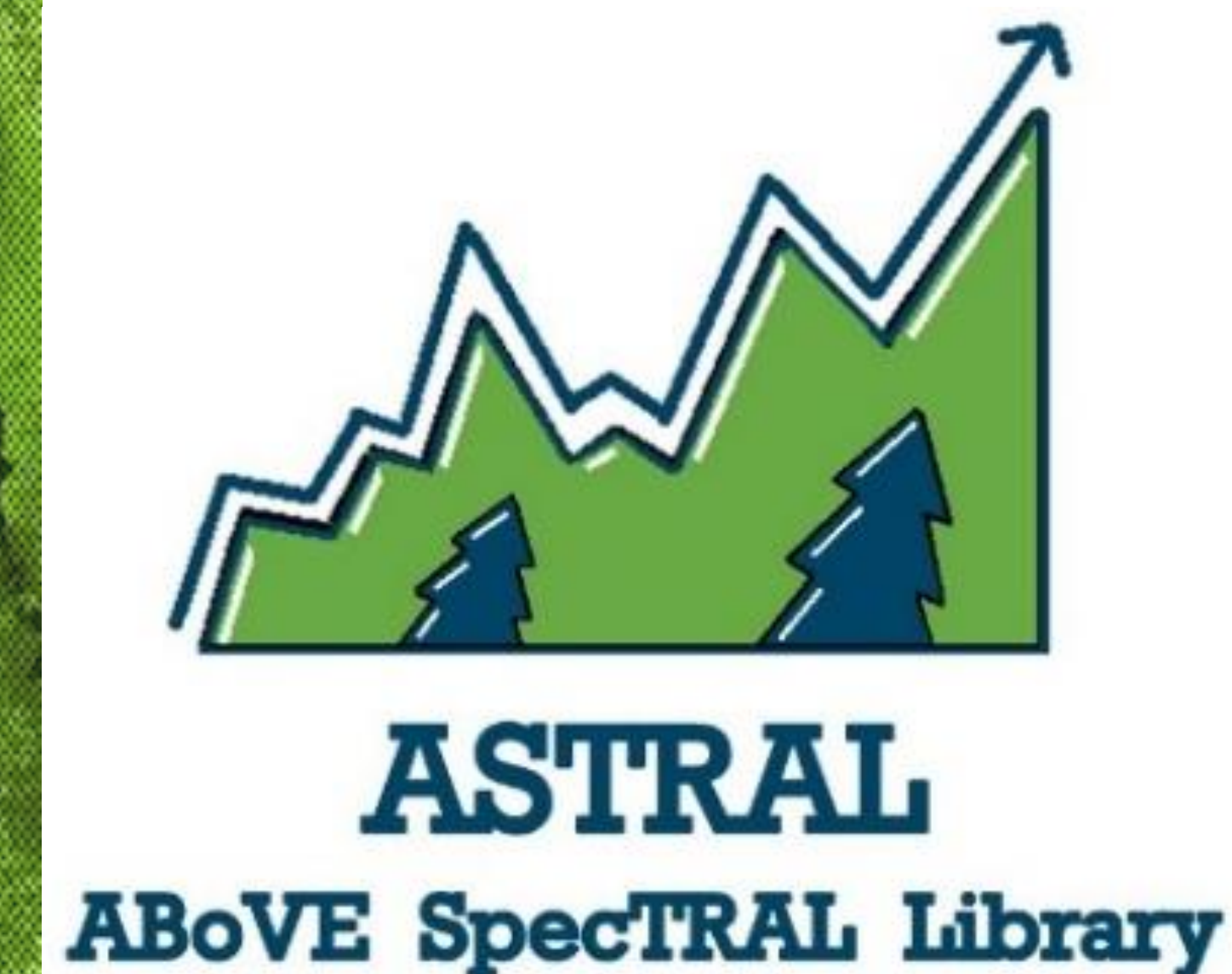
Abstract- The Arctic is experiencing among the most dramatic impacts from climate change on the planet.

- NASA's Terrestrial Ecology Program launched the Arctic-Boreal Vulnerability Experiment (ABoVE) in an effort to better understand the vulnerability and resilience of Arctic and Boreal ecosystems and societies to environmental variability and change.
- Remote sensing of natural targets, in particular hyperspectral reflectance, from ground, airborne and space borne platforms is a widely used method for monitoring changing arctic landscapes.
- Managing and visualizing large amounts of spectral data originating from a variety of sensors and data collection methods remains a challenge.
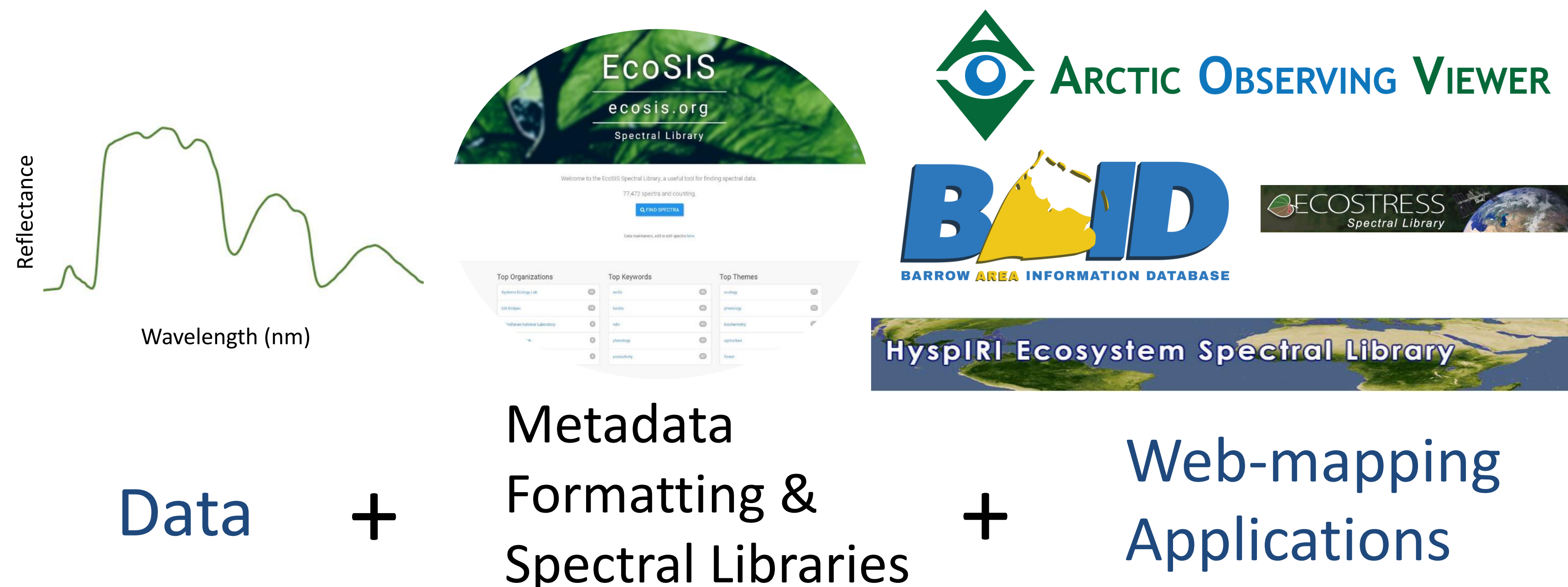
- Additionally, there's a large demand for consistent web based tools that aid the discovery, sharing and visualization of spectral reflectance data for these regions specifically.
- In an effort to alleviate these issues and help bring together our understanding, we have developed a hyperspectral reflectance library fused with a web mapping application that allows for the discovery, visualization, and sharing of spectral data across the ABoVE domain.
- Here, we present a beta application and welcome constructive suggestions on how to better design the application to be most useful for the Terrestrial Ecology Science Team, ABoVE and other stakeholders.

Objectives- Support NASA ABoVE goals by creating tools to manage, visualize and share hyperspectral reflectance data

1. Develop tools and leverage data to support Arctic Terrestrial Ecological research
2. Fuse ground to airborne-based spectral data into a single informational data archive suitable for meeting ABoVE Science objectives
3. Facilitate information and data discovery by integrating open-source ecoinformatics and cyberinfrastructure tools
4. Enhance visualization of information and spectral data
5. Share data with ABoVE end users and stakeholders
6. Fill current gaps in data management and sharing
7. Utilize agile software development approaches to ensure user needs are met- interoperability

Approach- Fuse open-source ecoinformatics and cyberinfrastructure tools

ASTRAL adopted the structural framework developed by EcoSIS to document important metadata for each individual spectral record. This allows for easy fusion and interoperability between existing databases like EcoSIS and our web mapping application. Additionally, this project draws from multiple web mapping applications previously developed and established.

Data + Metadata Formatting & Spectral Libraries + Web-mapping Applications

Hyperspectral data
Remote sensing
Integration of ground and remotely sensed data
Coordinated logistics
ecoinformatics
Ecological scaling
Data discovery
NASA ABoVE
Visualize and compare spectra across projects, sites, and/or years
Identify spatial overlap of reflectance spectra
Export RAW data and metadata
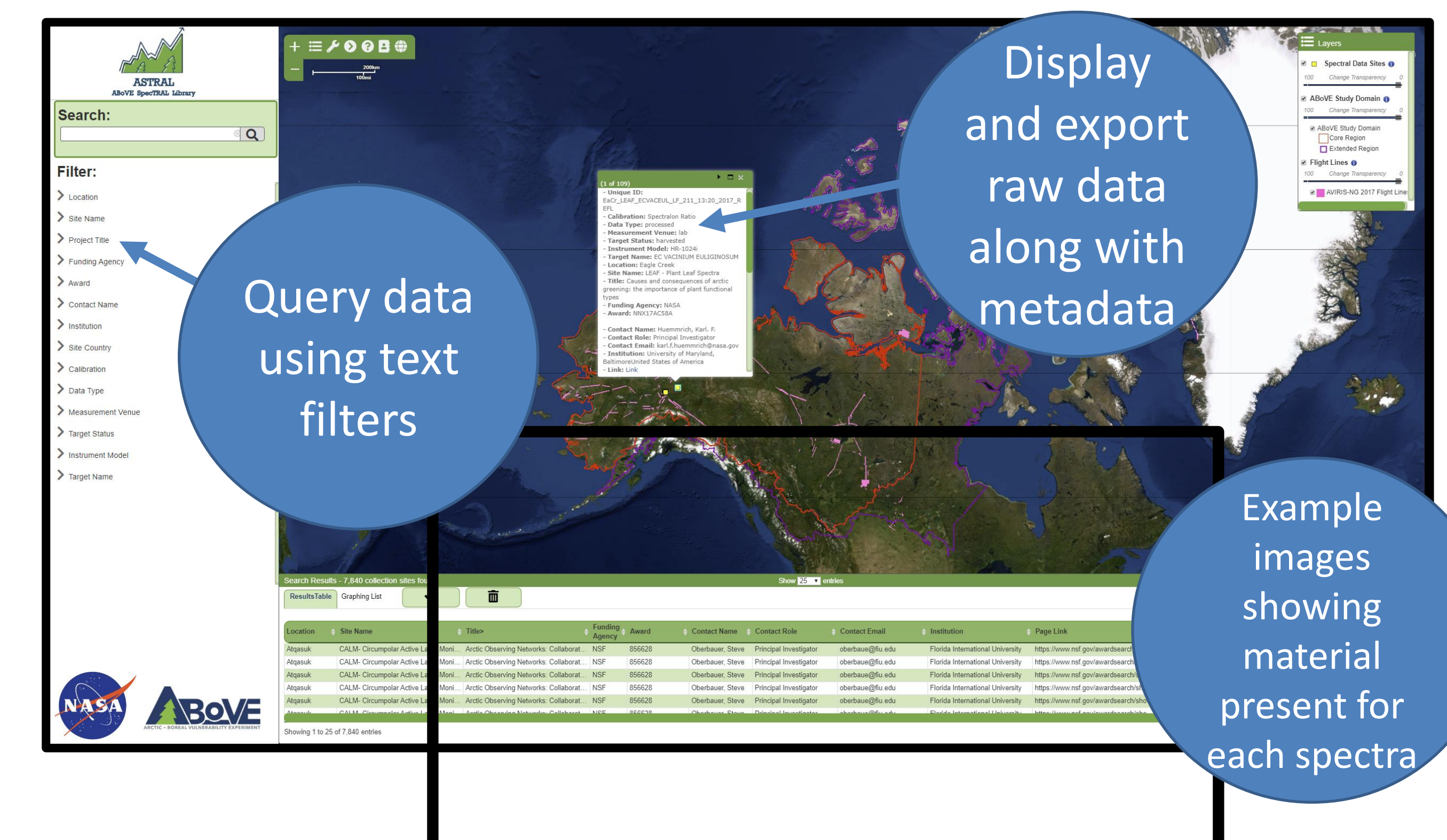Spectral reflectance

Current Prototype

ASTRAL currently displays over 8,000 spectra spanning nearly 10 observation sites across the ABoVE domain pertaining to multiple tundra vegetation species and communities. It now provides more powerful and intuitive geospatial search and filter tools. You can also print maps, save metadata details to Excel, or even export RAW data for further analysis.
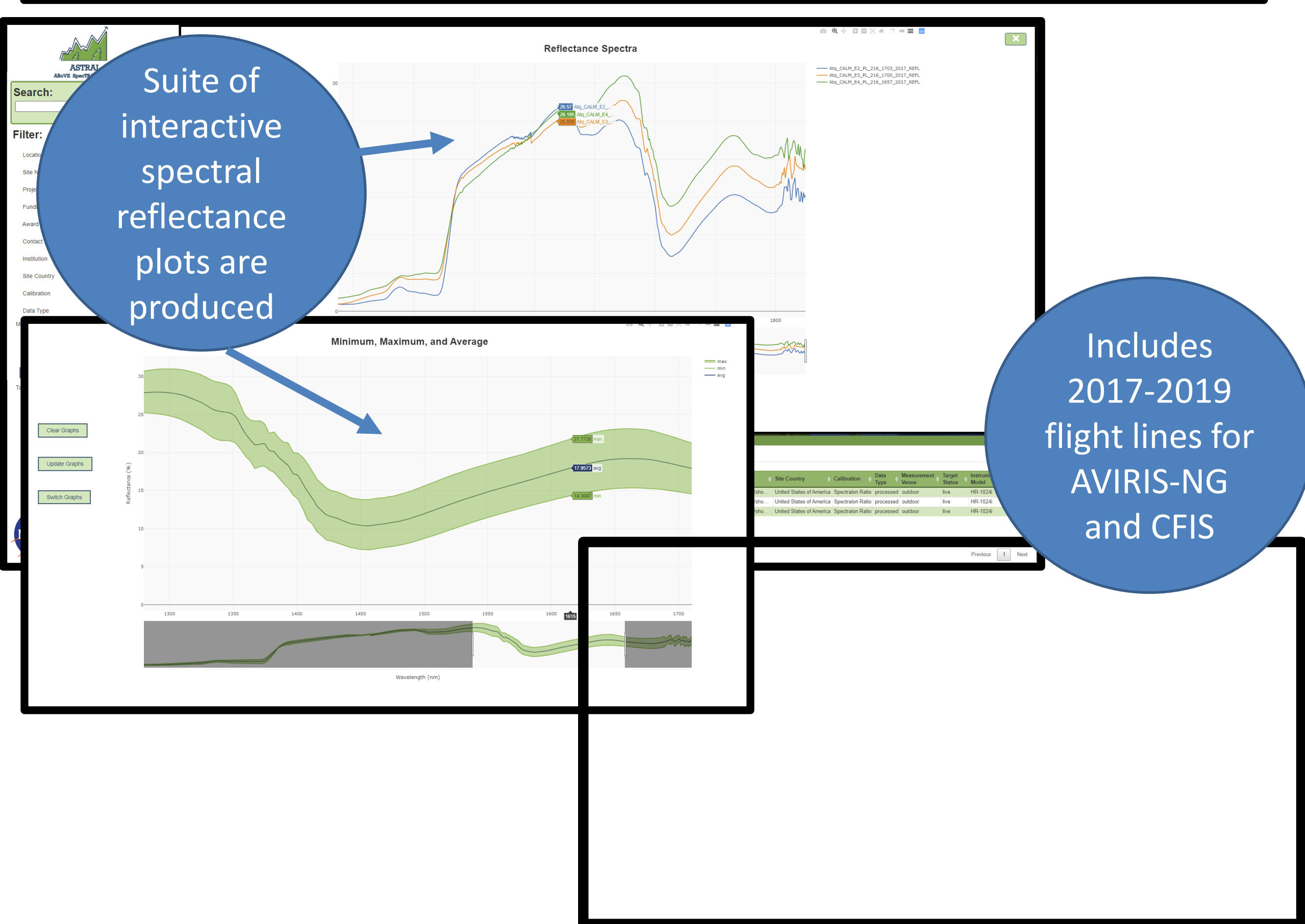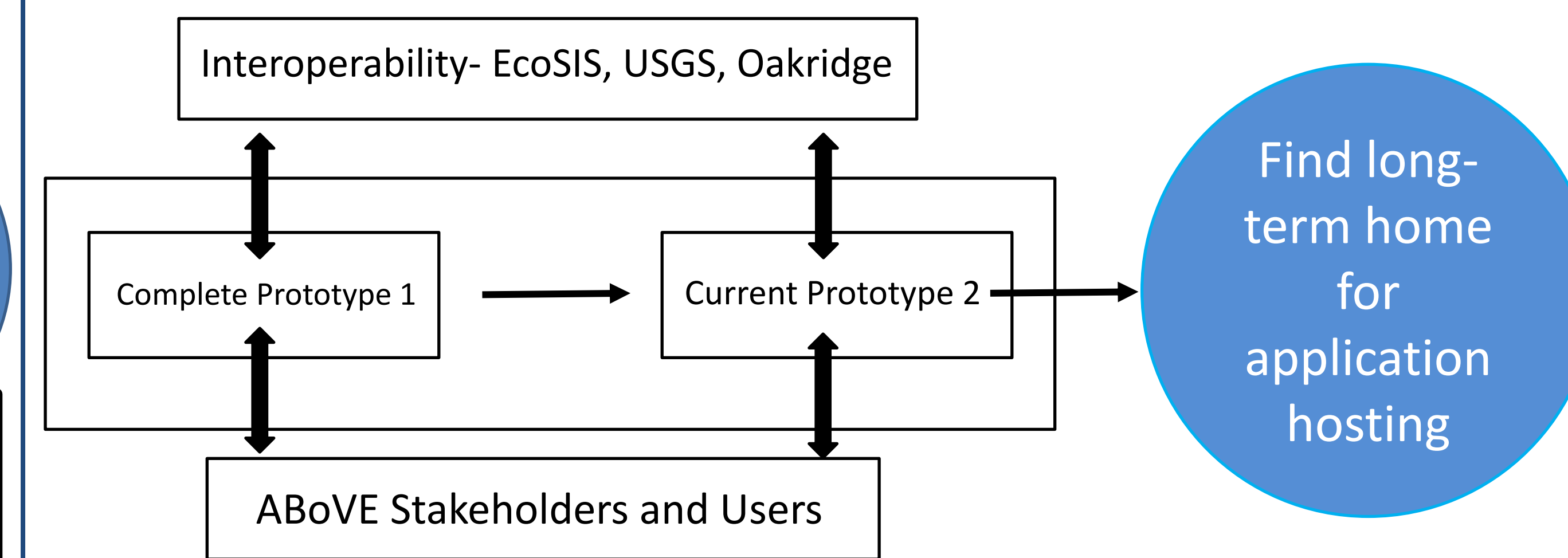

Select records to plot from list

Data discoverability with GIS environment
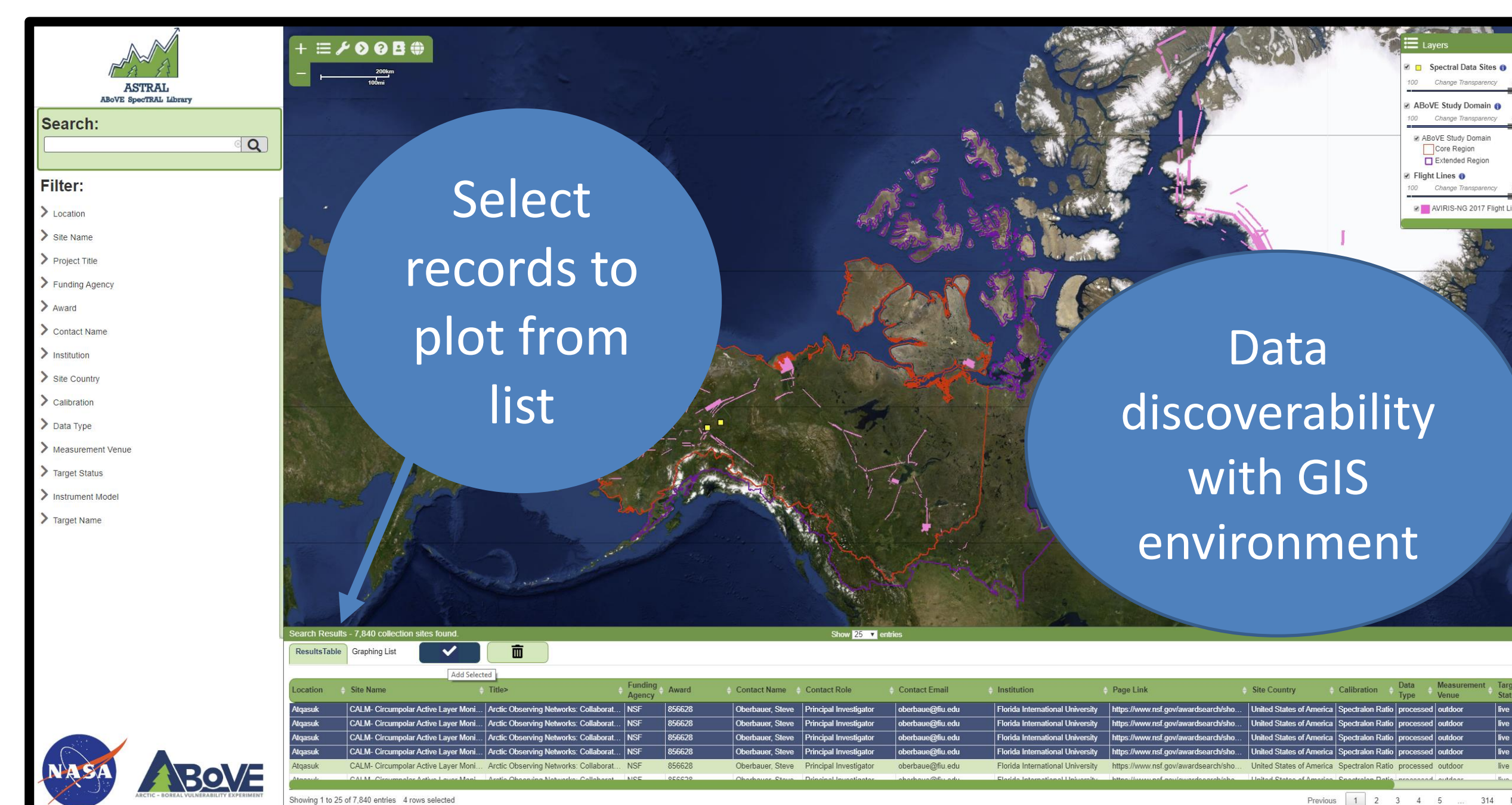
Built on HTML, JS, and CSS: SOLR for database, ESRI API 4.x for mapping, JS libraries for tools and visuals and Plotly JS for added visuals

Display and export raw data along with metadata

Query data using text filters

Example images showing material present for each spectra

Suite of interactive spectral reflectance plots are produced

Includes 2017-2019 flight lines for AVIRIS-NG and CFIS

Future Goals

1. Share tools with EcoSIS and other apps as needed
2. Refine tools based on user/community feedback
3. Build capacity to visualize spectral reflectance indices and time series
4. Include spectra from other ecosystems/projects within ABoVE domain
5. Include plot and leaf level example images
6. Find long-term home for application hosting

Interoperability- EcoSIS, USGS, Oakridge

Complete Prototype 1 → Current Prototype 2

ABoVE Stakeholders and Users

Find long-term home for application hosting

Go here to see the app: http://prodgis02.utep.edu/astral_viewer