Measuring mining impacts on water resources

An AVIRIS flightline over the San Juan Coal Mine in Waterflow, New Mexico

Problem

- Mining is known to affect the environment, but few software tools exist to quantify its impacts

- A large volume of **AVIRIS imagery** is available

- **Spectral libraries** contain samples of thousands of minerals and other materials

- **Environmental data** is collected by local, state, and national governments as well as non-governmental organizations

- Our goal is to contribute tools to **combine this data** in a coherent way

Solution

- Python library implementing a **suite of algorithms**

- **Classify minerals** and other land surface types

- **Identify mines** and other geographic features

- **Correlate environmental impacts** with mining operations

- Release as **Free and Open Source Software**

The San Juan Coal Mine and Generating Station. Courtesy San Juan Citizens Alliance/EcoFlight.

COAL AND OPEN-PIT SURFACE MINING IMPACTS ON AMERICAN LANDS (COAL)

COAL is a Python library for processing hyperspectral imagery from the Airborne Visible/InfraRed Imaging Spectrometer (AVIRIS)
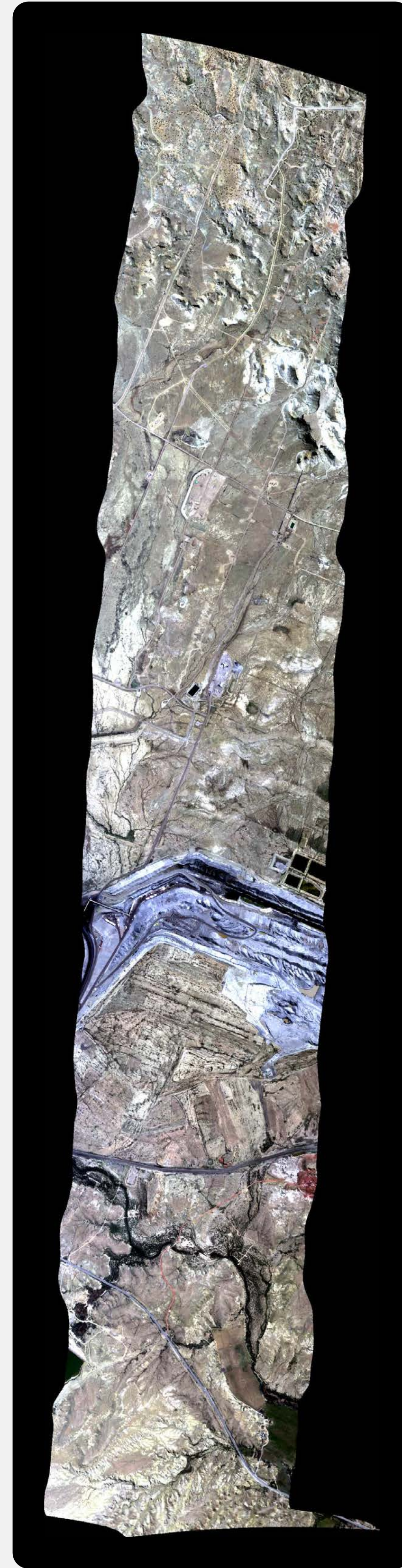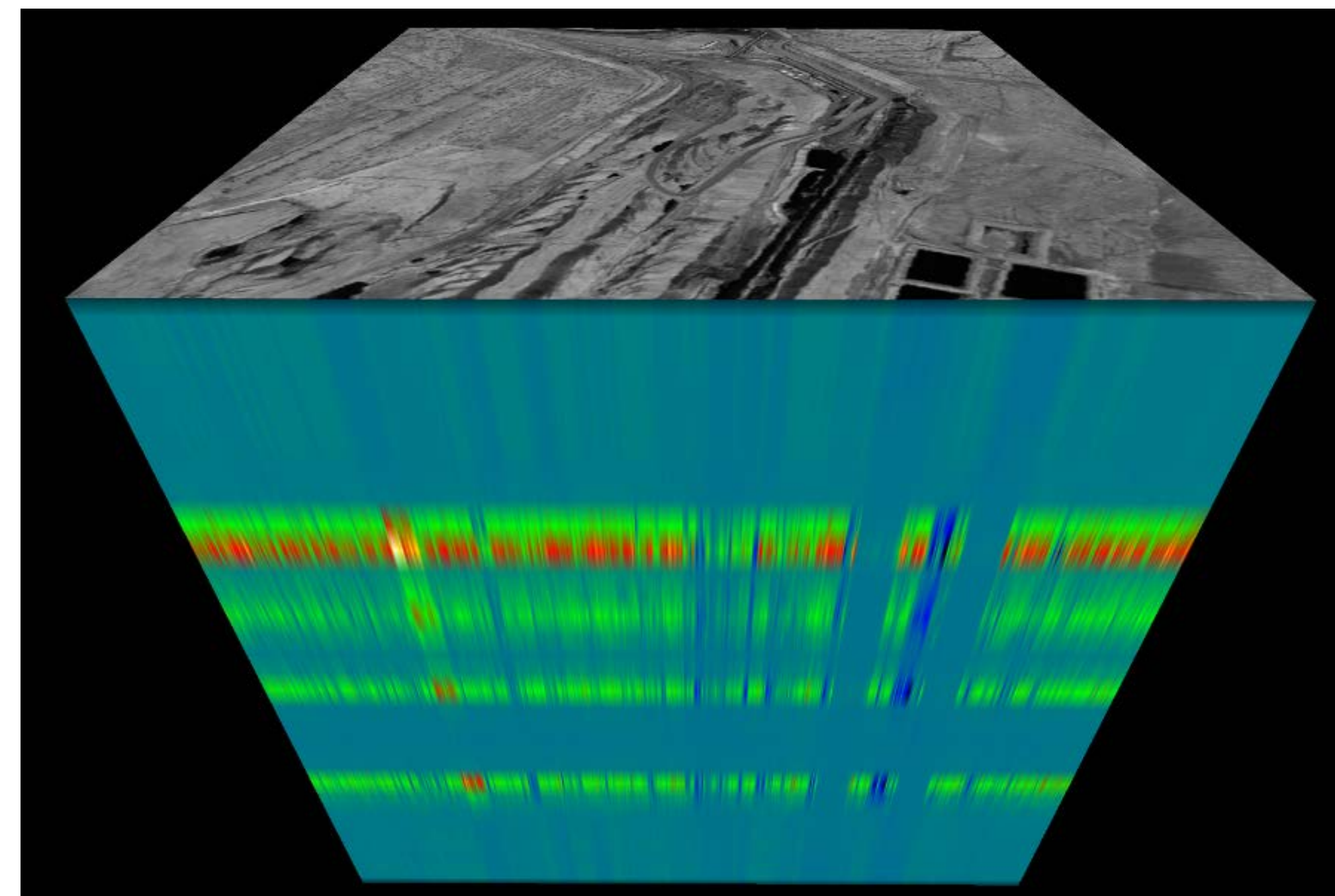

Three-dimensional visualization of hyperspectral imagery displaying spectral bands

Map of coal mine, waste classifications, water resources, and surrounding geography.
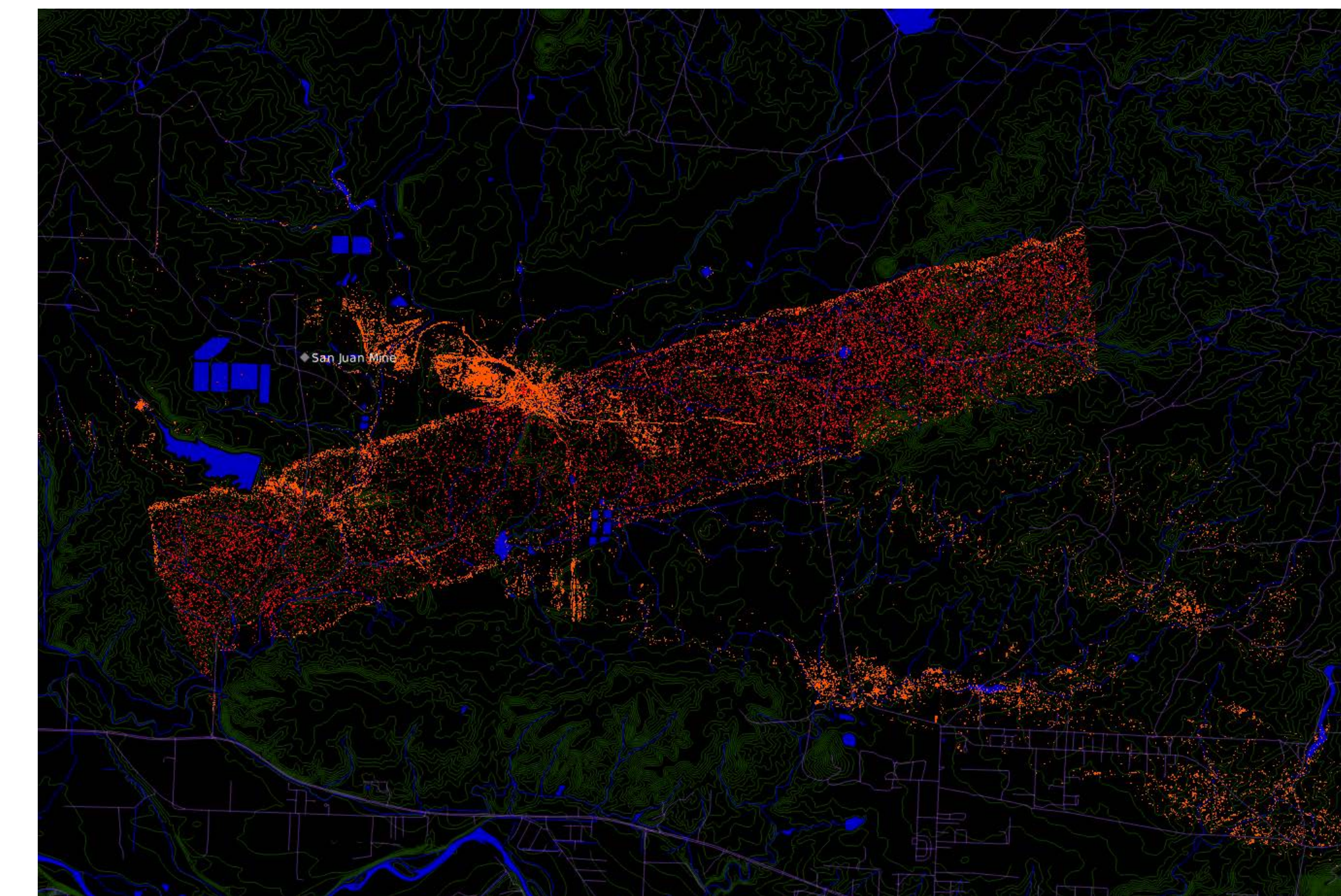
Mineral Classification

- All minerals have unique **spectral signatures**

- Samples of those spectral signatures are contained in **spectral libraries**

- Using the raw AVIRIS images with unknown land cover and spectral signatures, **classify** each pixel with **spectral angle mapper** classification

- Output is a **mineral classified file** where each pixel is assigned to a particular class in the spectral library

Mining Identification

- Use certain classes of minerals as **proxies** for presence of mining

- Output is a **mining classified file** where each pixel is identified as either corresponding to mining or not

Environmental Correlation

- **Map identified mines** in GIS applications and correlate them with water quality measurements

- Determine whether **water pollution** is linked to mining

- Use results to enhance **environmental understanding**

Temporal Analysis

- Implement a **Science Data System** to batch process past and present imagery

- **Facilitate research** with unique data products

- Enable analysis of **changes over time**

Mineral-classified image showing land surface types surrounding a coal facility in Craig, Colorado.
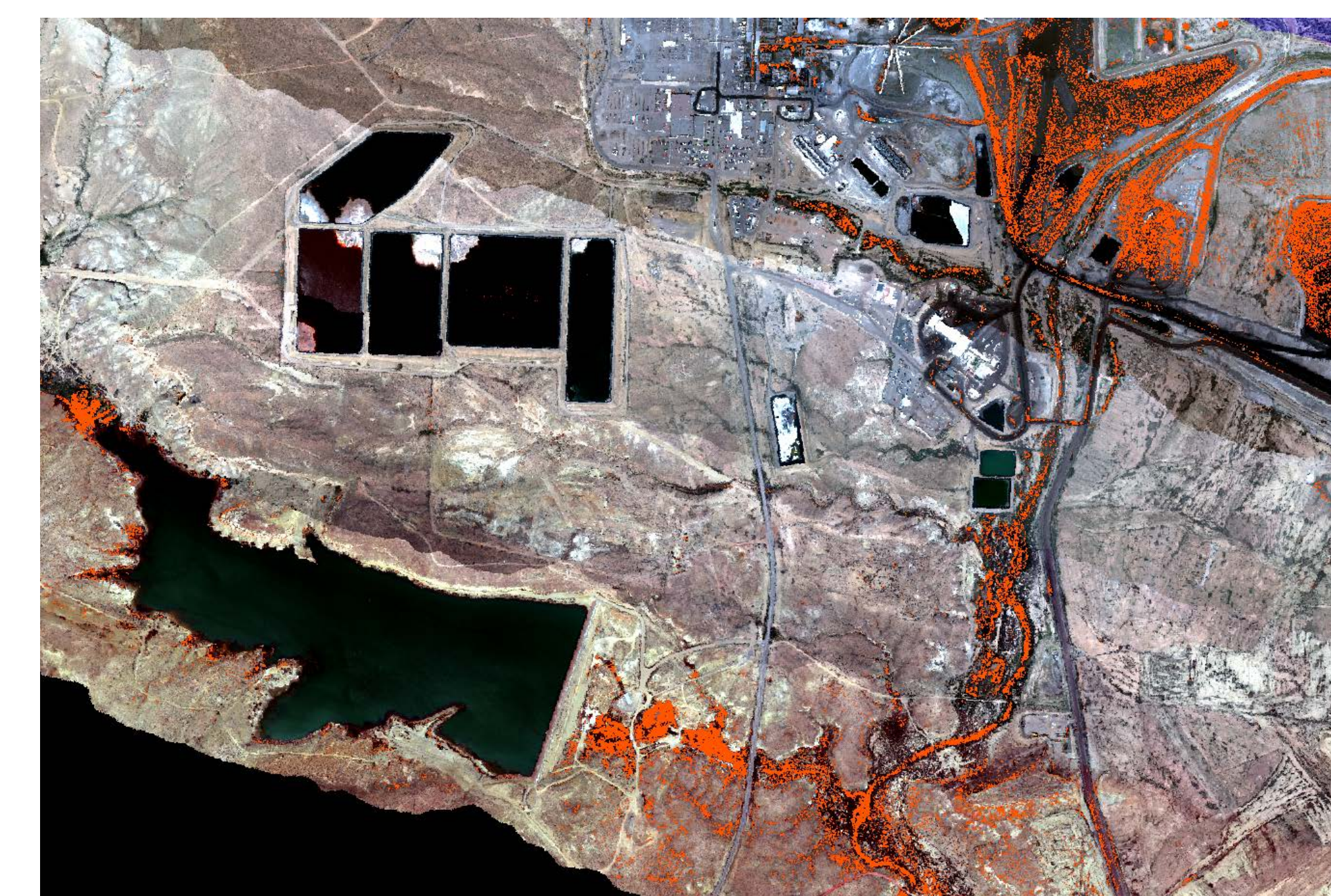
Distribution of coal mining waste classifications along streams and water bodies.

Hyperspectral imagery of the Escondida Mine in Chile. Courtesy NASA/JPL-Caltech.
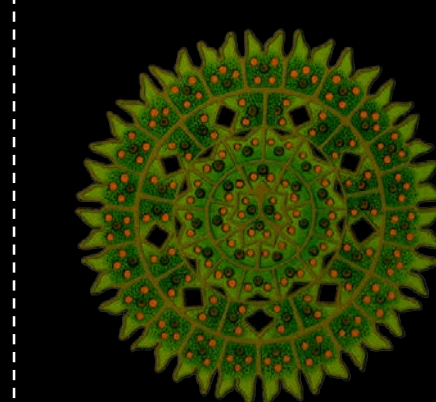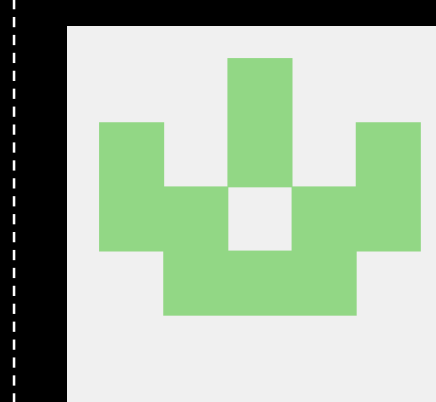
Capstone COAL

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Website

For more information, visit our website:
https://capstone-coal.github.io

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