
Software to Streamline Sharing of Agricultural Algorithms and Data

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THE UNIVERSITY OF ARIZONA
College of Agriculture
& Life Sciences

Introduction

Challenges

How to make appropriate data deposition commonplace?

Solution



UA Digital Agriculture Group

Mission: Providing solutions for computing in agriculture, so that we can engineer crops and sustainable agricultural landscapes.

Vision: Faster, more collaborative agricultural science and engineering through shared software and data.



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Collaborators, Too Many to List:

Tyson Swetnam, Brian Heidorn, CyVerse, Todd Mockler, Nadia Shakoor, Geoff Morris, Vasit Sagan, Robert Pless, Rob Kooper, Max Burnette, Steve Long

Others to be listed as we go ...

Outline: Our Approach in 4 Ts

- Tools
- Translators
- Tutorials
- Templates

Open Software as Germplasm:

Aligned with CG and Land Grant Missions



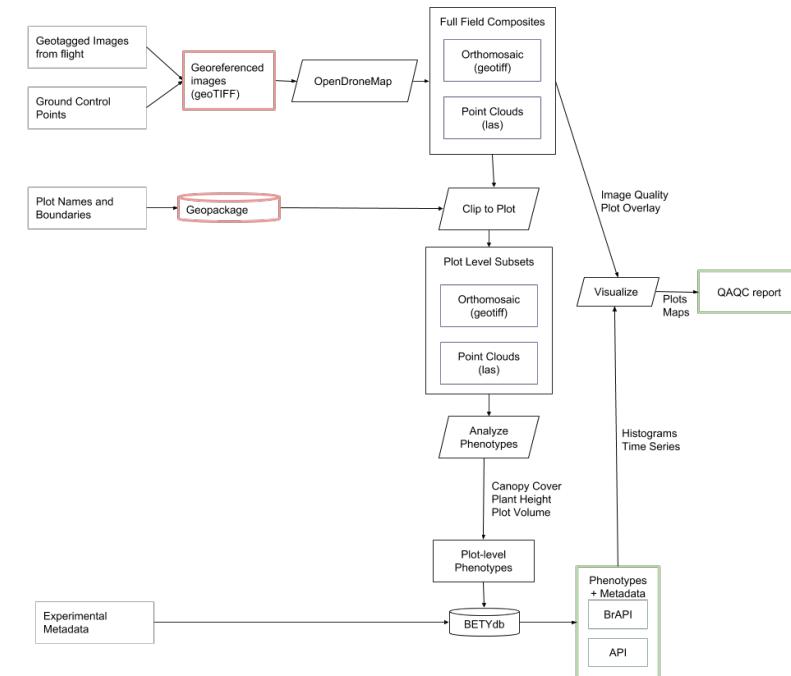
CIMMYT genebank

Outline: Our Approach in 4 Ts

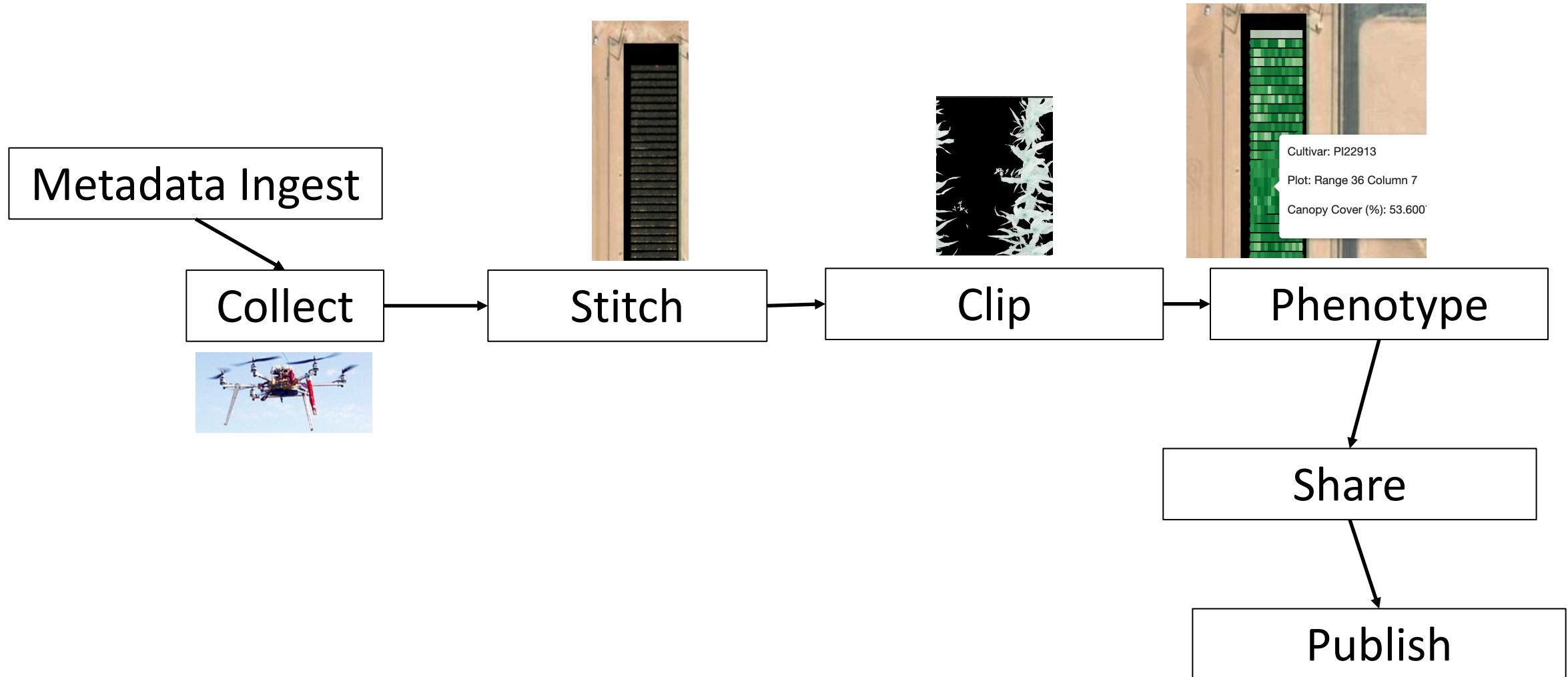
- Tools
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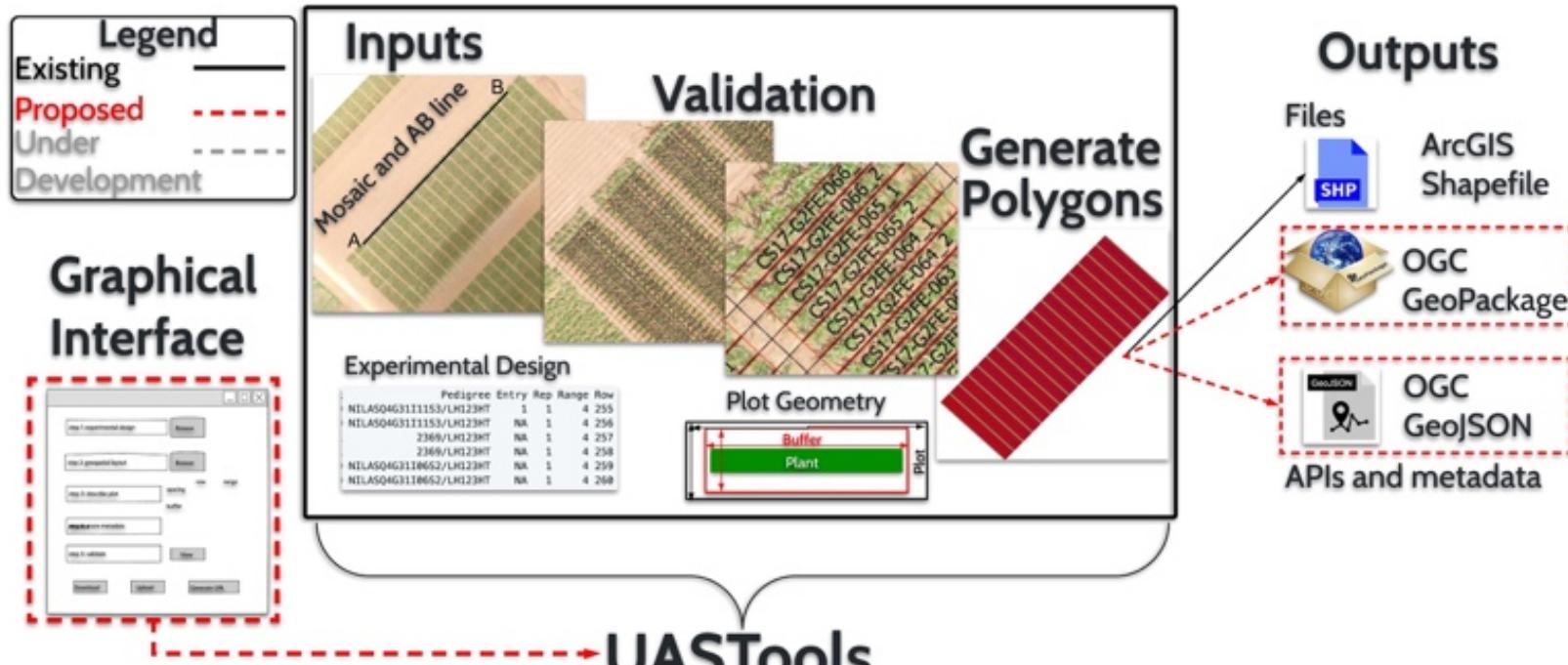
High Throughput Phenomics
(images → phenotypes)
Pipelines



A Simple Drone Pipeline

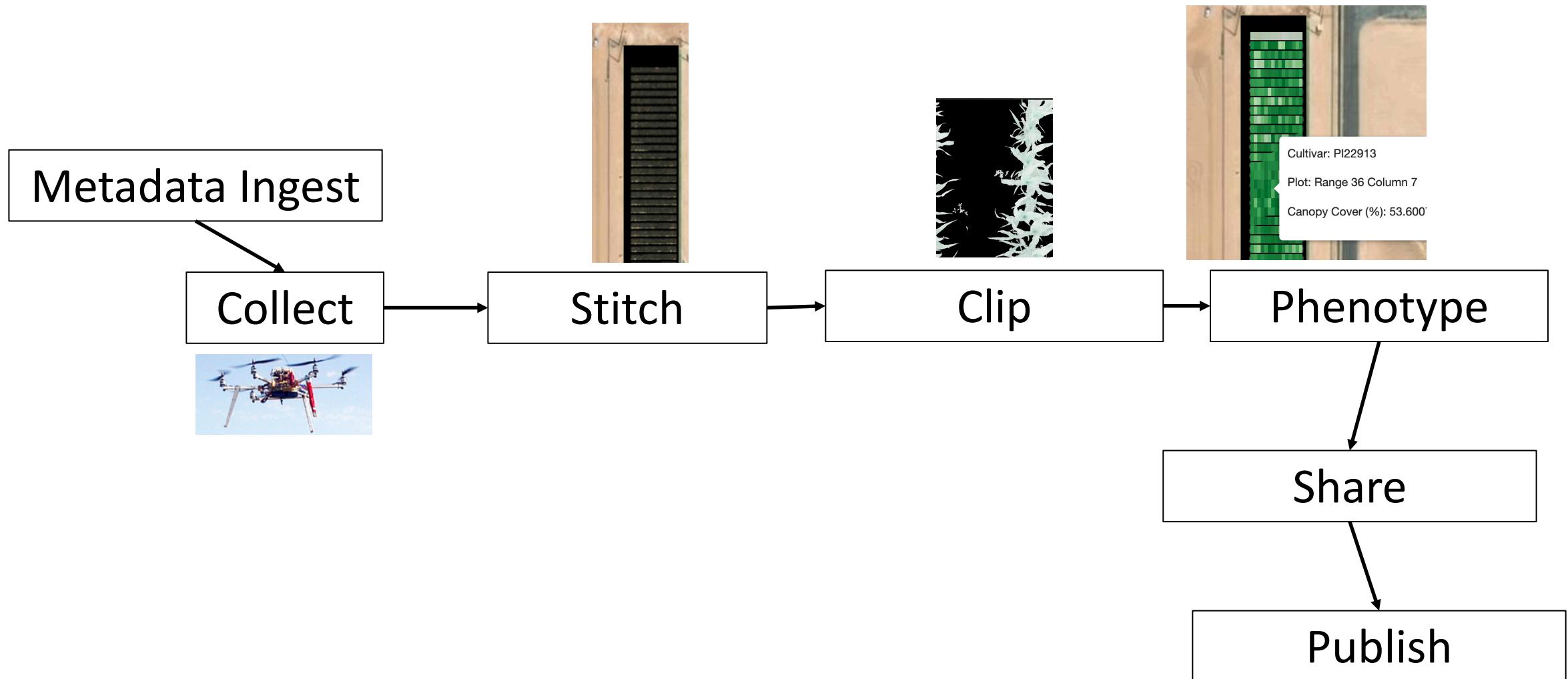


Metadata Ingest: Plot Boundaries

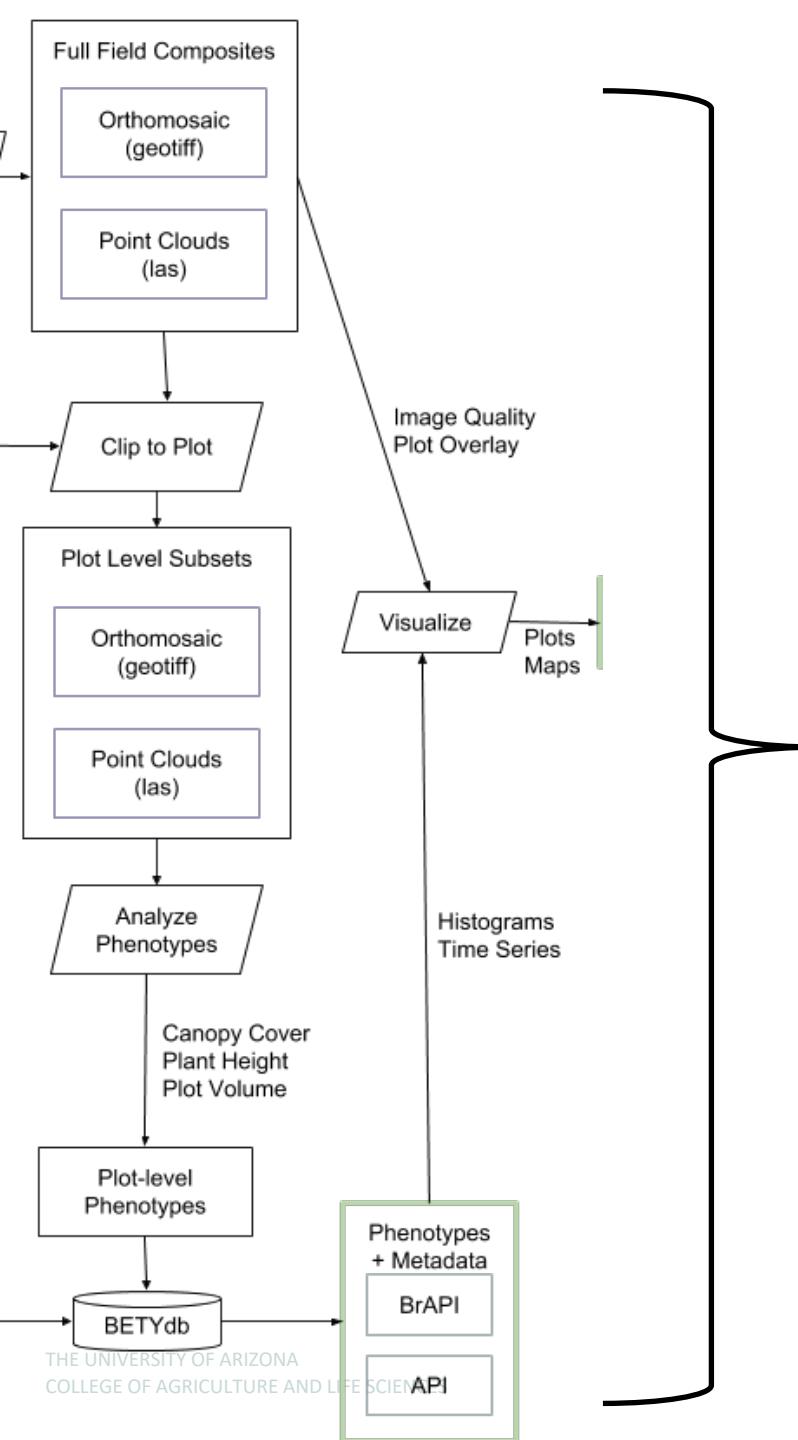


- Works ✓
- Open Source ✓ *
- Standard API ✓ *

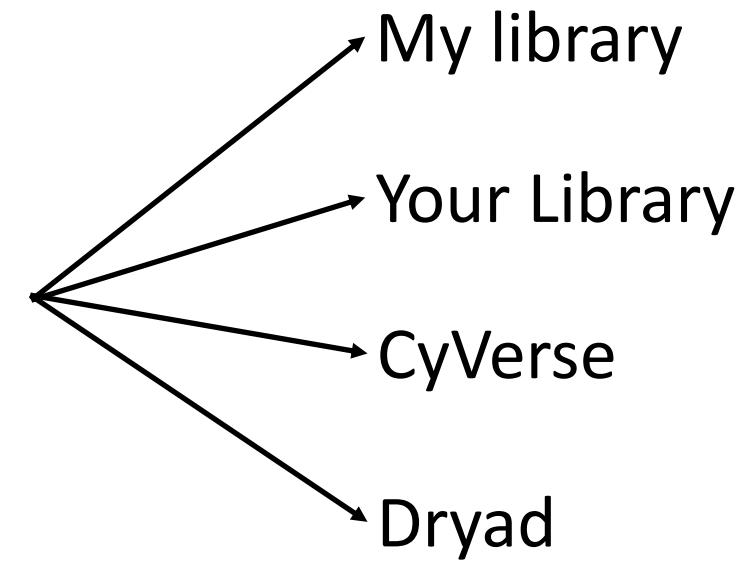
A Simple Drone Pipeline



Data Publication



Publishable
Object



Data Publication



Open Source Data Management for Long Tail Data

A customizable and scalable data management system to support any data format and multiple research domains. *Catalogs in the clouds.*

V1.8.0 RELEASED!

JOIN US ON SLACK!

terraref.org/clowder/

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COLLEGE OF AGRICULTURE AND LIFE SCIENCES

Create New Publication Request

Name

My Publication

Creator(s):

One or more creators are required

SELECT REPOSITORY
»

Edit Metadata

Note: The links in this page redirect to the live objects.

Add metadata

Select field

No metadata available for this resource

Select Repository

SUBMIT TO
REPOSITORY »

Candidate Repositories

The results below are based on an analysis of the dataset's properties and metadata and the preferences you specified.

Inter-university Consortium for Political and Social Research

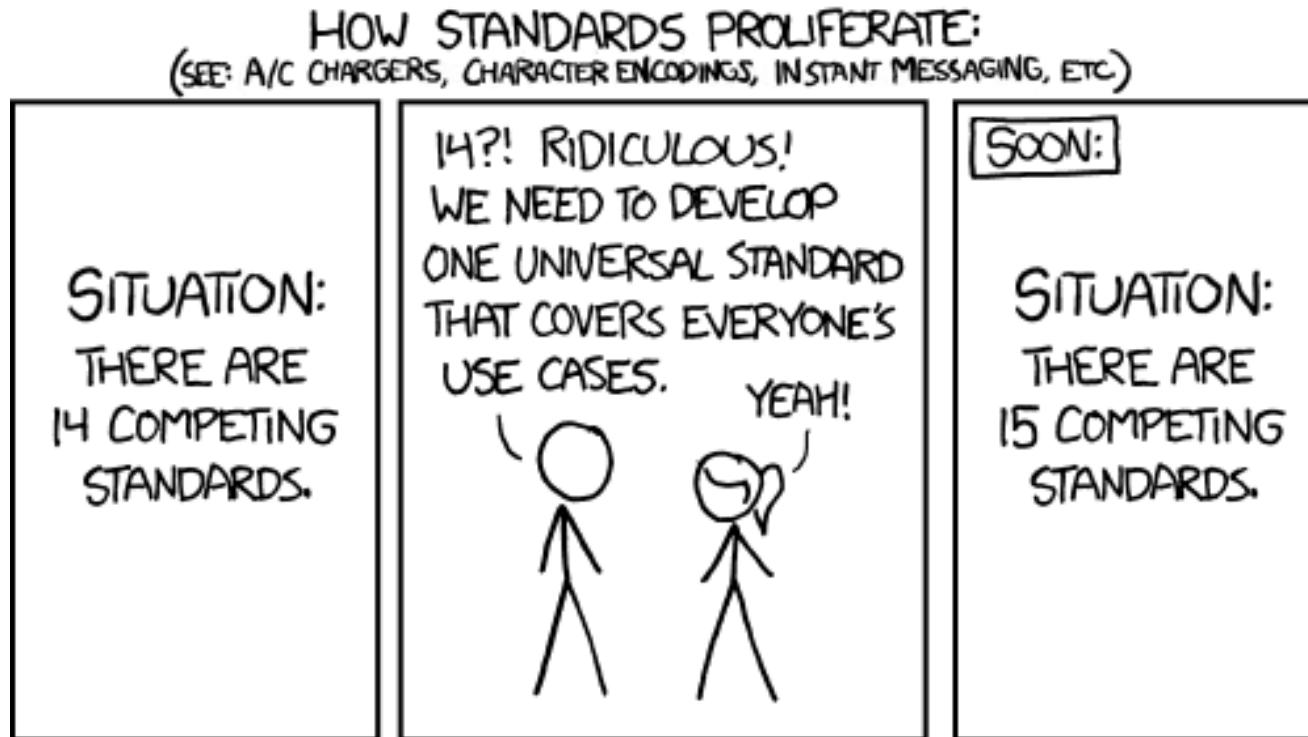
● Match: all requirements are satisfied.

[View details](#)

Outline: Our Approach in 4 Ts

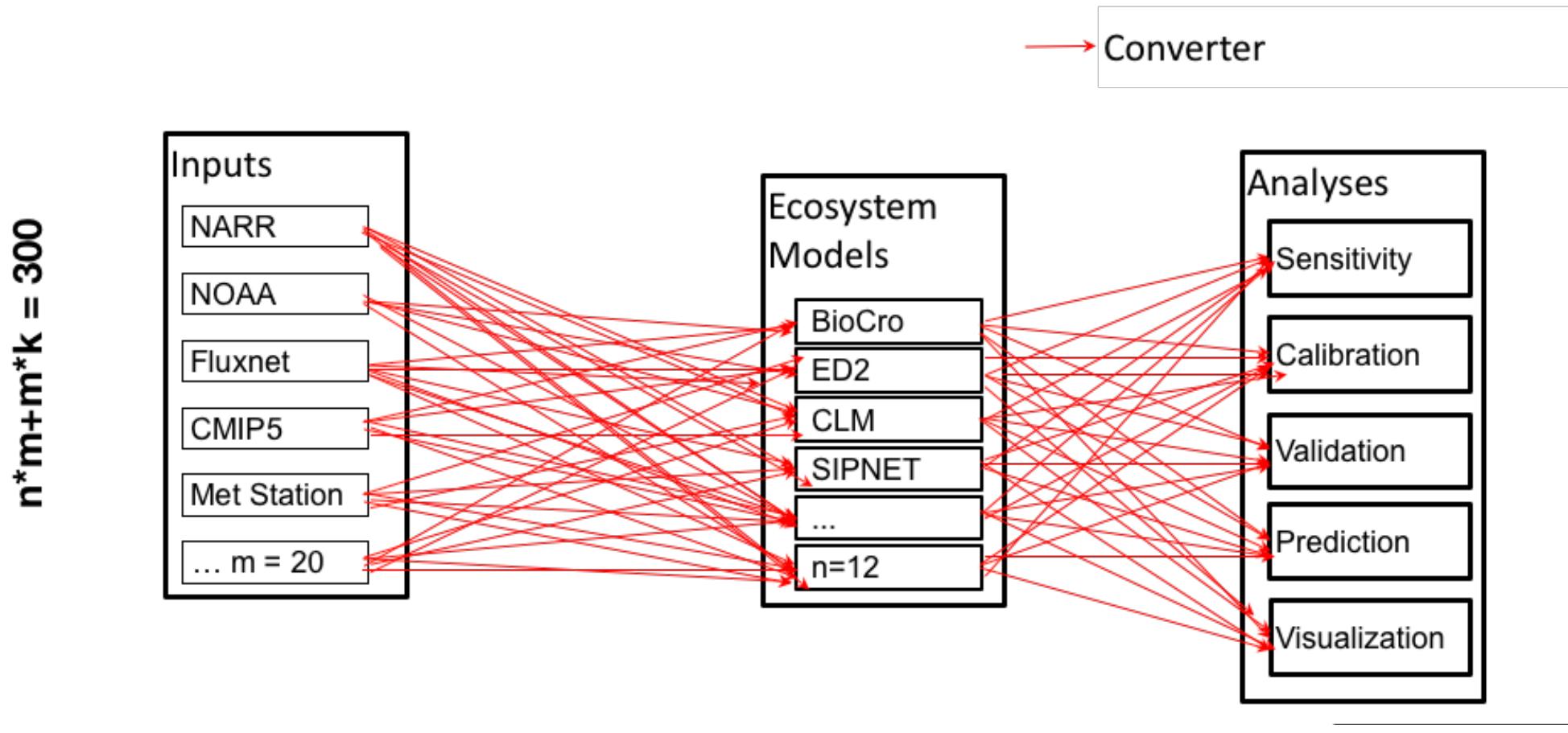
- Tools
- **Translators**
- Tutorials
- Templates

Translators

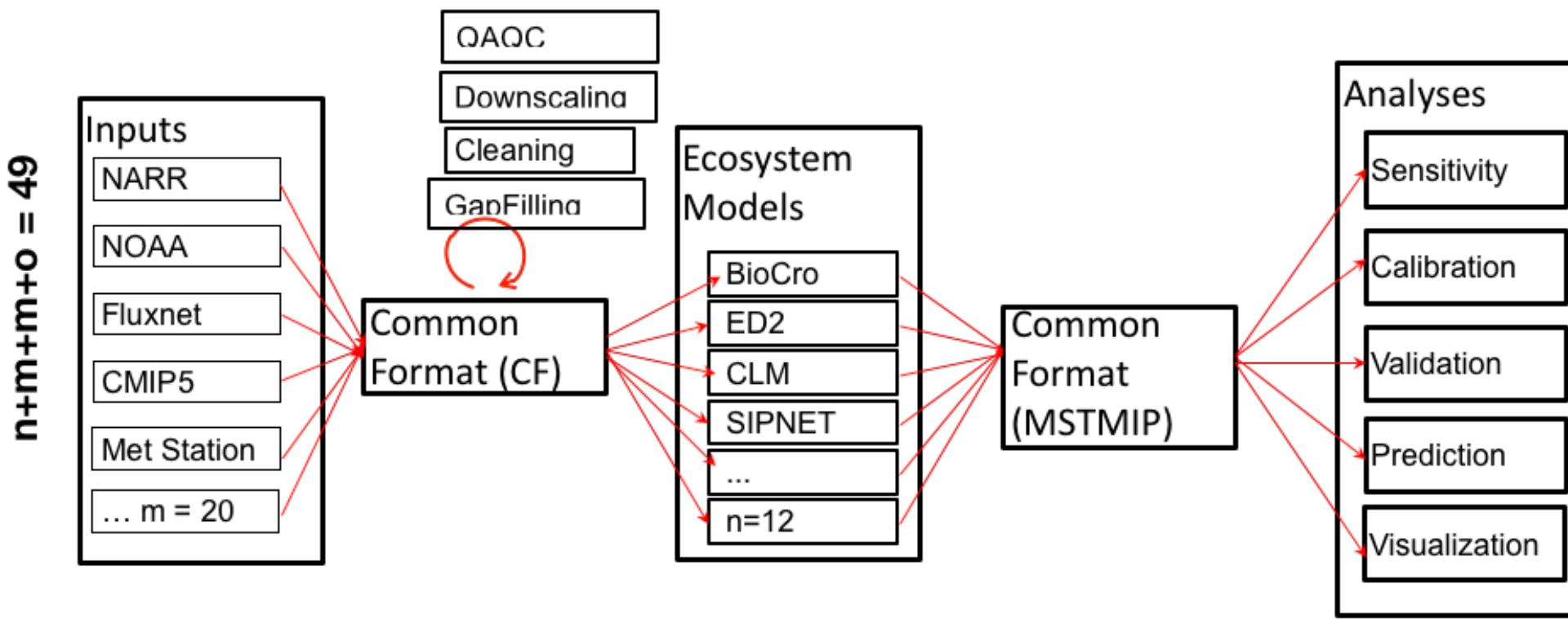


Alternative to a 'new'
standard:
Combine, translate among
existing standards.

Ecosystem Models Without Standards

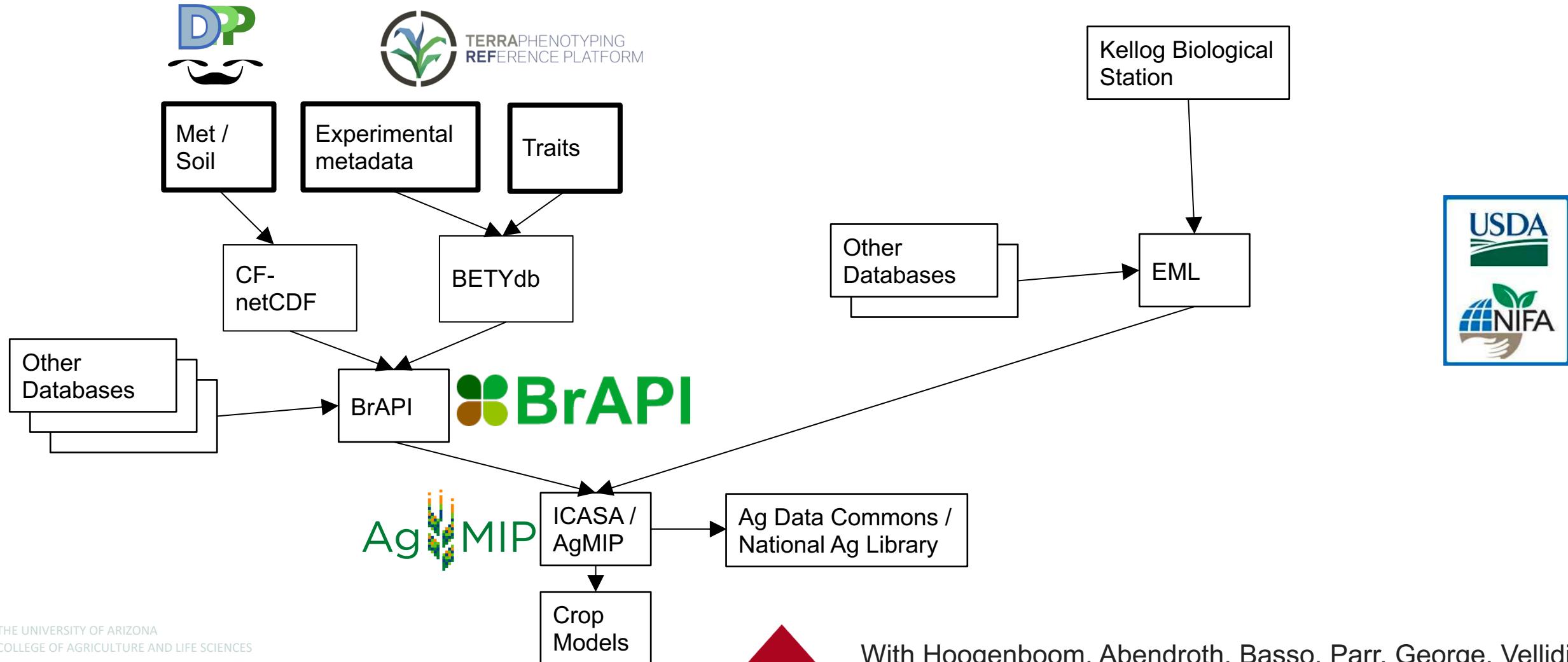


PEcAn + Standards: benefits of interoperability



pecanproject.org

Agricultural Research Data Network (ARDN)



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- Templates

Tutorials: Self Guided, Live Coding Webinars, Videos

 <https://terraref.org/tutorials>

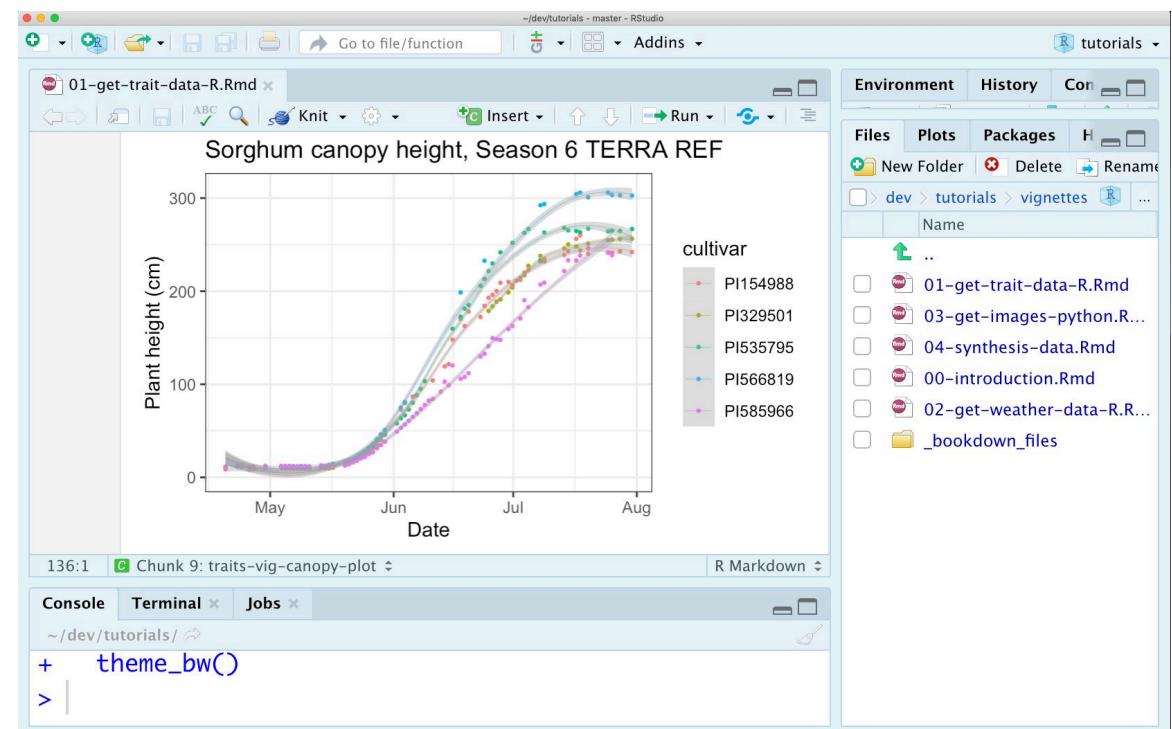
1 Overview
1.1 Pre-requisites
1.2 Ways of Accessing Data
1.3 Other Resources
Section 1: Vignettes
2 Vignettes Introduction
3 Accessing trait data in R
4 Accessing weather data in R
5 Retrieve source RGB image files
6 Combining trait, weather, and image ...
Section 2: Tutorials
7 Accessing Trait Data in R
8 Accessing meteorological data

TERRA REF Tutorials

David LeBauer and others
2020-01-06

Chapter 1 Overview

Kristina Riemer, UA



YouTube Videos

The screenshot shows the TERRA-REF YouTube channel interface. At the top, there is a logo of a stylized plant inside a circle, followed by the text "TERRA-REF". Below the logo are navigation links: HOME (underlined), VIDEOS, PLAYLISTS, CHANNELS, DISCUSSION, and ABOUT. A search icon is also present. The main content area is titled "Uploads" with a "PLAY ALL" button. Five video thumbnails are displayed, each showing a person's face in a video call interface. The thumbnails are labeled with their respective titles and durations:

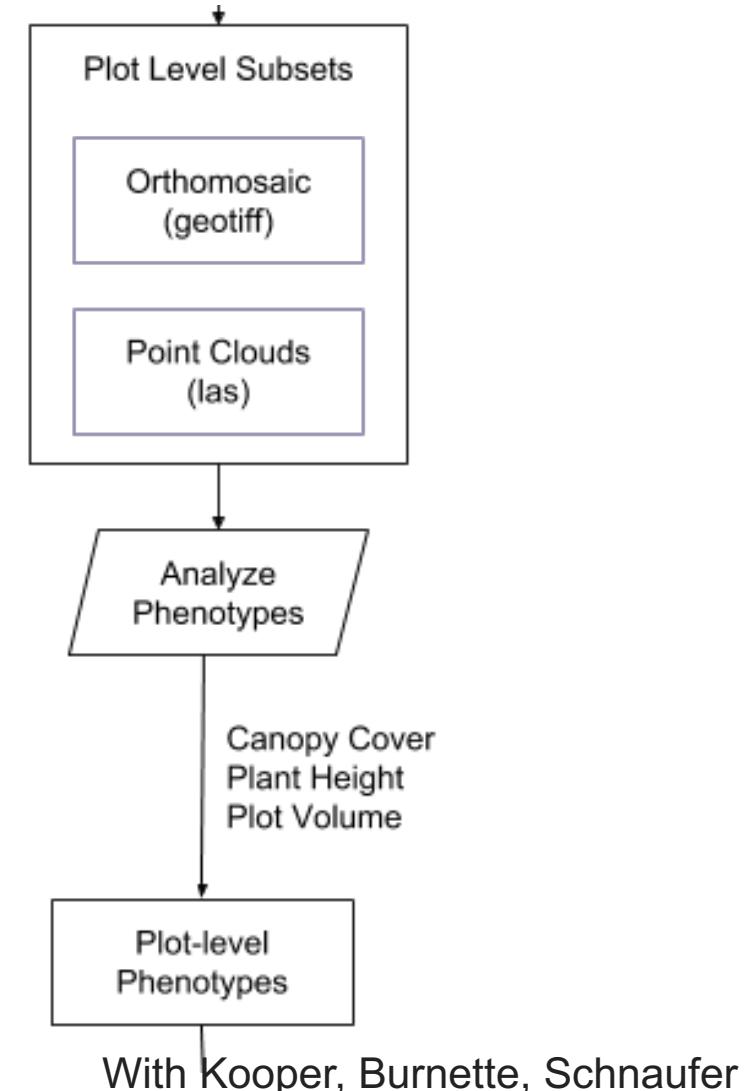
- Traits 4: How to get TERRA REF personal API key (0:58)
- Traits 3: How to plot TERRA REF trait data (7:08)
- Traits 2: How to select TERRA REF trait data by trait (2:47)
- Traits 1: How to download TERRA REF trait data (4:33)

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'Transformer' libraries

```
def calculate(data, metadata)
    do something
    return data, metadata
```



v1: github.com/terraref

v2: github.com/agPipeline

With Kooper, Burnette, Schnaufer

Templates

Guide users to best practices

- Standard formats and vocabularies
- Best practices
- Testing
- Documentation

Minimize Overhead

- Quickly integrate a new algorithm into a pipeline
- Versioning
- Sharing

Example template

```
def calculate(pxarray: np.ndarray):
    """Calculates one or more values from plot-level RGB data
    Arguments:
        pxarray: Array of RGB data for a single plot
    Returns:
        Returns one or more calculated values
    """
    # ALGORITHM: replace the following lines with your algorithm
    channel_size = pxarray[:, :, 1].size

    # RETURN: replace the following return with your calculated values.
    return channel_size
```

github.com/AgPipeline/template-rgb-plot
algorithm_rgb.py

A Template for Plot level RGB data



1. **Setup:** Click the `Use this template` button in GitHub to make a copy of this repository (or run `git clone`)
2. **Definitions:** Fill in and modify the definitions in the `algorithm_rgb.py` file
3. **Algorithm:** Replace the code in the `calculate` function with your algorithm
4. **Test:** Run the `testing.py` script to run your algorithm and validate the results
5. **Generate:** Run `generate.py` to create a Dockerfile
6. **Docker:** Create a Docker image for your algorithm and publish it
7. **Finishing:** Finish up your development efforts

Conclusions

Reusable software and data will accelerate science and engineering

Tools, Translators, Templates, and Tutorials enable open, synthetic science

More Information

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