

CLIMATE
FIELD
VIEW™

Weather data for agriculture

Holly Dail

Staff Researcher

Rapid developments in hardware, data, and modeling are enabling new precision agriculture tools

Seed genetics



Environmental conditions



Information from hardware

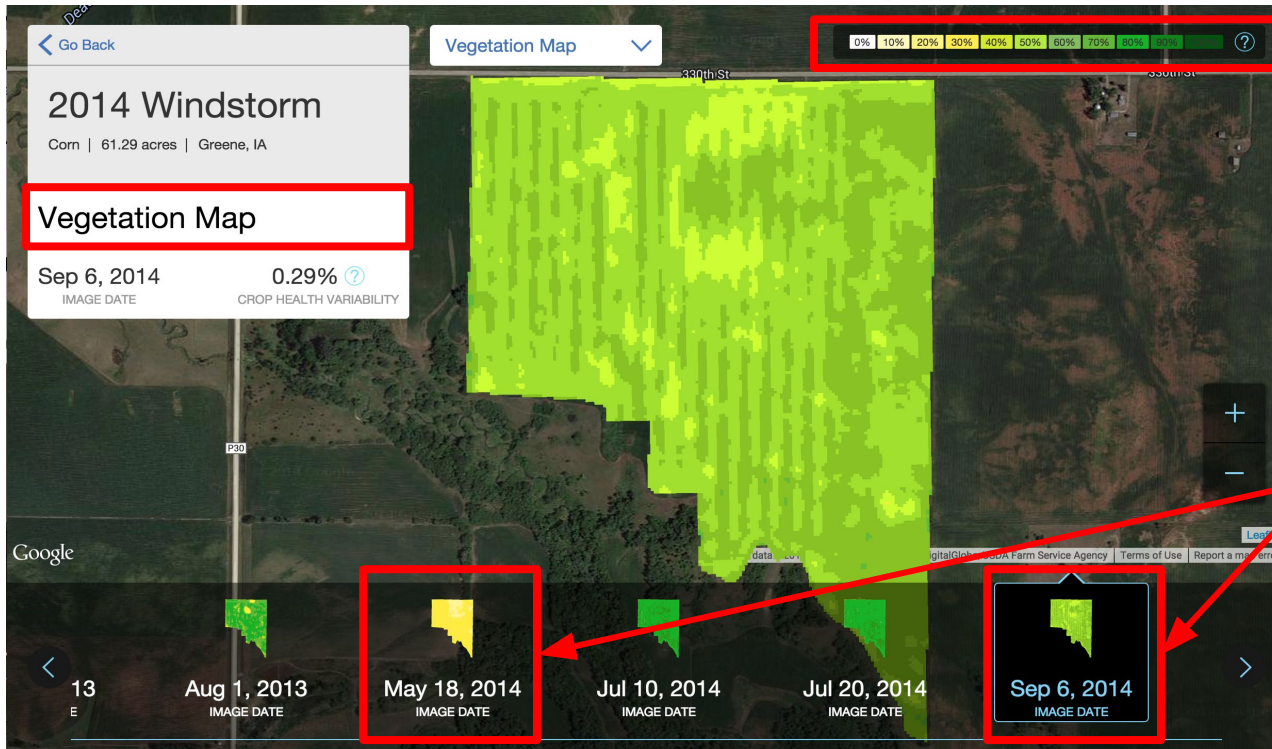


Sensors





Remote sensing enables field health monitoring

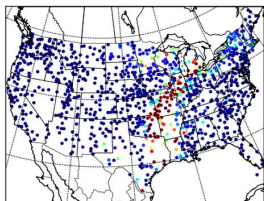


Color scale is constant throughout the season to allow tracking of biomass accumulation.

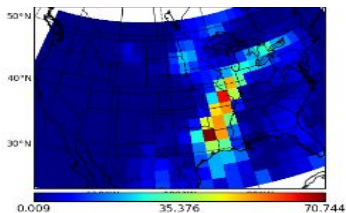
Identify subfield changes across time that may require corrective action.

Weather

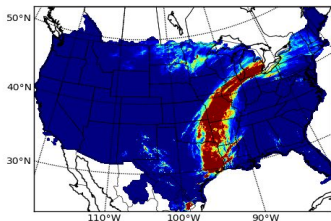
Gauge Data



Numerical Weather Models

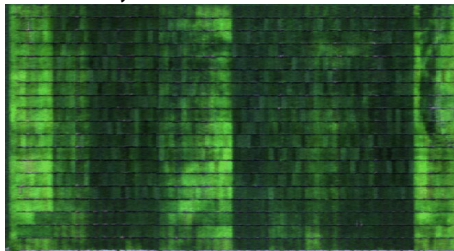


Multi-Sensor Derived Data

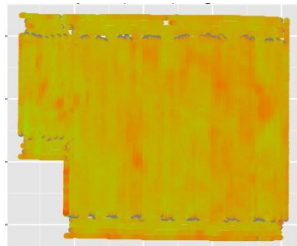


Field

Public, MON and TCC Trials



As Harvested Maps



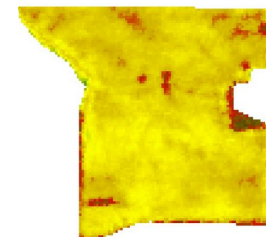
Other Variables
plant tissue samples
crop phenology
as-applied maps
topography

Soil



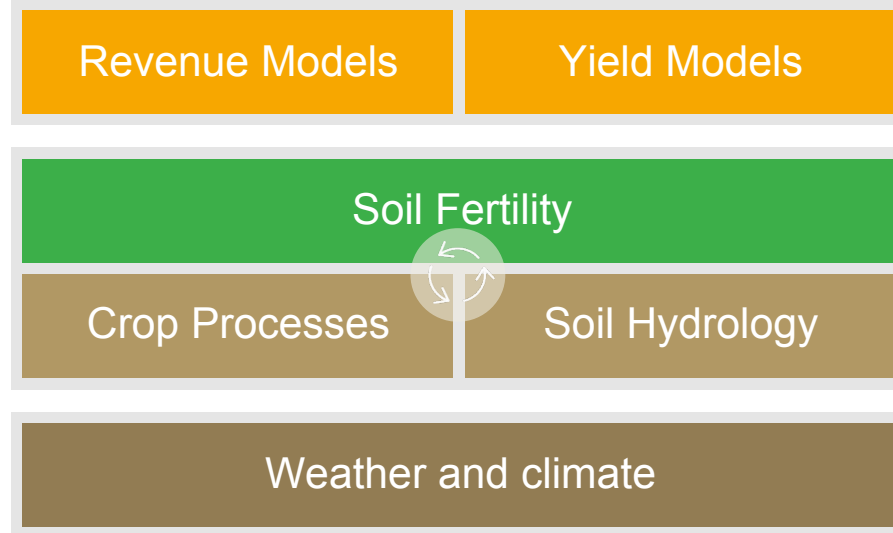
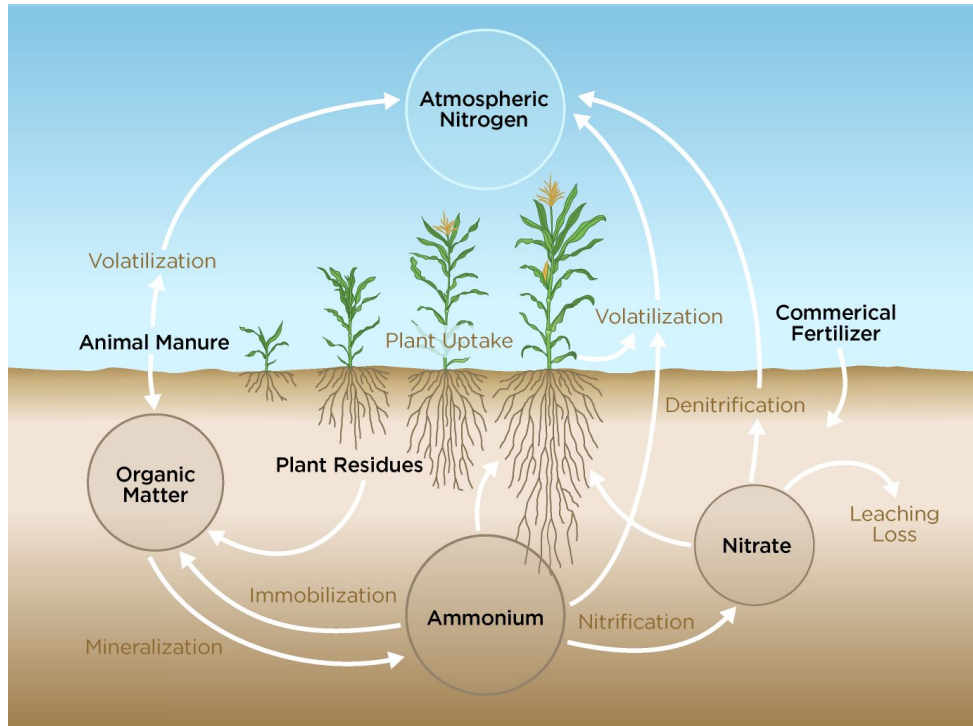
Variables
soil chemistry and texture
soil moisture
soil temperature

Imagery



Types
multispectral & hyperspectral
ground, air and satellite based
coarse to fine spatial resolution

Weather data are critical for agronomic models



Accurate, real-time weather data are needed for operational planning



Can I work my fields today?



Will it be calm enough to spray?



Should I plant drought-resistant seed?



Is the crop dry enough to harvest?

Climate

Precip Last 24 Hours could vary by 0.3" on some fields. Current: 40%

Sort by Precip Last 24 Hours

Home Quarter
Corn | Peoria, IL | 45 acres

V2 STAGE	10 mph WIND	15% NEXT 24H	2.1" LAST 24H
-------------	----------------	-----------------	------------------

Precip may be between 1.8" and 2.2"

Back 40
Soybeans | Peoria, IL | 125 acres

VC STAGE	7 mph WIND	35% NEXT 24H	1.1" LAST 24H
-------------	---------------	-----------------	------------------

East of Farm
Corn | Peoria, IL | 88.2 acres

V2 STAGE	12 mph WIND	40% NEXT 24H	0.5" LAST 24H
-------------	----------------	-----------------	------------------

SCOUT

Data requirements for precision agriculture

Feature	Requirement	Unique aspects
Variables	Temperature Dewpoint / relative humidity Precipitation amount (QPE) QPF and PoP Direct and diffuse solar insolation Wind speed and direction; gust risk Soil moisture and temperature Snow cover (depth, SWE)	Near-surface focus (< 1 m)
Critical datasets	Analyses with uncertainties Ensembles / multi-model ensembles Forecast uncertainty Precipitation QPE, QPF High-resolution forecasts in near real-time	Accuracy in rural areas Crop-land representations

Data requirements for precision agriculture

Feature	Requirement	Unique aspects
Spatial resolution	As high as possible	Rural focus
Temporal extent	~30 years ago to several years in the future	Need for consistency across all timescales
Frequency	Reconstructions Backcasting Nowcasting Short-range Medium-range Subseasonal Seasonal	daily hourly 5 to 15 minutes hourly daily weekly monthly
		Diurnal cycle at all timescales

Reforecast dataset requirements

- Storage approach:
 - Same methodology as production system → same error structure
 - Updated with each model version change
 - Available on public servers
 - Structured for automated download and ingest
- Reforecast characteristics
 - Full spatial resolution
 - Temporal resolution appropriate to use case
 - e.g. for short-range, 3-hourly reforecasts okay
 - Production frequency appropriate to use case
 - medium-range: prefer every 5th day for 5 years to every day for 1 year
 - seasonal: higher-frequency supports pseudo-ensembles

We contribute to, and rely on, open source



NumPy
Base N-dimensional
array package



SciPy library
Fundamental
library for scientific
computing



Matplotlib
Comprehensive 2D
Plotting



IPython
Enhanced
Interactive Console



Sympy
Symbolic
mathematics



pandas
Data structures &
analysis

Python 'proprscoring'

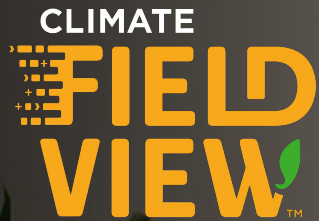
crps_ensemble
crps_gaussian
crps_quadrature
brier_score
threshold_brier_score

Docs » N-D labeled arrays and datasets in Python

[Edit on GitHub](#)

N-D labeled arrays and datasets in Python

xray is an open source project and Python package that aims to bring the labeled data power of pandas to the physical sciences, by providing N-dimensional variants of



QUESTIONS?

Thank you.

hdail@climate.com