Research on Tap: Understanding and Forecasting Change in Our Natural World

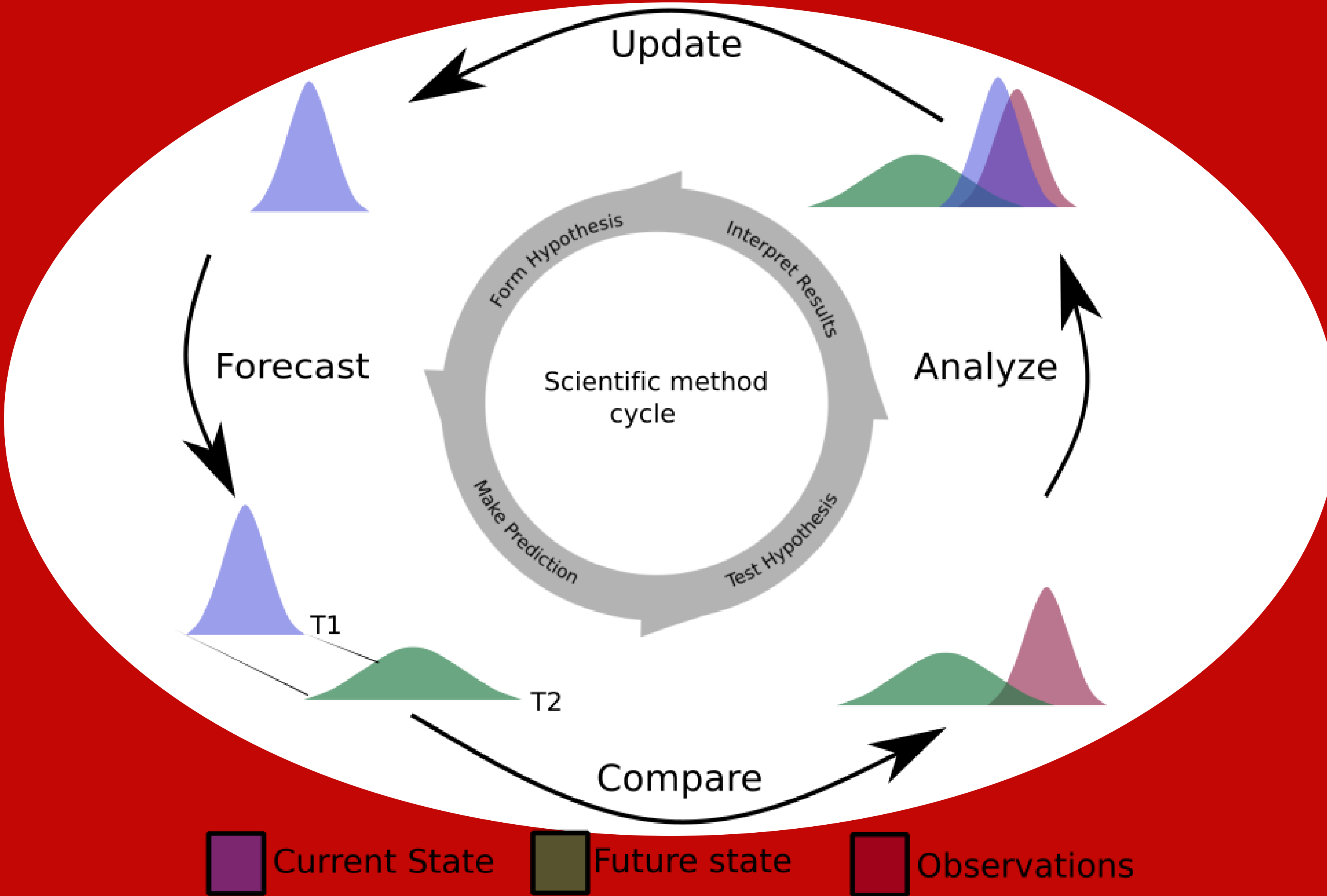
November 7, 2018

Solving the Challenge of Predicting Nature

Michael Dietze

Associate Professor
Earth & Environment, CAS

NEAR-TERM ITERATIVE FORECASTING IS WIN-WIN



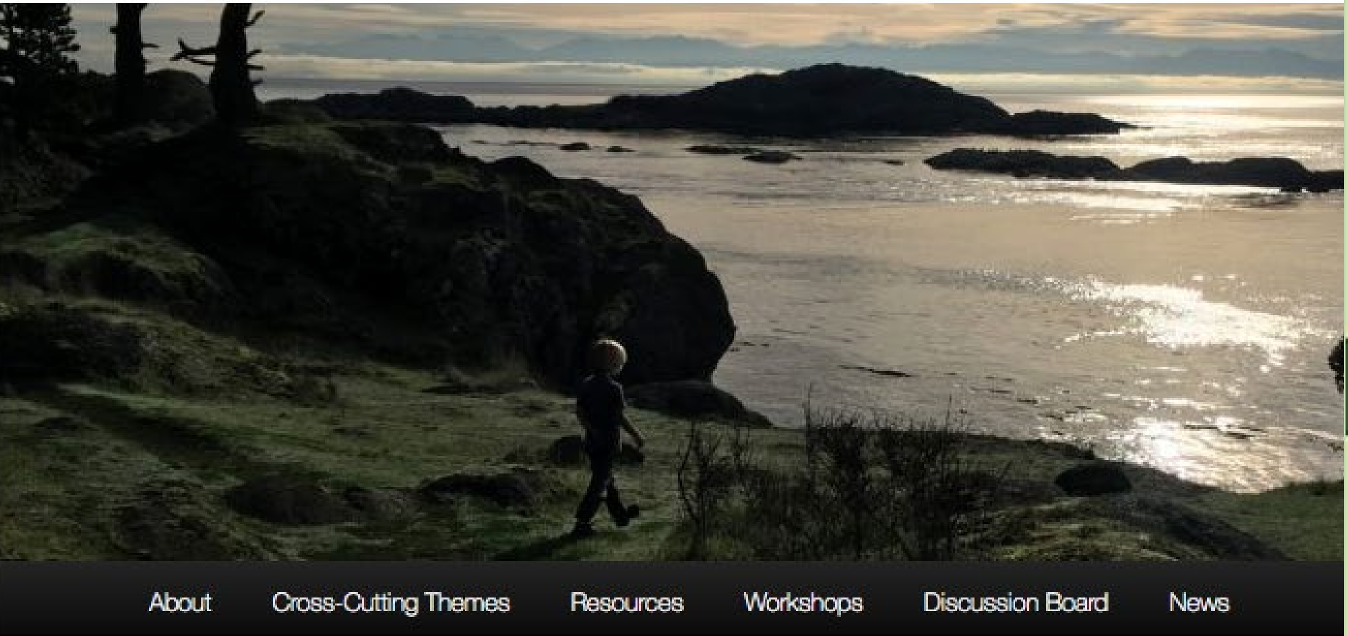
Dietze et al 2018 PNAS

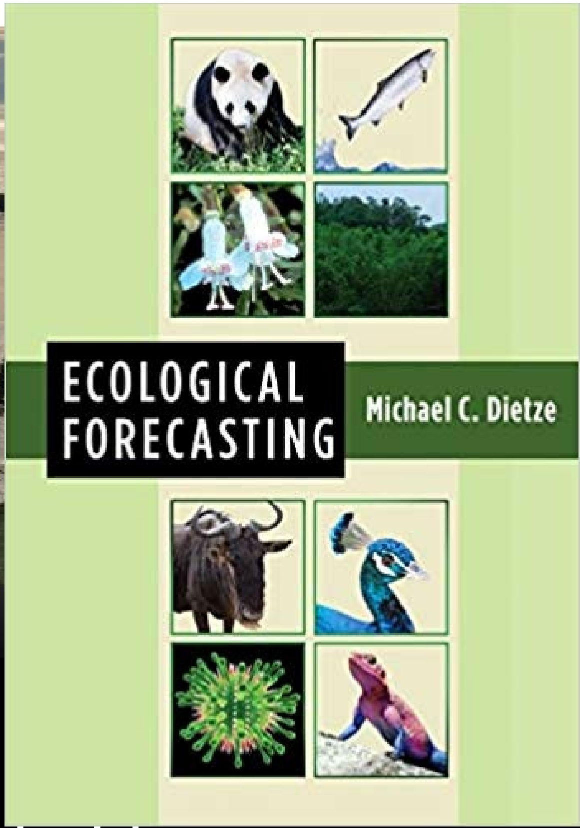
Near-term Ecological Forecasting Initiative
Dietze & Wheeler: Fluxes & Phenology
Weathers: Aquatic Productivity
LaDeau & Foster: Ticks & Small Mammals
Bhatnagar, Averill, & Werbin: Microbial diversity
MaxiFlex
neon
National Ecological Observatory Network

Ecological Forecasting Initiative

Forecasts to understand, manage, and conserve ecosystems

ecoforecast.org
@eco4cast





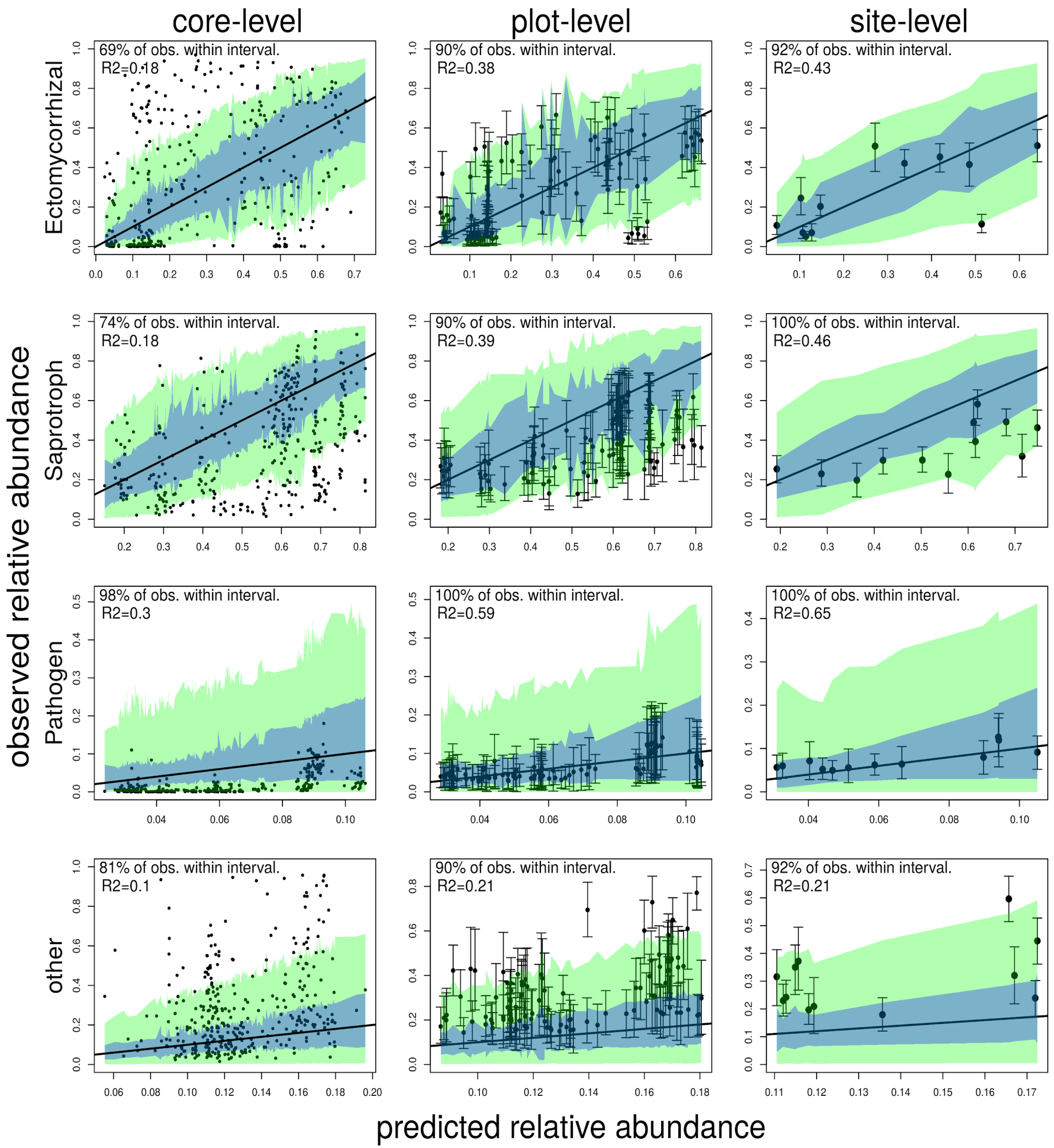
- Build a community of practice
- Build bridges to agencies, industry, stakeholders
- Advance theory, tools, cyberinfrastructure, decision sci.
- Education, training, and inclusion
- **Discover whether nature is predictable**

Forecasting the Earth Mycobiome

Jennifer Bhatnagar

Assistant Professor, Biology, College of Arts & Sciences

Forecasting the Earth Mycobiome



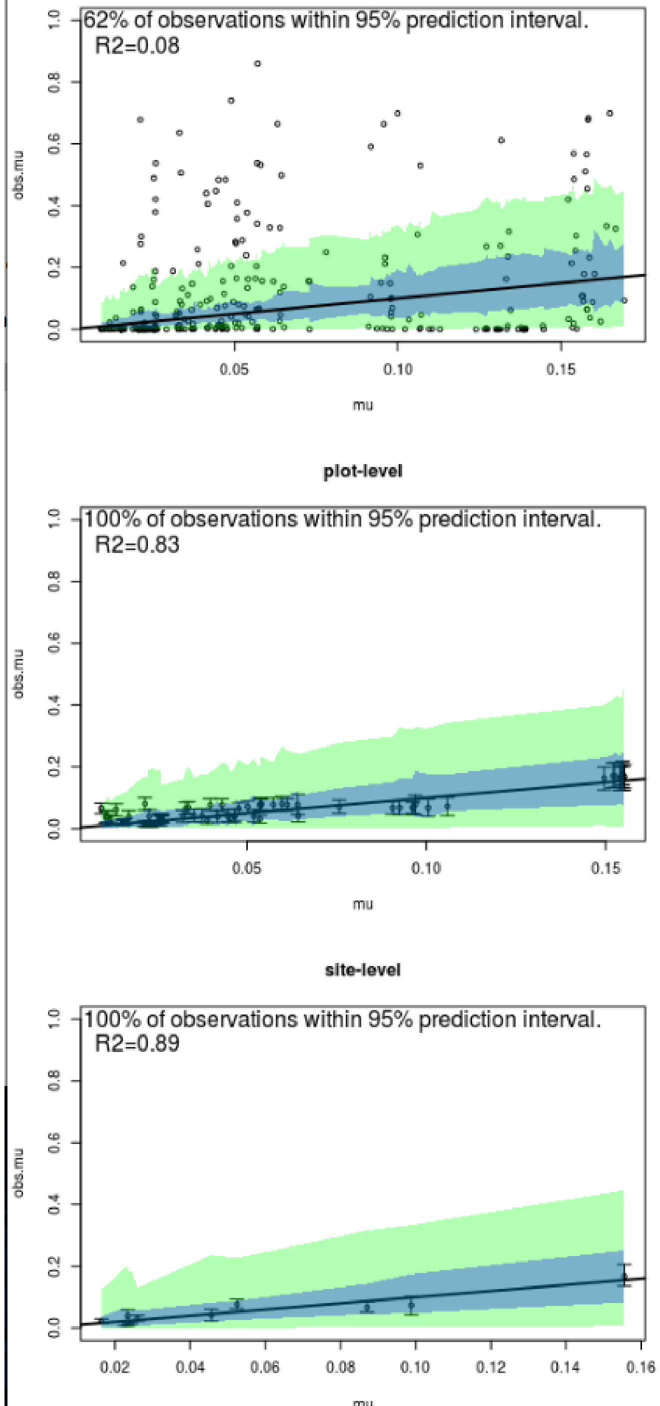
Jennifer Bhatnagar
Colin Averill
Zoey Werbin
Michael Dietze

Boston University
Biology

Best forecasts of widespread fungi that have specific niches

Russula species
- Dominant taxa in northern forests
- Critical mycorrhizal partners of mature trees
- Specificity of most russuloid taxa to a certain vegetation/soil type

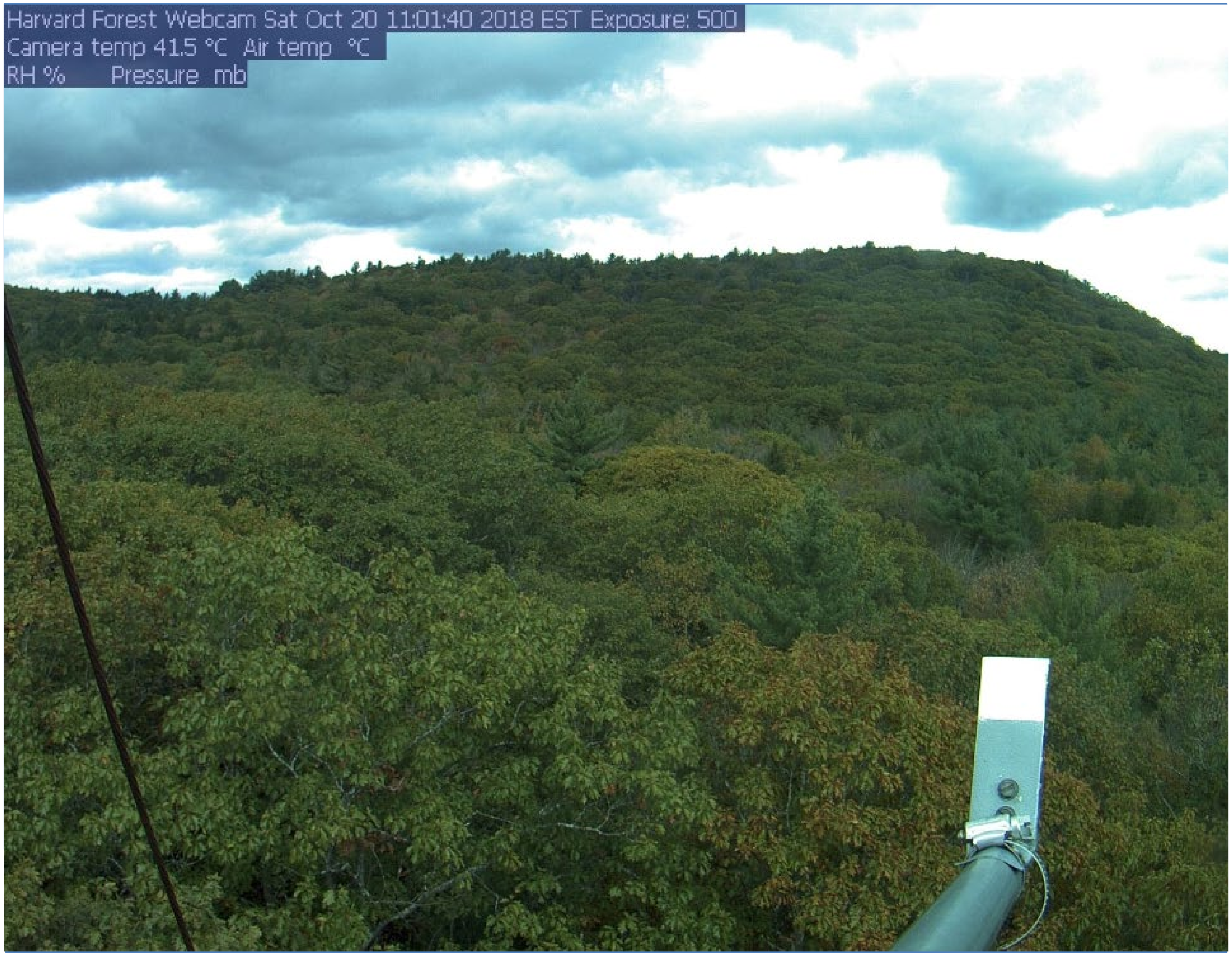
Next up:
- Decompose each model
- Prokaryotes
- Temporal forecasts



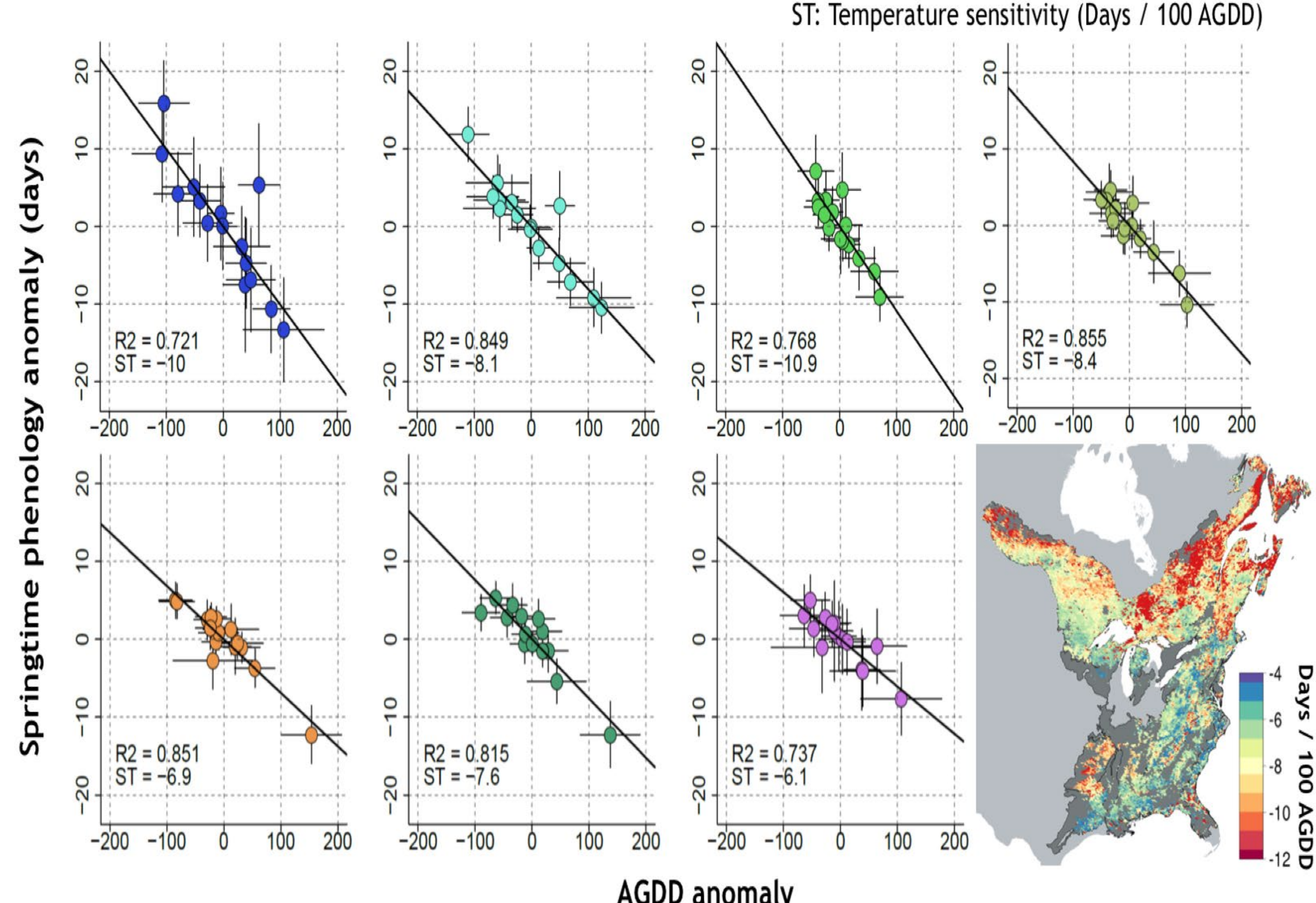
Ecosystems in Flux:
Changing Seasons in an Era of Climate Change

Mark Friedl

Professor
Department of Earth and Environment, CAS


Harvard Forest Webcam Sat Oct 20 11:01:40 2018 EST Exposure: 500
Camera temp 41.5 °C Air temp °C
RH % Pressure mb

- **Relationship between springtime phenology and temperature anomaly**



EcoForecast: A Scalable and Secure Cyberinfrastructure for the Repeatability of Ecological Research

Abraham Matta

Professor & Chair
Computer Science Department, College of Arts & Sciences

EcoForecast: System Overview

- Cyberinfrastructure for supporting Ecological Research
- Develop the analyses and automation procedures to make ecological forecasts and update these forecasts over time as new data become available
- Researchers can “compete” using different forecast models
- Provide state-of-the-art cloud-based infrastructure
- User code runs as a “Function” in the cloud
- Highly scalable and easy to manage

User submits her code, along with dependencies

1

Orchestrator:

- Analyze user code
- Install code dependencies
- Find “best” place for the code , e.g. Edge vs. Core
- Determine “best” configuration, e.g. amount of RAM

2

1

3

- Code runs as a “Serverless” function in a containerized environment in the cloud
- OpenWhisk supports the creation of code “actions” that can be “triggered” based on external factors

2

1

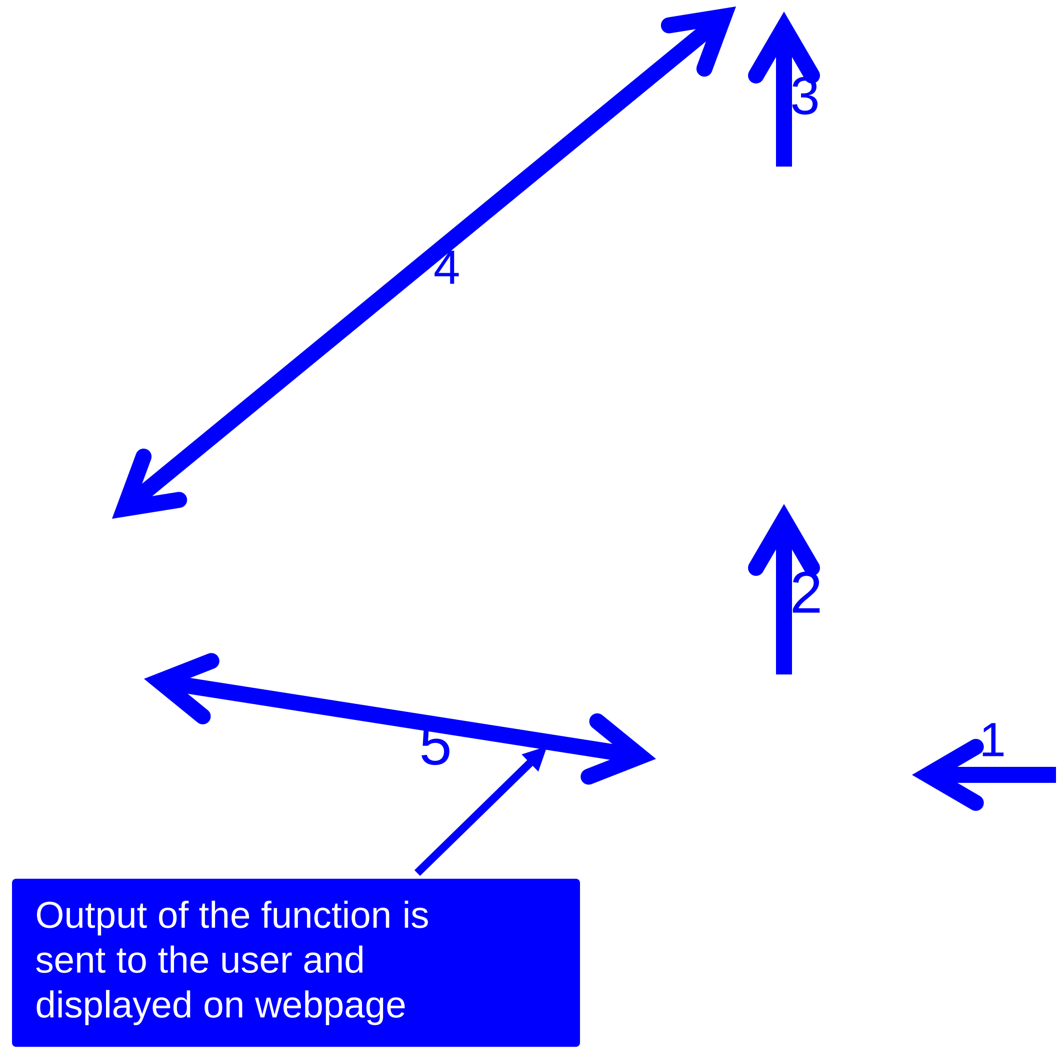
4

3

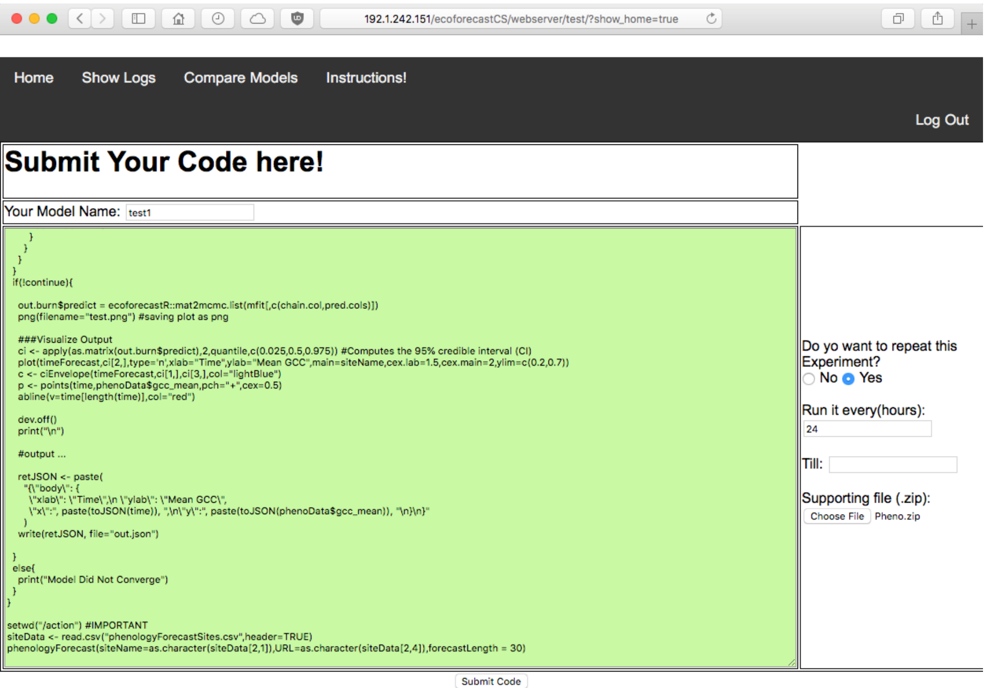
- Function processes data and stores results in database
- It is faster to run the function closer to the data source and storage

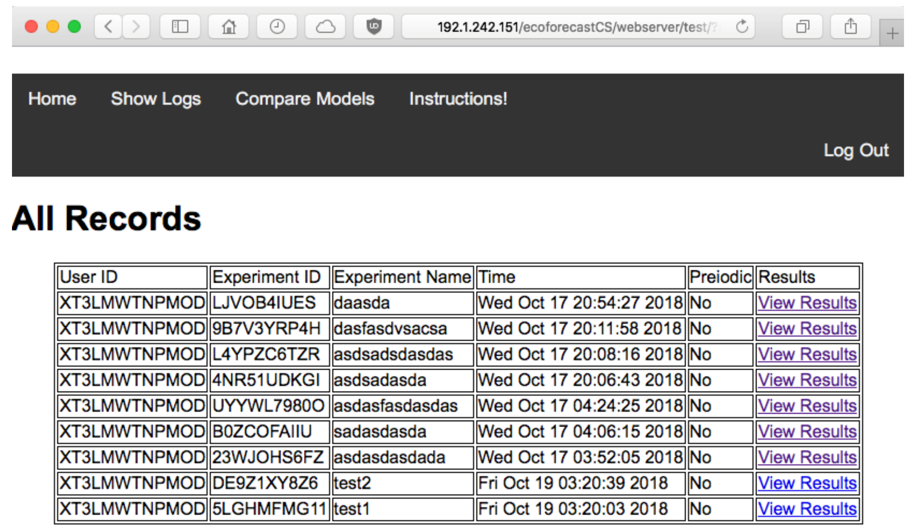
2

1


1
2
3
4
5
Output of the function is sent to the user and displayed on webpage

User's View





User ID	Experiment ID	Experiment Name	Time	Preiodic	Results
XT3LMWTNPMOD	LJVOB4IUES	daasda	Wed Oct 17 20:54:27 2018	No	View Results
XT3LMWTNPMOD	9B7V3YRP4H	dasfasdvsacsa	Wed Oct 17 20:11:58 2018	No	View Results
XT3LMWTNPMOD	L4YPZC6TZR	asdsadsdasdas	Wed Oct 17 20:08:16 2018	No	View Results
XT3LMWTNPMOD	4NR51UDKGI	asdsadasda	Wed Oct 17 20:06:43 2018	No	View Results
XT3LMWTNPMOD	UYYWL7980O	asdasfasdasdas	Wed Oct 17 04:24:25 2018	No	View Results
XT3LMWTNPMOD	B0ZCOFAIIU	sadasdasda	Wed Oct 17 04:06:15 2018	No	View Results
XT3LMWTNPMOD	23WJOHS6FZ	asdasdasdada	Wed Oct 17 03:52:05 2018	No	View Results
XT3LMWTNPMOD	DE9Z1XY8Z6	test2	Fri Oct 19 03:20:39 2018	No	View Results
XT3LMWTNPMOD	5LGHMFMG11	test1	Fri Oct 19 03:20:03 2018	No	View Results