Using environmental science to make decisions about human and ecosystem health

Agenda

1. **About me**
2. Introduction to ecological forecasting
3. Introduction to water quality
4. Water quality ecological forecast example
5. Hands-on activities

Agenda

1. About me
2. **Introduction to ecological forecasting**
    - **What** is ecological forecasting?
    - **How** are ecological forecasts made?
    - **Why** are ecological forecasts helpful?
3. Introduction to water quality
4. Water quality ecological forecast example
5. Hands-on activities

Agenda

1. About me
2. Introduction to ecological forecasting
3. **Introduction to water quality**
    - **What** do we mean by water quality?
    - **How** do we measure water quality?
    - **Why** do we care about water quality?
4. Water quality ecological forecast example
5. Hands-on activities

Agenda

1. About me
2. Introduction to ecological forecasting
3. Introduction to water quality
4. **Water quality ecological forecast example**
5. Hands-on activities

Agenda

1. About me
2. Introduction to ecological forecasting
3. Introduction to water quality
4. Water quality ecological forecast example
5. **Hands-on activities**
    - **Make decisions by interpreting ecological forecasts**
    - Create your own visualizations of ecological forecasts

Agenda

1. About me
2. Introduction to ecological forecasting
3. Ecological forecast example
4. **Hands-on activities**
    - Make decisions by interpreting ecological forecasts
    - **Create your own visualizations of ecological forecasts**

By this afternoon, you should be able to…

1. **Explain** in your own words what ecological forecasting is and why it's useful
2. **Explain** how ecological forecasting helps us manage water resources
3. **Interpret** graphs of water quality forecasts
4. **Create** visualizations to communicate water quality forecasts to different audiences

Career journey → Ecological forecasting

1. **What** is ecological forecasting?
2. **How** are ecological forecasts made?
3. **Why** is ecological forecasting useful?

Ecological forecasting

What?

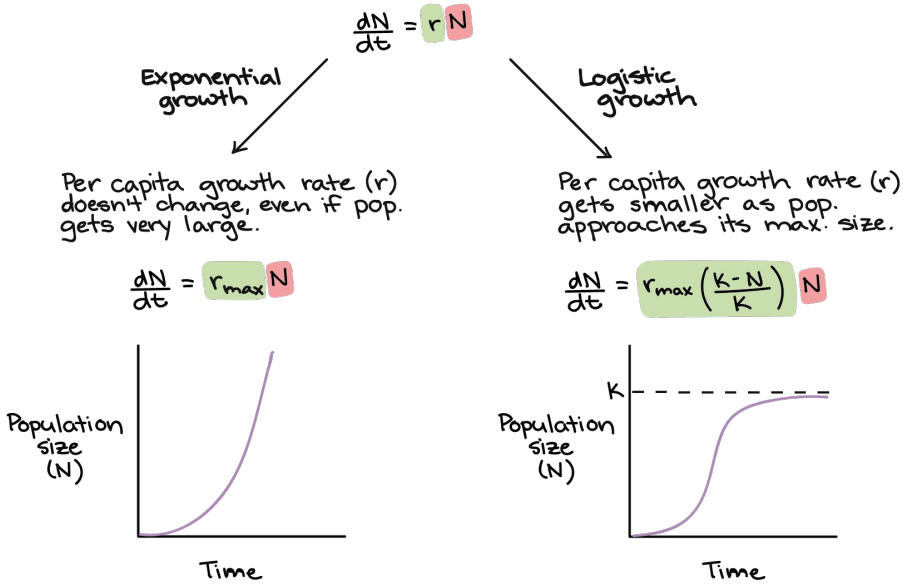
*A discipline focused on making **predictions** about ecosystems and their components, similar to **weather forecasting.***

Ecological forecasting

What?

*A discipline focused on making **predictions** about ecosystems and their components, similar to **weather forecasting.***

How?

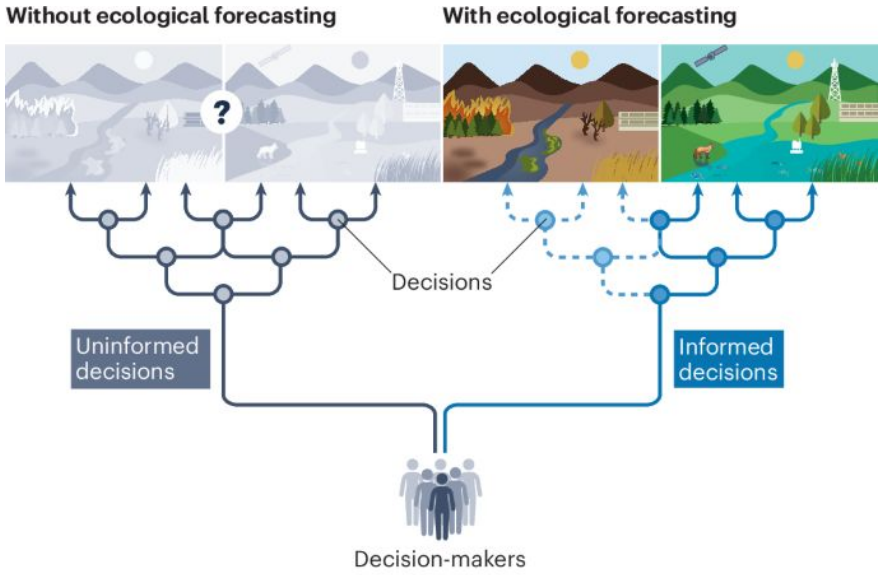


Ecological forecasting

What?

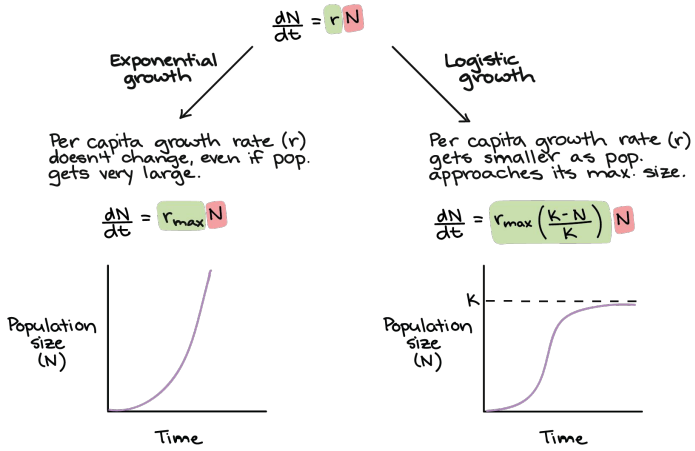
*A discipline focused on making **predictions** about ecosystems and their components, similar to **weather forecasting.***

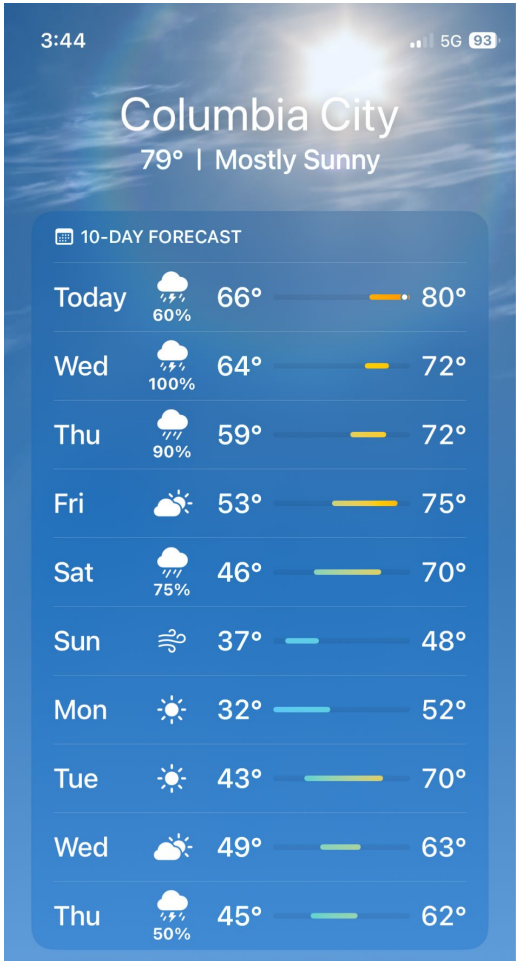
Why?

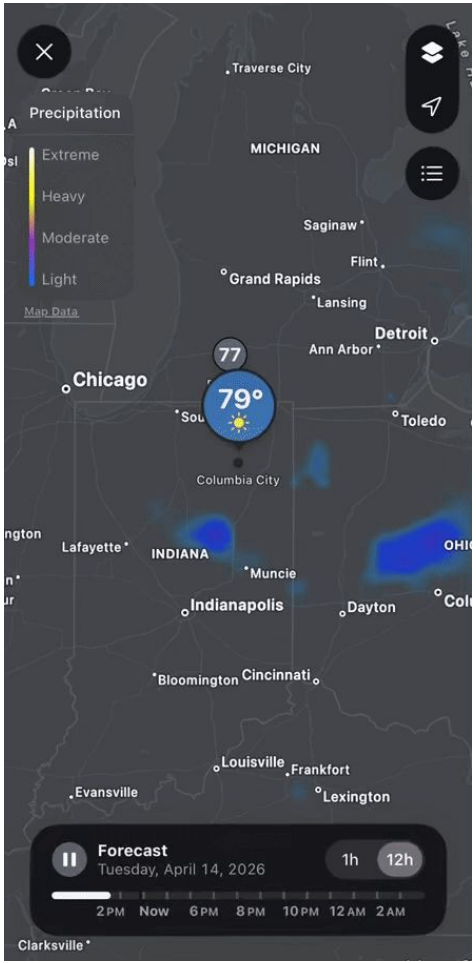


A forecast includes…

1. A **prediction**
2. The **uncertainty**



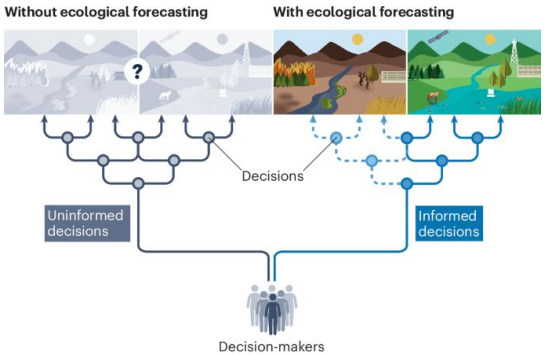


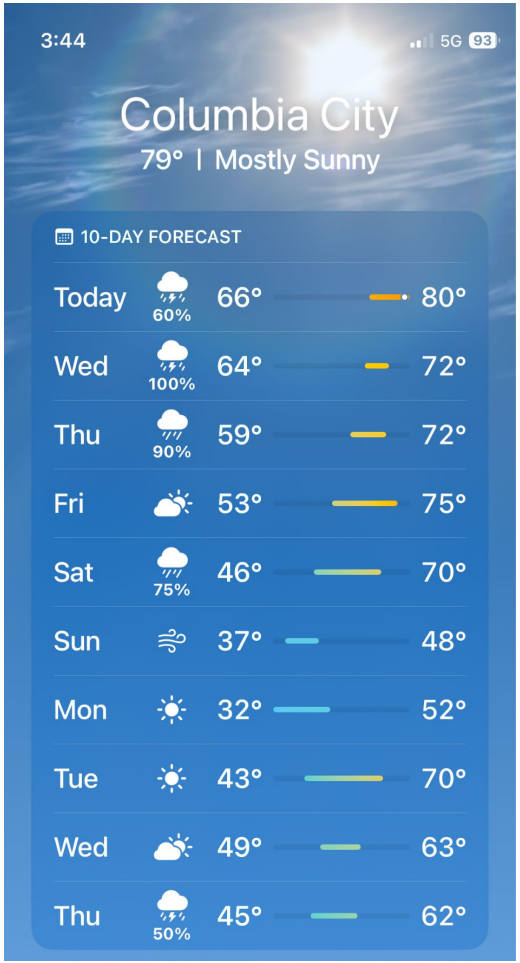


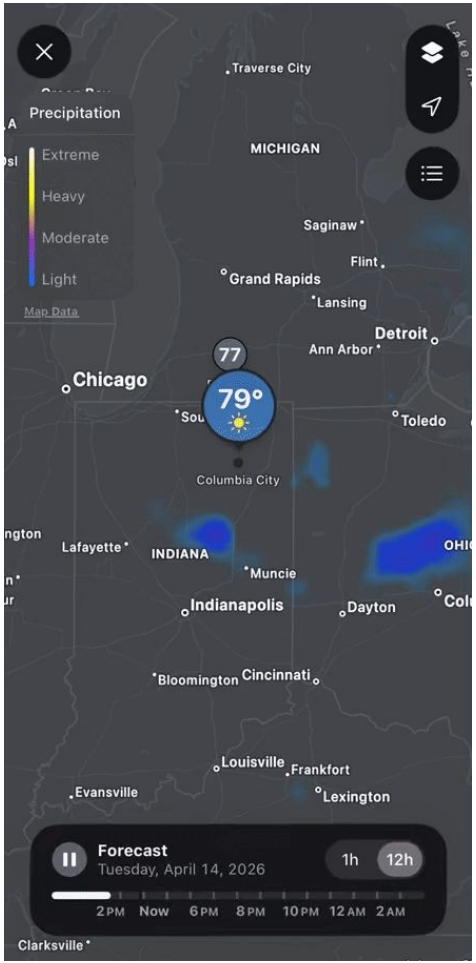
A forecast includes…

1. A **prediction**
2. The **uncertainty**

And the forecast is **actionable**





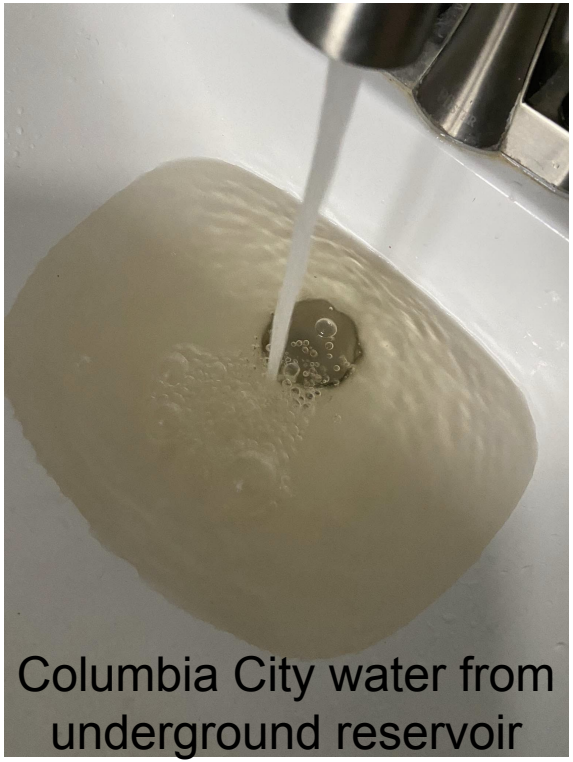


Something we might want to predict: water quality

- **What:** Water quality measures the health of water resources (lakes, rivers, …) for supporting uses of the water by organisms, including humans
- Some natural and man-made causes of bad water quality:
  - Chemicals reacting with organic material in the water (produce toxic byproducts)
  - Algal blooms (produce toxins and decrease oxygen in water)

Something we might want to predict: water quality

- **What:** Water quality measures the health of water resources (lakes, rivers, …) for supporting uses of the water by organisms, including humans
- Some natural and man-made causes of bad water quality:
  - **Chemicals reacting with organic material in the water (produce toxic byproducts)**
  - Algal blooms (produce toxins and decrease oxygen in water)



Columbia City water from underground reservoir

Something we might want to predict: water quality

- **What:** Water quality measures the health of water resources (lakes, rivers, …) for supporting uses of the water by organisms, including humans
- Some natural and man-made causes of bad water quality:
  - Chemicals reacting with organic material in the water (produce toxic byproducts)
  - **Algal blooms (produce toxins and decrease oxygen in water)**

Something we might want to predict: water quality

How do we measure water quality?

- **Higher** concentrations of **algae** & **cyanobacteria**
- **Lower** water quality (higher toxin concentrations and lower oxygen)
- **Measure** concentration of chlorophyll-a (chl-a), the photsynthetic pigment in algae & cyanobacteria
  - Higher chlorophyll-a → lower water quality
  - Lower chlorophyll-a → higher water quality

Something we might want to predict: water quality

Why do we care about water quality?

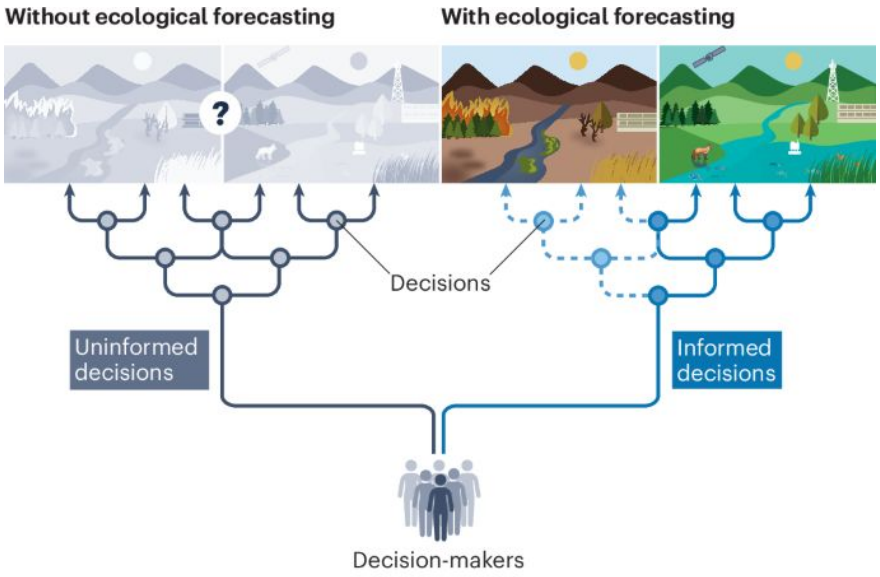
Something we might want to predict: water quality

Why do we care about water quality?

- Access to healthy drinking water
- Availability of recreation (fishing, boating, swimming)
- Economic benefits of quality drinking water and recreation
- Good water quality supports healthy ecosystems

Drinking water reservoir

Something we might want to predict: water quality

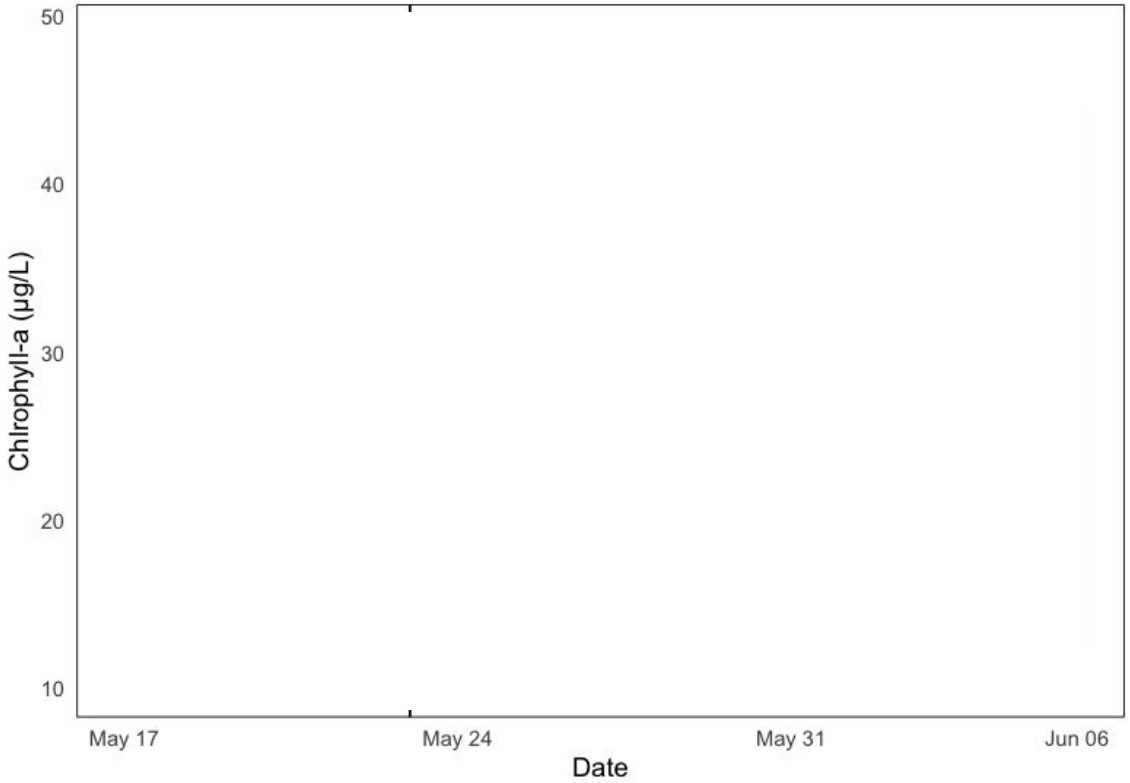


We can **predict** declines in water quality (increases in Chlorophyll a) **before they happen** and **make management decisions** to improve water quality:

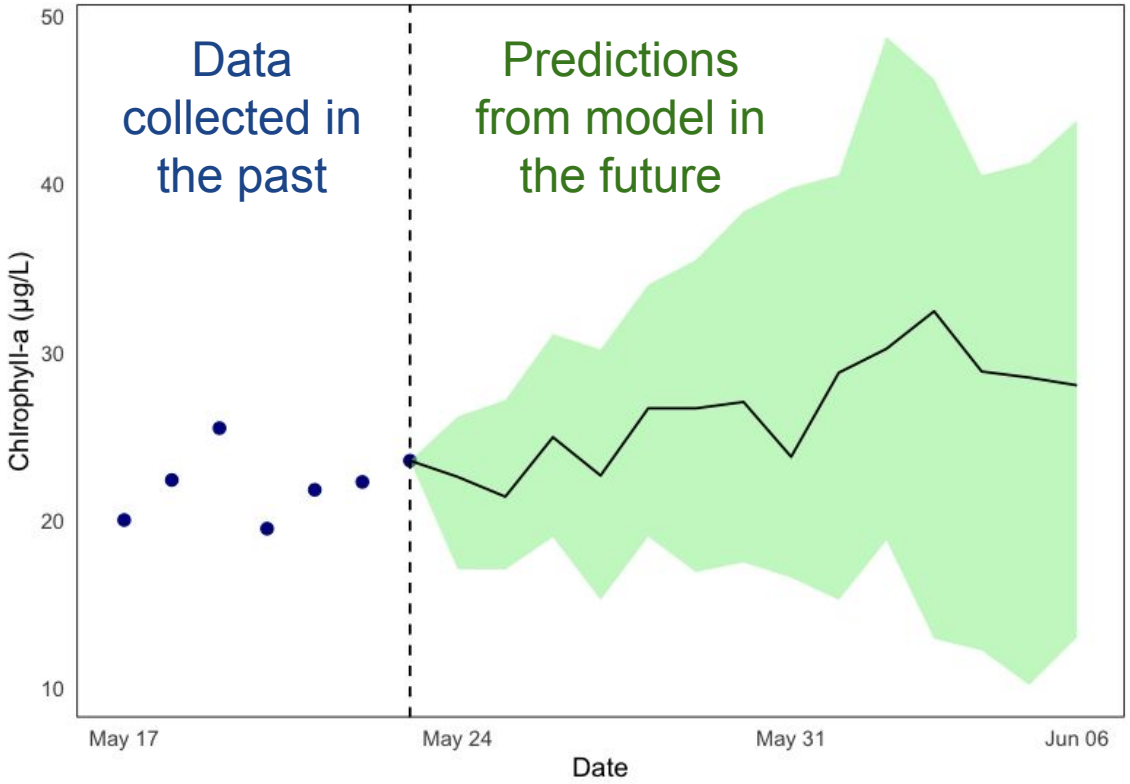
1. Stop people from drinking water
2. Stop people from using water resources for recreation
3. Use algaecide to kill algae & cyanobacteria

Video of FLARE water quality forecast system

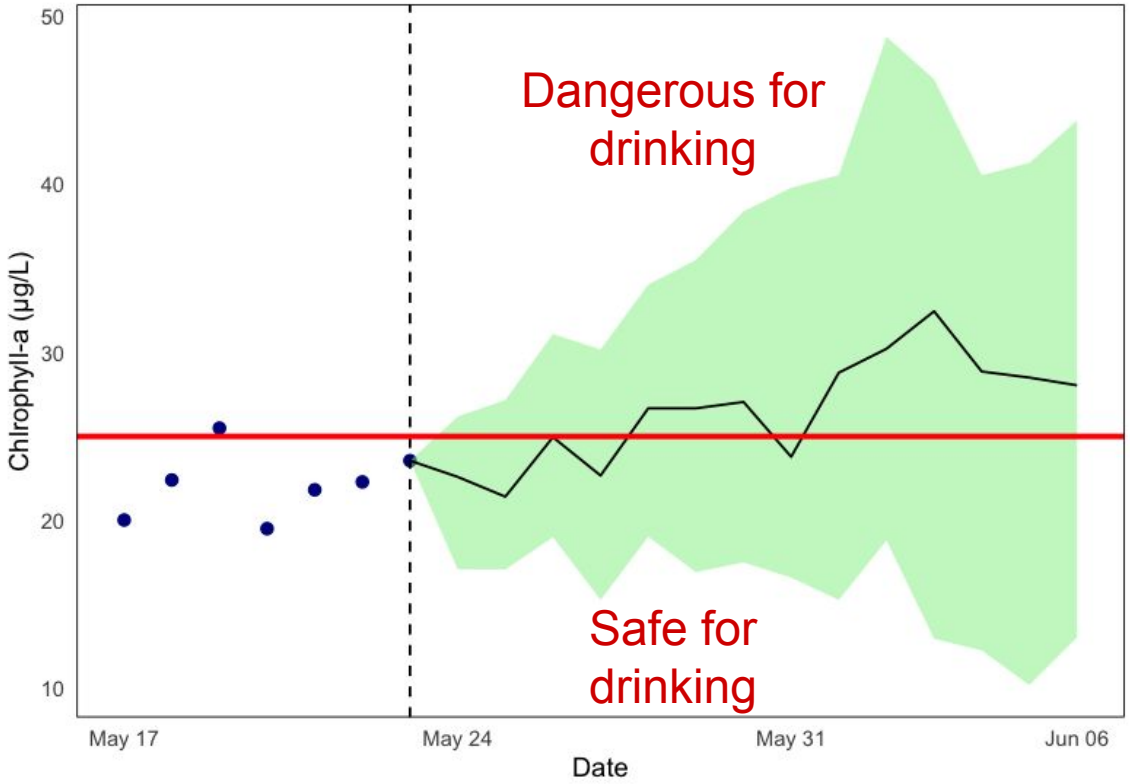
Example forecast



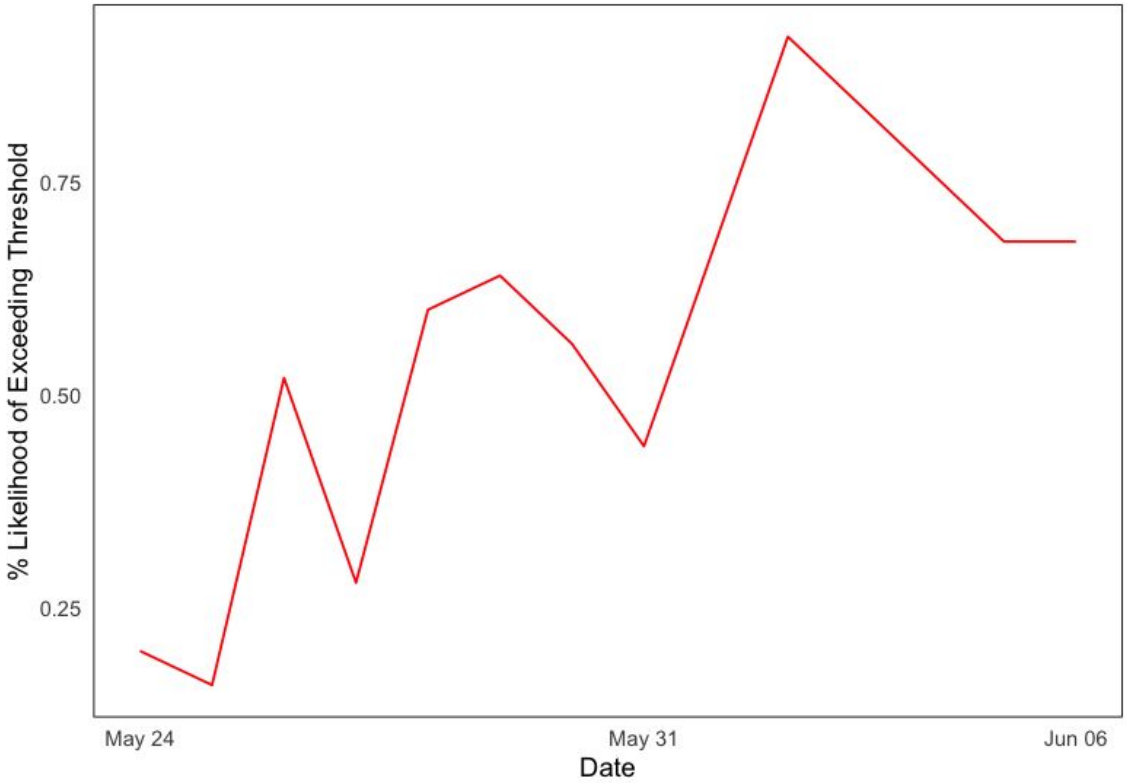
Example forecast

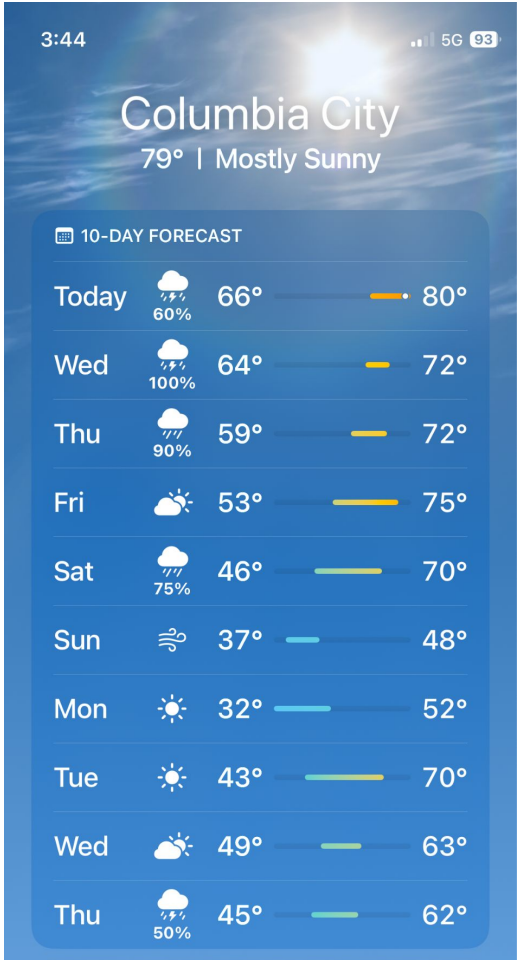


Example forecast

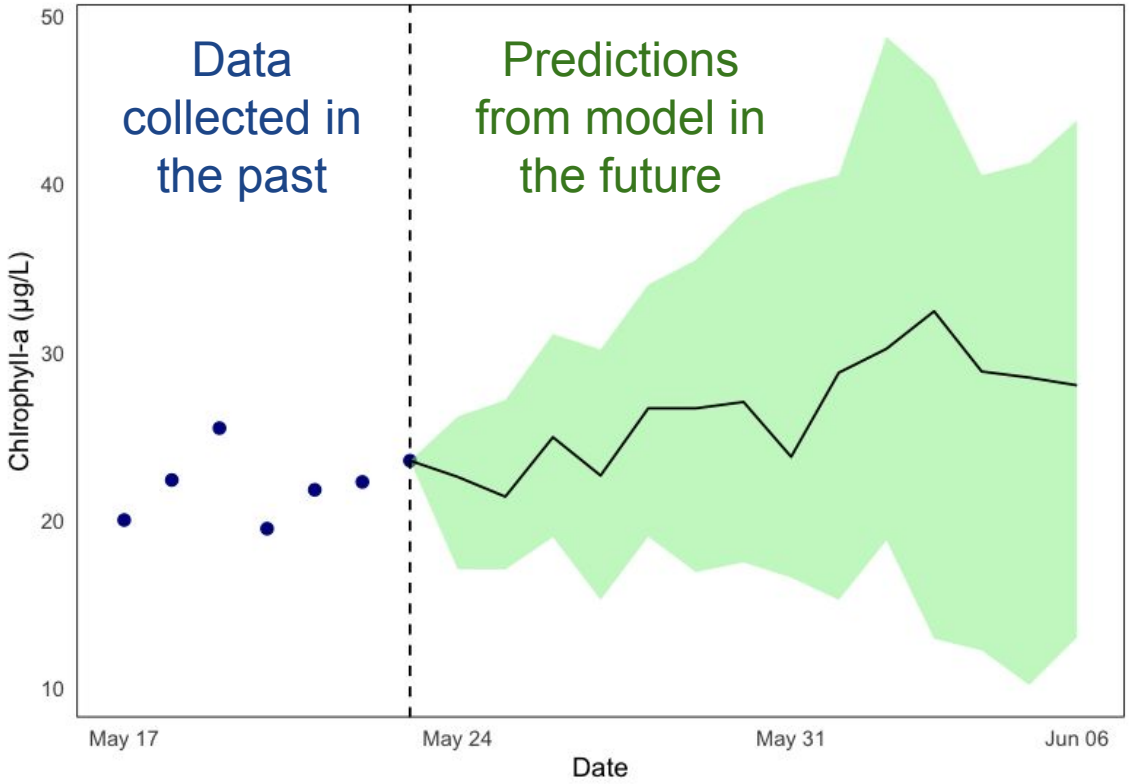


Example forecast

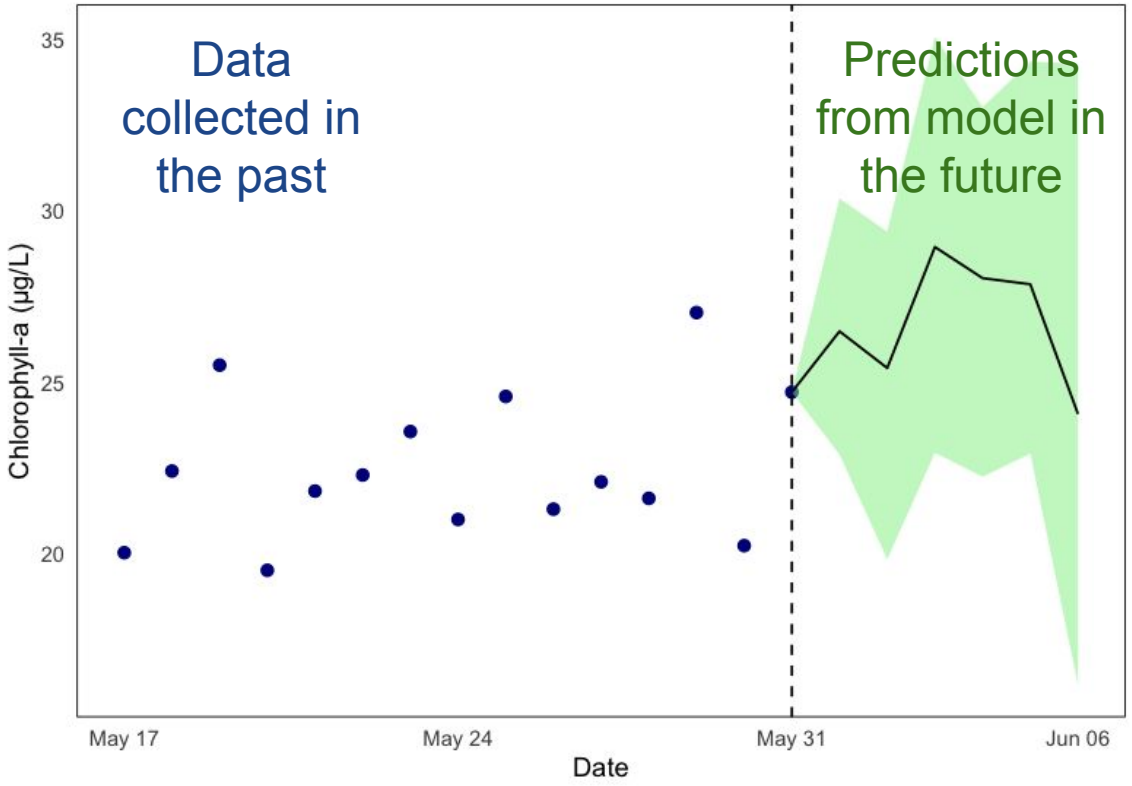




Example forecast



Example forecast

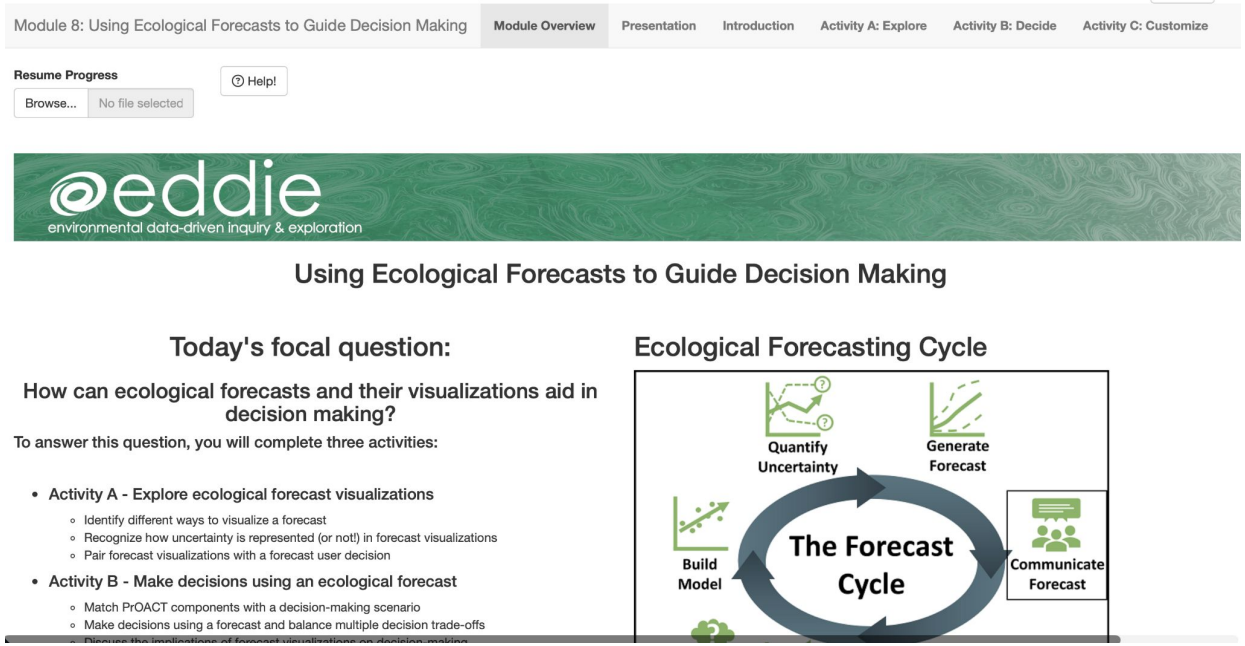


Tuesday

Thursday

Hands-on activities

https://macrosystemseddie.shinyapps.io/module8/



Activity B instructions

- Divide into pairs
- Add your name(s) in the “Before you start…” box in the Introduction tab
- Make a group name and use that for your ID number
- Click on **Activity B** tab (SKIP Activity A)
- Record your & your partners answers to each question – most questions have no right or wrong answer!
- After you **finish** and **any time you leave your computer**, save by clicking the “Save Progress” button

Activity B instructions

- Divide into pairs
- Add your name(s) in the “Before you start…” box in the Introduction tab
- Make a group name and use that for your ID number
- Click on **Activity B** tab (SKIP Activity A)
- Record your & your partners answers to each question – most questions have no right or wrong answer!
- After you **finish** and **any time you leave your computer**, save by clicking the “Save Progress” button

Discussion questions:

1. In Objective 4a, how did your decisions change from 14 days before the event to 2 days before the event?
2. How did you and your partner use the forecast to make your decision? What aspects of the graphs helped you make your decision?
3. In Objective 4b, did you make different decisions than in Objective 4a? What changed?
4. Which type of graph was easier to interpret as a decision maker?

Activity C instructions

- Form a group with another pair
- Click on **Activity C** tab
- Record your and your group's answers to each question
- Focus on **exploring different visualizations** in Objective 8 – don't just choose one!
- After you **finish** and **any time you leave your computer**, save by clicking the "Save Progress" button
- When you finish, go to **Introduction** tab, click "**Generate Report**" and then "**Download Report**"

Activity C instructions

- Form a group with another pair
- Click on **Activity C** tab
- Record your and your group's answers to each question
- Focus on **exploring different visualizations** in Objective 8
- After you **finish** and **any time you leave your computer**, save by clicking the "Save Progress" button
- When you finish, go to **Introduction** tab, click "**Generate Report**" and then "**Download Report**"

Discussion questions:

1. What forecast user did you choose and why would a water quality forecast be useful for that user?
2. What types of forecast visualizations were easiest to interpret?
3. Hardest to interpret?
4. What types of forecast visualizations were most informative?
5. Least informative?
6. How does the audience you're communicating your research to change what type of visualization you might choose?
7. What type of visualization did you decide was most appropriate for your forecast user?