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Climate Leaders Program 2023 Fall Symposium

Think and Do:

Climate Challenges and Solutions

CLP Student Lightning Talks

September 29, 2023

Thank You to Our Sponsors:

- Kenan Institute for Engineering, Technology & Science, Office of the Chancellor
- Office of the Provost
- KIETS Climate Leaders Program
- R.L. Rabb Science and Society Symposia
- Coastal Resilience and Sustainability Initiative

SUSTAINABILITY FUND

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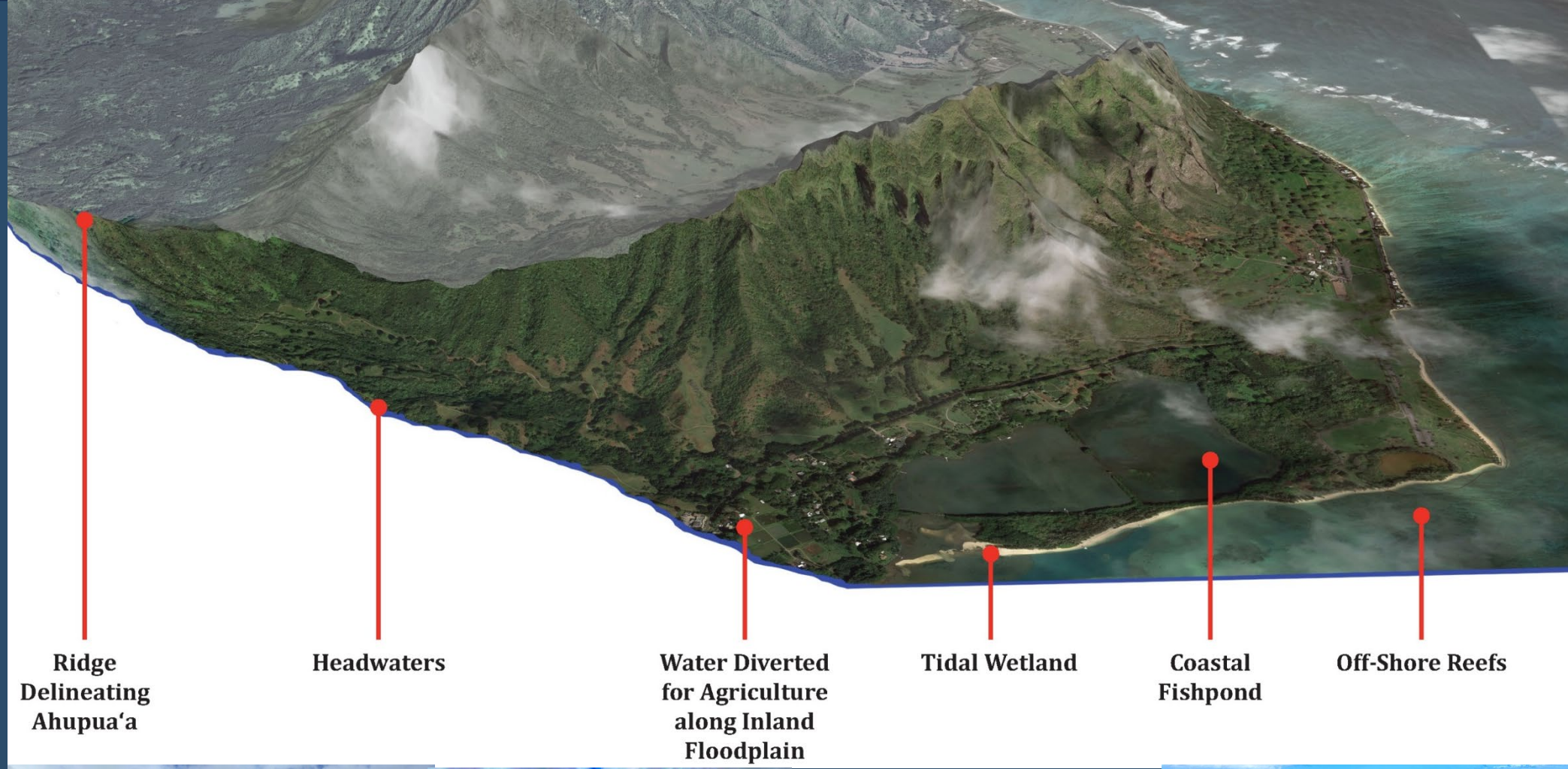
Ryan Anderson

Restoring Natural and Cultural Systems



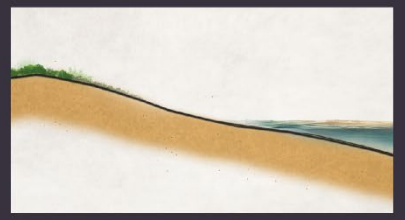
NATURE-BASED SOLUTIONS

1 Constructed Wetlands

2 Firebreaks

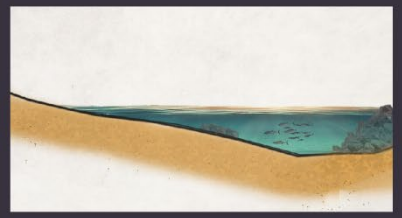
3 Loʻi

4 Wetland Restoration



5 Dune Restoration

6 Living Shorelines



7 Fishpond Restoration

8 Coral Reef Restoration

Mauka

Makai

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A Summer in Washington, D.C.

Julia Cunniffe

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Bio&Ag ENGINEERING

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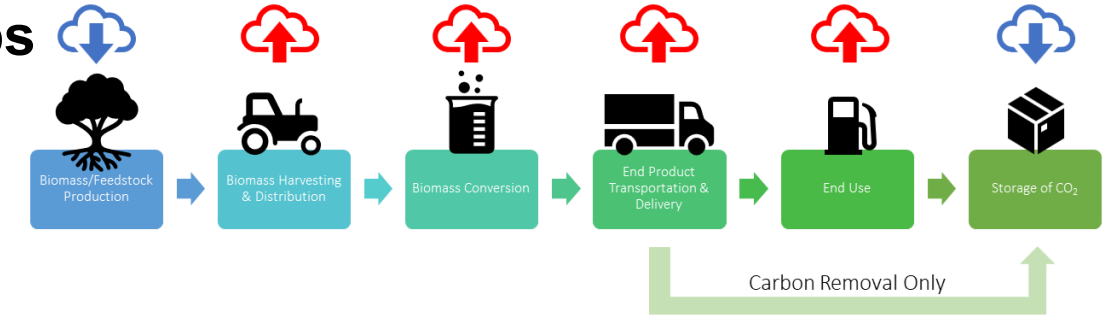
https://bipartisanpolicy.org/

Bipartisan Policy Center (BPC)

- Not-for-profit think tank
- Bring together policymakers from all sides
- Energy team
- **Task 1: Carbon MMRV**
  - Government role in quantifying carbon sources and sinks
  - Gaps in policy and knowledge
- **Task 2: Biomass Policy 101**
  - Existing and past policies support biomass across supply chain
  - Gaps in policy and knowledge
- **Task 3: Purpose Grown Crops/Energy Crops**
  - Myths/things you didn't know
  - Emerging - misunderstood

Bipartisan Policy Center



Policy and Energy Efforts

- Towards mitigating effects of climate change
- Ways to capture and sequester carbon
- Provide education and support to stakeholders
- Publish blogs and explainers sharing research to public
- Organize public and private events to gain industry and community perspectives
- Introduce and pass bipartisan legislation
  - Support production and use of clean energy
  - Improve carbon data

S.2241 - Advancing Research on Agricultural Climate Impacts Act of 2023

118th Congress (2023-2024) | Get alerts

BILL | Hide Overview ✕

Sponsor: Sen. Smith, Tina [D-MN] (Introduced 07/11/2023)

Committees: Senate - Agriculture, Nutrition, and Forestry

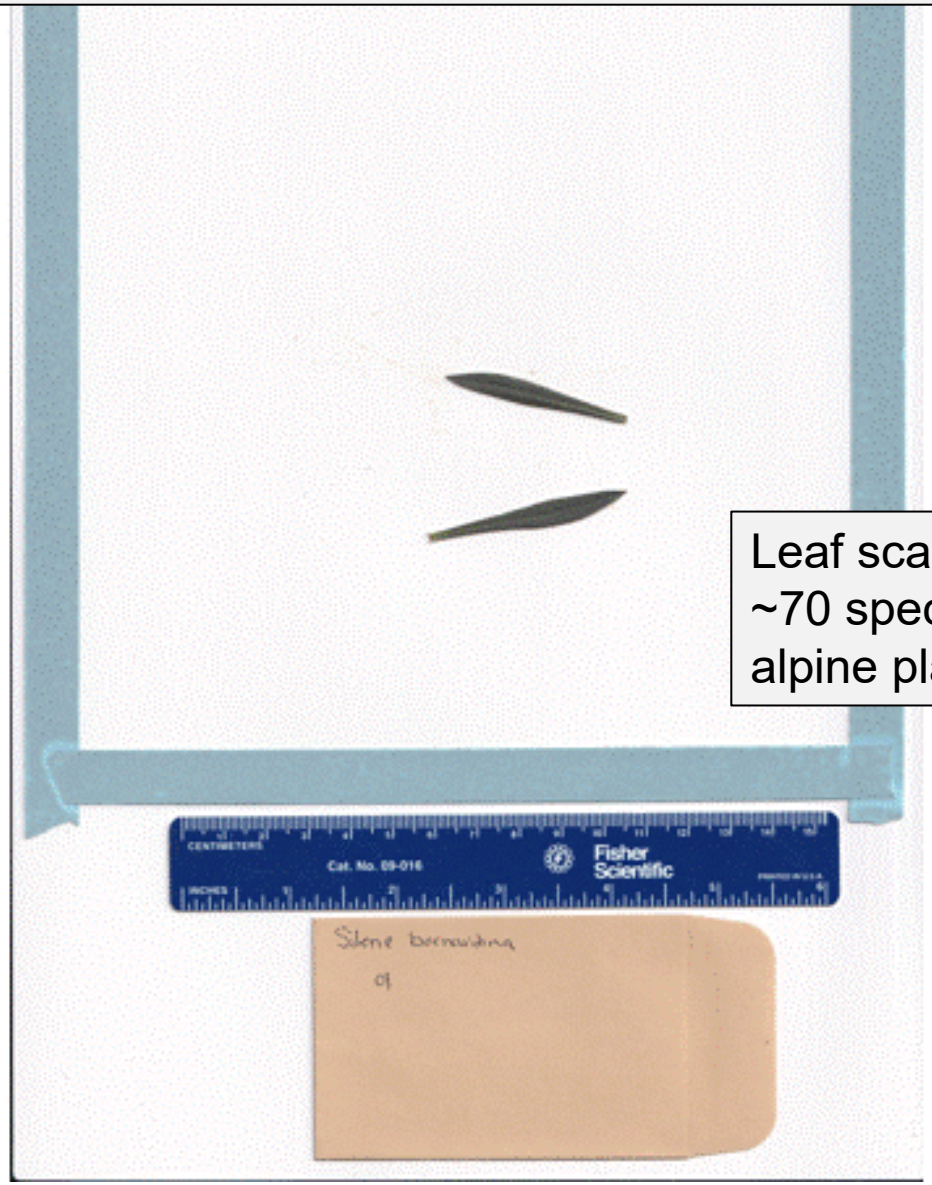
Latest Action: Senate - 07/11/2023 Read twice and referred to the Committee on Agriculture, Nutrition, and Forestry. (All Actions)

Tracker: Introduced > Passed Senate > Passed House > To President > Became Law

Kaleb A. Goff
PhD Student, Sheth Evolutionary Ecology Lab, NCSU
KIETS Climate Leadership Program 2022-2023

Photo: Kaleb Goff

In a rapidly changing climate, which facets of biodiversity are mostly likely to change?



Leaf scans for ~70 species of alpine plants

Measuring vegetative and generative height on *Astragalus calycosus.*

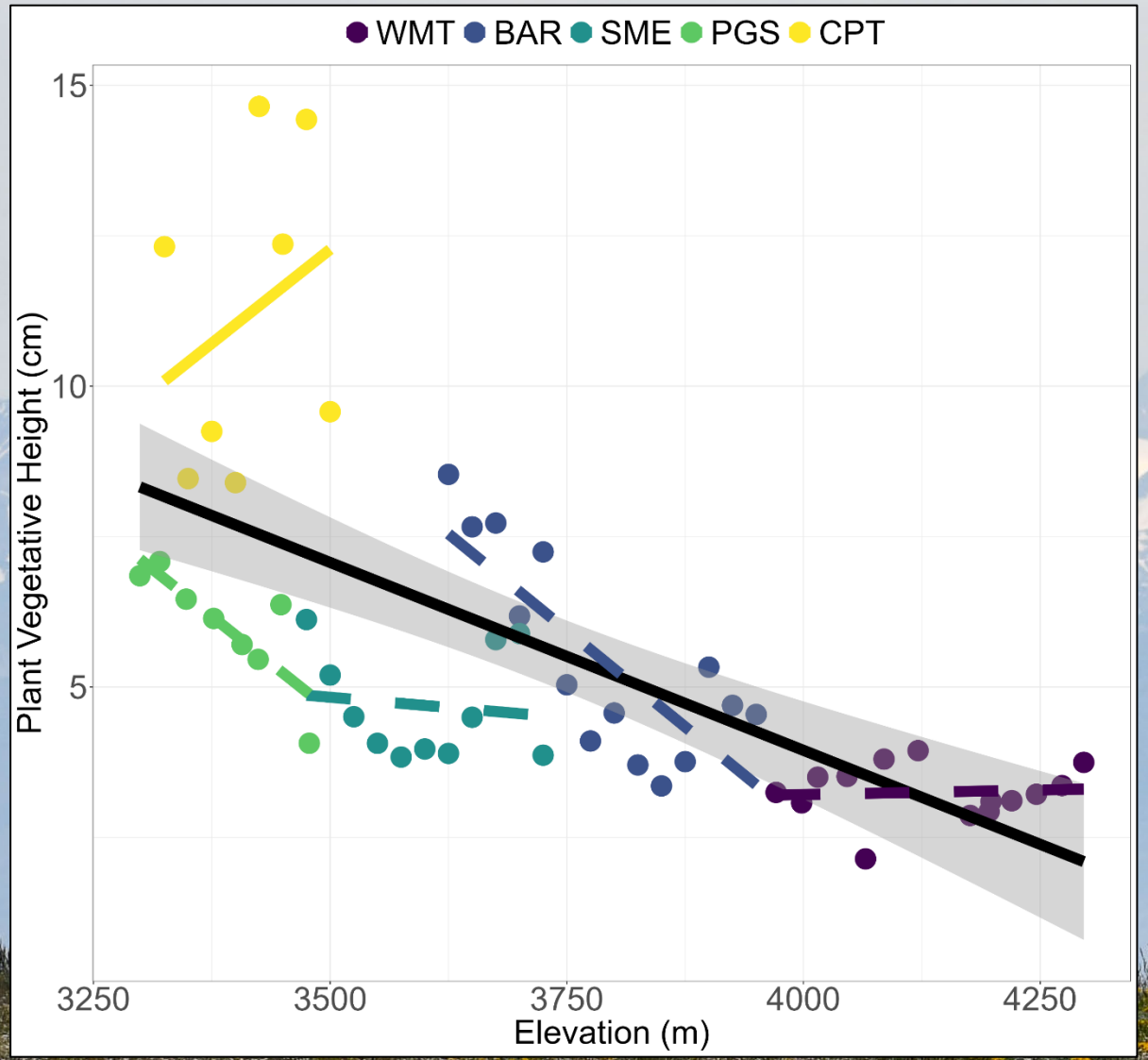


Photo: Brooke Wallasch

GLORIA GREAT BASIN

sheth evolutionary ecology lab

Kaleb A. Goff
Contact: kagoff@ncsu.edu

Is cobalt necessary for lithium & manganese rich cathode materials?

Augustyn Research Group, Fall 2021

Ishita Kamboj
PhD Candidate, Augustyn Research Group

Climate Leadership Program Symposium
September 28th-29th, 2022

NSF

Argonne NATIONAL LABORATORY

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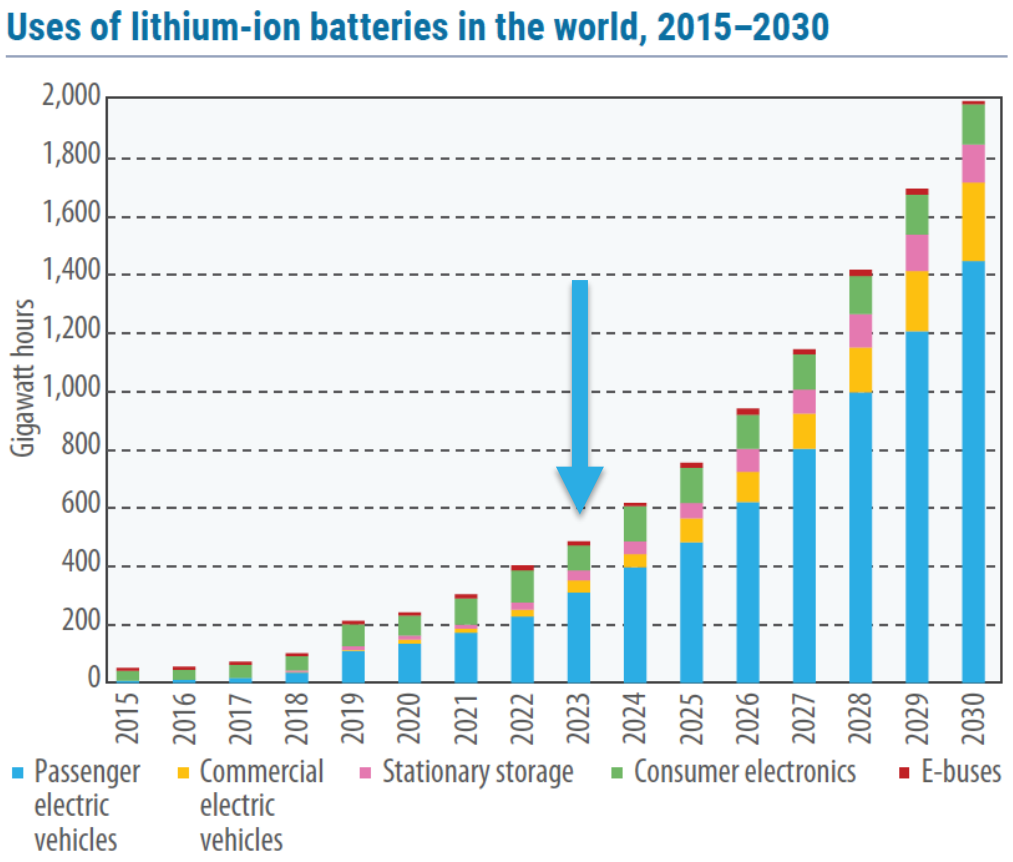
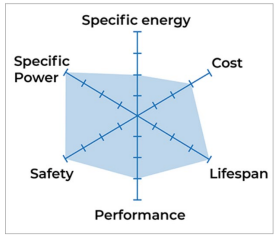
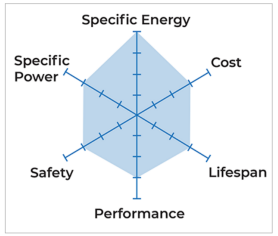
There is aggressive international pressure on the lithium-ion battery to facilitate the green energy transition



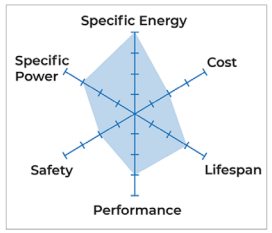
Most common Li-ion chemistries



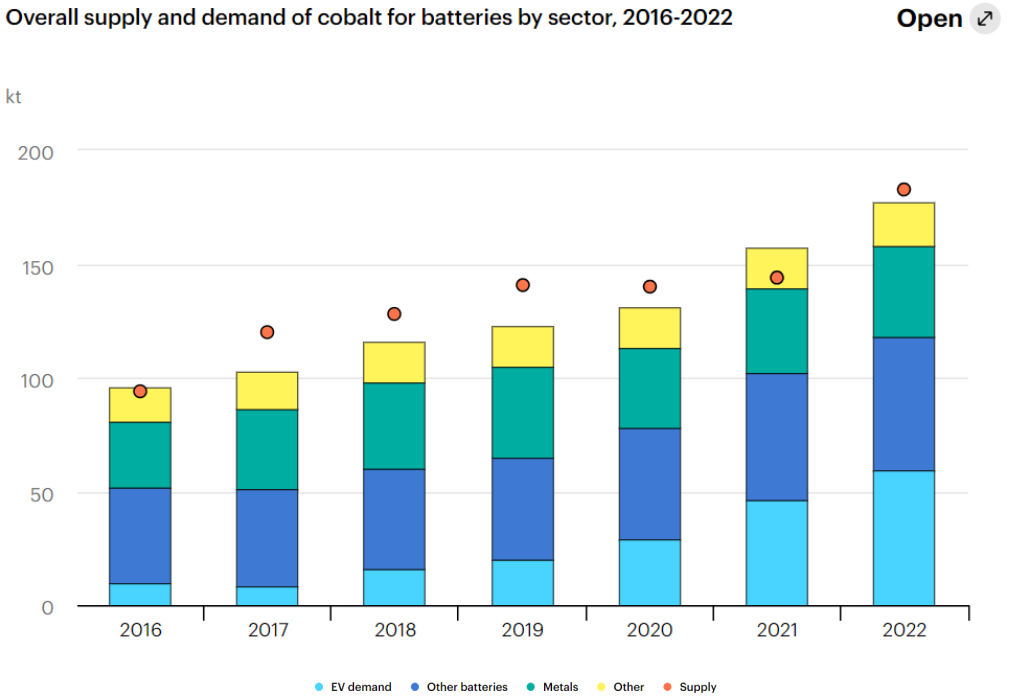
Lithium Ferrophosphate (LFP)



Lithium Nickel Manganese Cobalt Oxide (NMC)

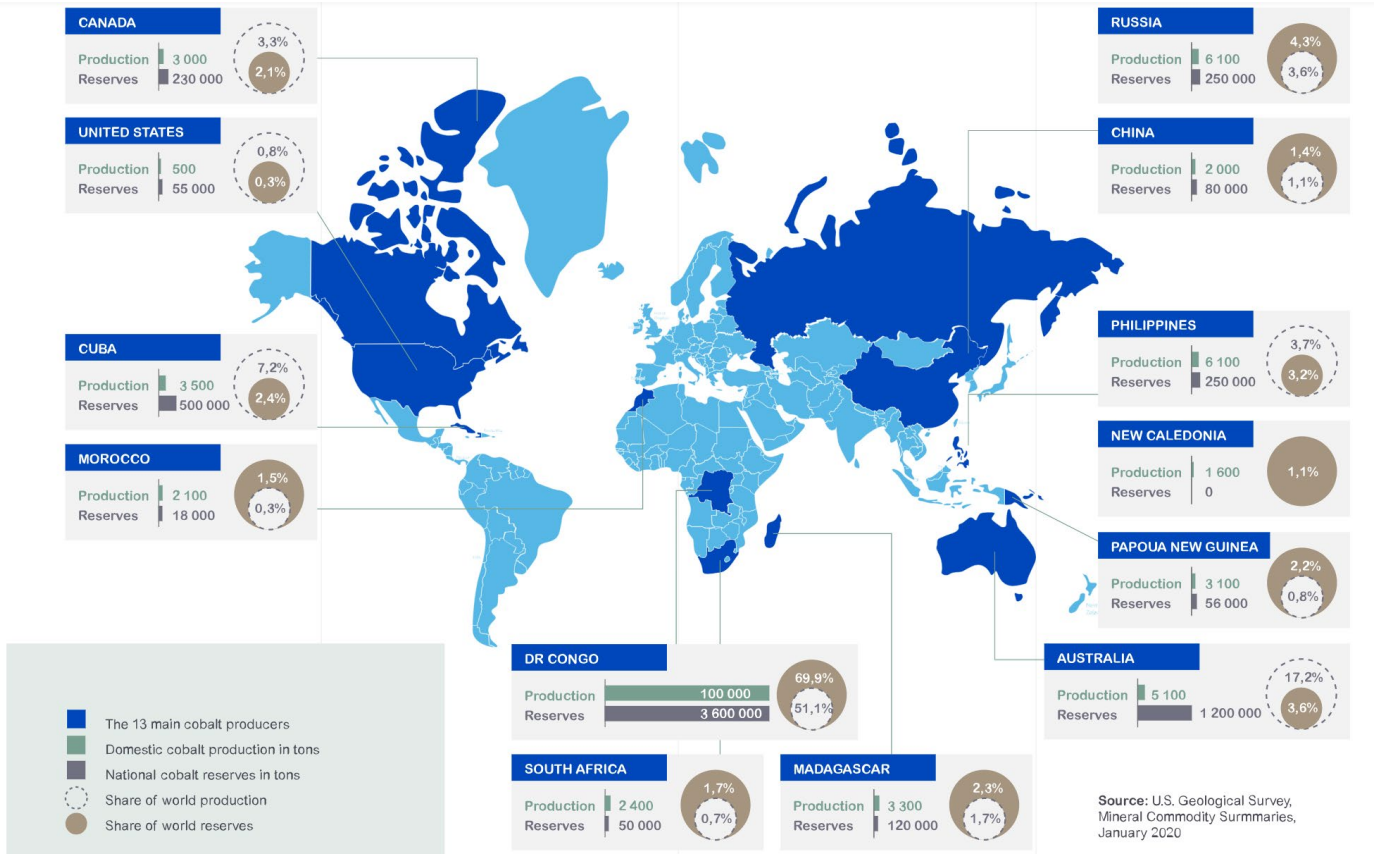


Lithium Nickel Cobalt Aluminum Oxide (NCA)



Lithium-ion batteries: A pillar for a fossil fuel-free economy? United Nations Frontier Technology Issues (2021); https://www.iea.org/reports/global-ev-outlook-2023/trends-in-batteries; https://www.onecharge.biz/lithium-cell-chemistry/

What's wrong with relying on cobalt in our lithium-ion batteries?



- Costs:
  - Mn = $1-2 USD per lb
  - Ni = $5-15 USD per lb
  - Co = $10-25 USD per lb
- Manganese is earth-abundant & economically viable (36x more abundant than Co or Mn)

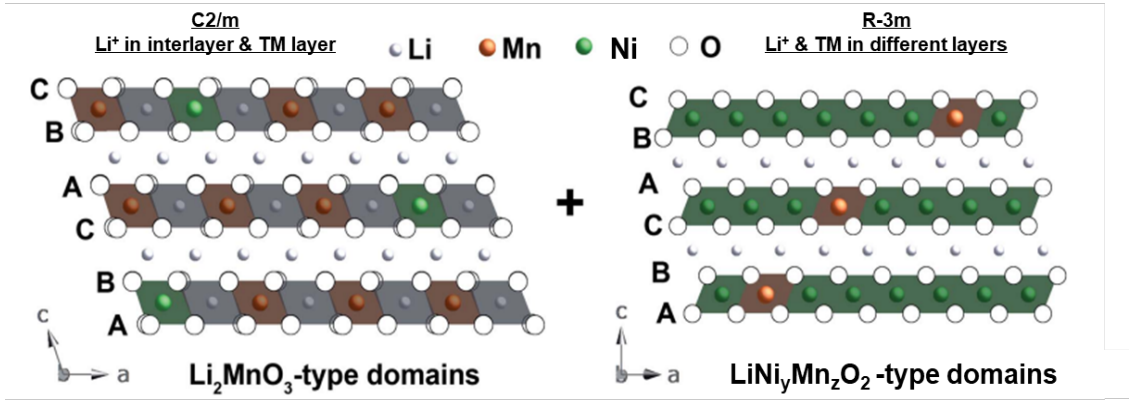
https://www.cobaltinstitute.org/about-cobalt/cobalt-life-cycle/

Nitta, Yushin, *et al. Mat. Tod.* **18** (5), 252-264 (2015); Rana, et al. J. Mater. Chem. A. **2**, 9099-9110 (2014)

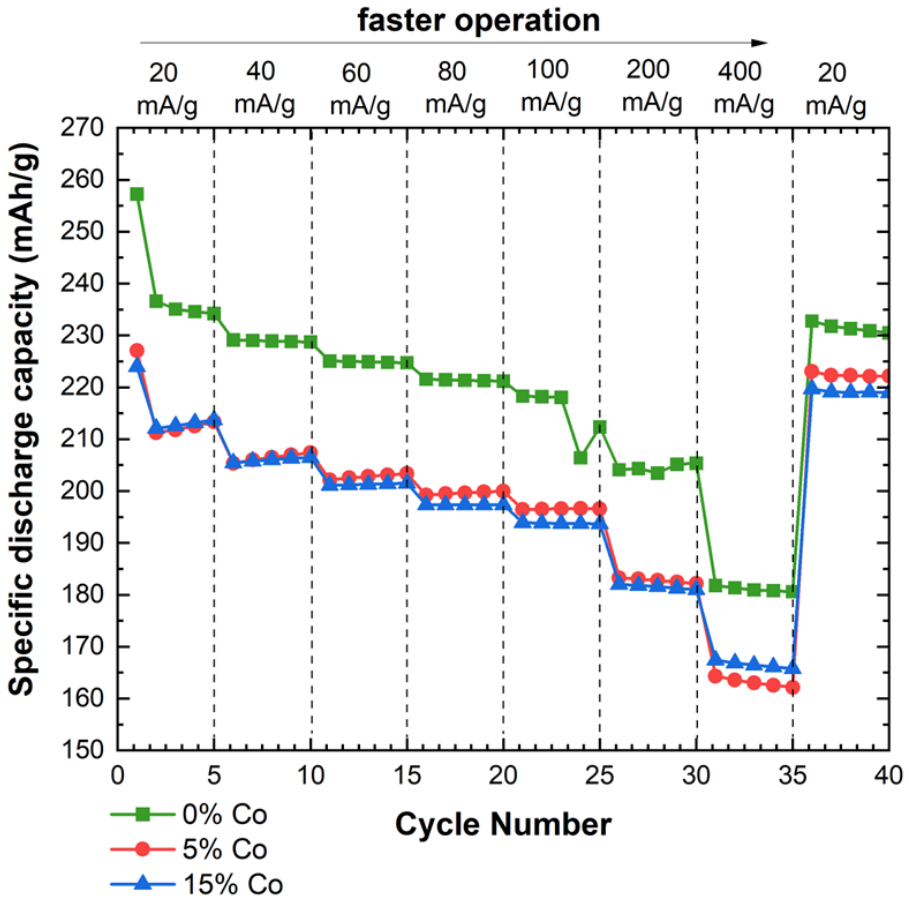
Lithium & manganese rich (LMR) oxide materials could provide a good compromise between cost & performance

>1 : 1
Lithium : Transition Metal
Manganese makes up over 50% of the transitional metal content

$xLi_2MnO_3 \cdot (1\text{-}x)LiNi_yMn_zO_2$ with x = 0.1, 0.3, or 0.5 and y + z = 1



Is cobalt necessary or beneficial for LMR oxides?



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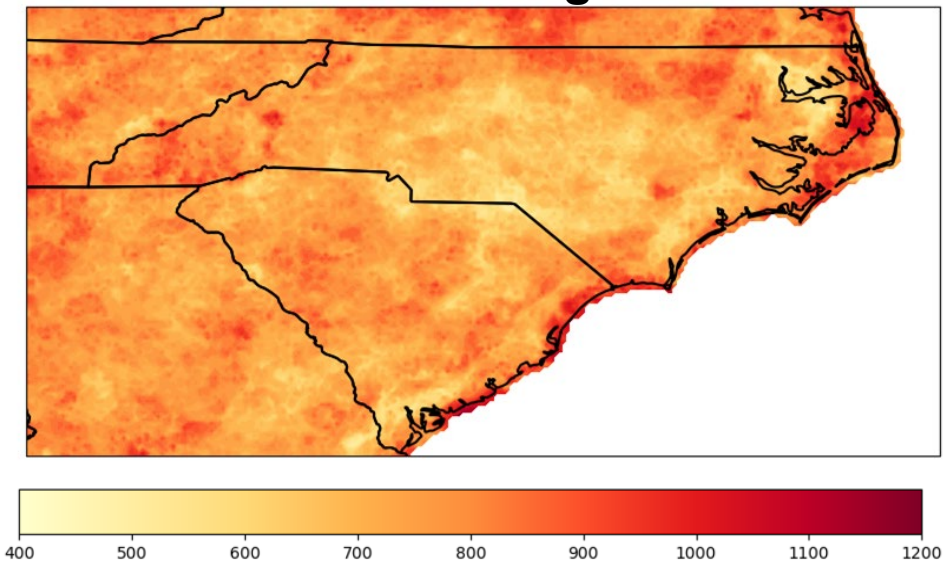
Kaitlin Karaffa

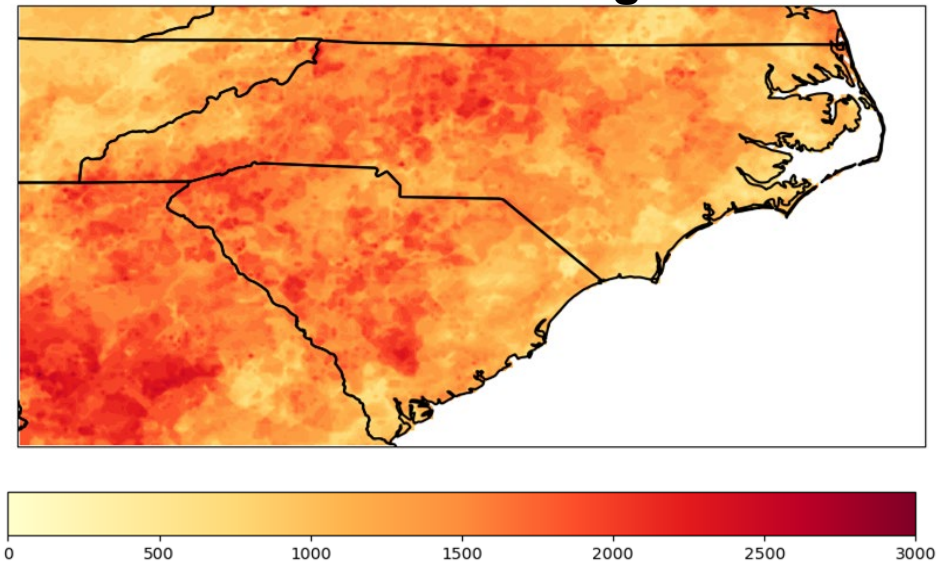
Analysis of Drought across the Carolinas on Two Different Timescales

Flash Drought

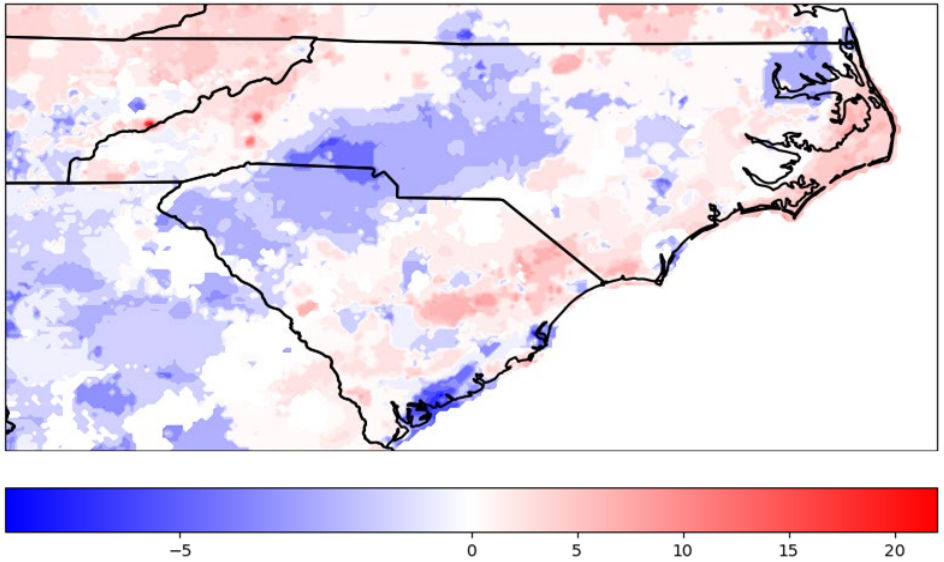
Persistent Drought

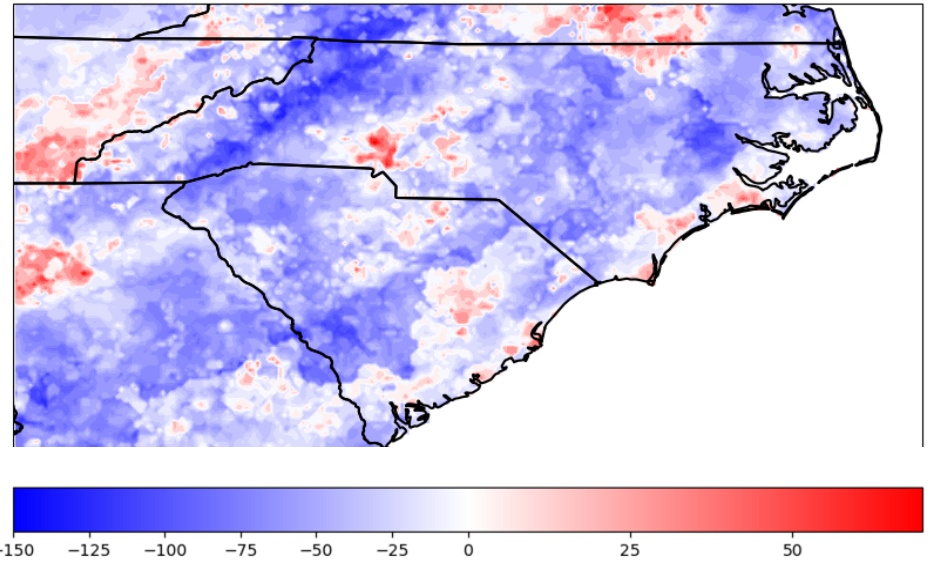
Total Drought Days





Change in Drought Days





Indigenous Solutions to Climate Challenges

Genevieve Myers

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Groundwater Vulnerability to Modern Contamination from Floods

Hayden Rudd

North Carolina State University

Elizabeth Guthrie Nichols, Damian Shea, Andy Neal, David P. Genereux

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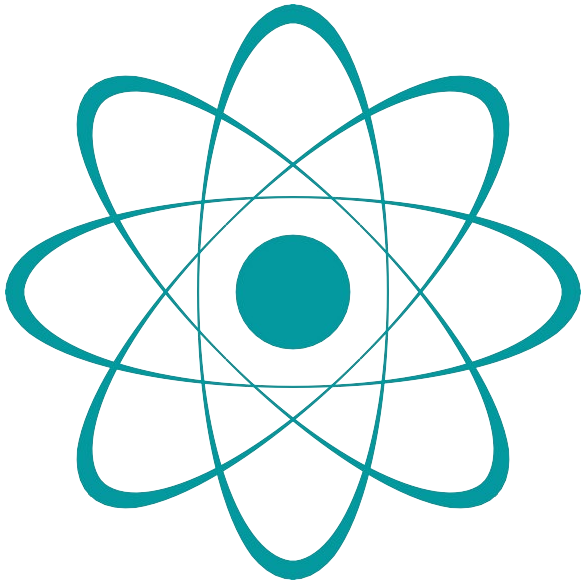
Is NC Groundwater Vulnerable to Flooding?

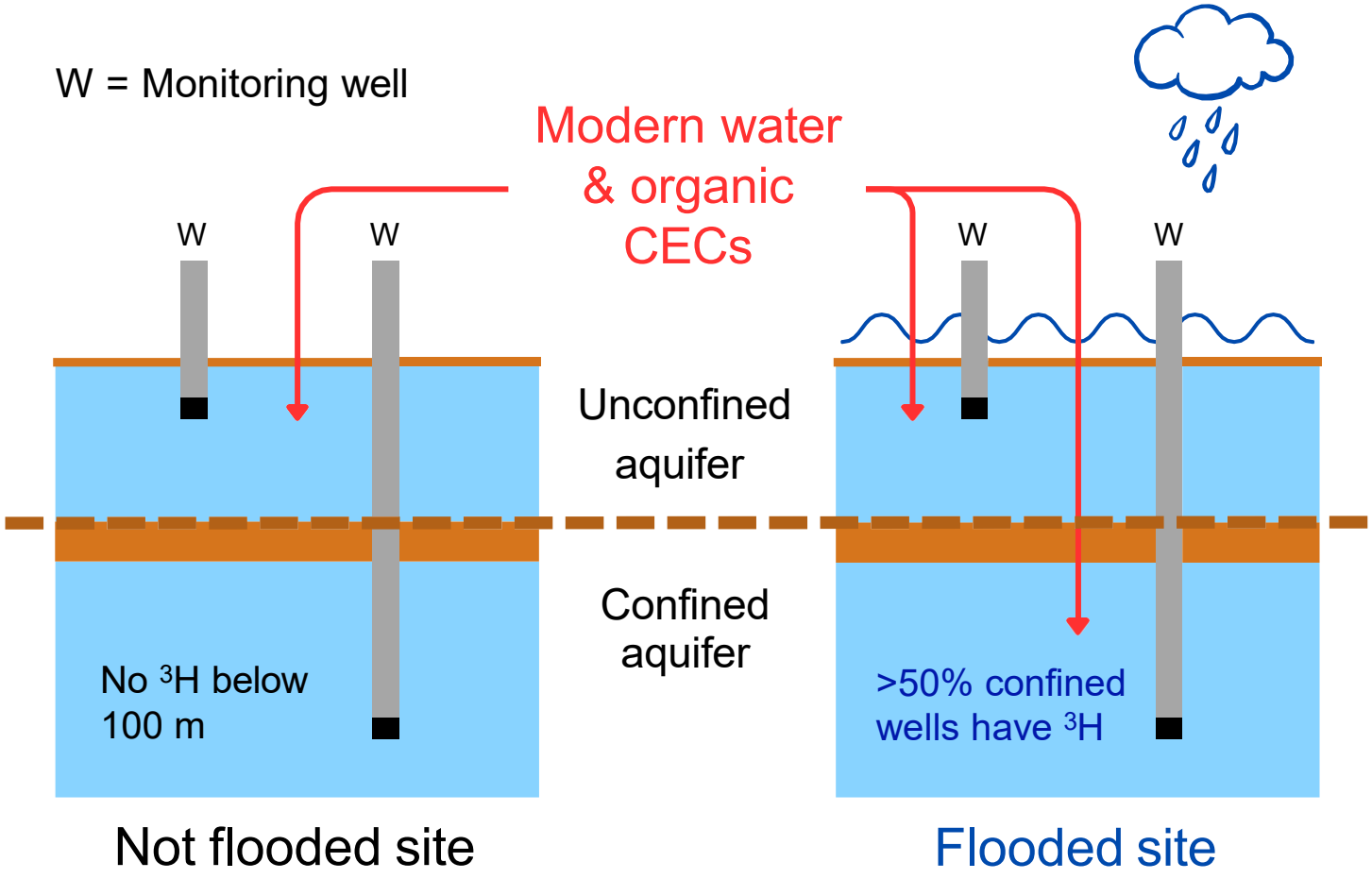
EXTREME PRECIPITATION

GROUNDWATER USERS

MODERN WATER INTRUSION



Unconfined and Confined Flooded Wells Are Vulnerable



Microcystins in Estuarine Food Webs

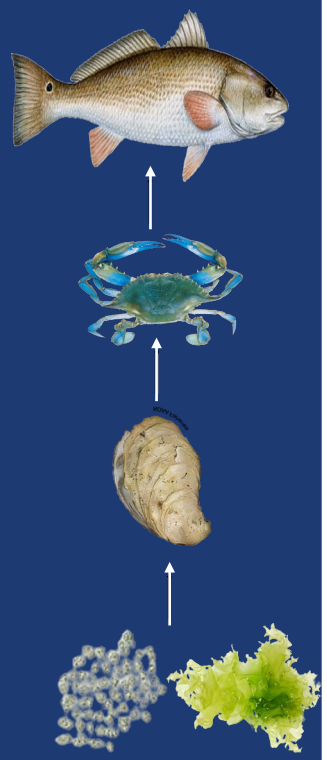
Freshwater toxins

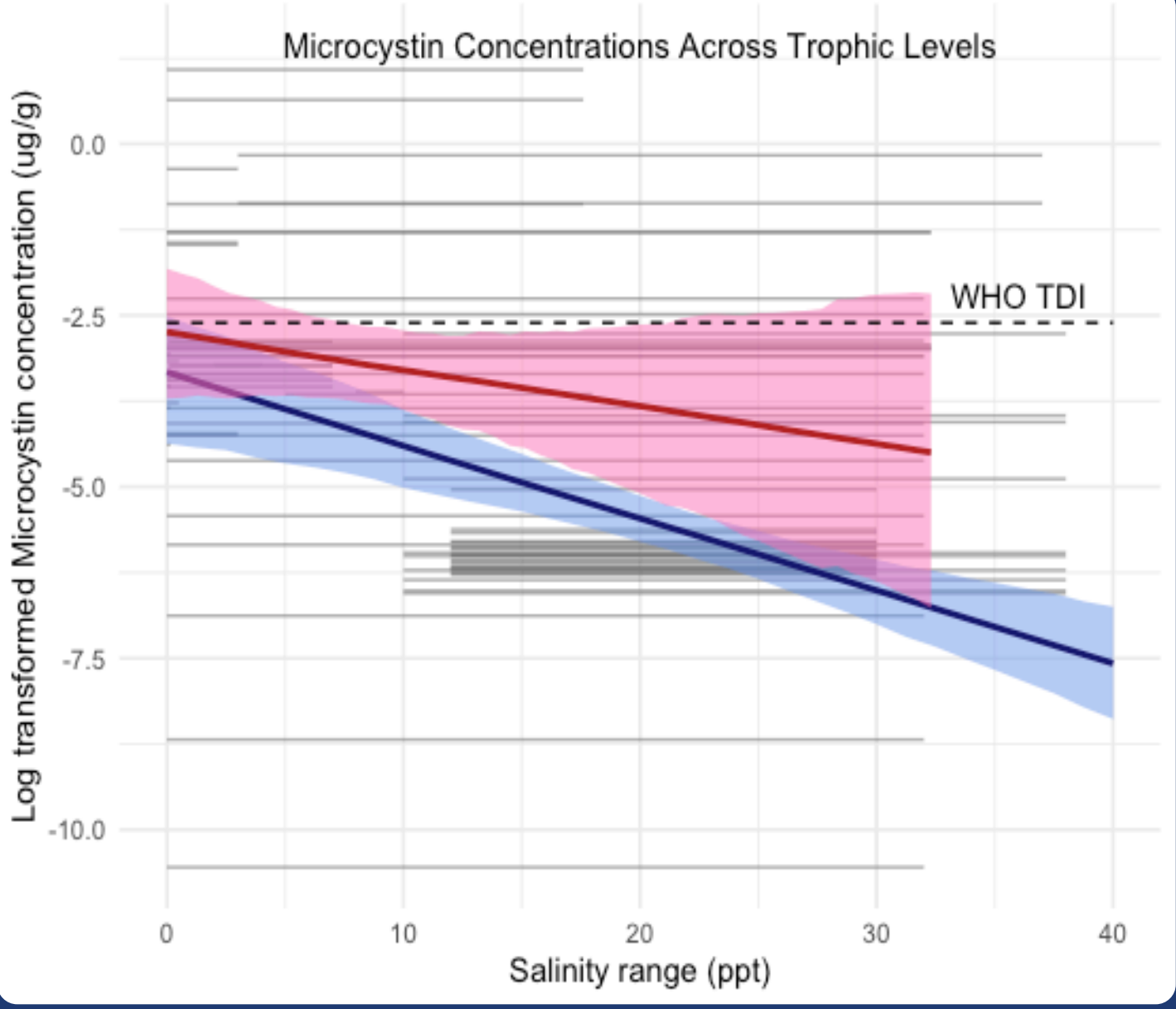
Downstream transport

Field studies

Commercially valuable species

Baseline monitoring program

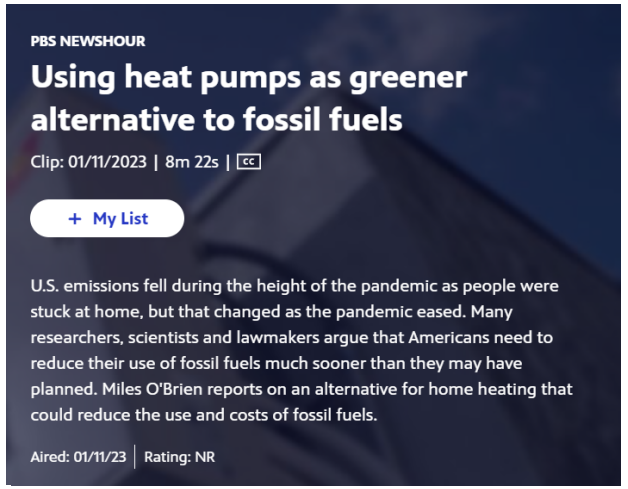


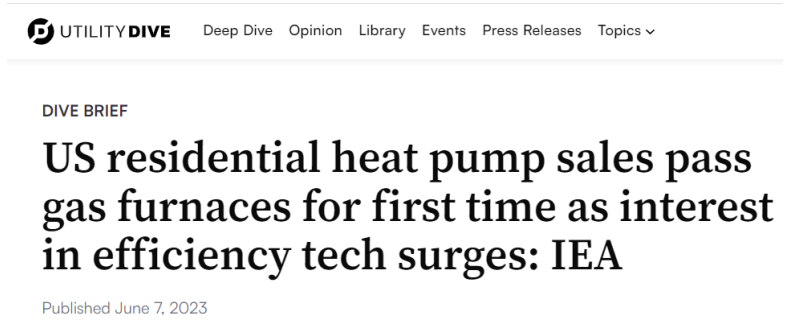


Kalle Simpson

HEAT PUMPS ARE GROWING IN POPULARITY:

Will Impact Electricity Demand Patterns.





CLIMATE CHANGE *is (and will) also Affect Electricity Demand Patterns:*

EPA United States Environmental Protection Agency

Environmental Topics ⌄ Laws & Re

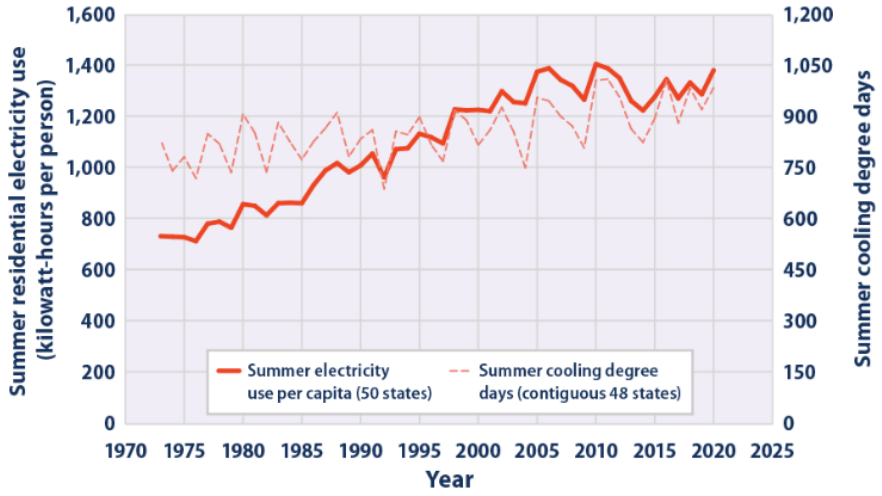
Climate Change Indicators: Residential Energy Use

This indicator examines trends related to home air conditioning and heating by tracking the amount of electricity used by U.S. homes in the summer and energy used in the winter.

Figure 1. Summer Electricity Use and Cooling Degree Days

Figure 2. Winter Natural Gas Use and Heating Degree Days

Figure 1. Residential Summer Electricity Use per Capita and Summer Cooling Degree Days in the United States, 1973–2020



What Could the *Simultaneous* Occurrence of Widespread Residential Electric **Heat Pump Adoption** and **Climate Change** Mean for The Future of the Power Grid?

A Texas case study.

Perceived Weather-Related Adaptation Needs of Agricultural Operations in the Southeast US

Andrew Waaswa

- Climate change is impacting producers:
  - Farmers, forest landowners, and grazing land managers
- The diversity of these operations makes the producers more prone
- There is need to understand the weather-related impacts producers are most concerned about addressing

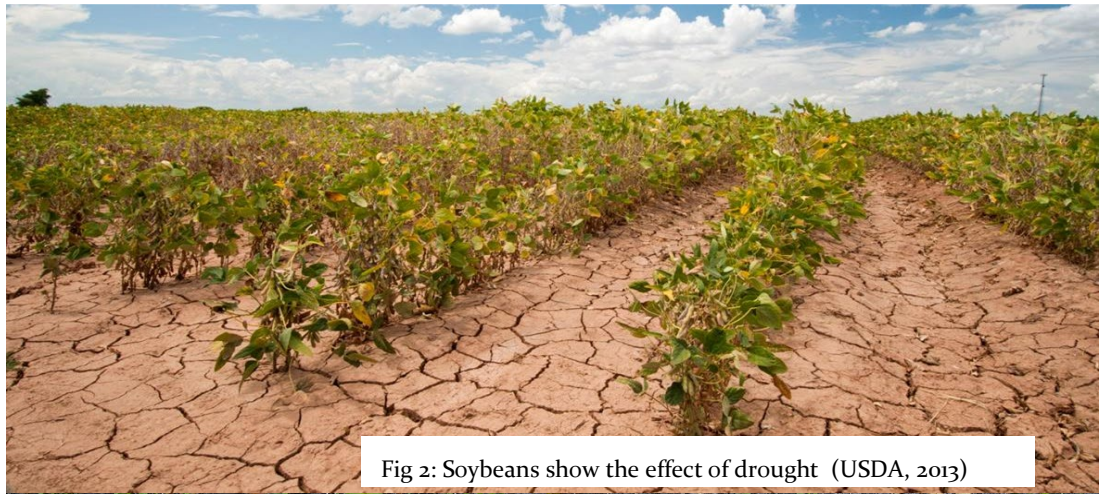


Fig 2: Soybeans show the effect of drought (USDA, 2013)

A needs assessment that targeted extension agents and agricultural technical services providers serving producers was conducted

Extreme heat, extremely hot days and severe drought emerged as the major weather-related concerns of southeast producers

Adaptation and mitigation strategies related to:

irrigation, drought-resistant crop varieties, and livestock breeds are a primary focus area to help build resilience and opportunities for producers' operations

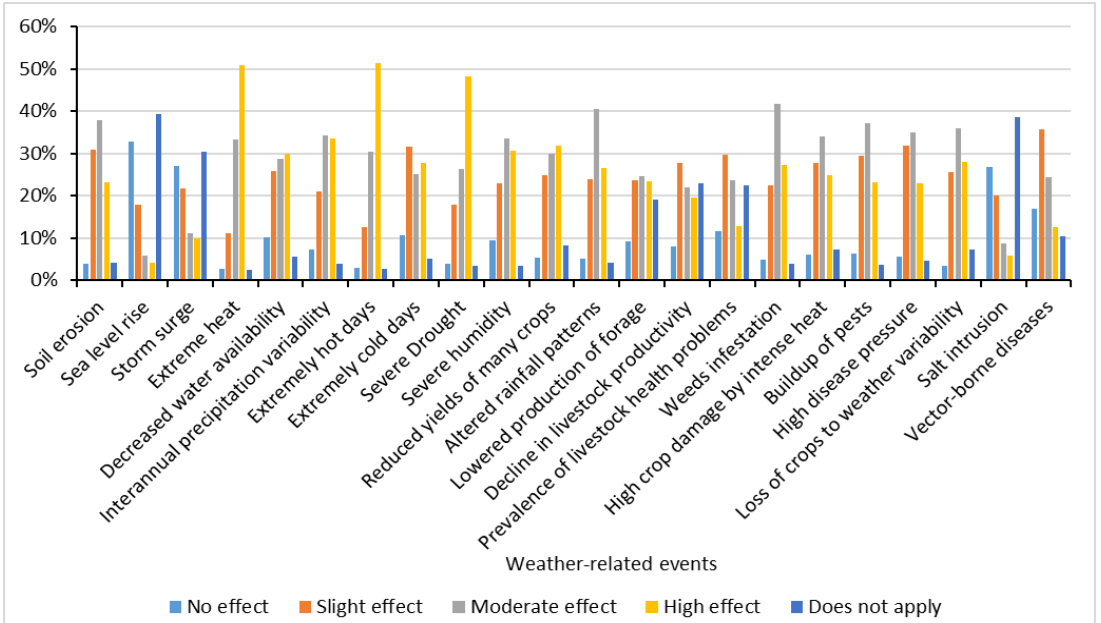


Fig 3. Weather-related adaptation needs of agricultural operations in the Southeast United States

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USDA Southeast Climate Hub
U.S. Department of Agriculture

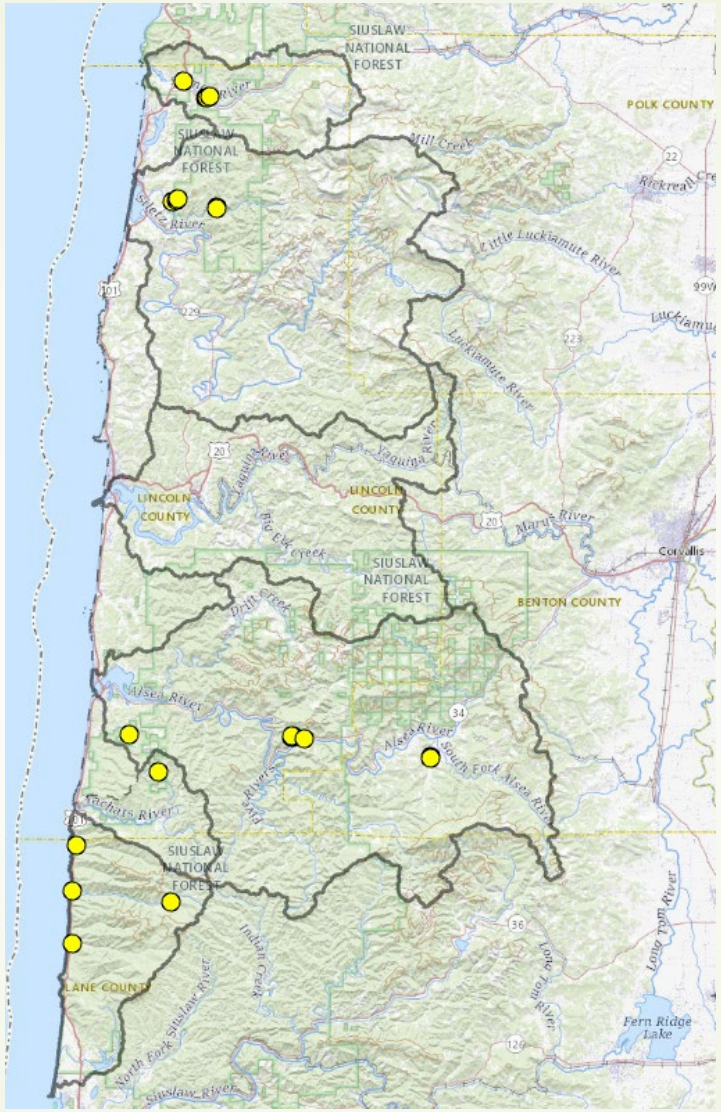
Opportunities for fieldwork

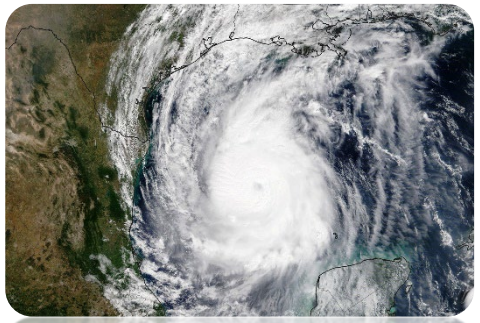
- Restoration is an important tool for coastal Resilience
- Fish passage and refugia provide vital services in life history complexity and resilience
- eDNA is a tool for identifying fish passage barriers

Adam Wampler

eDNA Surveys

- Goal to identify major fish passage barriers
- Collects DNA from large area of Watershed
- Continued testing can provide more complete picture




NASA Earth Observatory

The threat of climate change is felt from the **backyard to a global level**. When addressing this challenge, a **multi-scalar systems approach** is needed to mitigate and address the effects of climate change.


NASA Earth Observatory

COHABITATION + CLIMATE RESILIENCY + EDUCATION

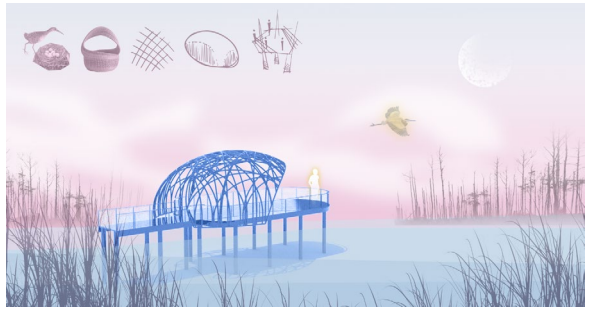

Northern Gardener

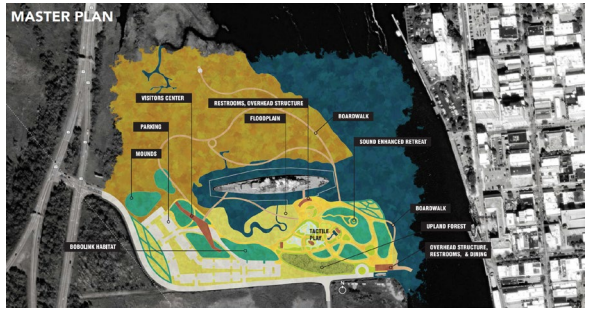

LAND Italia


Scape Studio

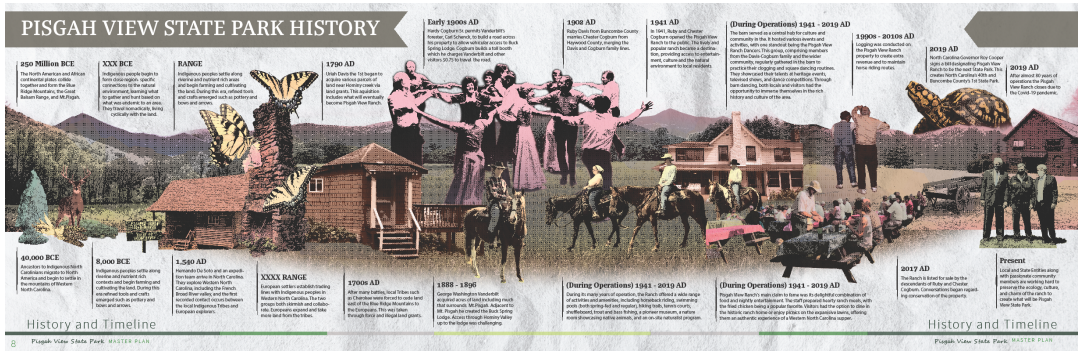
Site + Local **Regional** **State + National**

Battleship Park, Wilmington NC





Pisgah View State Park, NC



Next Steps

Global