



Cyberinfrastructure in EPSCoR Jurisdictions

computing and data partnerships in research and education

Panelists

Venice Bayrd, MSLIS (Data Curation Librarian, Montana State University)

Dr. Sean Cleveland (Director of Research Cyberinfrastructure, University of Hawai'i)

Dr. Fred Harris, Jr. (Nevada State EPSCoR Director)

Dr. Scotty Strachan (Principal Research Engineer, Nevada System of Higher Education).



Panelist Intro: Venice



Venice Bayrd, MSLIS

Data Curation Librarian

Library

Montana State University

- 15+ years in academic and specialized libraries
- 6 years: embedded Data Curation Librarian within NSF EPSCoR RII Track-1 & NASA EPSCoR projects
- 2+ years: leading Cyberinfrastructure Element within current Montana RII Track-1, SMART FIRES
- Open science/research & reproducibility advocate



Panelist Intro: Sean



Sean Cleveland Ph.D.

Director of Research
Cyberinfrastructure
Information Technology Services
University of Hawaii - System

- 16+ years of RCD experience as CI Research Scientists and Facilitator
- 10+ years at UH System
- 2 years: Director of Research Cyberinfrastructure
- PI/Co-PI on multiple NSF cyberinfrastructure projects from hardware, software and workforce.
- CI lead and Co-PI on the current HI EPSCoR Track I.
- Computer Science and Microbiology background



HAWAI'I DATA SCIENCE



HAWAII
NSF EPSCoR
ADVANCING GEOGRAPHIC DIVERSITY IN STEM

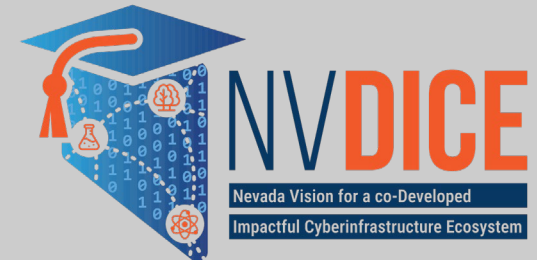


Panelist Intro: Fred



Dr. Frederick C. Harris, Jr.
Foundation Professor
Computer Science & Engineering
Associate Dean of Academic
Affairs
College of Engineering
University of Nevada, Reno

- Nevada State EPSCoR Director
- Project Director, Nevada NSF-EPSCoR
- 14 (!) students under current supervision
- UNR campus CI champion for 25+ years
- Scotty's favorite stat: over 150 undergrad co-



Panelist Intro: Scotty



Dr. Scotty Strachan

Principal Research Engineer
System Computing Services
Nevada System of Higher
Education

- 15+ years research staff/faculty in earth/environmental science (UNR Geography)
- 4 years: Director of Cyberinfrastructure at University of Nevada, Reno
- 3+ years: Leads Research Engineering group for state higher-ed System & regional network NevadaNet
- Works as a PI/peer with institutional faculty members & technology pros in Team Science
- Develops & coordinates strategy for Nevada research networks, RCD professional community
- Mountain climate & ecohydrology scientist

Acknowledgements

We'd like to thank the following individuals for their contributions to the formative stages of much of this work and the NSF EPSCoR CI Council. Any errors in representation remain our own.

- Dana Brunson
- Patrick Clemins
- Deborah Dent
- Gwen Jacobs
- William "Bill" Michener
- Claire Mizumoto
- Patrick Schmitz
- Alice "Pips" Veazey
- Workshop and CI Council participants

Three provocations

EPSCoR jurisdictions have fewer resources and the same or increased overhead - imperative to turn this around to become competitive. So need to overcome these challenges in team science in regional and institutional infrastructure:

1. **Technology capability gaps between Industry & Higher Ed are widening.**

Gaps are intensified within EPSCoR jurisdictions due to lagging institutional I.T. investment.

1. To survive as effective centers of STEM education, **institutions need a sharpened focus on developing modern technology expertise, capabilities, and partnerships.**

National “best practices” in Cyberinfrastructure development show that solo institutions can’t possibly “cover all the bases” needed in Research I.T.

1. **EPSCoR cultures** of regional cooperation, Team Science approaches, and integration of students in STEM research **promote the collaborative environment needed to evolve CI, and with it, research and education.**

Topics we'll cover today

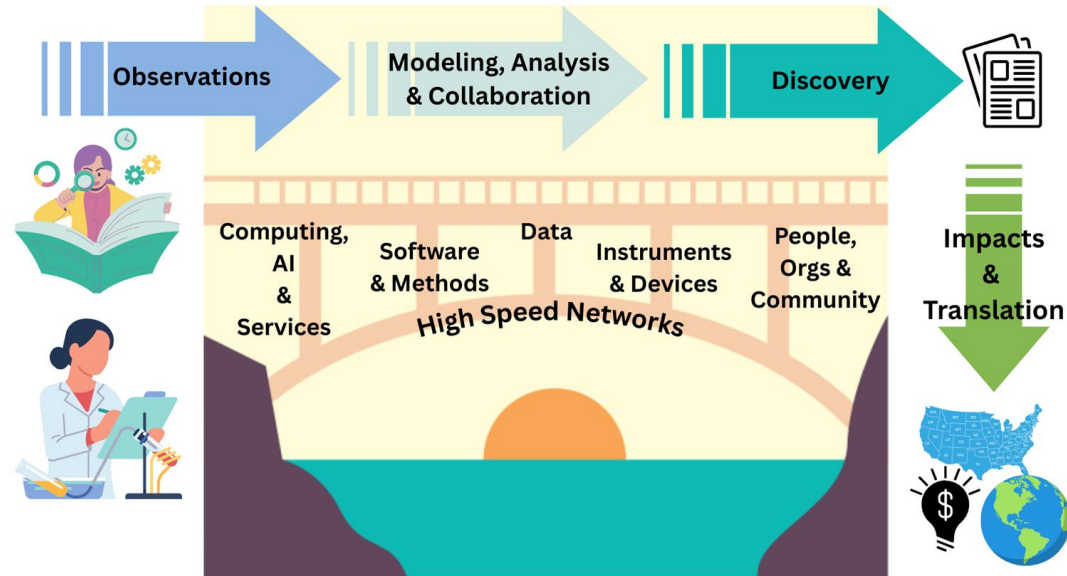
What is Cyberinfrastructure (CI)?

How can CI be integrated within institutional/regional contexts?

How can culture/investment be pursued from the ground up?

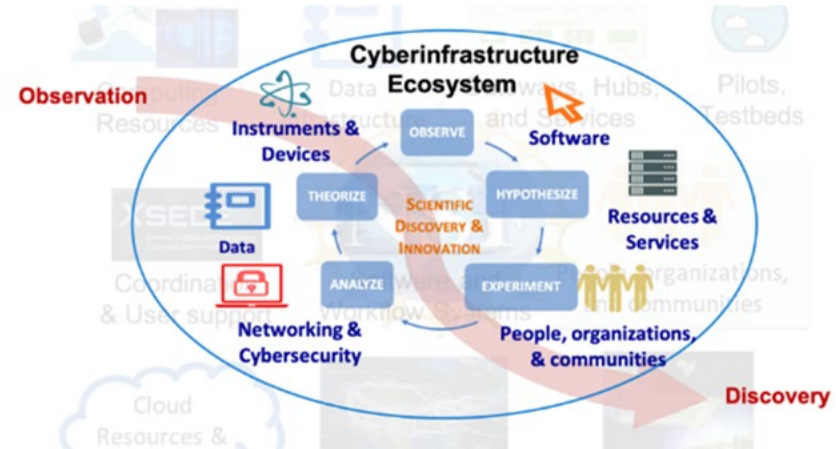
What do the national data tell us?

The EPSCoR CI Interest Group



RESEARCH IN THE 21ST CENTURY MEANS:

- Technology capability has transformative impact (reduce time-to-science).
- Easy access to tech infrastructure is critical for faculty and grad student recruitment and retention.
- We're at a generational inflection point of "how tech works".
- How to scale tech impact without scaling cost linearly?
Coordinated strategy at institutional & larger scales.
- Research Computing and Data (RCD) Capability is critically tied to your research organization's success.



What is Research Information Technology?



What is Research Information Technology?

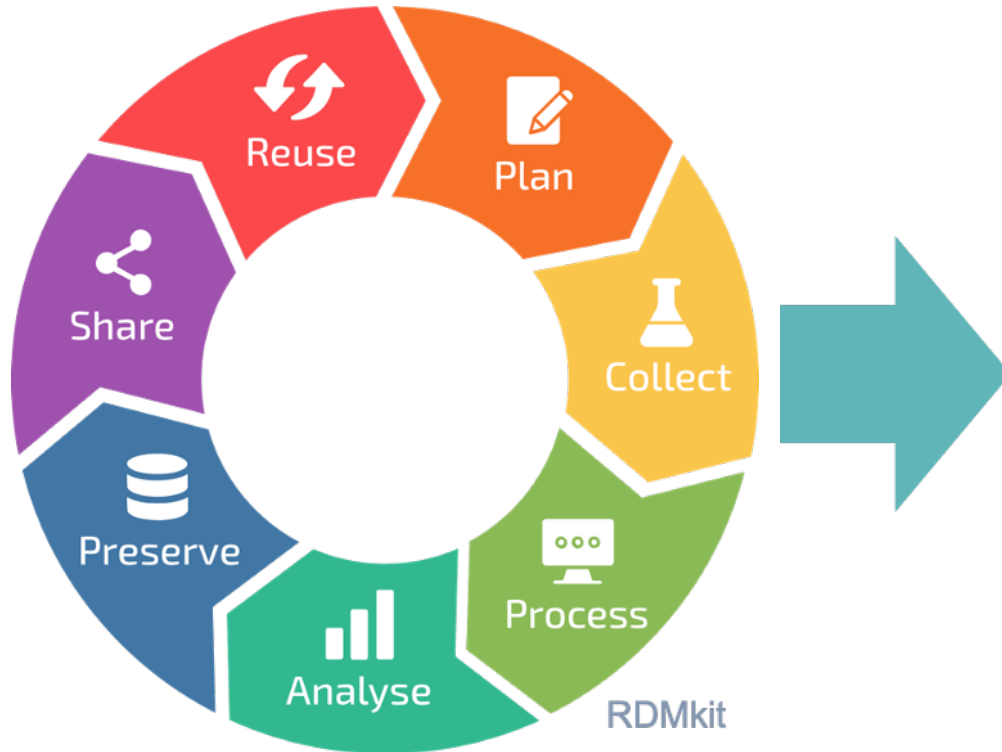


What is Research Information Technology?



- data storage, access, security
- research software
- computing interfaces, environments, and capacity
- network capacity
- **human capacity to deliver and capitalize on the above**

Research IT = “Cyberinfrastructure (CI)”



- data storage, access, security
- research software
- computing interfaces, environments, and capacity
- network capacity
- **human capacity to deliver and capitalize on the above**

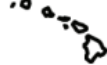
Hawai'i EPSCoR

Established Program to Stimulate Competitive Research

- Innovative science in the service of the state, translating research discoveries into actionable outcomes for the community
- Capacity building – recruiting and mentoring next generation of research leaders at UH
- Creating workforce pathways for research and industry
- Investments in Cyberinfrastructure to support thrusts in Data Science, Cybersecurity and AI - Last 2 Track 1

<http://hawaii.edu/epscor>

-By the numbers-


MORE THAN
\$68.6M
TOTAL EPSCoR FUNDING


23
FACULTY HIRES


594
PUBLICATIONS


171
NSF AWARDS WON
BY EPSCoR SUPPORTED FACULTY


\$92.4M
TOTAL NSF FUNDING


21 years
AS CATALYST FOR RESEARCH

-EPSCoR Track 1 participants-

847
TOTAL
PARTICIPANTS

140
FACULTY
PARTICIPANTS

23
POSTDOCTORAL
RESEARCHERS

60
GRADUATE
STUDENTS

97
UNDERGRADUATE
STUDENTS



UNIVERSITY OF HAWAII



HAWAII
NSF EPSCoR
ADVANCING GEOGRAPHIC DIVERSITY IN STEM



Hawai'i CI Investments

2011-2013

Previous Network &
Data Center Investments

\$1.8 M HPC
Institutional
Investment

2014

ACI-REF(People)

2015

The UH HPC opens for business
April 15, 2015

EPSCoR (People)

2016

\$733K HPC
PI Investment

2017

\$287K HPC
PI Investment



HAWAII DATA SCIENCE

2018

CSSI (People)

2020

\$250K - Institutional Investment

\$169K - PI Investment HPC

2022

\$400K / \$500K
CC* Koa / KoaStore
HPC



2023

\$80K HPC
PI Investment

EPSCoR (People)

2021

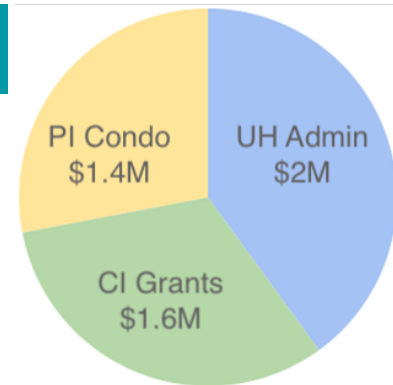
\$132K HPC
PI Investment

\$700K HPC
NSF MRI

2019

10 staff in
2025 - 2
institutions

\$5.2M
Hardware



HAWAII
NSF EPSCoR
ADVANCING GEOGRAPHIC DIVERSITY IN STEM



'Ike (knowledge) Wai (water) -2016

Changing and Extreme Weather Incidents and Conditions, Growth & Sustainability

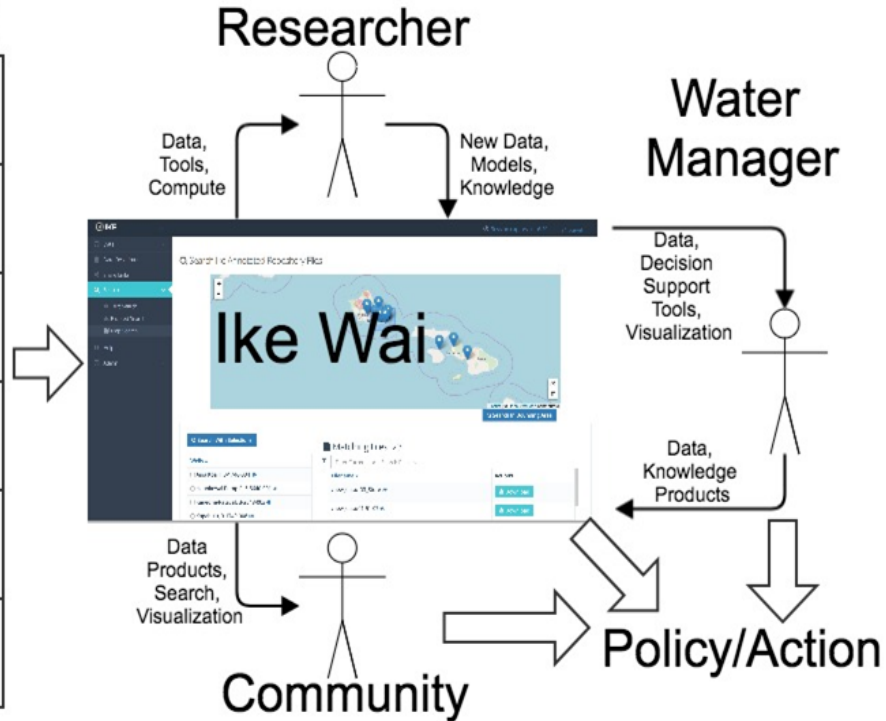
Science Gateway

Bring data, models, computation, analysis and visualization into one place

Enables decision and policy makers simpler access to better data and tools

Data

GeoPhysics
Geo-Chemistry
Rainfall
Well Monitoring
Agency Data
Legacy Data



UNIVERSITY OF HAWAII





Hawaii EPSCoR Technology Ecosystem



HAWAII
NSF EPSCoR
ADVANCING GEOGRAPHIC DIVERSITY IN STEM



Supporting Research, Education and Outreach With:

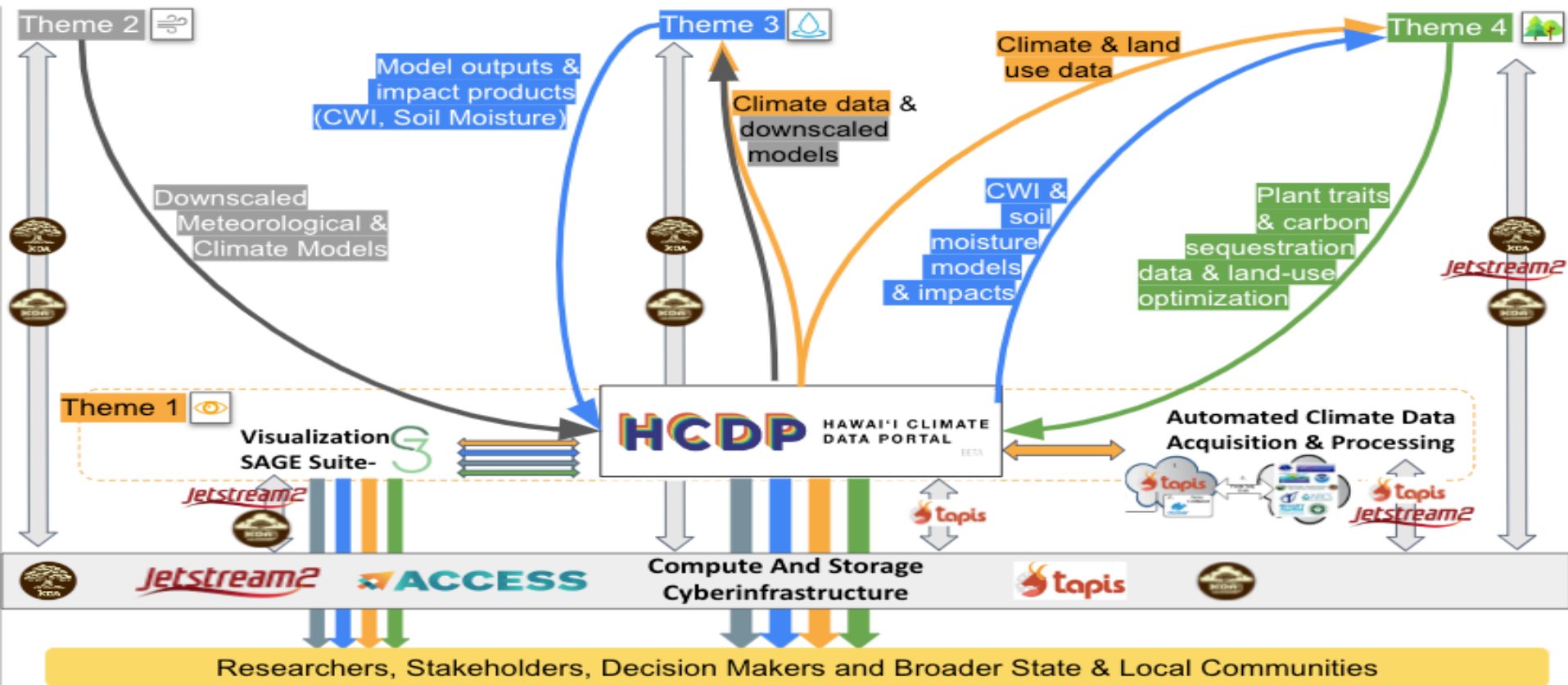
- Hardware, Networks, Middleware, Software and **People** (Facilitators, RSEs, DS)
- Open Source Software and Tools
- Previous Work & **Datasets**
- **National** and Local Resource Investments (HPC, HTC, Cloud)
- Reproducible Workflows and FAIR Support



Cyberinfrastructure: Interconnected Foundation



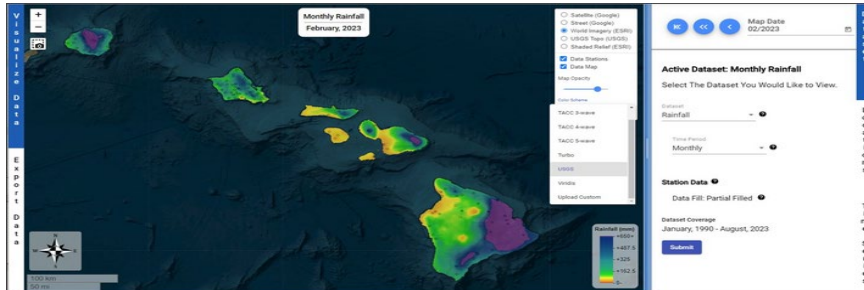
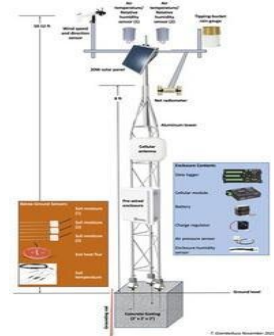
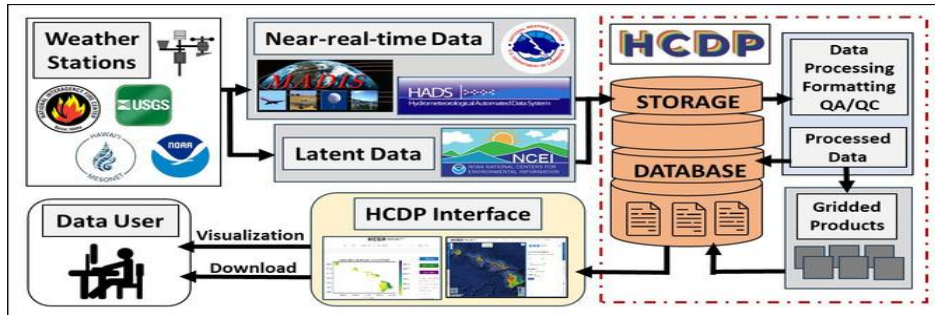
Atmospheric, Geophysics, Biologists and Computer Science domains



Hawai'i Climate Data Portal

Giambelluca, Longman, Lucas, Kodama, Cleveland, McLean, Geis, Wong

Goal: Create a 1-stop shop for all climate data for Hawai'i to serve researchers, educators, businesses, government & the general public.



66/100
New
Climate
Stations

Hawai'i Climate Data Portal

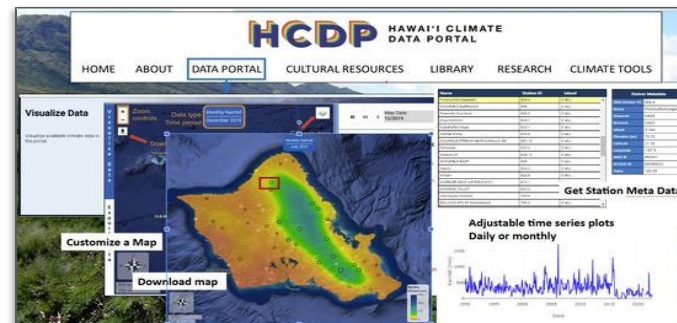


Datasets



105 Years
Monthly Rainfall
1,264 Maps

35 Years
Monthly/Daily
Temperature (Max, Mean,
Min)
> 39,000 Maps



35 Years
Monthly/Daily
Rainfall &
Temperature
Station Data

25 Years
Daily NDVI (Vegetation)
> 9,125 maps

23 Years
Daily/ Monthly
Relative Humidity
> 8,671 maps

Future Climate Projections
of Rainfall and
Temperature (2-Methods)
for
RCP 4.5 & 8.5

Hawai'i Climate Data Portal



HAWAII
NSF EPSCoR
ADVANCING GEOGRAPHIC DIVERSITY IN STEM



March 4, 2022 - May 6, 2025



HAWAII CLIMATE
DATA PORTAL
BETA

> 112K

Visitors

>258K

Visits

> 130

Countries

> 3.0M

API Requests

> 3.6K

Downloads

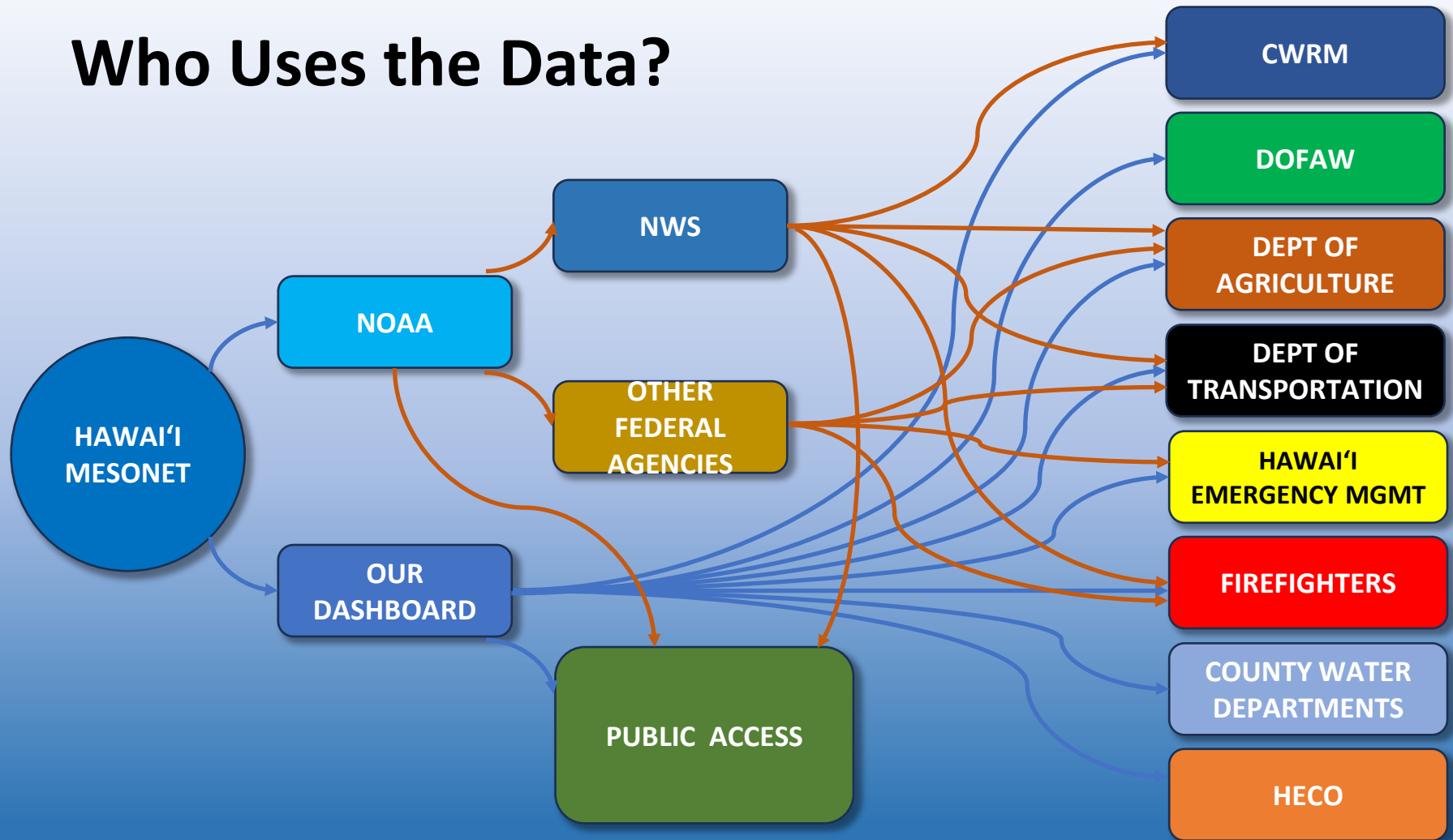
> 58.4M

Files Accessed

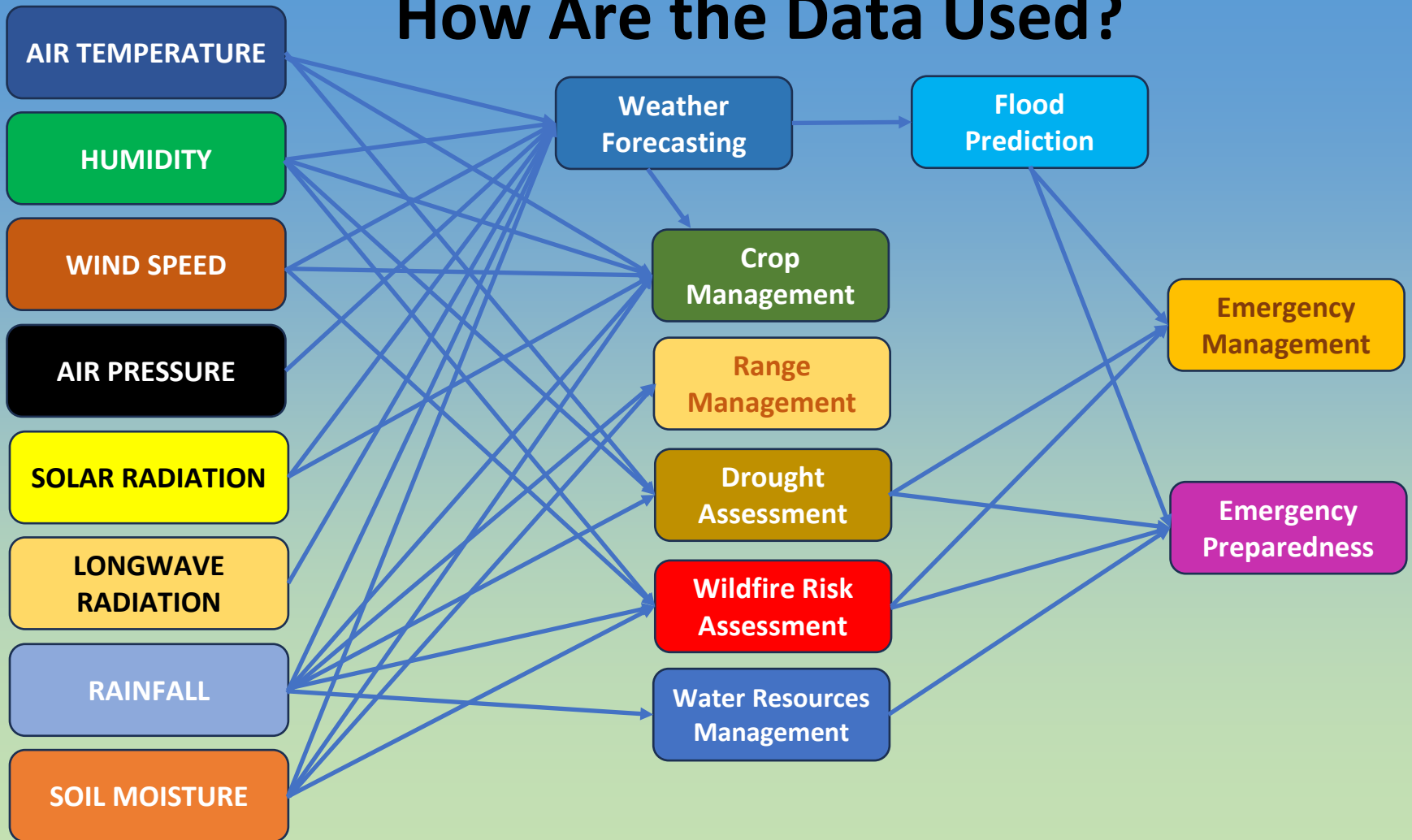
> 1.9TB

Downloaded

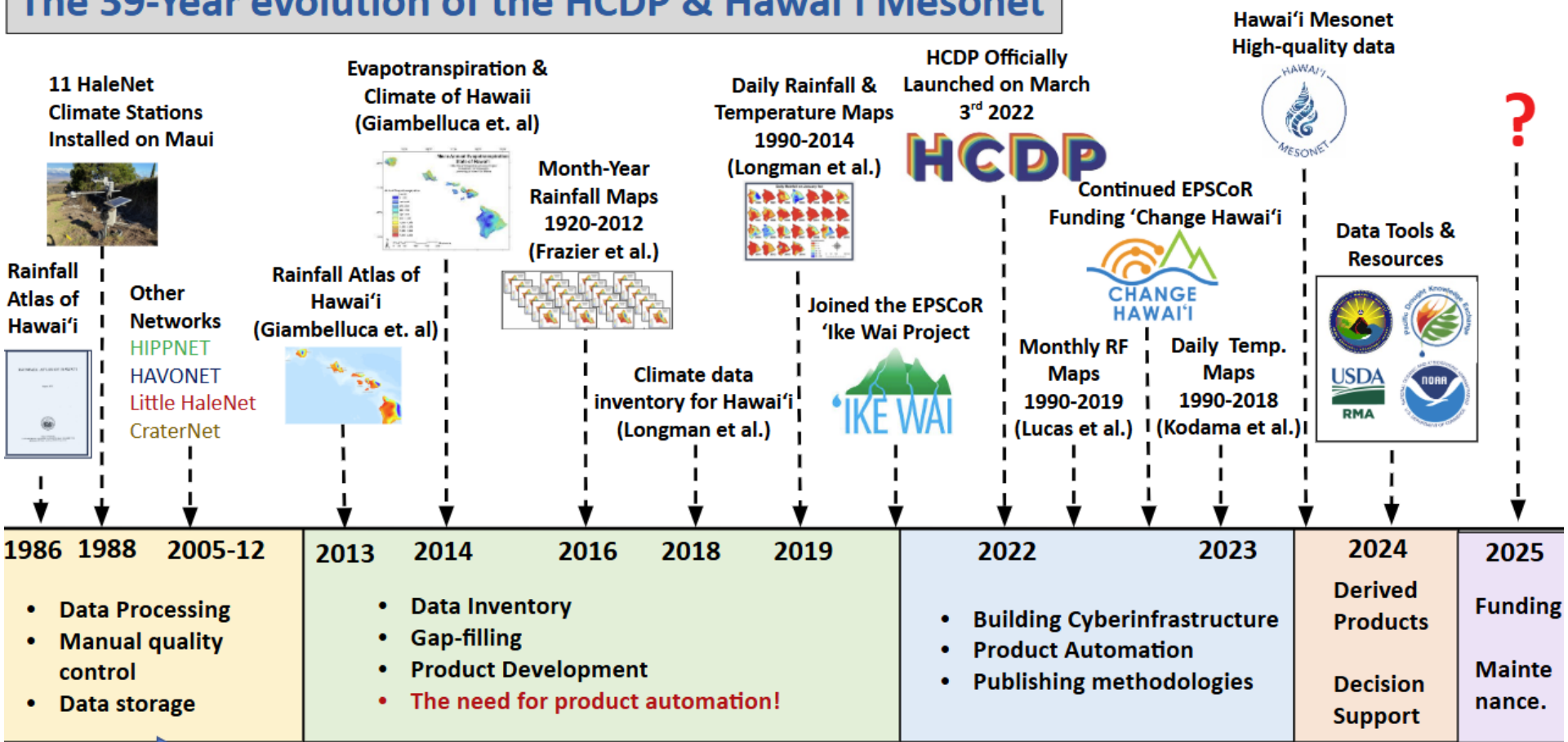
Who Uses the Data?



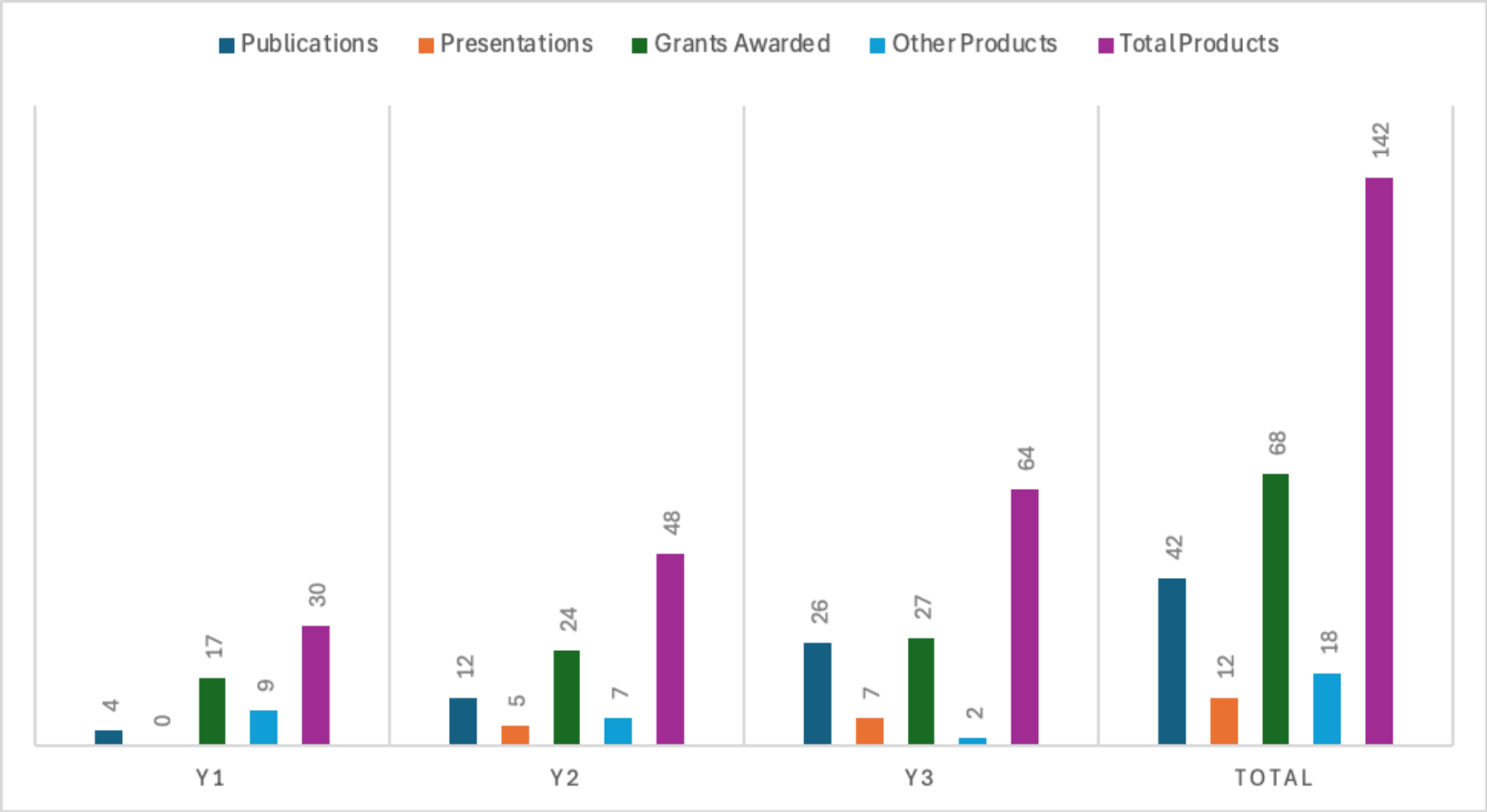
How Are the Data Used?



The 39-Year evolution of the HCDP & Hawai'i Mesonet

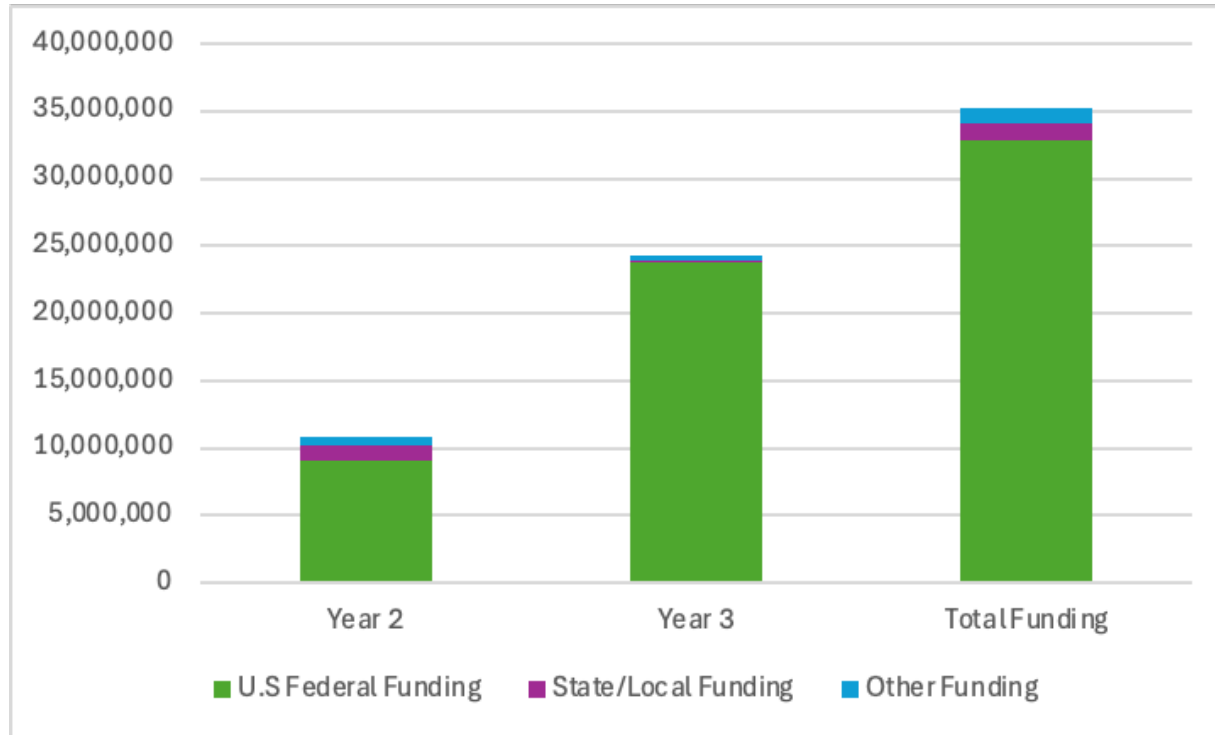


Publications, Presentations, Grants & Other Products (Years 1 -3)



Proportion of Total Federal, State & Local, and Private & International Funding Awarded (Years 2 & 3)

290% return on investment



SCIPE: Cyberinfrastructure Pacific Professionals (CI-PP) - Regional

NSF OAC #2417946 - \$6.5M



Led by the:

- University of Hawaii
- University of Guam (UoG)
- Chaminade University of Honolulu (CUH)
- Texas Advanced Computing Center (TACC)

Supports the enhancement of Cyberinfrastructure professional (CIP) capacity and training for research, education, practice and workforce in the **Hawaii/Guam** and **US Affiliated Pacific Islands (US-API)** region. **HIRE 3.5 Professional FTE-5 years**

Leverage CIPs, Graduate and Undergraduate students to enable researchers to adopt & leverage advanced local, regional and national CI

Build a shared regional model for sharing CIPs time and expertise as well as CI artifacts, materials and capacity.

Ability to Compete and Support More Research and Education

CI WORKFORCE & CAPACITY

Science Gateway

US-API

Hawaii & Guam

Regional
CI-PPs

TACC &
National CI
Resource &
Expertise

TACC

Hawaii

Guam

Stitching NSF CI projects together: a regional strategy for Team Science



SCOTTY STRACHAN, Ph.D.
Principal Research Engineer, NSHE-SCS
Nevada NSF-EPSCoR CI Lead & Track-1 co-PI
NSF-CC* PI, NSF-SCIPe PI, NSF-CSSI co-PI
Alumnus, Western Nevada Community College



Nevada System of Higher Education

Founded 1865



Administration

State Board of Regents (elected)
System Administration (Chancellor)
System Computing Services (CIO)



Eight Institutions

College of Southern Nevada
Desert Research Institute
Great Basin College
Nevada State University
Truckee Meadows Community College
University of Nevada, Las Vegas
University of Nevada, Reno
Western Nevada College



Nevada

7th largest state (110,557 sq mi)
9th least densely populated, 17 school districts
Driest, most mountainous state
80.1% Federally-managed land



Student Enrollment

106,366 students total

Fall 2023

22,007 total degrees awarded
2023-24



Employees

10,362 full time (2023)

5,546 part time (2023)

< 20 research-facing IT total



Research

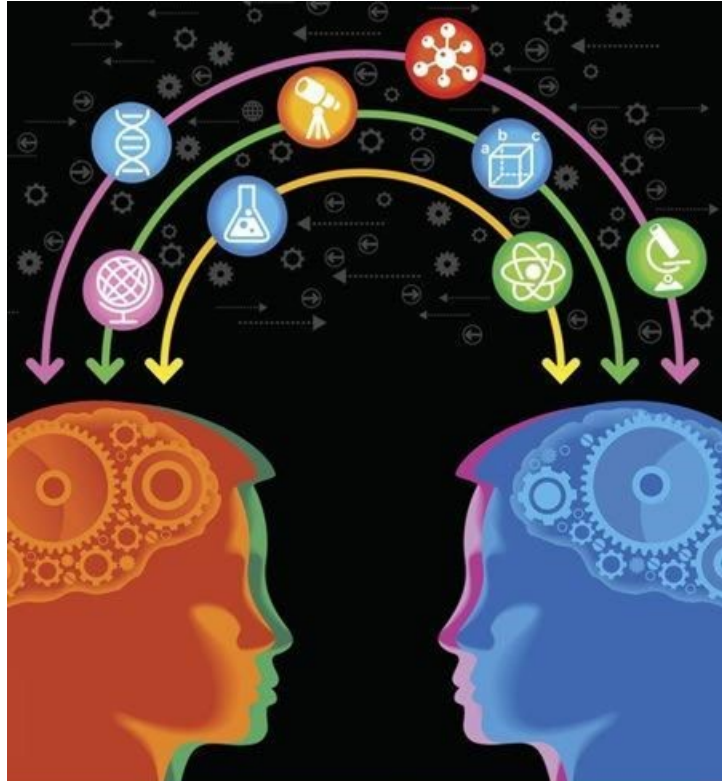
~1.51 doctoral degrees awarded per 100 FTE

\$302 million R&D expenditures (2021)

these are ~half of the national means for a single R1



Team Research in Nevada:



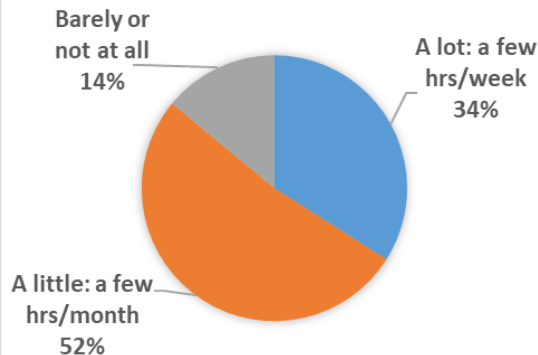
- **Brings students together** across disciplines
- Prepares students with **skills cross-training**
- Crosses **administrative boundaries**
- Is often **regional in scope**
- Produces data products **useful to communities**
- Requires **low-friction interoperable technology** (networks, identity, security, software, etc)

CAMPUS DISCOVERY

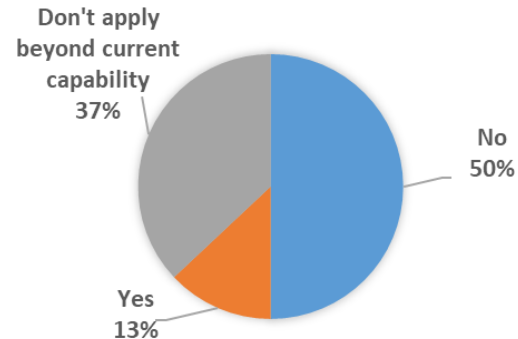
*current state of research IT
support?*

[faculty surveys indicate
significant technical debt]

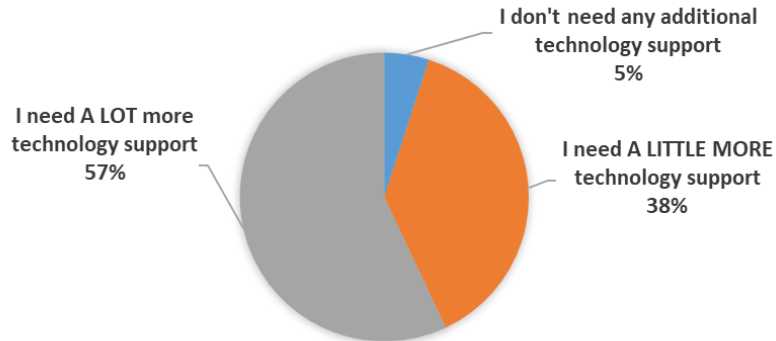
RESEARCH TIME SPENT MAINTAINING BASIC TECHNOLOGY



HAVE YOU BEEN TURNED DOWN FOR FUNDING BECAUSE OF TECH CAPABILITY LEVEL?



WOULD ADDITIONAL TECHNOLOGY SUPPORT CONTRIBUTE TO YOUR RESEARCH SUCCESS?



What is the role of THE IT ORGANIZATION in Research & Education?

Campus-level “business” friction
is a total buzzkill for team
science & collaboration.

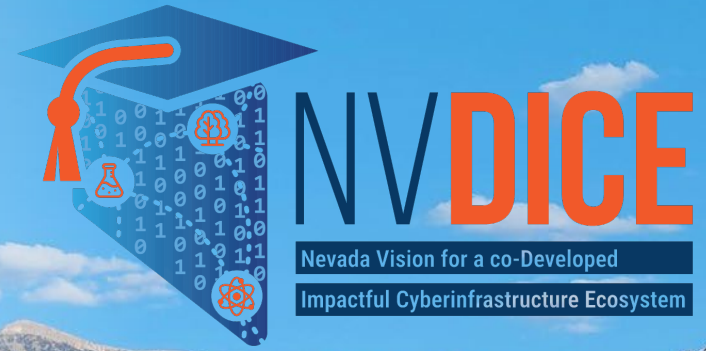
We lose excellent faculty
members every year to other
states because of this.

CC*Campus & Regional
projects (w/ EPSCoR \$\$!) are
perfect frameworks for IT orgs
to assist with RCD foundations
within and across institutions.



1st Nevada Higher-Education Research Technology Strategy Workshop

April 24-25, 2025

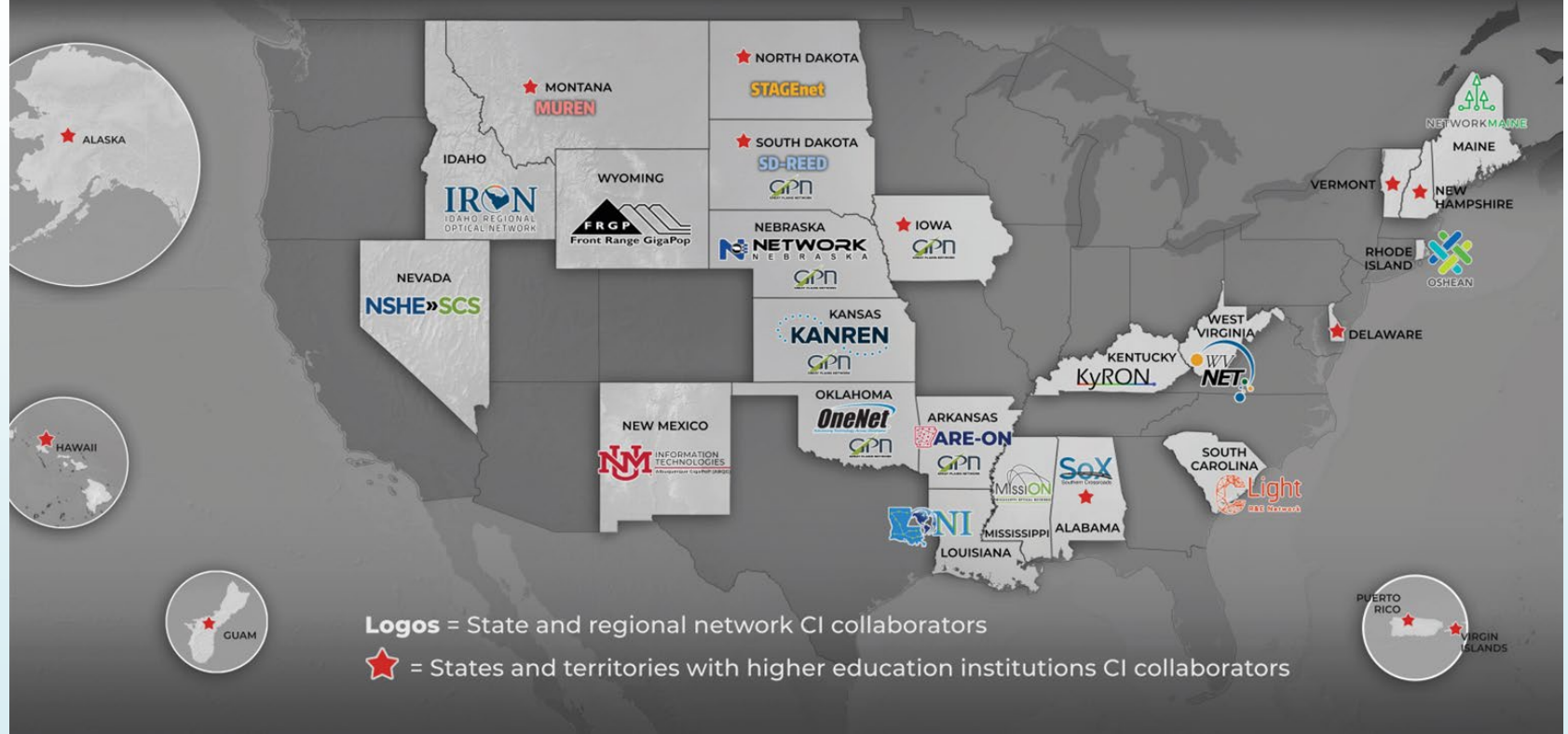


Welcome! Day 1



The NV-DICE project is sponsored by the
U.S. National Science Foundation
CISE-OAC-CC*-CIRA Award #2346263

CI COLLABORATORS IN EPSCoR STATES



Exploratory/Discovery

Campus HPC (R1)

EPSCoR T1 CI Component ★

MRI GPU cluster (R1)

CI-CI cybersecurity (R1)

Intentional Alignment

★ CSSI elements

★ EPSCoR T1 CI evolution

★ CC* Network (R1)

EPSCoR workshops

CC* Compute (R1)

Nevada's NSF CI Journey (partial)

MRIs (R1)

EPSCoR E-Rise(s)

SCIPe Collab (R1)

CC* Data (R1)

Organized Strategy

CC* Plan (regional)

CC* Regional

★ EPSCoR T1 CI integration

EPSCoR E-Core

★ SCIPe Team (regional)

CC* PUI

★ Leveraged common CI domain expertise &
field science infrastructure

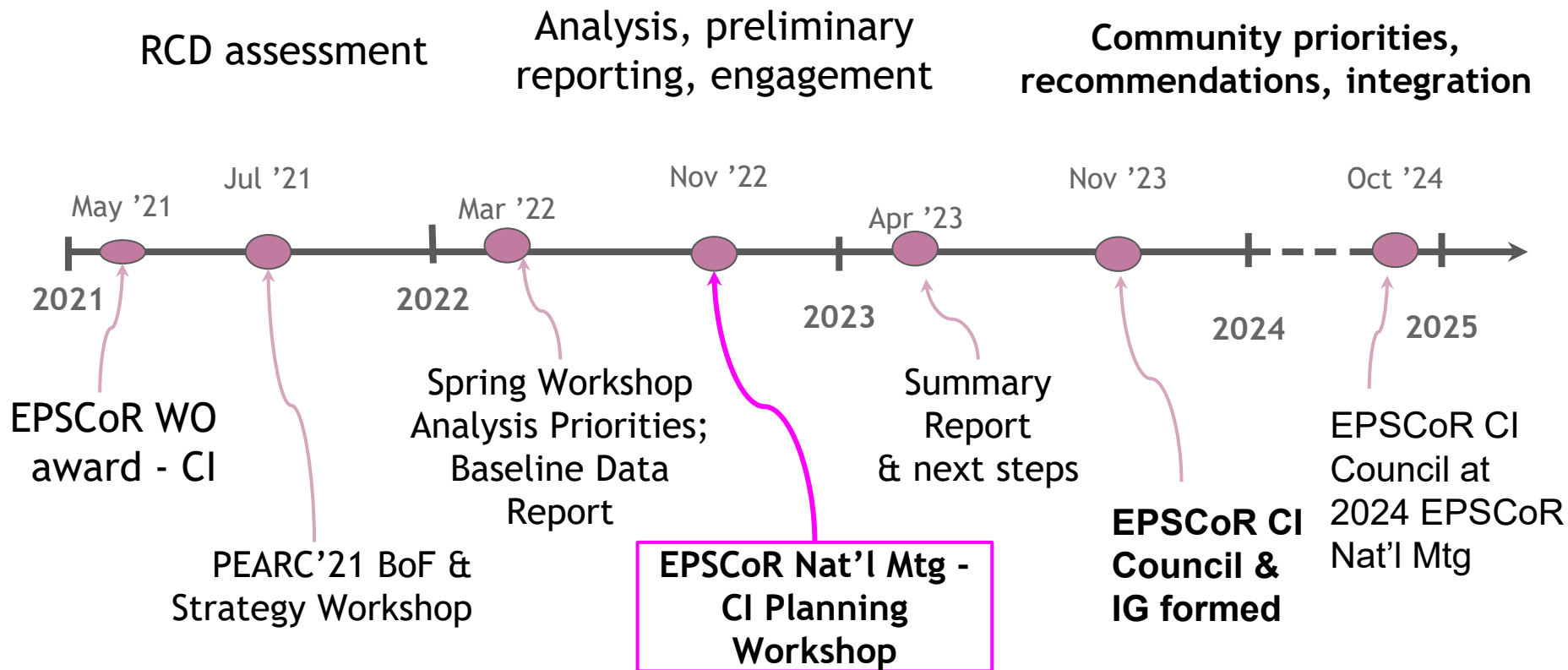
Y-10

Y-5

Y0

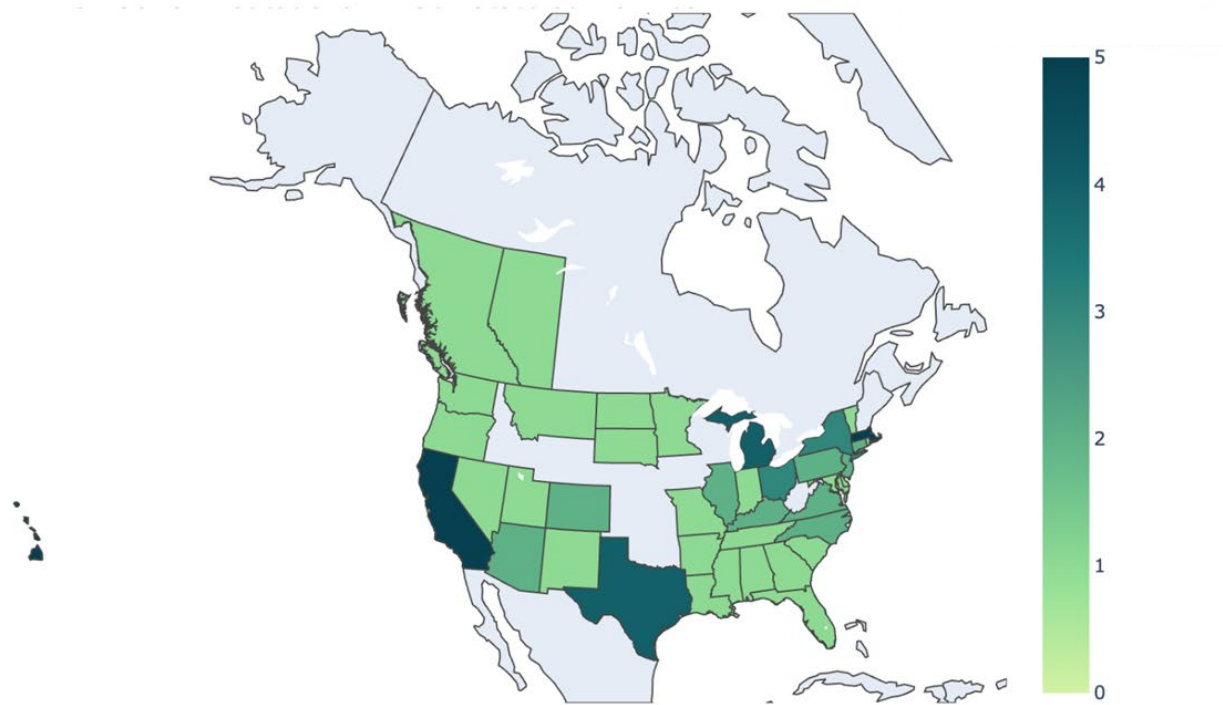
Y+5

NSF EPSCoR CI Group Timeline, 2021-present



2020 - 2025: 20 EPSCoR institutions; 73 institutions total contributed data

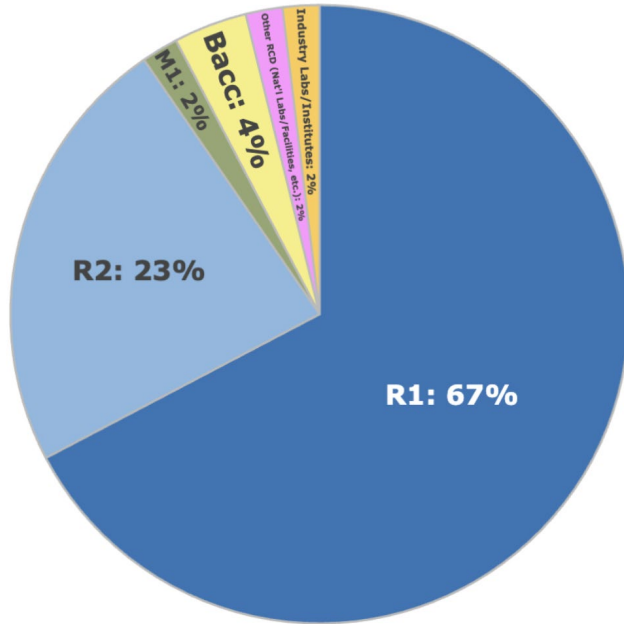
Geographic Distribution of 73 Contributors



2020 - 2025: R1s are the primary contributors

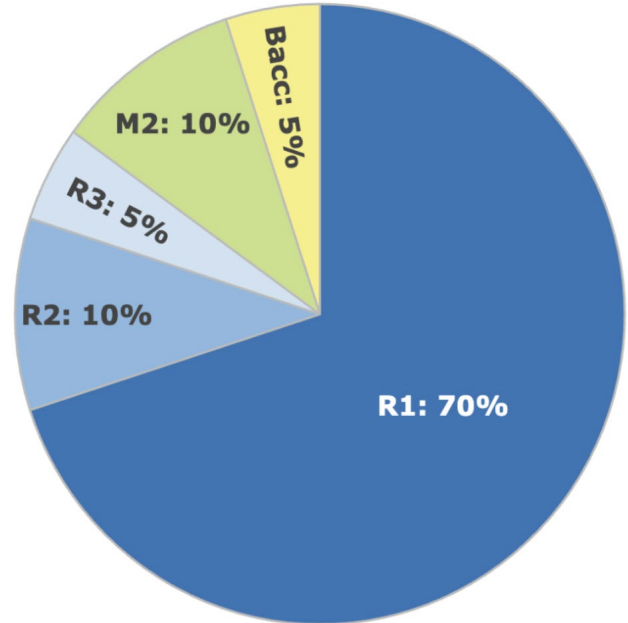
Non-EPSCoR Institutions

Institutional Classification of 52 Contributors



EPSCoR Institutions

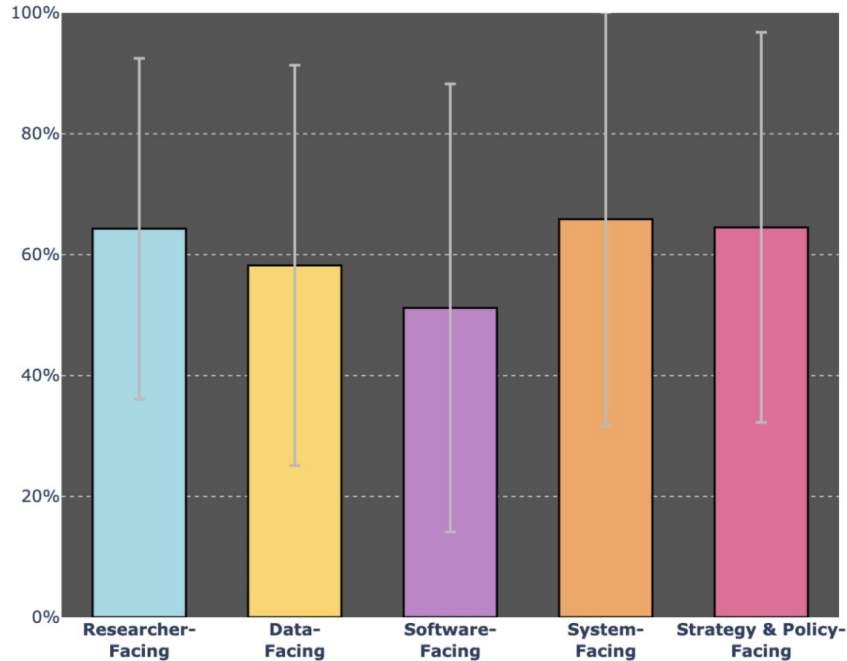
Institutional Classification of 20 Contributors



2020 - 2025: EPSCoR institutions lag behind non-EPSCoR institutions in CI

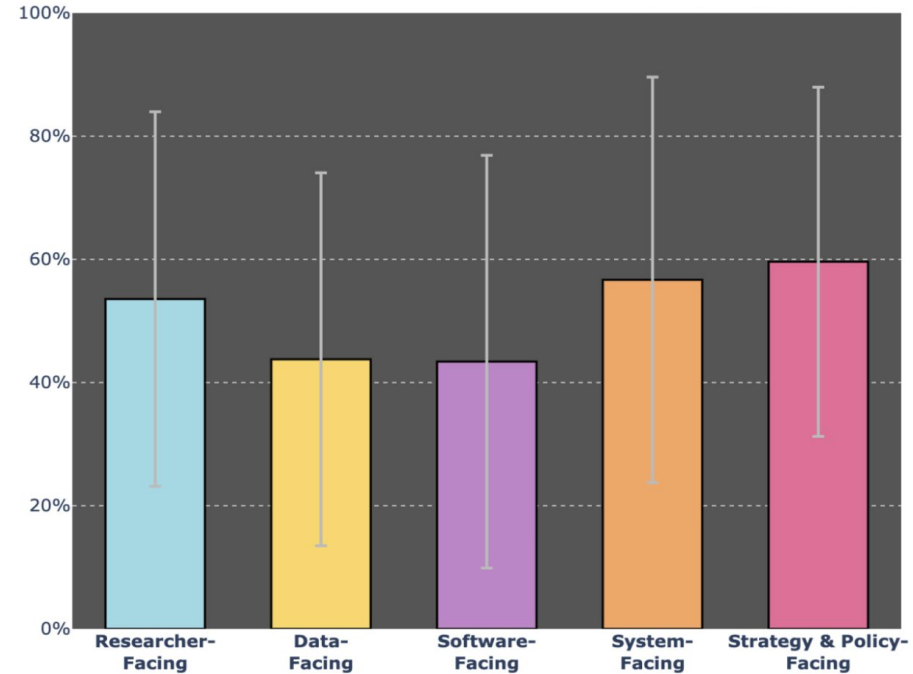
Non-EPSCoR Institutions

Summary for All Facings (52 Institutions)



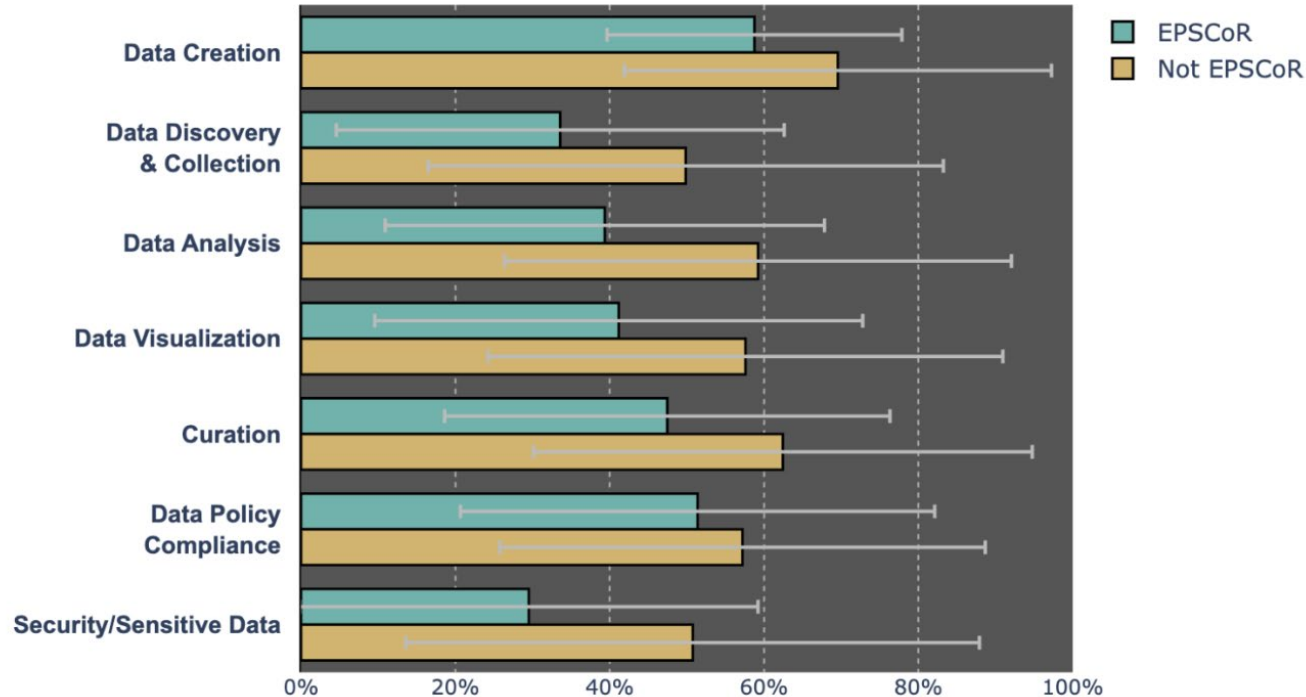
EPSCoR Institutions

Summary for All Facings (20 Institutions)



2020 - 2025: Variance provides the foundation for future partnerships

Data-Facing Topics by EPSCoR status (73 Institutions)



Baseline data creates an opportunity to share & coordinate CI/RCD planning & implementation approaches

Objectives
Strategies
Leading practices
Expertise
Lessons learned
Multi-institution proposals
Common language
Recommendations to EPSCoR



Use this to coordinate/strengthen your state's RCD planning and infrastructure proposals!

EPSCoR Cyberinfrastructure (CI) Interest Group



Who we are:

- CI/RCD professionals, CI leadership, CI-adjacent faculty/staff in EPSCoR Jurisdictions
- EPSCoR CI co-PI's, Senior Personnel for RII-type grants, regional RCD coordinators

*we also welcome folks who come from generally under-resourced or coordination-challenged academic regions/institutions

What we discuss:

- Common **cultural**/operational CI/RCD **challenges**/opportunities
- **Needed** communication **messaging** to Jurisdiction leaders, funding agencies
- **Sharing practices**, things that worked for EPSCoR projects
- Connecting people across jurisdictions to **create** collaboration **opportunity**

Background on EPSCoR:

<https://new.nsf.gov/funding/initiatives/epscor>



EPSCoR CI Interest Group

When we meet:

~Ad hoc Interest Group calls
& CI Council & Chairs calls

How to get involved:

- <https://carcc.org/epscor-ci/>
- epscor-ci-team@carcc.org

Group leaders:

- Venice Bayrd, Montana State University Library, venice.bayrd@montana.edu
- Sean Cleveland, University of Hawai'i, seanbc@hawaii.edu
- Scotty Strachan, Nevada System of Higher Education, sstrachan@nshe.nevada.edu



Three provocations

EPSCoR jurisdictions have fewer resources and the same or increased overhead - imperative to turn this around to become competitive. So need to overcome these challenges in team science in regional and institutional infrastructure:

1. **Technology capability gaps between Industry & Higher Ed are widening.**

Gaps are intensified within EPSCoR jurisdictions due to lagging institutional I.T. investment.

1. To survive as effective centers of STEM education, **institutions need a sharpened focus on developing modern technology expertise, capabilities, and partnerships.**

National “best practices” in Cyberinfrastructure development show that solo institutions can’t possibly “cover all the bases” needed in Research I.T.

1. **EPSCoR cultures** of regional cooperation, Team Science approaches, and integration of students in STEM research **promote the collaborative environment needed to evolve CI, and with it, research and education.**

Thank you!