

An aerial photograph of a vast, mountainous landscape. The foreground and middle ground are dominated by rolling hills and valleys covered in dense, vibrant autumn foliage in shades of yellow, orange, and green. A winding river flows through the lower part of the scene, its path curving through the terrain. In the background, dark, rugged mountains rise against a bright blue sky filled with scattered white clouds. The overall scene is one of natural beauty and tranquility.

RESTORING BALANCE TO THE EARTH

Guiding Conservation Actions Now and for the Long View

Breece Robertson

September 5, 2024

My favorite places...



San Juan River, Utah



Wilson Peak, Colorado

Collaboration - Accessibility - Inclusiveness



UCLA CENTER FOR HEALTH POLICY RESEARCH

Health Policy Brief

March 2013

Physical Activity, Park Access and Park Use among California Adolescents

Susan H. Babey, Joelle Wolstein, Samuel Krumholz, Breece Robertson, Allison L. Diamant





WE ARE
EXPERIENCING
UNPRECEDENTED
TIMES IN HISTORY

An aerial photograph of a suburban residential development. The houses are arranged in a grid-like pattern with winding streets. Many houses have swimming pools. A large white circle with the number '1' inside is overlaid on the left side of the image. The background shows a dry, sandy landscape with some sparse vegetation.

1

**DISAPPEARANCE
OF NATURE**



2

CLIMATE
CHANGE



3

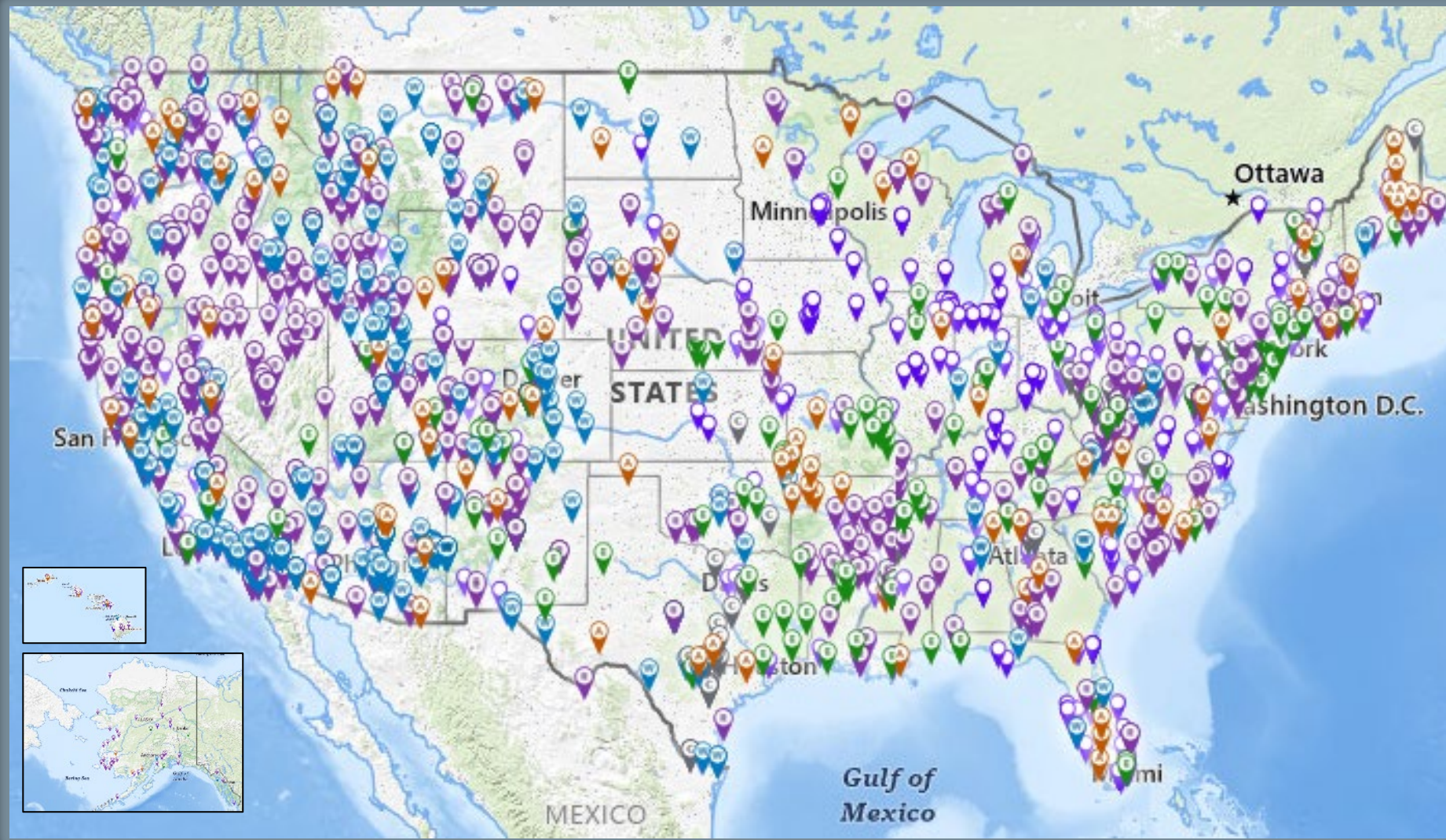
**INEQUITABLE ACCESS
TO THE OUTDOORS**

1 TRILLION *IN FUNDING* CREATED

- Land and Water Conservation Fund – 900m/year
- Infrastructure Investment and Job Act – 550 Billion
- Inflation Reduction Act – 700+ Billion
- America the Beautiful (30 x 30) – 1 Billion
- Justice40 Initiative



Tracking Impacts – Conservation.gov



Bipartisan Infrastructure Law (BIL) Restoration and Resilience Projects

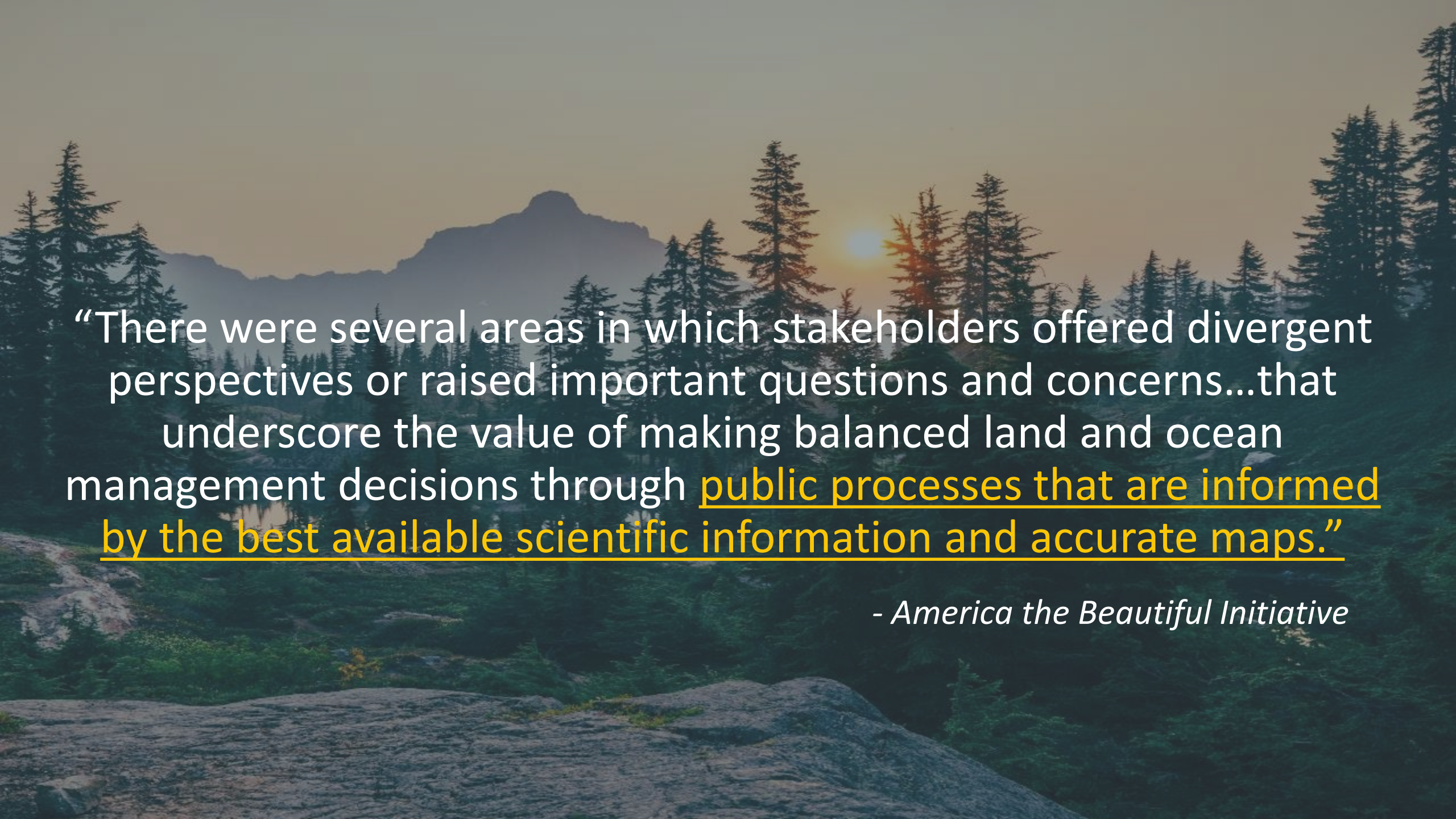
- R** Resilience and Ecosystem Restoration
- W** Water Infrastructure
- E** Environmental Remediation
- A** America the Beautiful Challenge Grants
- C** Clean Energy and Power

Inflation Reduction Act Projects

- P** (Purple Pin)

[LINK](#)

Bipartisan Infrastructure Law Restoration and Resilience Projects and Inflation Reduction Act Projects



“There were several areas in which stakeholders offered divergent perspectives or raised important questions and concerns...that underscore the value of making balanced land and ocean management decisions through public processes that are informed by the best available scientific information and accurate maps.”

- *America the Beautiful Initiative*

America the Beautiful Since 2021

41 million
acres of land
and water
conserved

5 new
national
monuments

4 new
national
wildlife
refuges

4.3 million acre
expansion of
private working
lands

9 million acres
of restoration of
protections in
Tongass NF

500k acres of new
ranch, farms and
forest conservation
easements



Scaled Quail Covey
Credit: Deb Whitecotton





State & Local Actions – Protect Wildlife Connectivity in Local Plans

Aug 28, 2024 • Written By Gillian Roy

California Senate Moves to Improve Wildlife Connectivity With Room to Roam Act

August 27, 2024 – PRESS RELEASE

CONTACT

Mari Galloway, Wildlands Network, (209) 373-9973,
Email: mari@wildlandsnetwork.org

J.P. Rose, Center for Biological Diversity, (408) 497-7675, Email: rose@biologicaldiversity.org

SACRAMENTO, Calif.— The California Senate passed a bill today that would require cities and counties to protect wildlife connectivity in their land-use plans. The Room to Roam Act, Assembly Bill 1889, directs local officials to minimize harm to wildlife movement as part of their long-term planning and offers development guidelines such as incorporating wildlife-friendly fencing and lighting.



Credit: CALTRANS

The difference “right location” makes

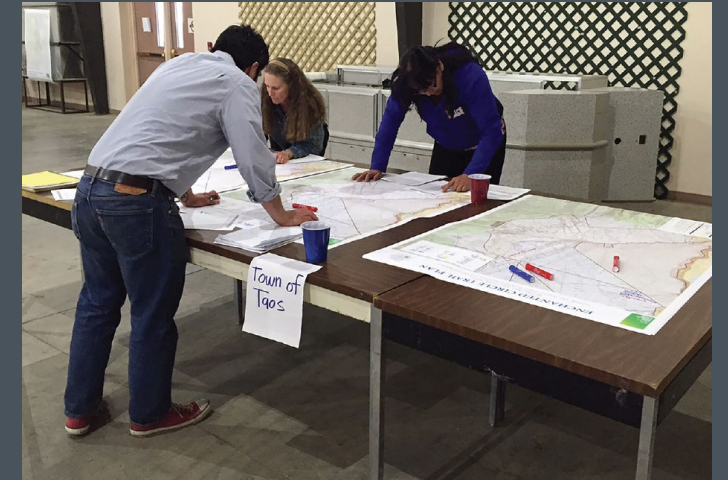



Green Schoolyards - New York PS7X
Courtesy of The Trust for Public Land



Los Angeles Green Alleys
Courtesy of The Trust for Public Land

Engaging communities & diverse partnerships unearths deep collective knowledge and guides collaborative and holistic investments



The background is an aerial photograph of a vast, dense forest covering rolling hills. In the center of the image, there is a circular graphic with a black border. Inside this circle is a close-up of a thick, braided rope, likely made of natural fibers, with a mix of green and brown tones. Surrounding this central circle are four light-yellow, semi-transparent oval callouts, each containing text. The callouts are positioned at the top, left, right, and bottom of the central circle.

**Tribal and
Indigenous
Leadership &
Stewardship**

**Traditional
Ecological
Knowledge**

**Equitable
Community
Engagement**

**Western
Science, Data
and Practices**

Policy Context: Indigenous Stewardship & Traditional Ecological Knowledge

2021

2022

2023

2024

2025
& Beyond

- Justice40 Initiative
- Memorandum on “Indigenous Traditional Ecological Knowledge and Federal Decision Making”

- Executive Order 14072: “Strengthening the Nation’s Forests, Communities, and Local Economies”
- Memorandum on “Indigenous Knowledge Guidance for Federal Agencies”
- Joint Secretarial Order 3403: “Fulfilling the Trust Responsibility to Indian Tribes in the Stewardship of Federal Lands and Water”

- National Forest Plan Amendment to Conserve and Steward Old Growth Forests
- Inventory of forests, threat analysis, Climate Risk Viewer

- Tribal Roundtables for National Old Growth Amendment

- TBD:
- Recommendations
 - Funding
 - Planning, Design and Science
 - Implementation

Traditional Ecological Knowledge



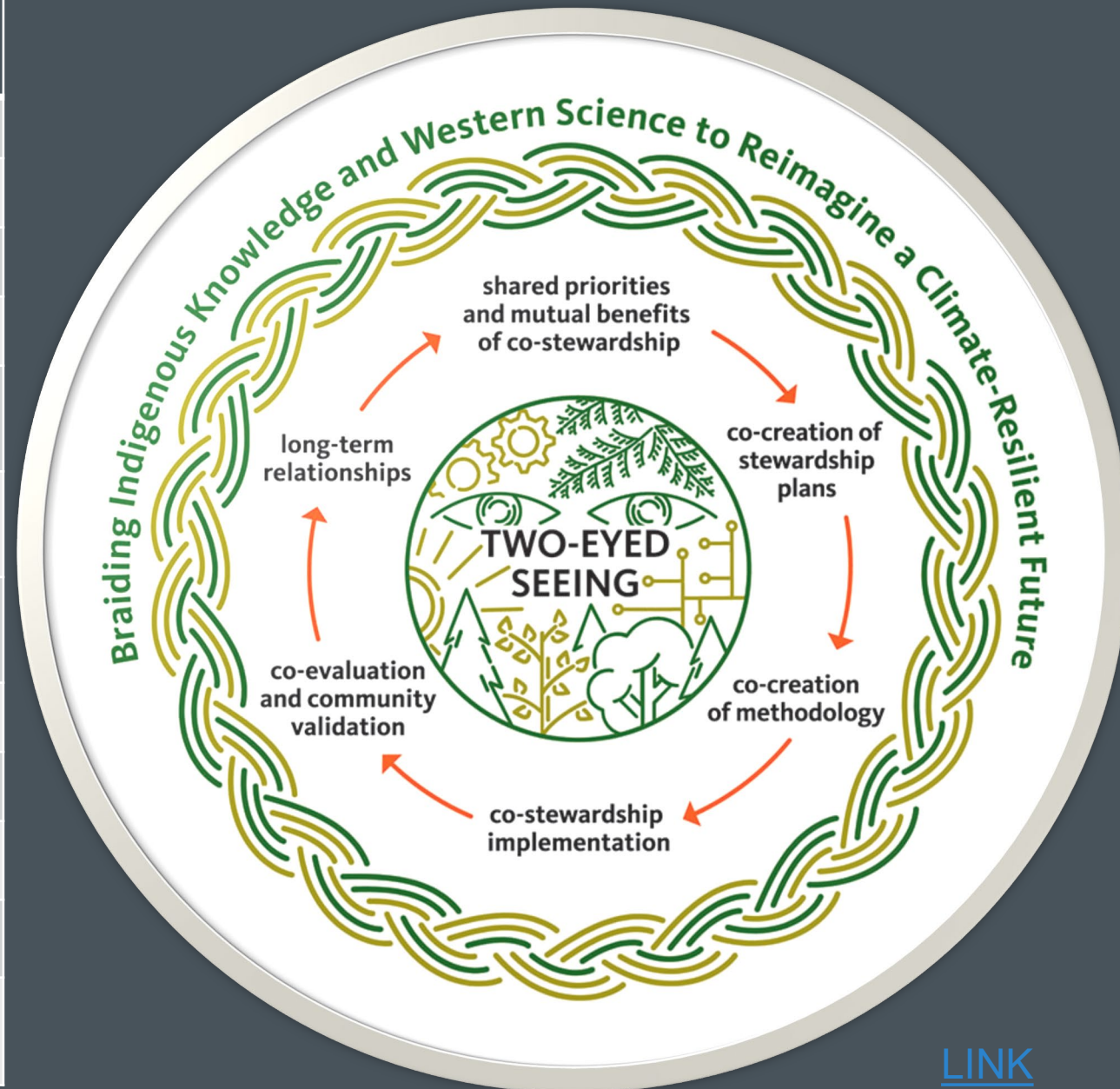
Swinomish tribal members from Washington state participate in a clam garden restoration in British Columbia. PHOTO COURTESY OF SWINOMISH INDIAN TRIBAL COMMUNITY ([ARTICLE](#))

Traditional Ecological Knowledge, also called by other names including Indigenous Knowledge or Native Science, (hereafter, TEK) refers to the evolving knowledge acquired by indigenous and local peoples over hundreds or thousands of years through direct contact with the environment.

This knowledge is specific to a location and includes the relationships between plants, animals, natural phenomena, landscapes and timing of events that are used for lifeways, including but not limited to hunting, fishing, trapping, agriculture, and forestry.

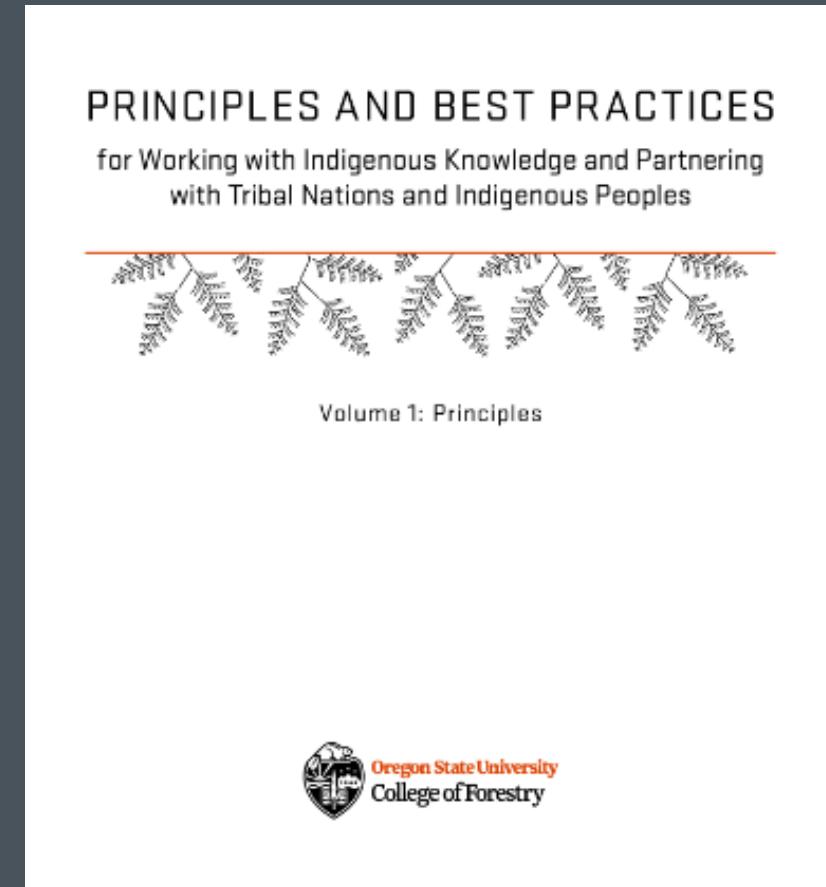
[USFWS TEK Factsheet](#)

Traditional Ecological Knowledge	Western Science
Abstract	Concrete
Qualitative	Quantitative
Inclusive	Exclusive
Intuitive	Intellectual
Diachronic (long-duration, intergenerational)	Synchronic (short time-series, broad generalities)
Humans as part of nature	Humans separate from nature
Community data	Outside scientific specialists' data
Holistic	Linear
Matriarchal	Patriarchal
Value-driven	Unbiased
Part of daily life	Aristotelian hypothesis testing
Expansive	Reductionist



Tribal and Indigenous Partnerships & Indigenous Knowledge

- Acknowledge historical injustices including genocide, ethnocide, and ecocide.
- Practice early and sustained engagement with Tribal Nations and Indigenous knowledge holders.
- Earn and maintain trusting relationships by being transparent, open, and honest.
- Respect different processes and worldviews.
- Recognize, respond to and adapt to challenges with cultural humility.
- Support co-stewardship and co-management partnerships.
- Support co-production of knowledge.
- Provide ample funding to Indigenous Peoples for involvement at each step.
- Share power and decision-making authority with Tribal Nations and Indigenous Peoples.



[Traditional Ecological Knowledge Lab](#)
[Link to Paper](#)

“Stories make it memorable...

Data makes it credible”



VICTORIA'S VOLCANIC
HISTORY CONFIRMS THE
STATE'S ABORIGINAL
INHABITATION BEFORE 34,000
YEARS

New techniques for dating volcanic eruptions, a lone axe and Indigenous oral traditions give us a new minimum age for human occupation in Victoria

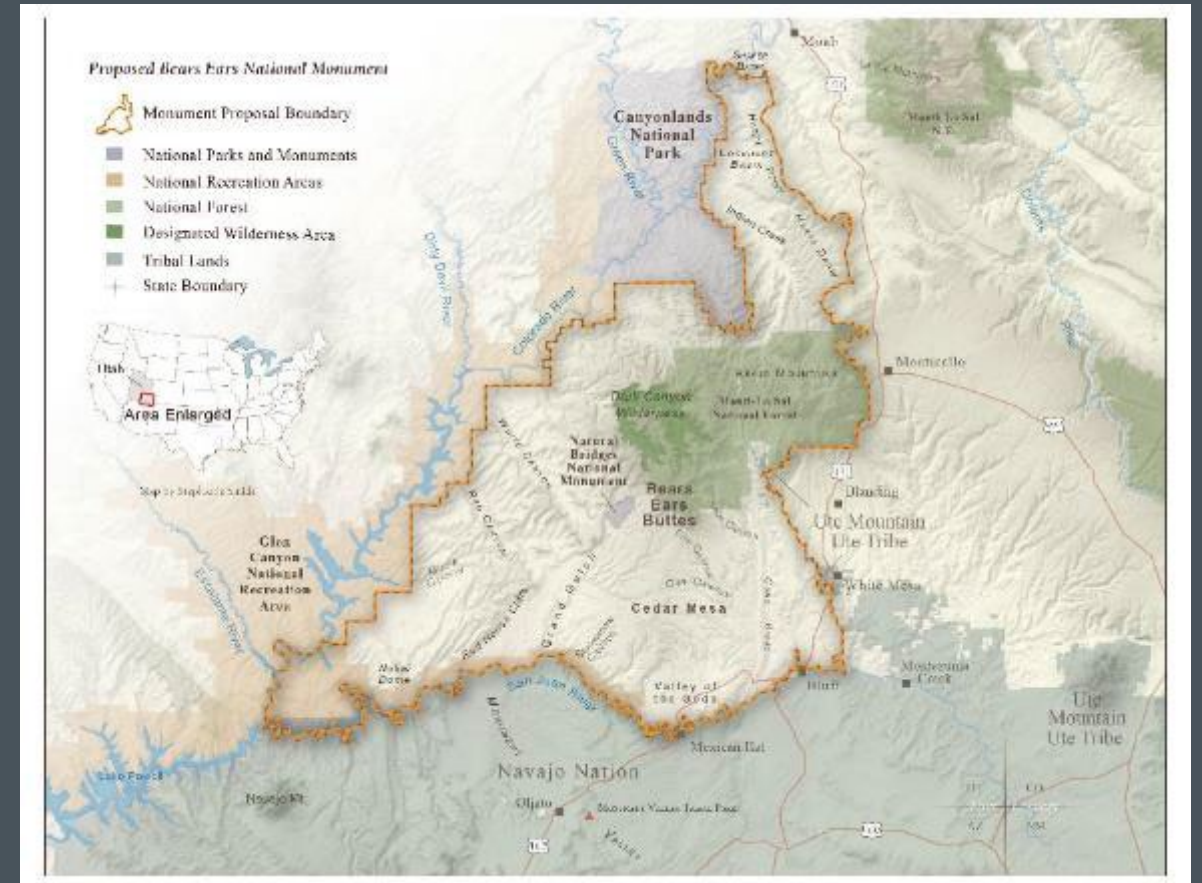
We need the old stories &
we need new stories.

Things are changing rapidly.

Technology helps us see
what we can't see or
perceive.

The Important Role of Maps

Maps provide context, continuity, document historical changes, are visual storytelling devices and provide a different kind of discourse for understanding issues.



Courtesy of Stephanie Smith, Grand Canyon Trust

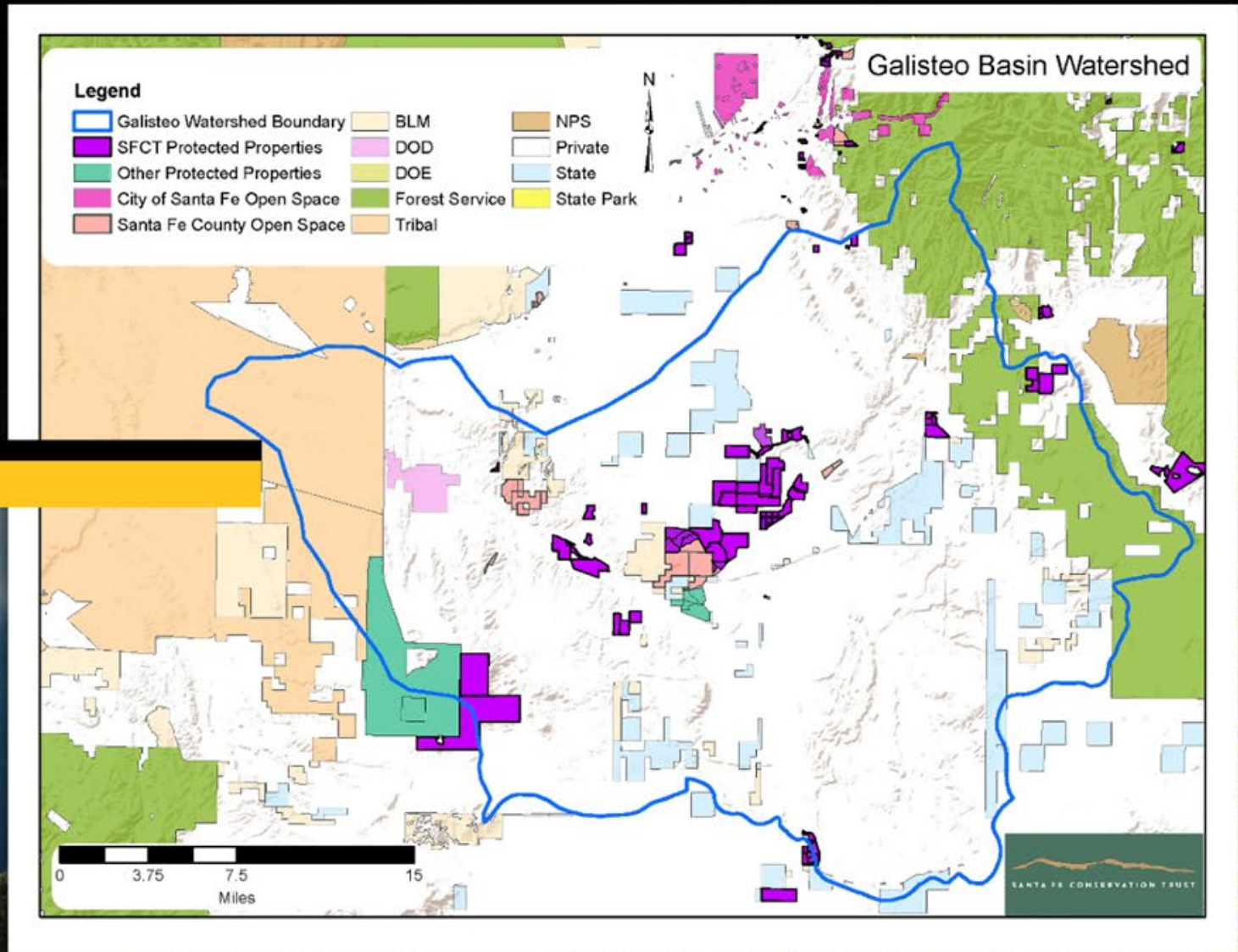
LOCAL ACTIONS, *BIG GOALS*

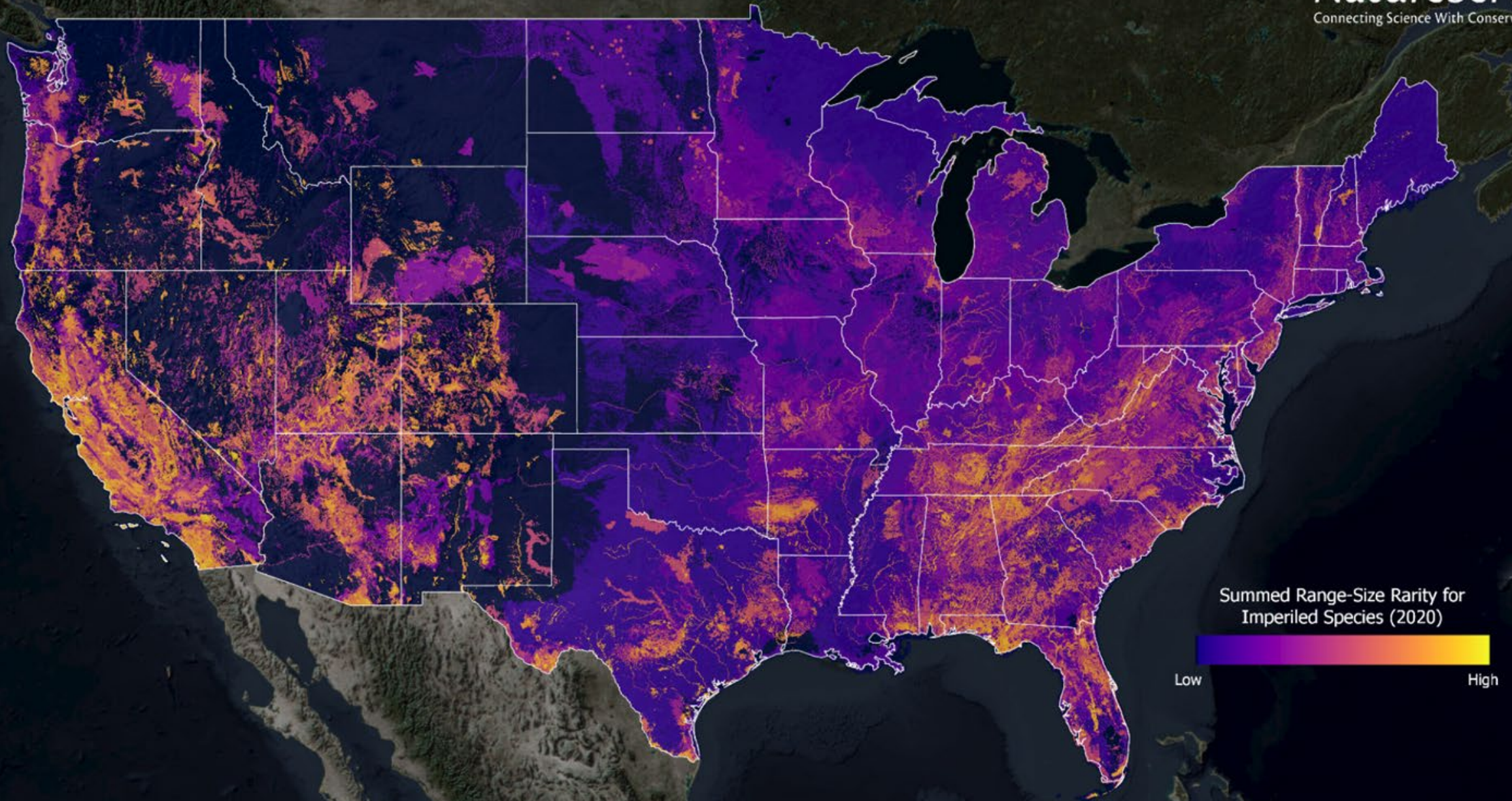
The Western Wildway

Partners working to connect wildlife habitat along the Spine of the Continent

Western Wildway Conservation Planning Boundaries

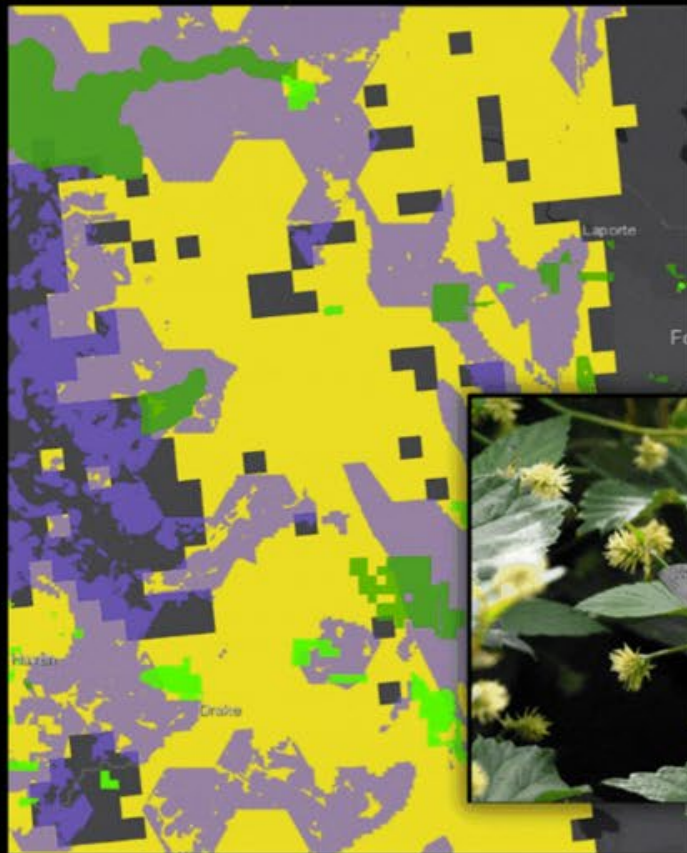
- Brooks - Richardson Ranges
- Taku River
- Yellowstone to Yukon
- Greater Crown of the Continent
- Heart of the West
- Southern Rockies
- Colorado Plateau
- Grand Canyon
- New Mexico Highlands
- Sky Islands
- Sierra Madre
- Western Wildway



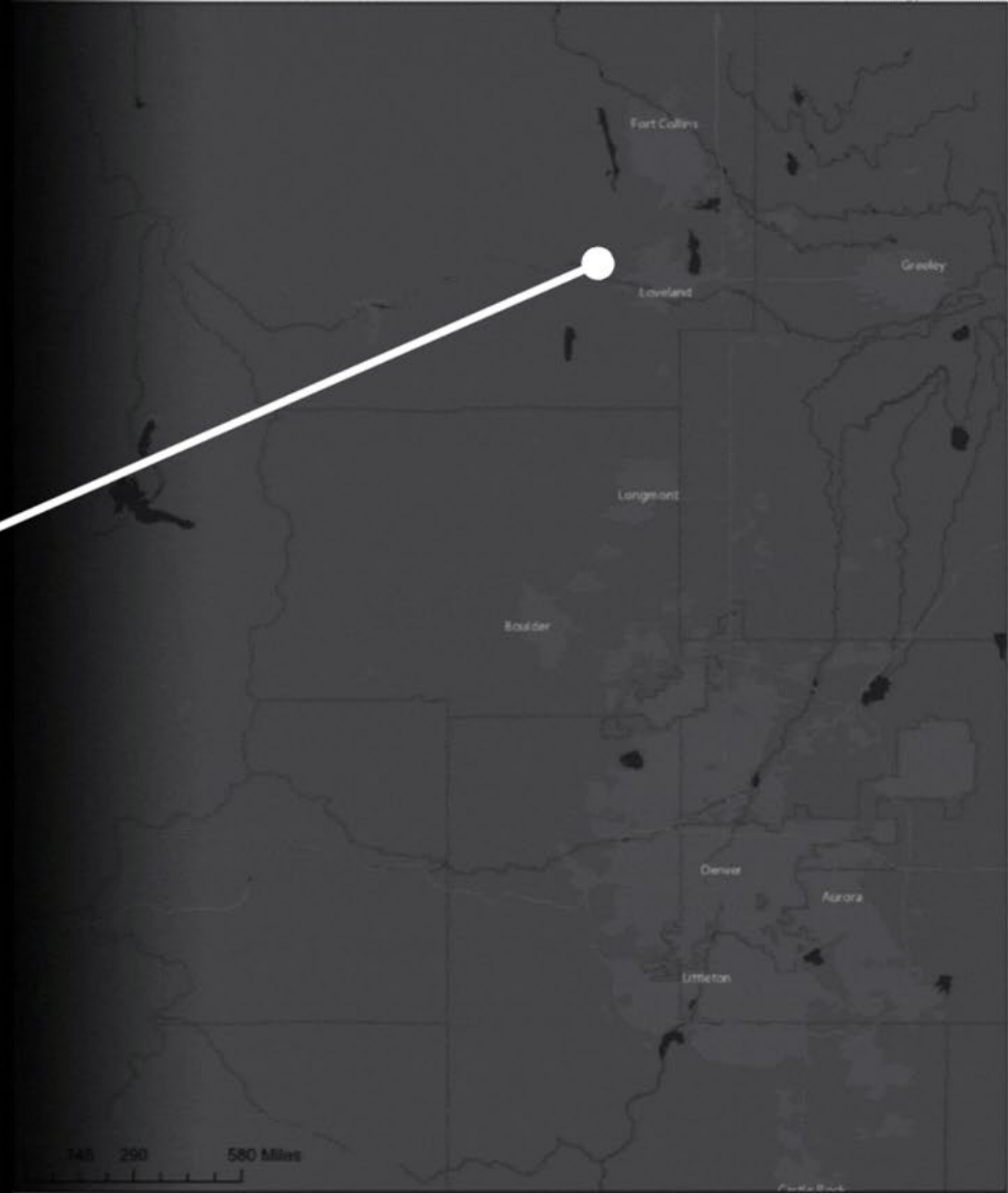


A CLOSER LOOK AT WHAT'S AT

STAKE



Hops Azure
(*Celastrina humulus*)
G2 Imperiled



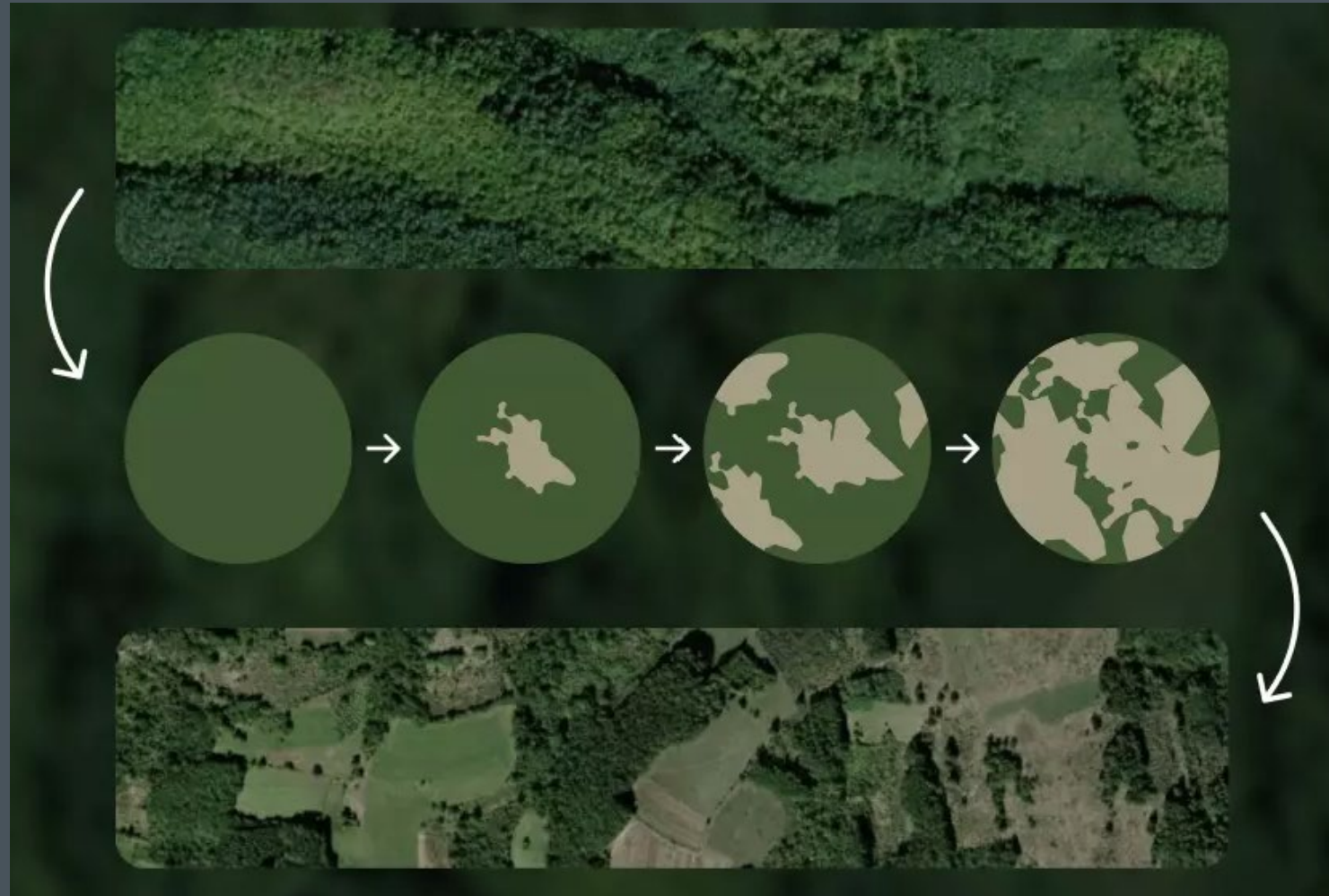
Healthy Forests & Ecosystems vs. Fragmentation & Disturbance



Max Whittaker



Mark Bult



Courtesy of EOS Data Analytics



Max Whittaker



Kyle Cooper

Digital Monitoring, Reporting and Evaluation



SELF REPORTED
DATA



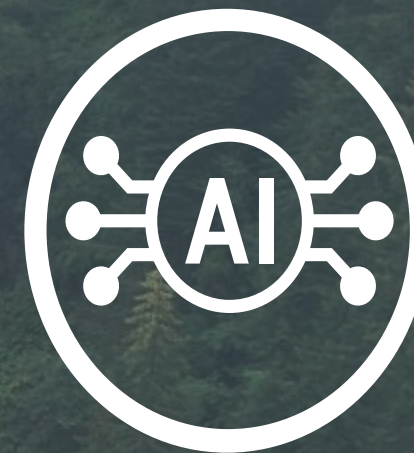
DRONE &
SATELLITE
IMAGERY



DATA
INFRASTRUCTURE



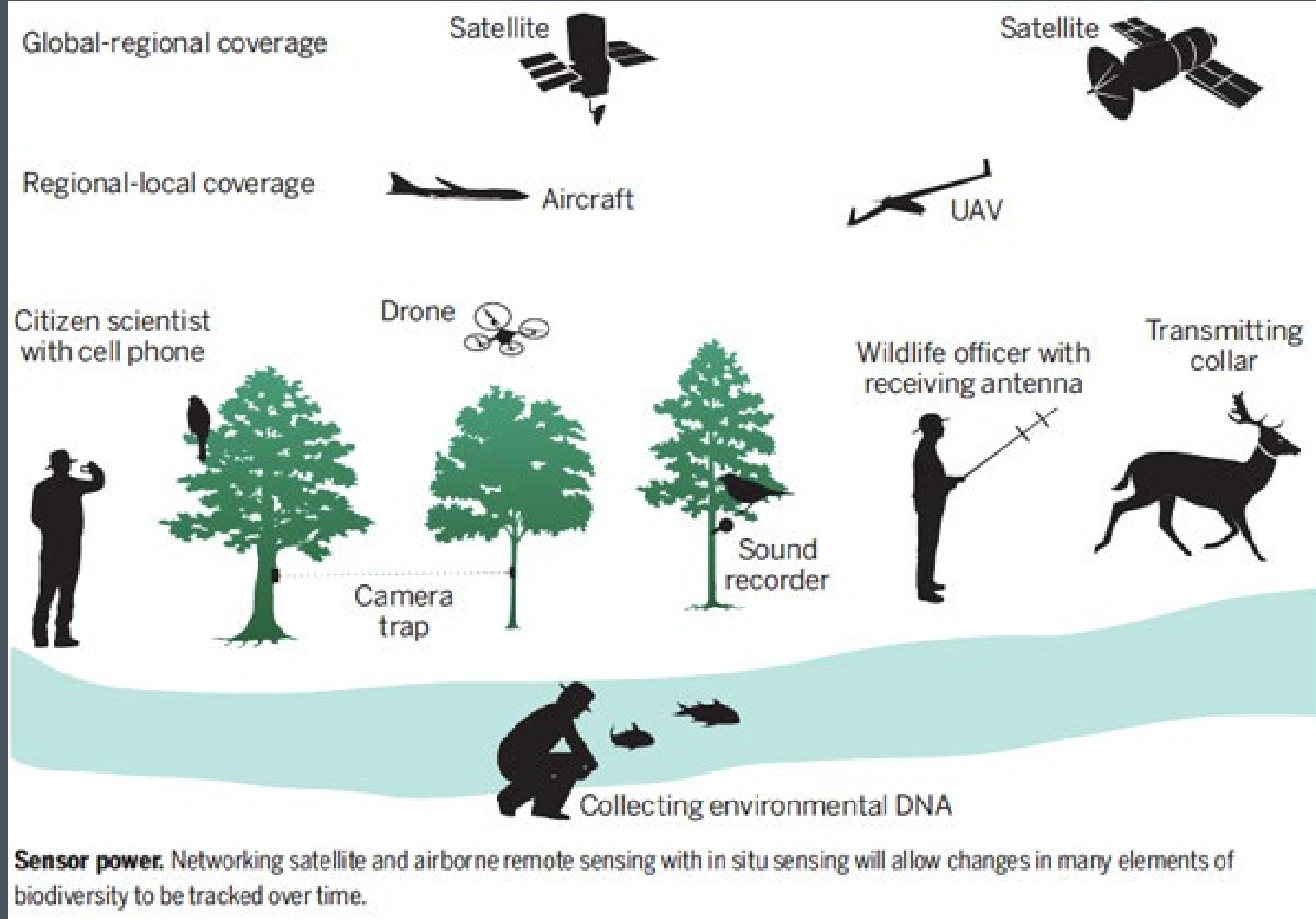
EVALUATION &
IMPACT
REPORTING



EMERGING
TECHNOLOGIES
(AI & ML)

MEASURING IMPACTS OF ECOSYSTEMS & BEYOND

Types of Monitoring

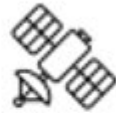


Monitoring for Forest Health



Satellite Monitoring:

High resolution imagery & datasets used for tree mapping



Drone Monitoring:

Site ground-truthing and early vegetation detection



Geotagged Photos:

Photographs with GPS coordinates for precise ground observation



Field Measurements:

GPS-mapped field plots for measuring vegetation

Year 0

Year 0-1

Year 1-2

Year 3-4

Year 4-5

Year 6+

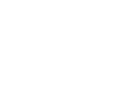
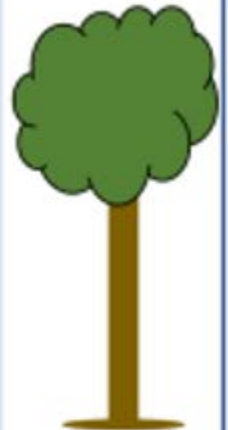






Image courtesy of
Save the
Redwoods League.

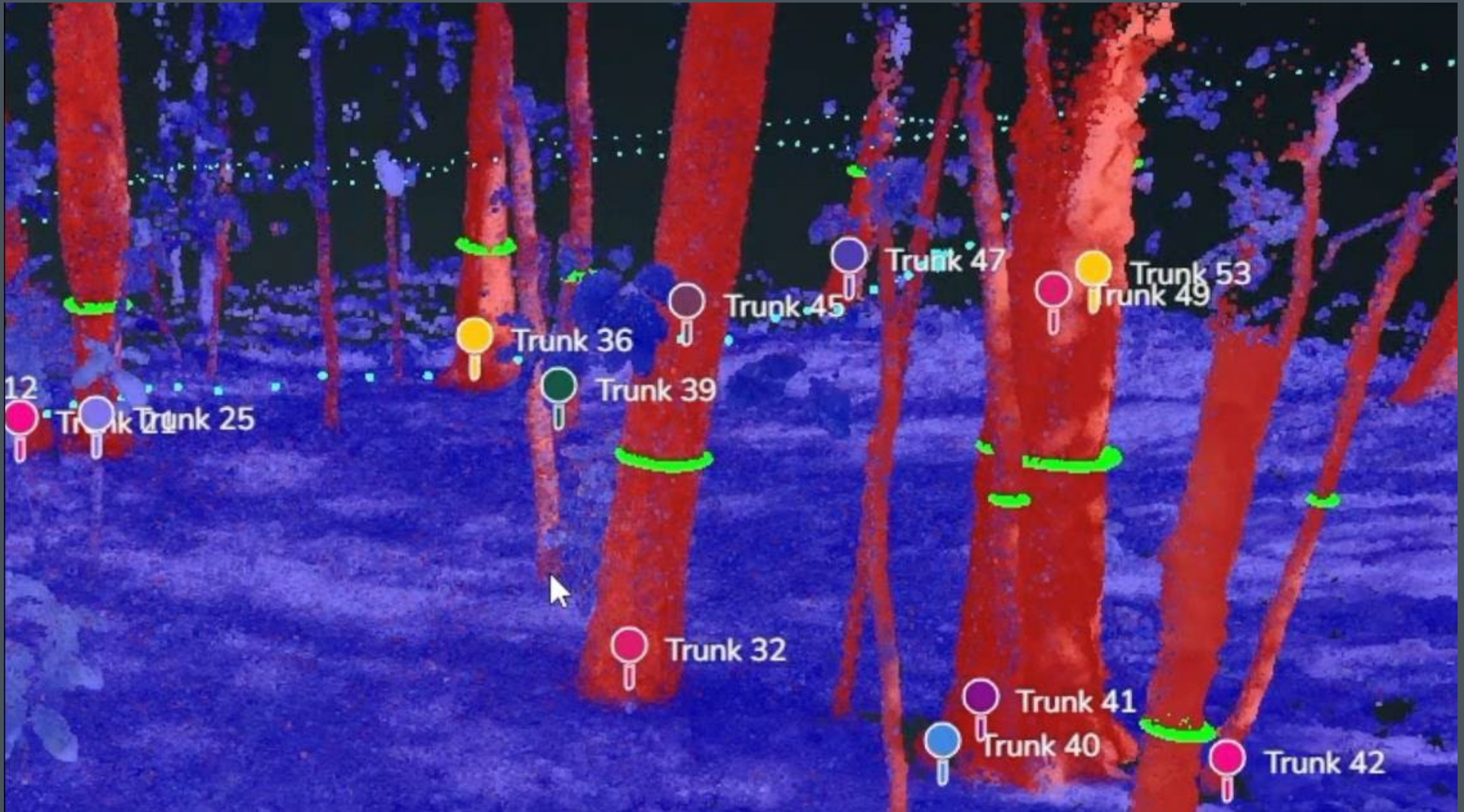
Pictured: Marie
Antoine (left) and
Jim Campbell-
Spickler (right).

Photo by Stephen
C. Sillett.

GPS On

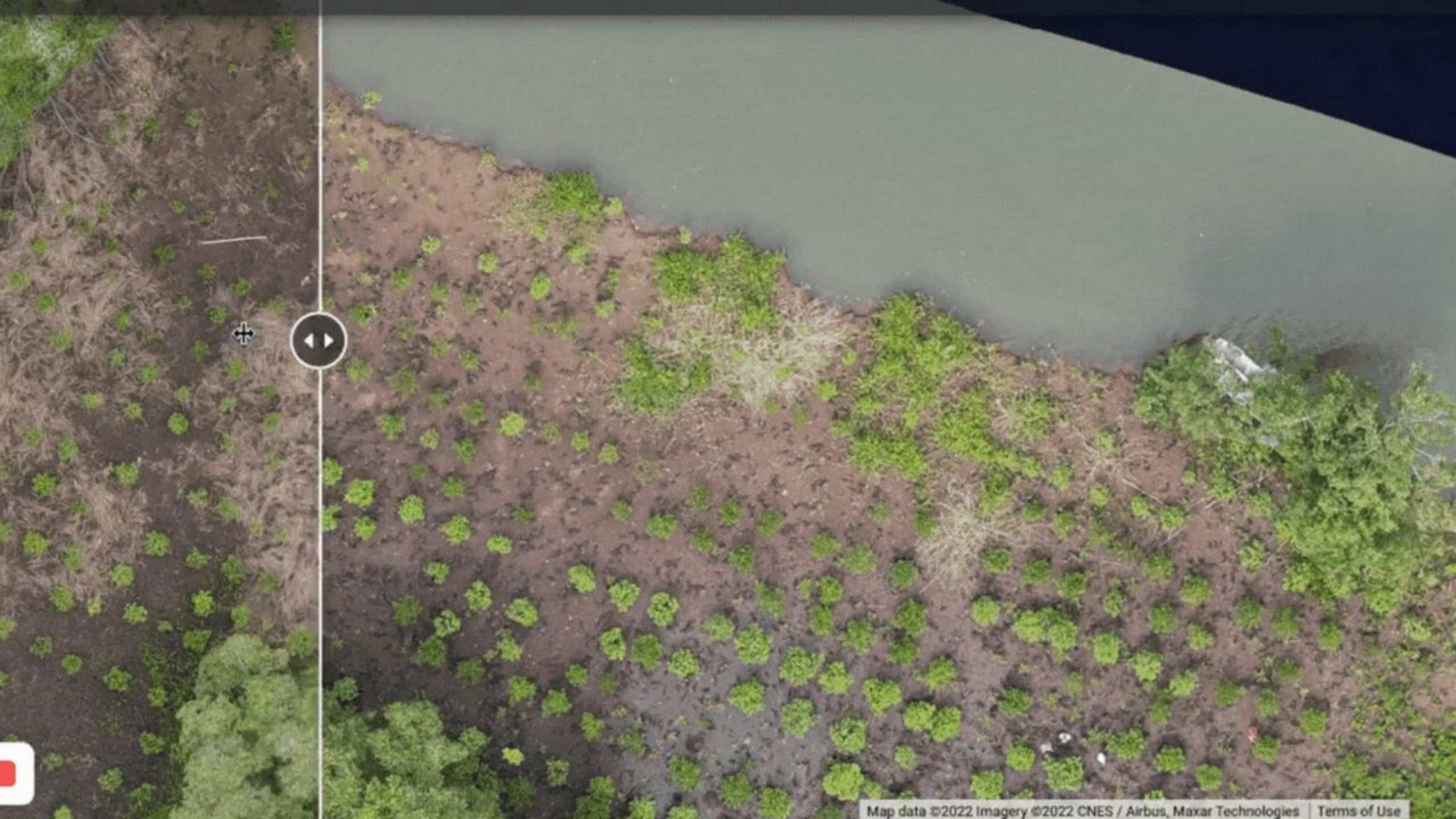


Creating Digital Twins



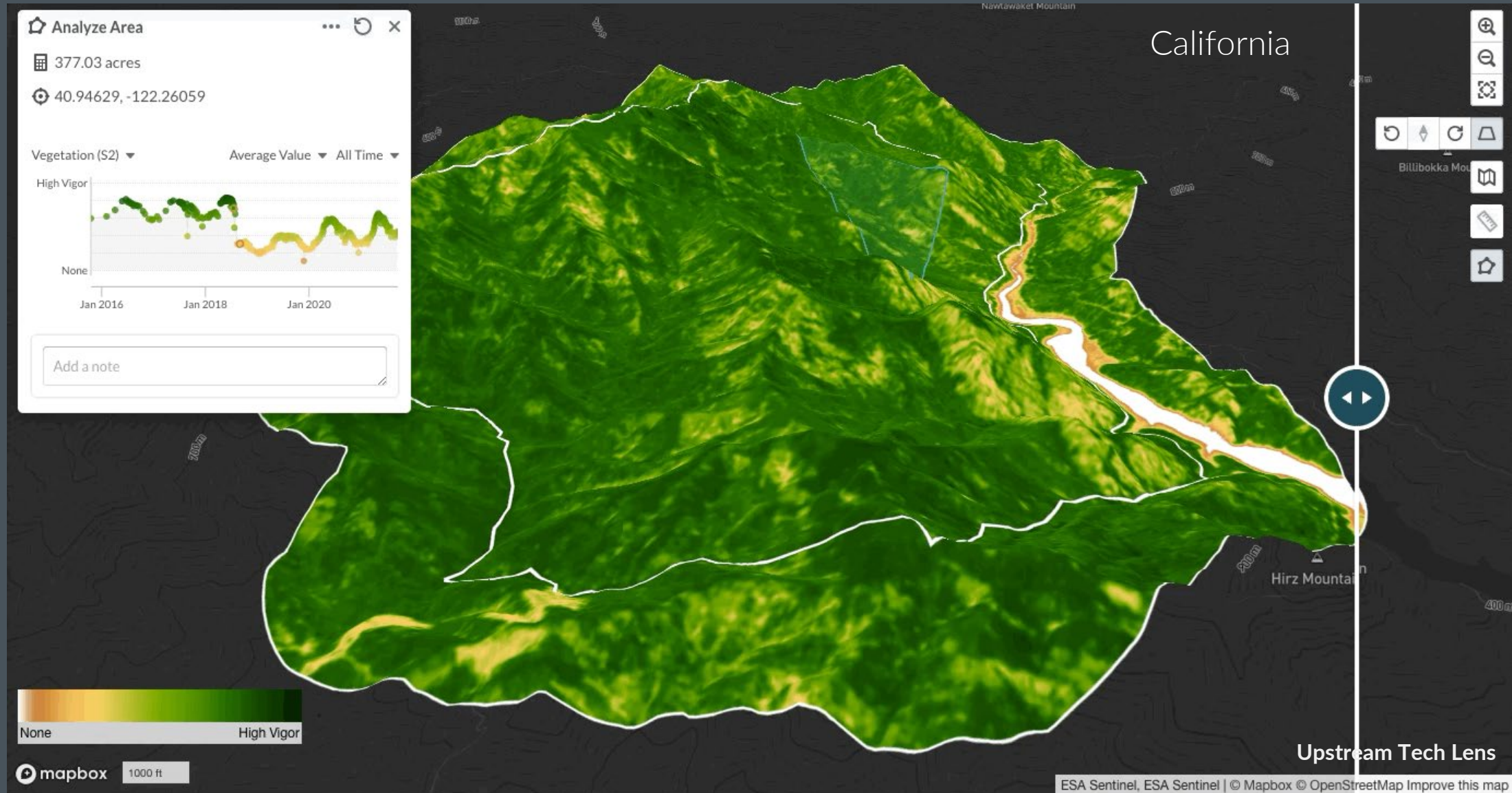
Monitoring From Above – Remote Sensing

- **Better insights into the past and present of protected lands**
- **Reduced costs of stewardship**
- **Increased visibility and accountability via shared perspective and data**

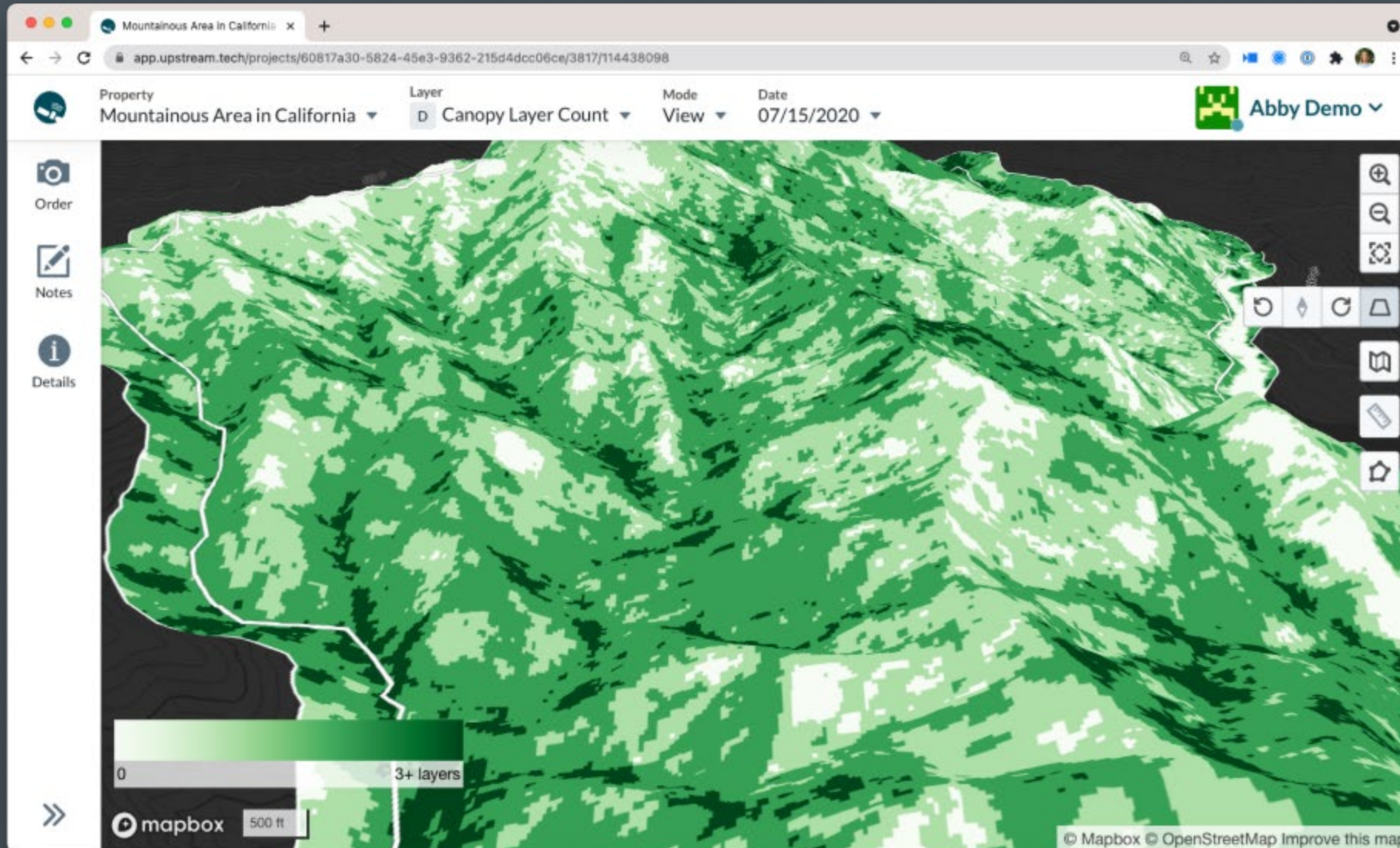




Look Back in Time at Ecological Changes on a Landscape



Assess Climate-related Risks on a Landscape



- Canopy Cover
- Canopy Height
- Canopy Base Height
- Canopy Bulk Density
- Canopy Layer Count
- Ladder Fuel Density
- Surface Fuels



Ferguson Fire Perimeter in California

Planet Aboveground Carbon (30m)

12/31/2020

HR Truecolor

08/05/2020

Help



m



Order



Notes



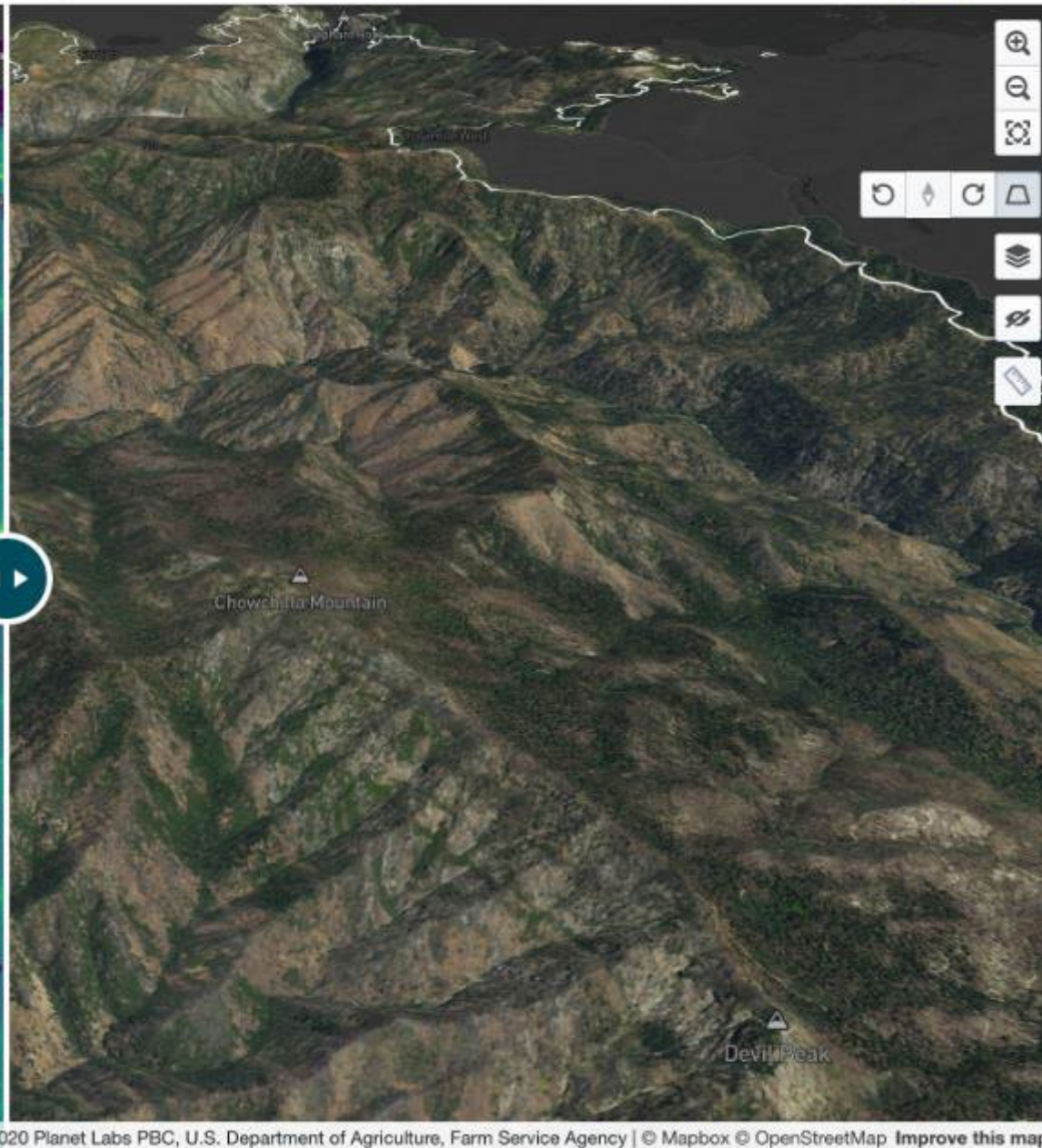
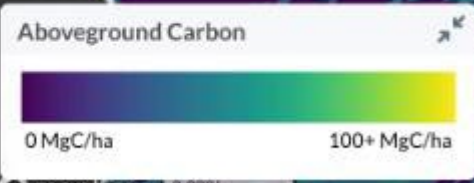
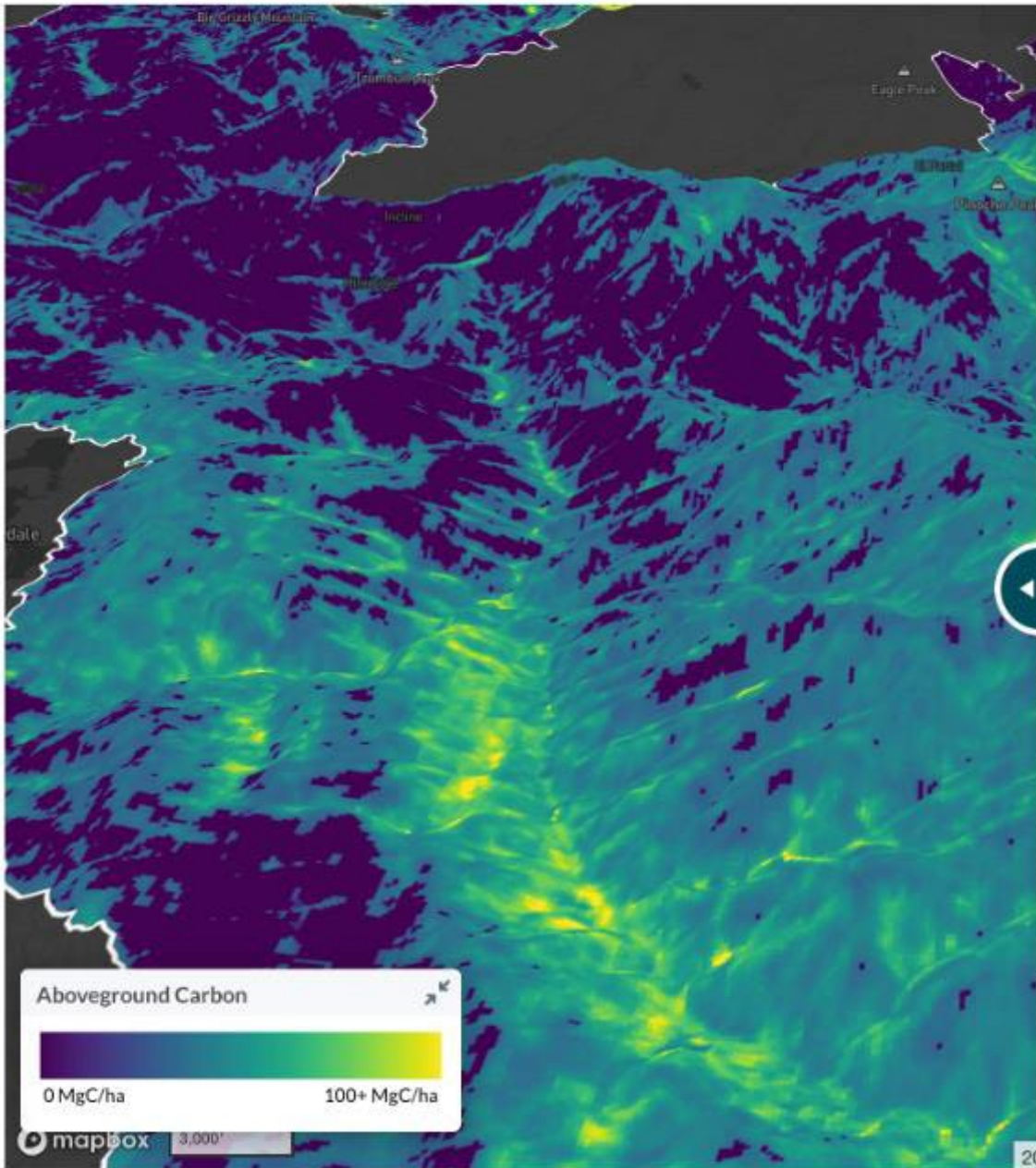
Analyze



Details



Alerts



mapbox

3,000'



Order



Notes



Reports



Analysis



Alerts

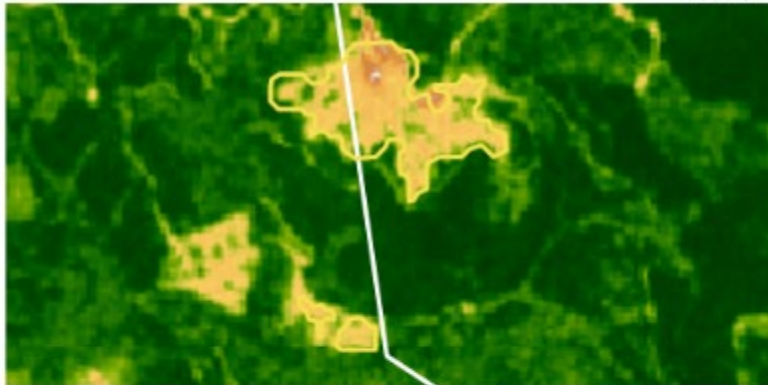
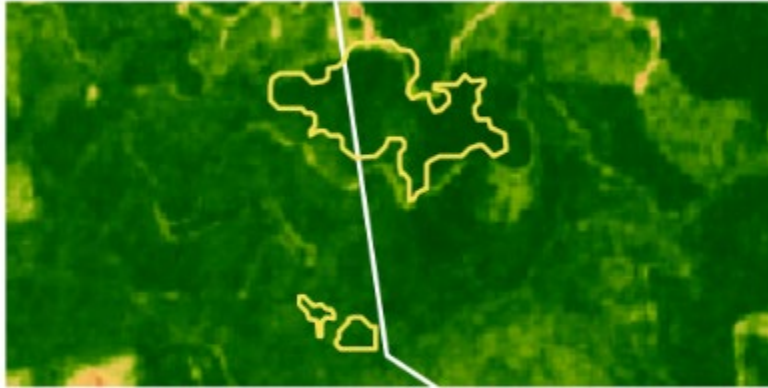


Details



Reporting and Change Detection

Note 6: Vegetation Drop



Interpretation

CENTER
41.44718, -123.95624

NOTE
Vegetation drop detected 2021-02-04 to 2021-04-05

AREA
22.17 acres



Image, top

CAPTURE DATE
April 17, 2020

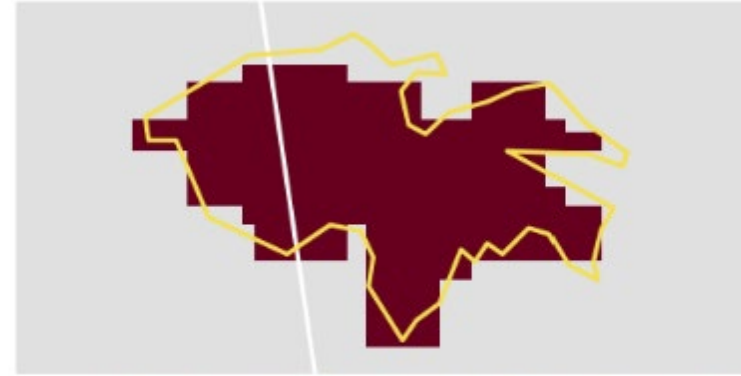
SOURCE
Vegetation
ESA Sentinel-2A/B (10m)
Copernicus Sentinel data 2020

Image, bottom

CAPTURE DATE
April 5, 2021

SOURCE
Vegetation
ESA Sentinel-2A/B (10m)
Copernicus Sentinel data 2021

Note 13: Global Forest Loss Analysis



Image, top

CAPTURE DATE
Includes data captured between
January 01, 2020 and December 31,
2020

SOURCE
Global Forest Loss
University of Maryland GLAD Lab
(30m)
Hansen/UMD/Google/USGS/NASA.
Creative Commons Attribution 4.0
International.

Image, bottom

CAPTURE DATE
July 17, 2021

SOURCE
Truecolor
Maxar WorldView (0.5m)
Includes copyrighted material of
Maxar Technologies Inc. 2021

Interpretation

CENTER
41.44739, -123.95476

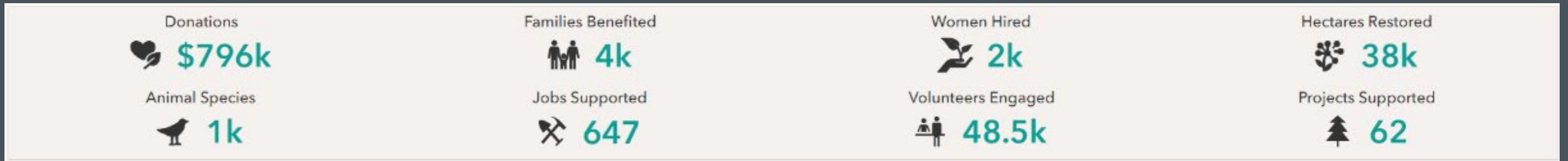
NOTE
This harvest was detected by the Global Forest Loss data, confirming that this was a harvest of roughly 20 acres that took place in 2020.

AREA
24.21 acres

GLOBAL FOREST LOSS (30M)

Evaluation and Impact Dashboards

Showcasing the multitude of benefits



Project List

Search...

California 2022 - Bald Fire reforestation

Hectares Restored: 1,100

Total Donations: 1,050

Key Impacts: Forest Fire Restoration, Watershed/Riparian Restoration, Climate Stability, Biodiversity/Habitats

Status: OTP Reporting

Explore

California 2022 - Susanville

Hectares Restored: 1,012

Total Donations: 436

Key Impacts: Forest Fire Restoration, Watershed/Riparian Restoration, Soil Stability and Erosion Control, Social/Community Impact, Climate Stability, Biodiversity/Habitats

Status: OTP Reporting

Explore

Note: volunteer and benefit metrics are reported by our planting partners and may not include all volunteers or benefits realized by the project.

California 2022 - Susanville

REGION	North America
COUNTRY	United States
STATE/PROVINCE	California
YEAR	2022
END DATE	May 14, 2022
NUMBER OF TREES	480,500

KEY IMPACT AREAS

Forest Fire Restoration, Watershed/Riparian Restoration, Soil Stability and Erosion Control, Social/Community Impact, Climate Stability, Biodiversity/Habitats

PROJECT DESCRIPTION



Esri, Maxar, Earthstar Geographics, and the GIS User Community

Powered by

California 2022 - Susanville

REGION	North America
COUNTRY	United States
STATE/PROVINCE	California
YEAR	2022
END DATE	May 14, 2022
NUMBER OF TREES	480,500

KEY IMPACT AREAS

Forest Fire Restoration, Watershed/Riparian Restoration, Soil Stability and Erosion Control, Social/Community Impact, Climate Stability, Biodiversity/Habitats

PROJECT DESCRIPTION

This project will have a significant positive impact on California's environment. Replanting the forest will help to restore biodiversity and improve the health of the land. It will also help to reduce the effects of climate change in the state as trees act as a carbon sink, absorbing and storing carbon dioxide from the atmosphere. Additionally, restoring the burn area will protect wildlife, soil, and water resources, as well as reduce the risk of flooding and mudslides in the future.

The project will also have a positive economic impact. By restoring the forest, it will create jobs in the community and help to revive the local forestry industry. Furthermore, it will help to restore the area for recreational activities like camping, fishing, and hiking, which will bring more visitors to the area and help to stimulate the local economy.

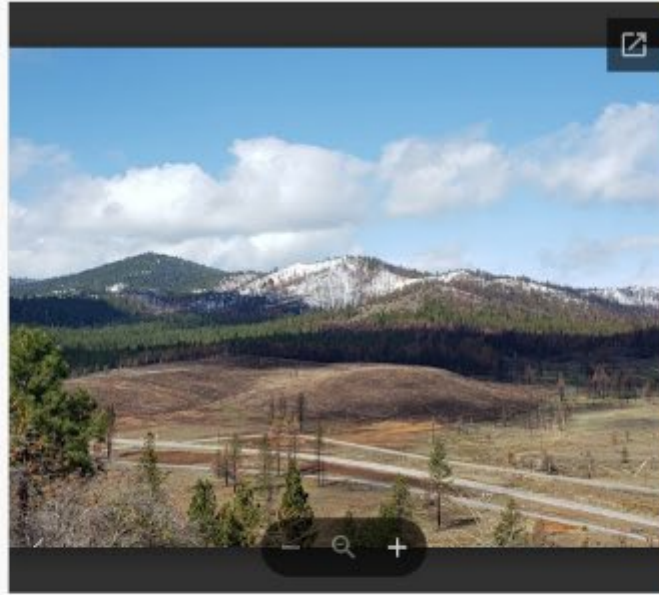
Overall, this project is an important step in restoring the environment and economy of California, and is a great example of the positive effects of reforestation efforts.

ECOLOGICAL BENEFITS

This project will bring a range of social and environmental benefits to the local area and community as well as to the State of California as a whole. The immediate local ecological benefits of reforestation include reduced post fire erosion, enhanced water quality and quantity, as well as wildlife habitat. The restoration and preservation of watersheds are particularly crucial to California in the face of Climate Change and the state's already limited water supply. This project takes place in watersheds that are both important to the state water supply and which have been hard hit by fire.

An additional unique aspect of this project is the presence of Grey Wolves in the project area. Grey Wolves are a species that has just recently returned to the state after having been hunted to extinction with the state boundaries over 100 years ago. As a large predator grey wolves rely on large landscapes with healthy ecosystems. This project will both restore and protect this important habitat.

In addition to the local benefits are climate and global benefits offered by planting trees. The climate is a resource upon which all human and non-human species depend. On a global scale and with respect to the climate benefits of this project, planting a tree in California after a fire will sequester carbon and benefit all of humanity. This project in particular will offer long term climate benefits



Esri, Maxar, Earthstar Geographics, and the GIS User Community

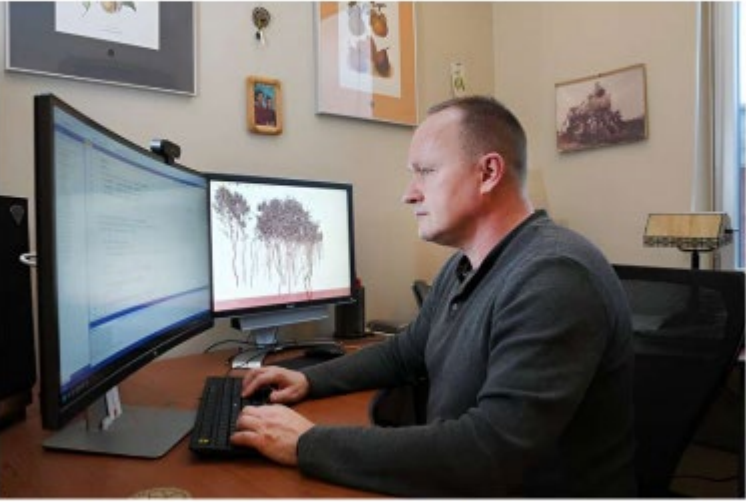
Powered by Esri

Innovations

JANUARY 22, 2024 ✓ Editors' notes

AI learns to simulate how trees grow and shape in response to their environments

by Steve Koppes, Purdue University



Bedrich Benes, professor of computer science and a member of the Institute for Digital Fore...



credit: einfachips

AI and Climate Change: Leveraging Machine Learning for Reforestation Efforts



Technology + Western Science + TEK????

```
NEWSPOTS(ITERN) < NEWSPOTS(LENGTH, ITERN+ 1) >
CATALOG = 0
NEW = 0
NEW = 0
= 0, ITERN) < NEWSPOTS(LENGTH, ITERN+ 1) >
(ITERN) GETTHESPOT() GETCENTROID() > XMAXNEW) (
NEWSPOTS(ITERN) GETTHESPOT() GETCENTROID()
```

A.I. for Cetacean Research



Date: 2018-09-21
Location: Unknown
Sex: Female
Assigned ID: H-031
Size: Unknown
Number: lssd94kp-bv6s-w

The role of AI in ecosystem management and environmental monitoring and conservation

- Wildlife tracking
 - Analysis of remote sensed and IoT data to ID population size, movement, etc.
- Habitat assessment & resource conservation
 - Image analysis for habitat health assessments, stewardship and restoration needs
- Biodiversity analysis & species identification
 - Presence through eDNA, acoustic and camera trap footage



(REVIEW ARTICLE)



Reviewing the role of AI in environmental monitoring and conservation: A data-driven revolution for our planet

Onyebuchi Nneamaka Chisom ^{1,*}, Preye Winston Biu ², Aniekan Akpan Umoh ³, Bartholomew Obekoye Obaedo ⁴, Abimbola Oluwatoyin Adegbite ⁵ and Ayodeji Abatan ⁶

¹ National Examinations Council (NECO), Nigeria.

² Independent National Electoral Commission (INEC) Nigeria.

³ Independent Researcher, Uyo Nigeria.

⁴ Department of Building, Ambrose Alli University, Ekpoma.

⁵ IHS Towers Nigeria Plc, Nigeria.

⁶ Saltwire Network, Halifax, Canada.

World Journal of Advanced Research and Reviews, 2024, 21(01), 161–171

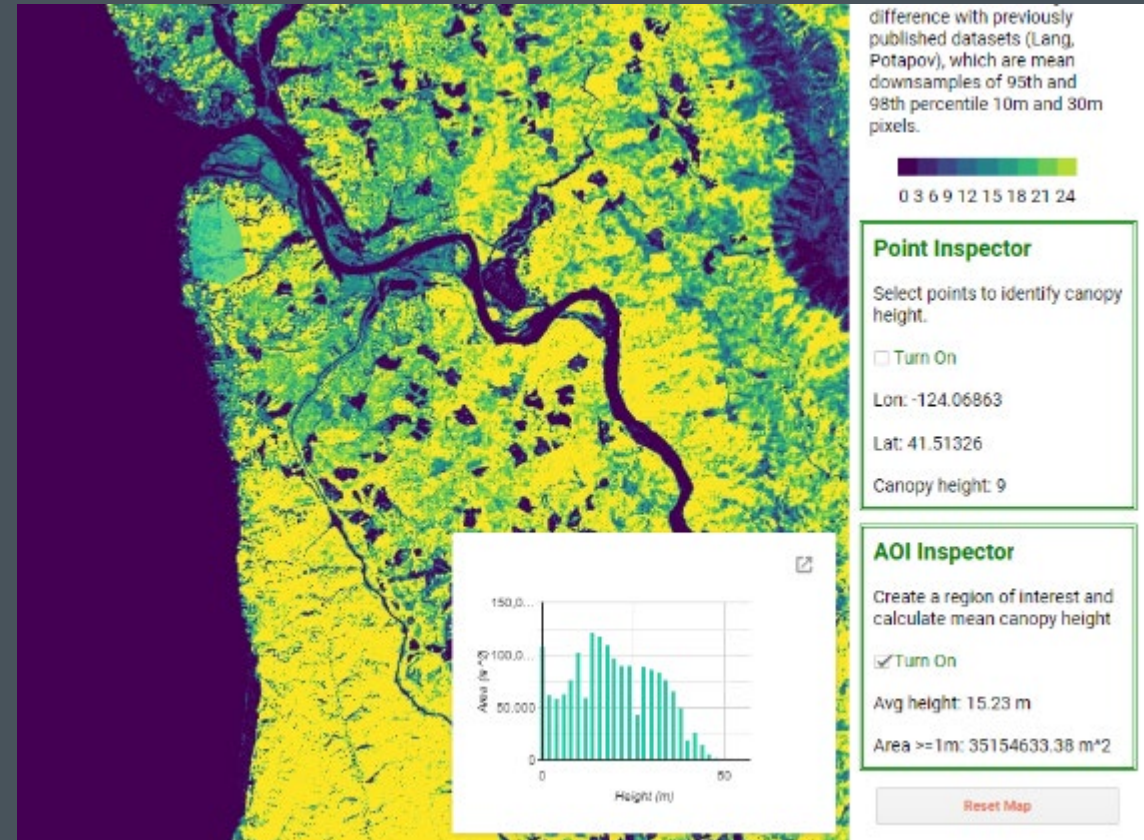
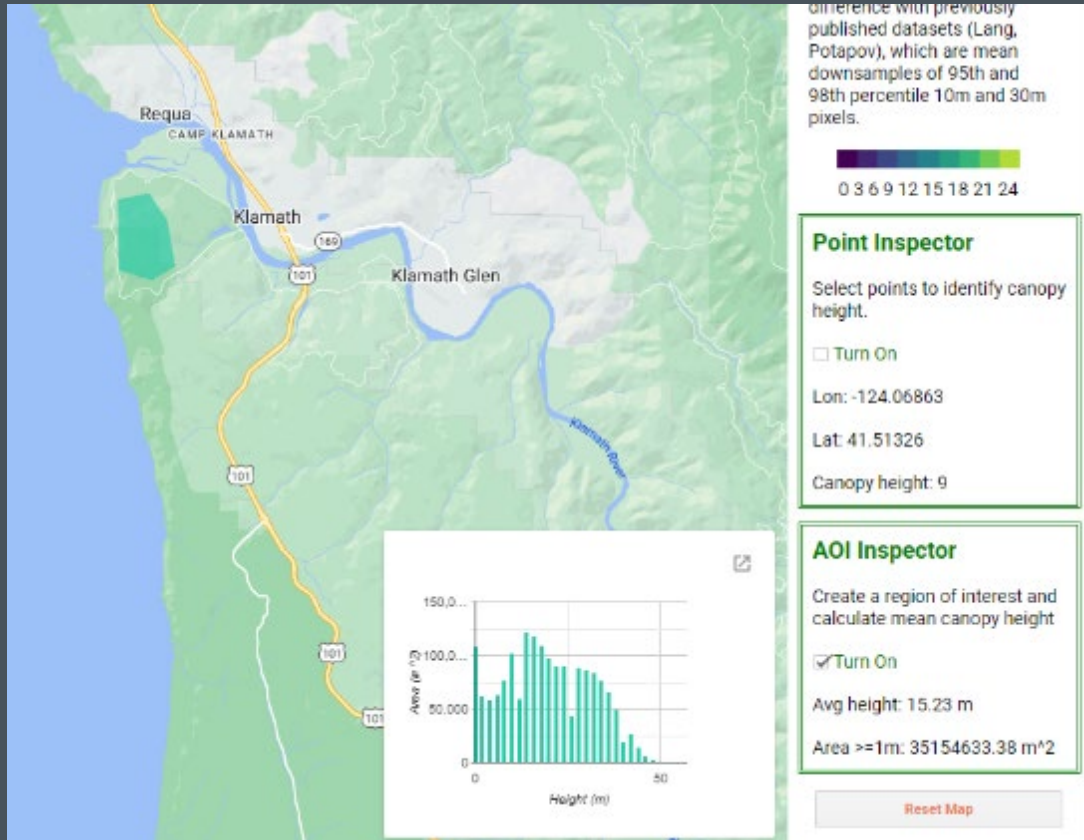
Publication history: Received on 23 November 2023; revised on 30 December 2023; accepted on 01 January 2024

Article DOI: <https://doi.org/10.30574/wjarr.2024.21.1.2720>

Using Artificial Intelligence to Map the Earth's Forests

JAMIE TOLAN, CAMILLE COUPRIE, JOHN BRANDT, JUSTINE SPORE, TOBIAS TIECKE, TRACY JOHNS, PATRICK NEASE

1 meter resolution = individual trees



An aerial photograph of a winding asphalt road through a dense green forest. Three large white circles are overlaid on the image, each containing a number from 1 to 3. Below each circle is a block of text describing a benefit. The background shows the road curving through the trees, with some rocky outcrops visible.

1

BETTER INSIGHT
into the past,
present and
future of
protected lands

2

**PROACTIVE
AND
STRATEGIC**
management
and decision-
making

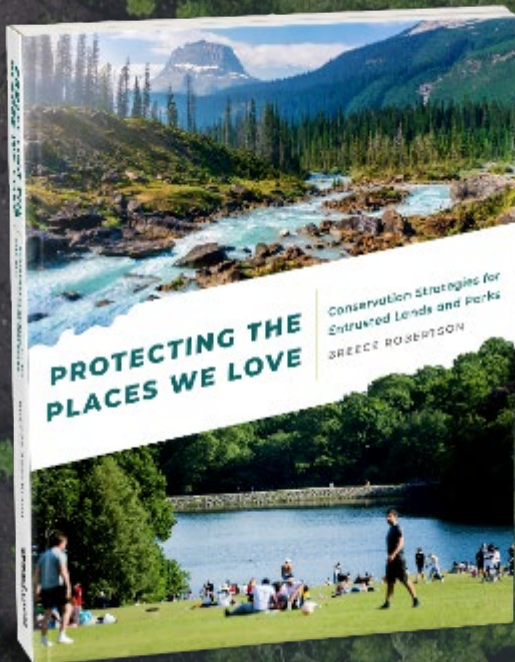
3

**INCREASED
VISIBILITY AND
ACCOUNTABILITY**
via shared
perspective
and data



WE ARE CAPABLE OF MORE,
TOGETHER

Thank You!



Protecting the Places We Love
(SCGIS members get 40% off at Indie Pubs with code brobertson)

www.BreeceRobertson.com

Unless someone like
you cares a whole
awful lot,
nothing is
going to get
better.
It's not.

