



**THE ERIC AND WENDY SCHMIDT CENTER
FOR DATA SCIENCE & ENVIRONMENT**

DSE THE ERIC & WENDY SCHMIDT CENTER
Data Science &
Environment
2023 ANNUAL REPORT



2023 has been a foundational year for the Eric and Wendy Schmidt Center for Data Science & Environment (Schmidt DSE). In this first operating year, our community of passionate individuals came together to build a talented team, narrow in on the unique grand environmental challenges where we are confident that we can make a difference, and begin creating the kind of change with our programs that provide a preview of the full impact to be generated in the years ahead.

We are proud of what we have accomplished in just a few short months, but recognize that this is just the beginning and there is much to be done to realize the change we wish to see for our planet. With the stage now set and actions underway, we are energized and thrilled to have the opportunity to bring great science to action and to help overcome the bottlenecks that prevent true impact from happening on the ground.

This report highlights our work and commitment to using our expertise in data science, artificial intelligence and open source practices to make meaningful improvements to five key challenges: how our agricultural systems work, how our lands are equitably managed with indigenous communities, how we can reduce and eliminate plastic waste, how we can better prepare water managers to understand what to expect from our snowpack, and how we can help our parks overcome the climate-exacerbated threat of fire.

While new technology and data science applications pave the way for our ability to create transformative change for our environment and replicate those successes, none of this is possible without the people and communities we work with, an already wide and diverse network of scientists, advocates, communicators, students, and more. We intend to capitalize on this momentum to continue to develop the key relationships that, along with new methods and technologies, make it possible for our work to have a lasting impact.

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Launched in 2022, the DSE is a partnership between UC Berkeley's Rausser College of Natural Resources and the College of Computing, Data Science, and Society, with the financial support of Eric and Wendy Schmidt.

OUR MISSION

Data-enabled solutions to our most pressing environmental challenges

The environmental issues that affect us are complex and critical to our wellbeing. These challenges include **CLIMATE CHANGE**, the **EXTINCTION CRISIS**, **ENVIRONMENTAL JUSTICE**, and more. We must act smarter and faster if we are to avoid the most dire projections that are at stake within our lifetimes.

Modern data science approaches offer a transformative opportunity to develop and deploy solutions that can make a tangible difference in our outcomes, but to achieve maximum effectiveness we must also ensure that they reach and speak to the stakeholders who have the power to make change happen. At Schmidt DSE we aim to use the best of data science to take on the urgent environmental problems we face, through active engagement with the people who have the ability to make a change with improved understanding.

CO-DESIGN OF TECHNOLOGY FOR TRIBAL ENVIRONMENTAL STEWARDSHIP

The Problem

Wildlife populations have dropped by 69% in the past fifty years, and the decline is only accelerating. In the face of climate change, this loss of biodiversity will lead to the irreversible loss of ecosystem health and presents an existential challenge to the future of life on Earth as we know it.

The Opportunity


We are now witnessing unprecedented efforts to conserve, connect, and protect large areas of land.

In late 2022, the global community came together at the United Nations Biodiversity Conference to boldly commit to a plan to halt and reverse nature loss. These goals created conditions that could unlock the flow of billions of dollars to those managing and conserving biodiversity.

However, those responsible for the future of the lionshare of the planet's biodiversity are all too often excluded from access to these potentially transformative investments. Indigenous People are responsible for the protection of 80% of global biodiversity. Just forms of collaboration with Tribal communities can help co-develop tools that allow these Tribes to engage as power players in this new global movement for biodiversity conservation.

Our Vision

With this project, we seek to develop tangible data science approaches and AI tools co-designed with a partner Tribe that is at the forefront of wildlife conservation. Moving forward, we aim to extend this work beyond a single Tribe and increase the capacity of Indigenous Environmental Stewardship.



“In our eternal connection to this place, the modern tools we use for wildlife data collection serve as just one of the many bridges we have to the ancient wisdom of the animals and plants that grace our beautiful home.”

— TRIBAL WILDLIFE TEAM

WHERE WE ARE NOW

COLLABORATION WITH DEFINED GROUP

Better tools and technology are only part of the solution. Here at Schmidt DSE, we are focusing on working directly with Tribes to put these tools into the hands of the people who can make a difference. Our goal is to connect tools to people and people to their environment. We've partnered with an Indigenous Tribe in Northern California, who have developed a vast array of wildlife monitoring practices and data. The Tribe's Wildlife team are keen to amplify their work by leveraging emerging, state-of-the-art data science practices. We are currently co-designing a suite of technological tools to better enable their team to make decisions on wildlife conservation interventions.

We are particularly focused on the production of two interrelated tools for the Tribe's Wildlife Team:

1. An AI-powered visualization tool to help the Tribe's team parse and better understand biodiversity data using a camera trap array distributed across their Ancestral Territory.
2. A broader data infrastructure and platform to ingest and efficiently process a full suite of biodiversity insights collected by the Tribe in a fashion that protects their autonomy over the data, while giving them more power to engage in conversations ranging from elk harvest quotas to fire management.



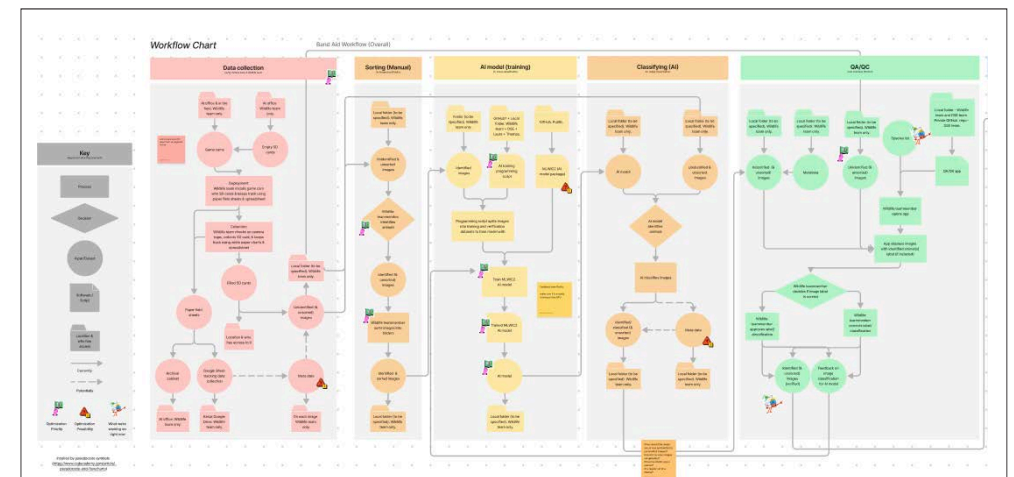
WHERE WE ARE GOING

WIDER IMPACT The biodiversity monitoring network we are collaborating on is just one example from hundreds of other Tribes taking on similar projects. The challenges of facilitating data training and open data collaboration while maintaining data sovereignty, privacy, and accessibility also apply to these other Tribes' work. Our goal is to scale the work we are doing to other Tribes building wildlife monitoring networks for environmental conservation. In order to achieve this goal we must co-design with the wider Indigenous communities.

RELATIONSHIP AND TRUST BUILDING In order to facilitate the co-design process and ensure that the work we do is not redundant with other efforts, we have extensively mapped out the current work being done in this space. We are in conversation with other Tribal networks to form collaborations on future projects. Through this work, we have further defined a vital role Schmidt DSE will play in acting as a connector to these groups. In the new year we will continue this work in building trust with our existing relationships and extending collaborations, highlighting our vision for increasing the capacity of Indigenous Environmental Stewardship practices.

PRODUCTS FOCUS We have begun working with our partners on two areas which will be utilized by the wider Indigenous environmental community.

1. A data infrastructure library and template to efficiently store and query sensor data for monitoring wildlife.
2. A white paper, toolbox, and accompanying communications which break down sovereignty, ownership, and licensing for Tribes working with and developing data pipelines and AI models.



UNLOCKING REGENERATIVE AGRICULTURE PRACTICES AT SCALE

The Problem

Conventional agriculture is a notorious driver of the global climate and biodiversity crises. The massive monoculture cropping systems (e.g. corn, soy) that dominate the agricultural landscape have well known impacts, including water pollution, soil erosion, greenhouse gas emissions, landscape simplification, biodiversity loss, consolidation of farms, low profits for farmers, and vulnerability to the growing threat of extreme climate events.

The Opportunity

Science-informed regenerative agriculture practices (including crop rotation, cover cropping, and others) have been rigorously demonstrated to create benefits for farmers and the environment at almost all scales of agriculture. Yet, despite the potential advantages, these practices are not being implemented at a large scale.

New developments in data science present an exciting opportunity to remove some of the barriers to scaling regenerative agriculture, which would allow farmers to grow more nutritious food, make farms more climate secure, capture more carbon, and generate profits — all without imposing impractical burdens on the industrial agricultural system.

Our Vision

We aim to remove obstacles that prevent scientifically-proven regenerative agricultural practices from scaling by developing open and informative tools that enable crop insurance and agricultural finance agents to quantify the benefits of regenerative agriculture and offer farmers incentives to make a change or support for continuing to employ these practices.

WHERE WE ARE NOW

BUILDING THE TOOL Schmidt DSE is working with a team of experts from academia, insurance-adjacent non-profits, the industrial agricultural insurance, and lending industry to develop a pilot tool that leverages cutting edge data to showcase how simple and tractable regenerative agricultural practices could generate a suite of benefits for farmers, insurers, and the environment. We have begun focal work on the risk reduction and yield impacts of crop rotations within the industrial corn system in the State of Illinois, leveraging the agricultural risk model developed by the Land Core Risk Model Project team, which includes the UC Berkeley Agroecology team led by Dr. Tim Bowles, the Rice University Statistics team led by Dr. Frederi Viens, and the University of Arkansas Agricultural Economics team led by Dr. Lawson Connor.

Our pilot Illinois Soil Health Tool can be accessed at illinois-soil-health-tool.org

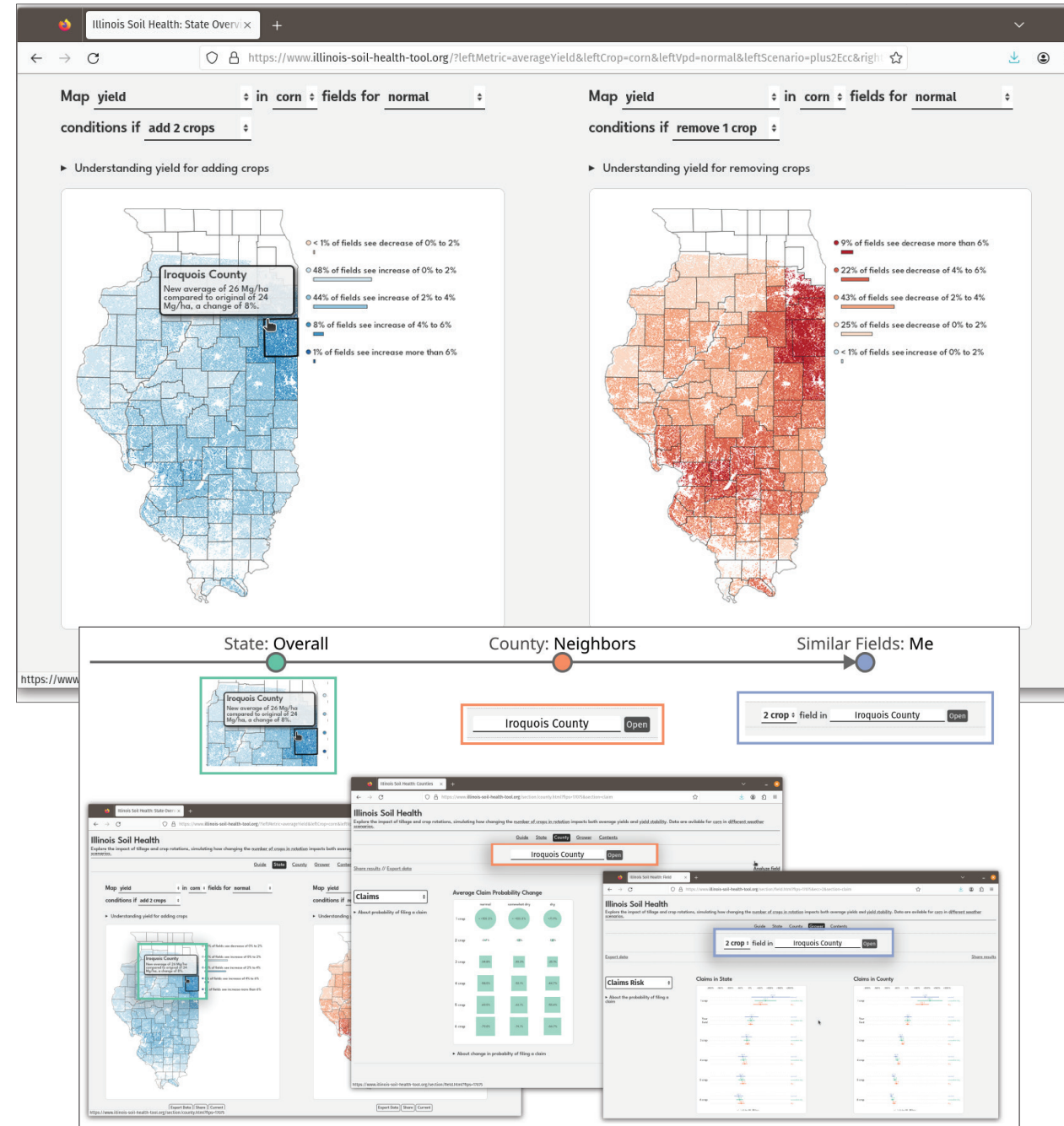
FACILITATING OPEN SCIENCE Our work has laid the path for open data in an environment that was previously more proprietary; the Illinois Soil Health Tool and the underlying model outputs, upon which the tool was built, will soon be made publicly available for free and open use by a range of interested parties, thus enabling this impact of this effort to be further magnified.

ENGAGING PRIVATE INSURANCE COMPANIES AND LENDERS To ensure that our work directly addresses real-world needs and concerns, we have actively engaged stakeholders from the private agricultural insurance and lending industries through user demos / feedback sessions. Stakeholder responses drove our iterative process as we engineered an increasingly applicable tool.

Of note, the Illinois Soil Health Tool reveals distinct pilot program opportunities: localities where increased crop rotation practices would likely increase crop yield and reduce the risk of insurance claims in years of weather extremes. We have shared these findings with key private insurance providers for the state of Illinois, and continue to discuss the application of the tool in a pilot program.

MEETING THE NEEDS OF THE US DEPARTMENT OF AGRICULTURE Most recently, our tool prototype has sparked interest among representatives of the USDA, particularly the Risk Management Agency (USDA subdivision responsible for crop insurance), about how this work could be integrated into the RMA formula for setting insurance premiums, such that regenerative agriculture could be incentivized through that hugely impactful channel.

► **OF NOTE** the Illinois Soil Health Tool reveals distinct pilot program opportunities: localities where increased crop rotation practices would likely increase crop yield and reduce the risk of insurance claims in years of weather extremes. We have shared these findings with key private insurance providers for the state of Illinois, and continue to discuss the application of the tool in a pilot program.



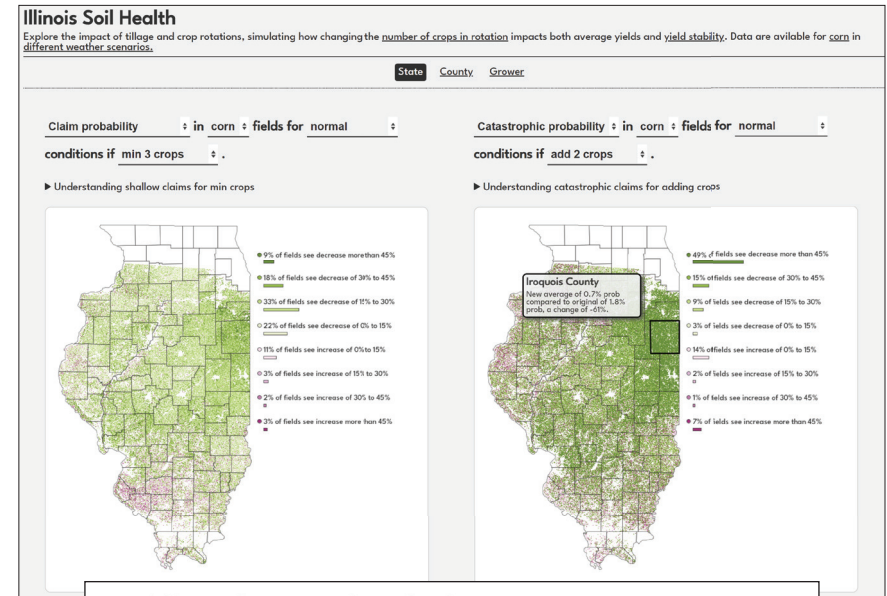
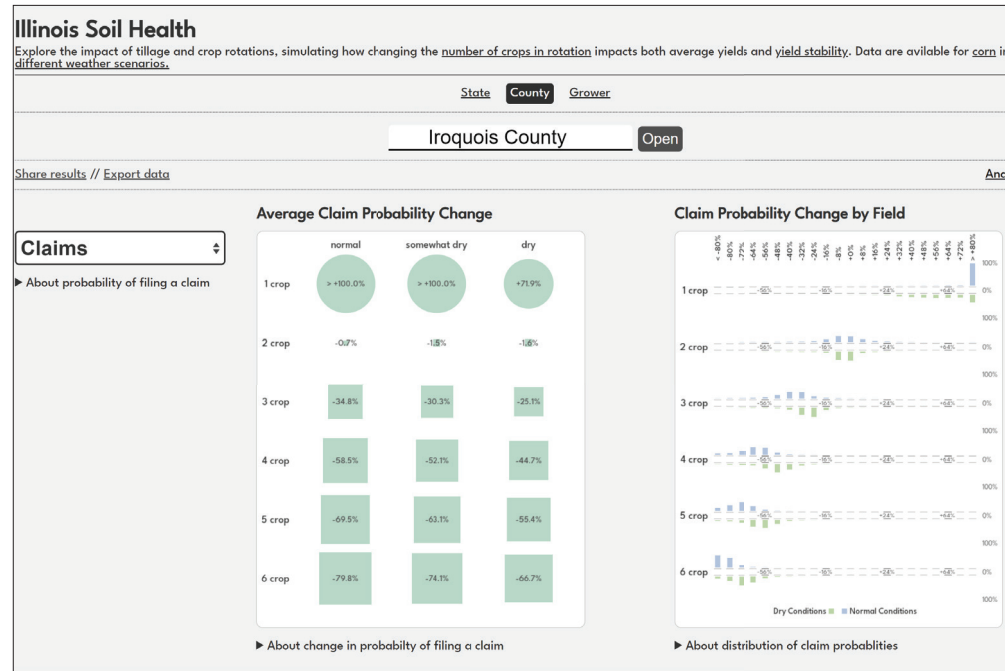
WHERE WE ARE GOING

Our tool has already advanced the conversation on incentivization of regenerative agriculture practices and we are excited to pursue the abundant avenues for the next phase of the work in 2024.

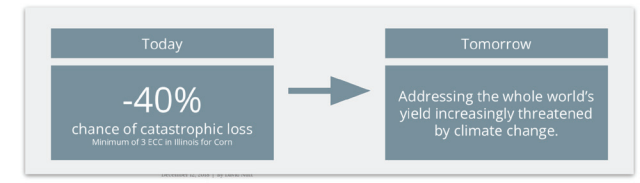
SCALABILITY FOR IMPACT Our approach of engaging both private industry and governmental stakeholders in the crop insurance world positions us for broad impact as our regenerative agriculture work advances. Our goal is to leverage initial success working in Illinois with one significant private industrial agricultural insurance company to eventually expand to partnership with multiple insurers in multiple states. Ultimately, we aim for this to tool guide changes in future policy for the largest private and governmental agricultural insurers, as we continue our journey toward greater impact and adoption of regenerative agriculture practices.

BEYOND CROP ROTATION, BEYOND CORN

Resounding input from our stakeholders teaches us that building additional regenerative agriculture practices, starting with cover cropping, into the expanded future iteration of the soil health tool will broaden its utility for applied use. Schmidt DSE is now leveraging our internal team expertise in remote sensing and satellite imagery interpretation to model a cover cropping dataset which will be an input to the future modeling effort. Eventual model expansions can include the environmental implications of other practices, such as water usage, as well as inclusion of additional crop species.



Avoiding a future *without* food



SOLVING THE SNOW PROBLEM WITH REMOTELY SENSED DATA

The Problem

Snow plays a critical role in storing and supplying fresh water to billions of people worldwide. In addition to the western US, it accounts for a significant portion of our water resources in areas like the Ganges and Indus River basins. However, the amount of snow can vary greatly from year to year and season to season, and this variability is only worsened by climate change. Too much water from snow melt, too fast, and people die from floods. Too little without foresight, and crops fail and people perish.

One of the holy grail challenges in snow science has been accurately measuring the volume of water in snow, snow water equivalent (SWE), in real-time, using low-cost satellite imaging. Current methods can accurately measure snow water equivalent, but they are extremely expensive, complicated, and time-consuming - and thus are accessible only to wealthiest water constituents. Furthermore, these computations arrive on a delayed timeline that precludes their use in seasonal management decisions. As a result, water managers in most of the world have limited information to make critical decisions.

The Opportunity

We see an exciting opportunity to create an AI-powered scalable data product that leverages freely available global satellite datasets, rather than expensive and limited instruments, and to develop a web-based platform that puts free, life-saving snow and water data in the hands of anyone. This advancement has the potential to significantly improve the reliability of fresh water system forecasting, helping billions of people better prepare for both floods and droughts.

Our Vision

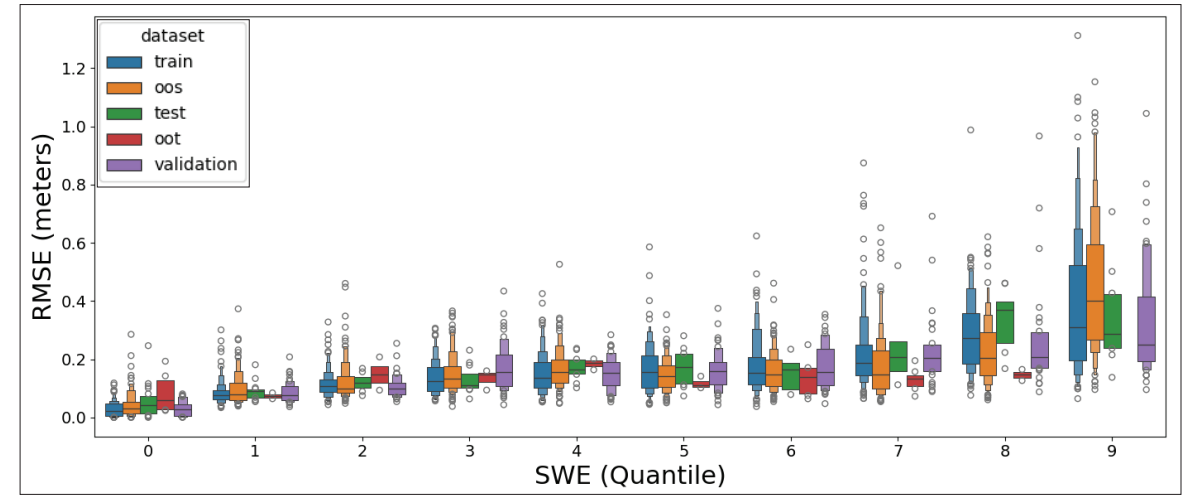
Schmidt DSE aims to develop freely available global data products that use remote sensing and machine learning to accurately estimate global snow water equivalent in near real-time. Partnered with lead scientists in the field, including UC Berkeley's Dr. Manuela Girotto, we seek to leverage and improve current approaches to make a dynamic model that can be applied globally with little resource use and with available data.

WHERE WE ARE NOW

BUILDING A NOVEL MODEL In collaboration with leading researchers at Berkeley and beyond, we are refining our snow water equivalent model using satellite-obtained Sentinel radar data to enhance its accuracy, aiming to create a model that utilizes globally available data, is not hindered by cloud cover, is cost-effective, and maintains or improves precision of current model, at a finer geographic scale. While the development of novel modeling approaches is time-consuming and carries some level of risk, we firmly believe that the potential for far-reaching impact justifies the risks involved in this project.

LEVERAGING A DYNAMIC DATA PIPELINE Furthermore, the data pipeline we're building in this project has been invaluable to our other AI-related initiatives, including vegetation estimation for our fire recovery project in partnership with the National Park Service (NPS) and cover crop estimation in our regenerative agriculture work.

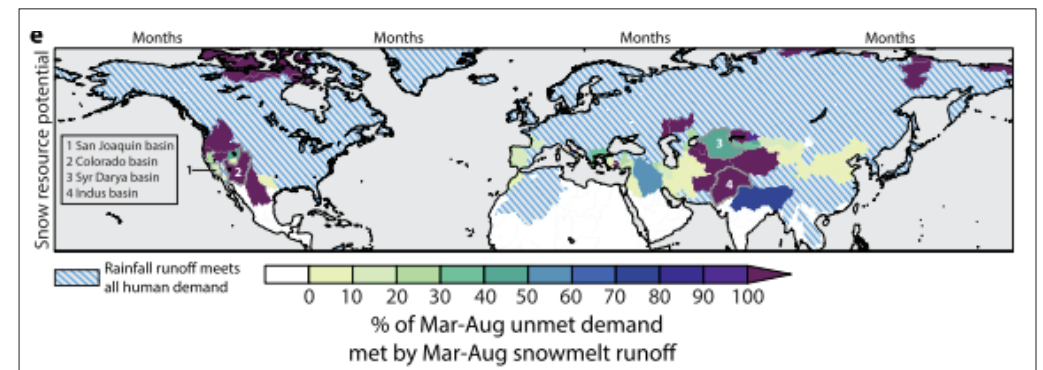
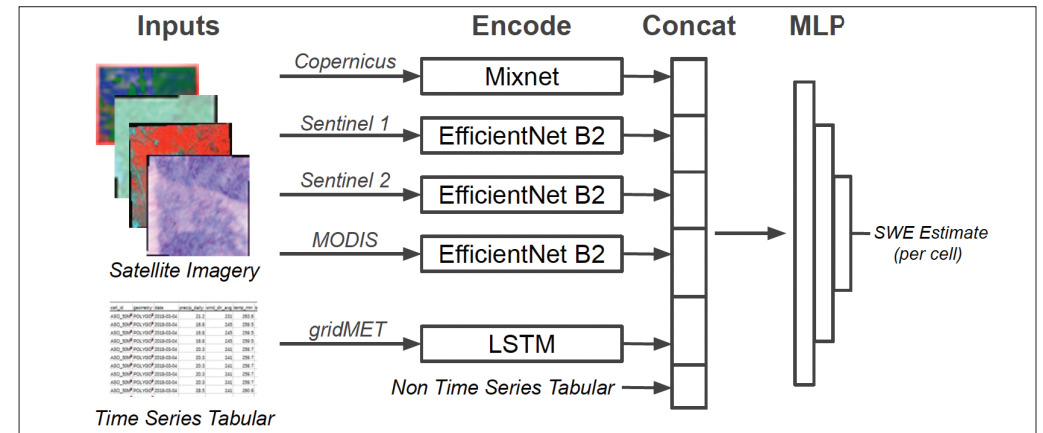
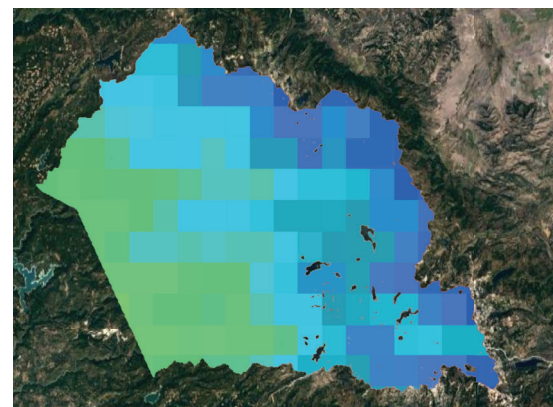
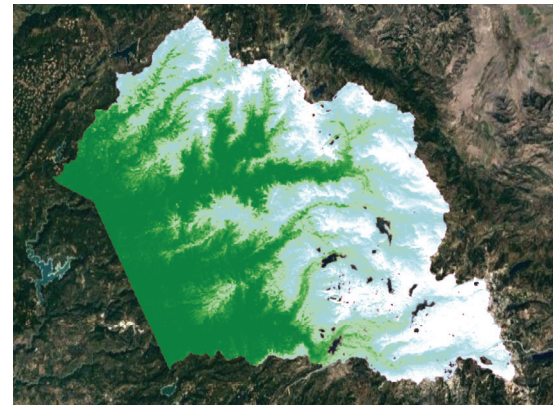
► **OUR IN PROGRESS SNOW WATER EQUIVALENT (SWE) MODEL** is demonstrating some promise at creating accurate measurements at low levels of snowpack, but yet requires refinement to perform well when snowpack is high.



WHERE WE ARE GOING

MODEL STATUS Our modeling effort for estimating snow water equivalent has improved upon the accuracy and spatial resolution of existing models in the field. Despite these encouraging results, our current prototype has challenges generating accurate outputs during conditions when snowpack is at its highest. We are continuing to iterate our modeling process to further improve the accuracy and utility over prior versions.

FEEDBACK FROM ON-THE-GROUND WATER MANAGERS We are actively building relationships with international stakeholders to ensure the practical utility of our model on the ground. As our model becomes more mature, we will expand our work with these stakeholders to develop the web based tools that they can use to easily access the data and put it to work in meaningful ways. These efforts to connect our preliminary model outputs with water managers will be a defining area of focus for our next quarter of work.





ENDING PLASTIC POLLUTION. FOREVER.

The Problem

The global plastics problem is of urgent and growing concern that is exacerbating the climate crisis, creating threats to endangered species and at-risk ecosystems, putting human health at risk, and amplifying core environmental justice challenges.

The Opportunity

The United Nations recently convened a global treaty negotiation that has the potential — if thoughtfully implemented — to bring an end to plastic pollution forever. With this unique and timely moment, there is an opportunity for Schmidt DSE to fill a critical role in helping to provide reliable data-driven insights into what specific policies can be combined by negotiators in the Treaty to solve the global plastic waste problem.

Our Vision

Schmidt DSE aims to provide UN negotiators and the general public with an AI-powered tool that accurately depicts what our future could look like given a range of different plastic interventions.

WHERE WE ARE NOW

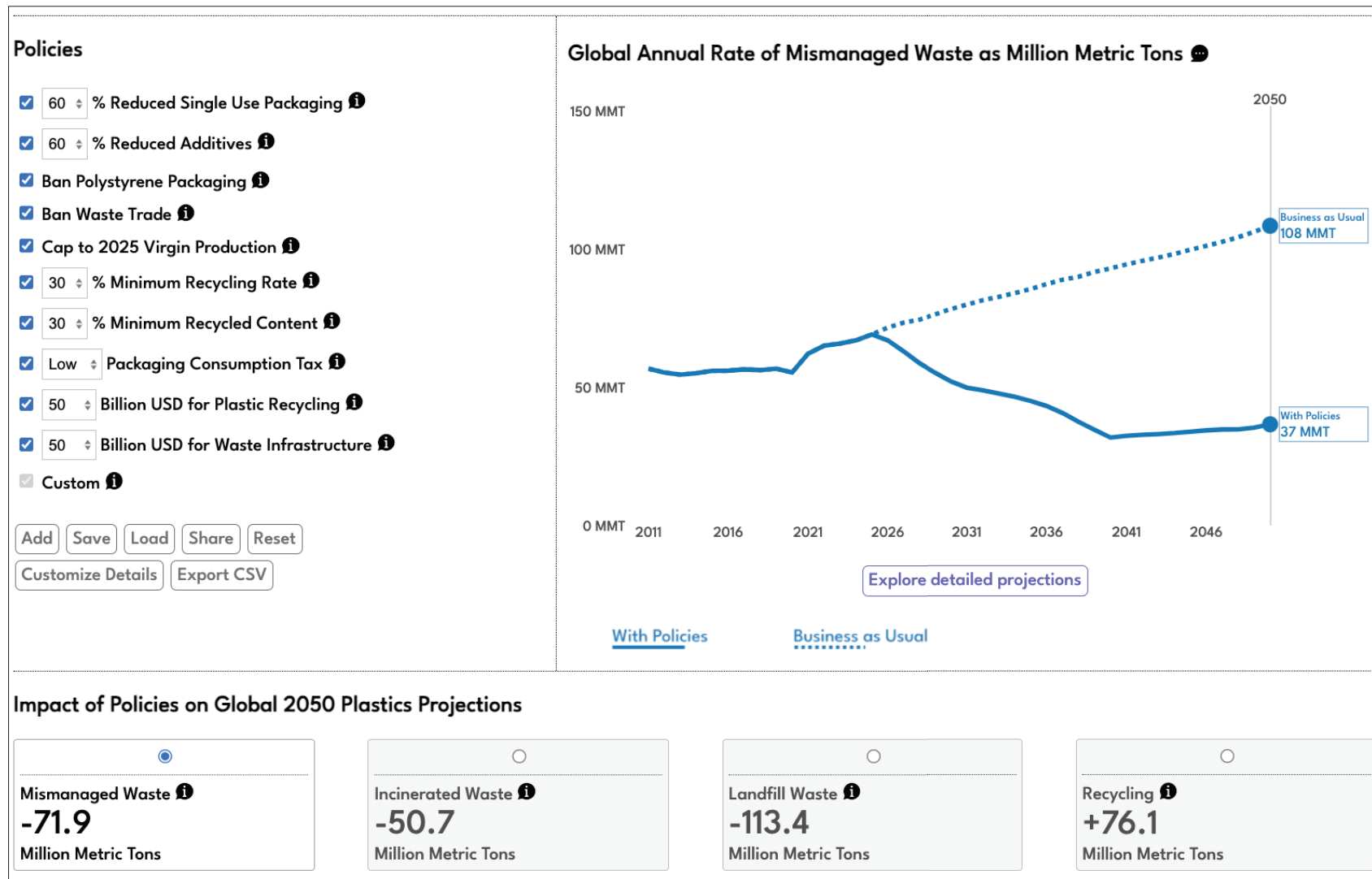
In collaboration with other domain area experts in the global plastics system, Schmidt DSE created a model and built an interactive data tool that allows UN negotiators to visualize the impact that candidate Treaty policies would have on ending plastic waste.

This unique decision support tool helps inform policy makers and enables them to explore the impacts of different policy interventions in the upcoming international negotiations. One of the primary discoveries of this research project has been that it is possible to zero out mismanaged plastic waste by 2040 (see Figure Plastics_tool_1).

This interactive policy simulation environment which projects plastic under different scenarios using machine learning is available in pre-release at <https://global-plastics-tool.org> and open source at <https://github.com/SchmidtDSE/plastics-prototype>.

IMPACT ON GLOBAL STAGE Researchers from our team shared our tools at the United Nations third session of the Intergovernmental Negotiating Committee (INC-3) in Nairobi in November 2023. We held an in-person side event at INC-3 entitled “Modeling the Path to Zero Plastic Waste: Tools in Support of the UN Global Plastics Treaty”, which brought together researchers and INC-3 delegates to discuss how scientific data and tooling can be used in negotiations. While at INC-3, we talked in person with over 40 people from over 16 countries and gained an extensive amount of feedback regarding our path forward (see Refining Tool Features below).

BROADER ENGAGEMENT We made a scrollable storyboard making the results of our work more digestible to the general public (<https://plasticstreaty.berkeley.edu/>). Our work gathered international and media attention, including being a focus in many news outlets including ABC7, Time, Nature, Berkeley CDSS, and The Washington Post.



▲ **PLASTICS_TOOL_1** This interactive policy simulation environment which projects plastic under different scenarios using machine learning is available in pre-release at <https://global-plastics-tool.org> and open source at <https://github.com/SchmidtDSE/plastics-prototype>

WHERE WE ARE GOING

GETTING THE TOOL IN THE RIGHT HANDS We are currently preparing for attendance at INC-4 in April 2024, where we will be there again in service of decision-makers seeking to strategically understand how specific policies can help eliminate plastic waste decisions. This includes sustaining our work putting science into the hands of the national delegations with which we are already engaged and expanding our outreach to new countries. We are especially excited for the release of the new tool features described below in these next UNEP convenings.

REFINING TOOL FEATURES From the extensive feedback we received on tool improvement, we identified key improvements to implement in time for INC-4. In addition to minor improvements on usability and accessibility, we are driving forward on implementing two new major features: the incorporation of greenhouse gasses as a metric to and further articulation of the regionalization and country specificity of the data. We are especially excited about these new measures for quantifying the climate footprint of the plastics system to better connect the dots between plastics and climate change in these negotiations. Both new features require the addition of new data sources and methodology in our modeling efforts.

COMMUNICATING RESULTS Our team is co-authoring two papers, one focused on the design of the tool and the other on the methodology and results of our research which we are submitting to peer reviewed journals. All of this work will be accompanied by open data, code, and software for full reproducibility so other researchers can truly scale and extend our work.



◀ **SCHMIDT DSE** has thus far shared results of this work with delegations from 16 countries engaging with the Treaty process.

Global Plastic Policy Tool

Countries are exploring ways to reduce the impact of plastic. This tool explores different policy interventions both regionally and globally.

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Showing **Plastic Waste** in **Global** at **2040** as **Annual Million Metric Tons**

Show change from baseline due to interventions.

Plastic Waste 2040 Global

Landfill	68 MMT
Incineration	85 MMT
Recycling	230 MMT
Mismanaged	10 MMT

Show Waste

Production 2040 Global

Overall	460 MMT
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Show Production

Consumption 2040 Global

Packaging	36 MMT
Construction	100 MMT
Textile	109 MMT
Household	77 MMT
Electronic	44 MMT
Transportation	41 MMT

Global Annual Plastic Waste in Annual Million Metric Tons

Historical

Landfill

Incineration

Plastic Waste by Region in 2040 as Annual Million Metric Tons

Sort

	China	EU 30	NAFTA	Rest of World	Global
Landfill	25	3	25	15	68
Incineration	33	14	6	32	85
Recycling	82	36	40	71	230
Mismanaged	3	0	0	7	10

Policy

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Products

▼ **Production**

China Virgin Plastic Production Cap: 145 MMT

	2040 Mismanaged Waste	2040 Incinerated Waste	2040 Landfill Waste	2040 Recycling
Impact on Global	-0.73 MMT	-6.25 MMT	-4.93 MMT	+8.57 MMT

▶ About China Virgin Plastic Production Cap

EU 30 Virgin Plastic Production Cap: 55 MMT

	2040 Mismanaged Waste	2040 Incinerated Waste	2040 Landfill Waste	2040 Recycling
Impact on Global	-0.71 MMT	-8.6 MMT	-1.39 MMT	+8 MMT

▶ About EU 30 Virgin Plastic Production Cap

NAFTA Virgin Plastic Production Cap: 90 MMT

	2040 Mismanaged Waste	2040 Incinerated Waste	2040 Landfill Waste	2040 Recycling
Impact on Global	-0.71 MMT	-8.6 MMT	-1.39 MMT	+8 MMT

▶ **Recycling**

▶ **Waste**

▶ **Taxation**

▶ **Trade**

▶ **Financial Assumptions**

▶ **System Assumptions**

NATIONAL PARK SERVICE CLIMATE CHANGE DECISION SUPPORT

The Problem

The National Park Service (NPS) oversees vast protected lands in all fifty states, totaling 85 million acres (an area 12 times the size of Massachusetts). These lands serve as critical refuges in a changing climate, support threatened species, and act as vital carbon sinks, sequestering millions of metric tons of carbon dioxide annually.

We know that a grand climate change-driven challenge for the NPS and for the west itself is fire. Megafire upon megafire have ravaged these iconic locations leading to an urgent need to understand and address all challenges related to fire. And, while significant resources have been allocated to fire prevention and preparedness, there is very little ongoing effort to address recovery and how best to manage a landscape in the time sensitive periods after it has burned.

The Opportunity

We have a unique and exciting opportunity to work hand in hand with the NPS to develop first of its kind decision support tools on fire, and over time for a wide range of climate challenges. Through the generous and timely award granted by NPS, we are able to focus resources on this work in a concentrated way, allocating designated data science and academic staff to the rapid advancements of tools to meet NPS needs.

Our Vision

Schmidt DSE intends to develop data-enabled tools that empower park managers to decide how best to track and manage an area after it has burned, something that unfortunately will happen more and more in our parks each year. While many tools have been developed to help detect and stop wildfire, the niche of using data science tools to helpfully restore lands after a fire remains an underserved area.

WHERE WE ARE NOW

We narrowed in on our initial fire recovery project area through a careful assessment of feasibility, user needs, impact, partnership opportunities, and scalability.

EXPLORING UNDERSTUDIED AREAS While our primary deliverables are still under consideration, we are enthusiastic about how our AI-enabled remote sensing capabilities may be used to improve near real-time high resolution mapping in places like Joshua Tree National Park, a practice that has previously required years of laborious work.

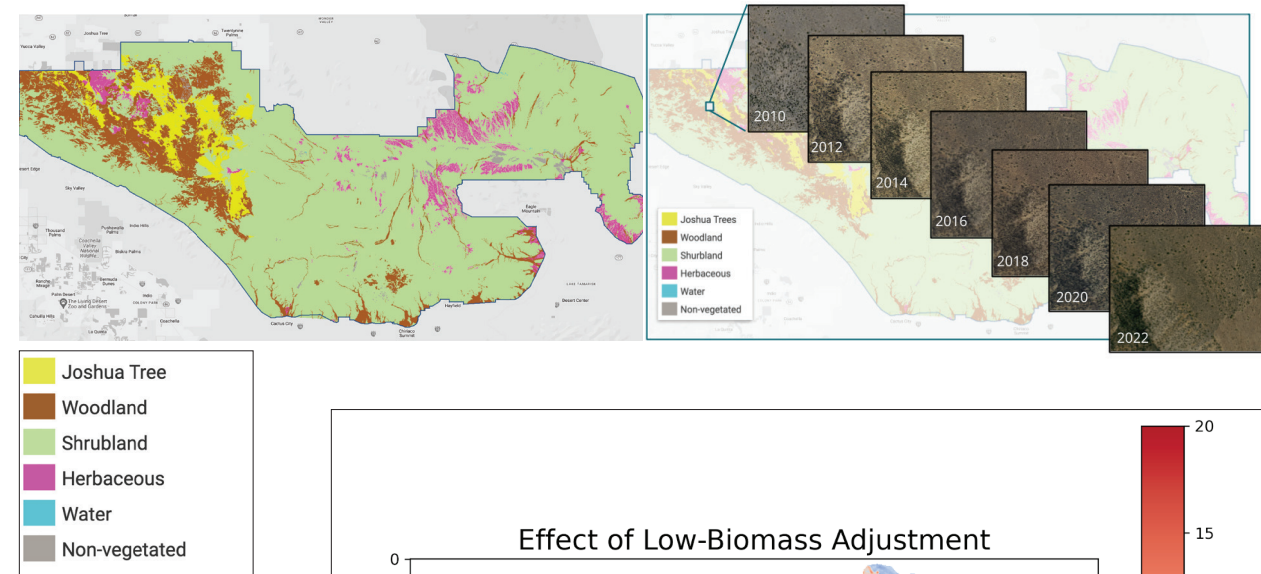
BUILDING PARTNERSHIP was a crucial factor, with NPS partners showing enthusiasm to actively engage in the co-design and iterative refinement of the tool, including hosting our team in an on site visit to the park. Their willingness to provide feedback greatly enhances our collaborative efforts.

FILLING AN URGENT NEED Our NPS partners enthusiastically requested an initial tool assessing fire severity in the immediate aftermath of fire events, which they can use to quickly build out their emergency response plans. We have devised a quickly executable, satellite imagery driven tool that is tuned to the ecological subtleties of the desert ecosystem.

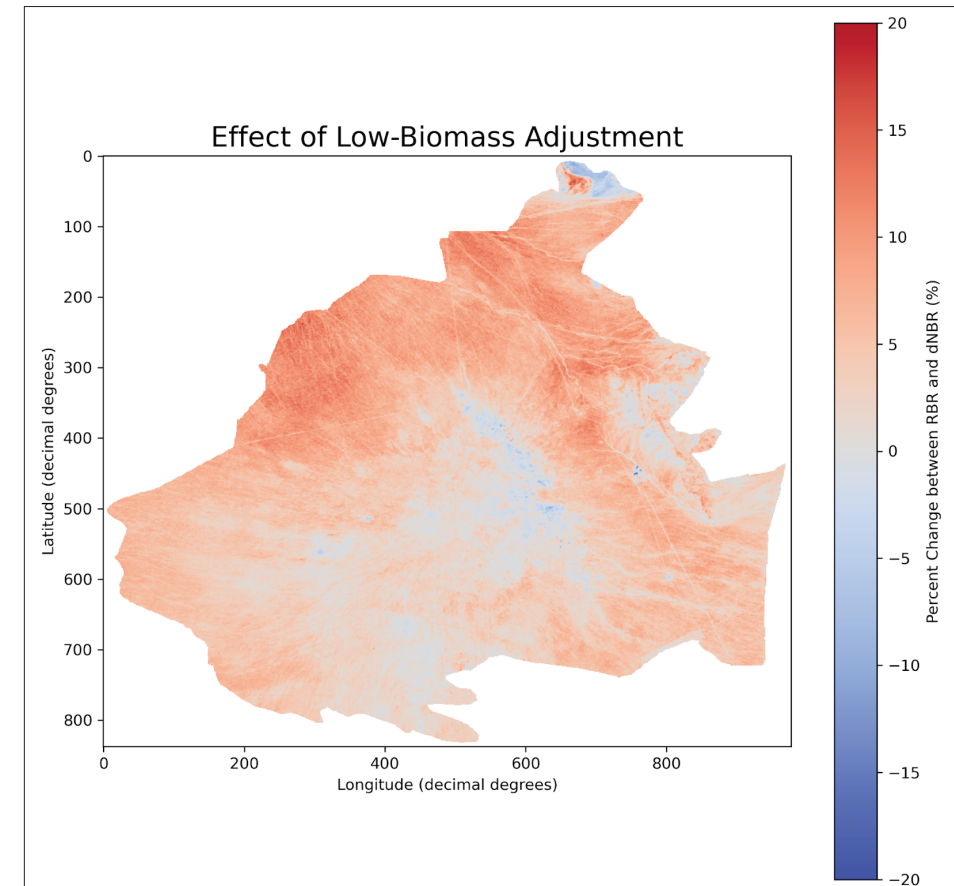
WHERE WE ARE GOING

FIRE RECOVERY TOOLBOX Supported by our forthcoming NPS post doctoral researcher, we see the eventual product for fire recovery as a toolbox that centralizes existing resources and our bespoke tools in a single location (another partner request). Ambitious tooling directions include linking our burn severity mapper to species specific mortality predictions, and eventually vegetative succession modeling, which would allow users to project the future of a burned area under a range of recovery/intervention scenarios and considering future climate expectations.

SCALING OUR WORK Our aim in developing an initial pilot project is to demonstrate the utility of how data-enabled decision support tools can help NPS managers to make better decisions related to the climate impacts that are, and will continue, impacting these landscapes. Scalability is an essential element of our approach, as we aim to create a tool that can be refined and adapted for use in diverse geographies, landscapes, and for various species. Our prototypes in one park can be adapted and scaled to eventually benefit additional parks and protected areas both throughout the US and globally.



► Effect of adjusting remote sensing-derived burn severity indices for lower biomass and sparse vegetation, within the August 2020 Dome Fire in Mojave National Preserve.





CO-DESIGN OF TECHNOLOGY FOR TRIBAL ENVIRONMENTAL STEWARDSHIP



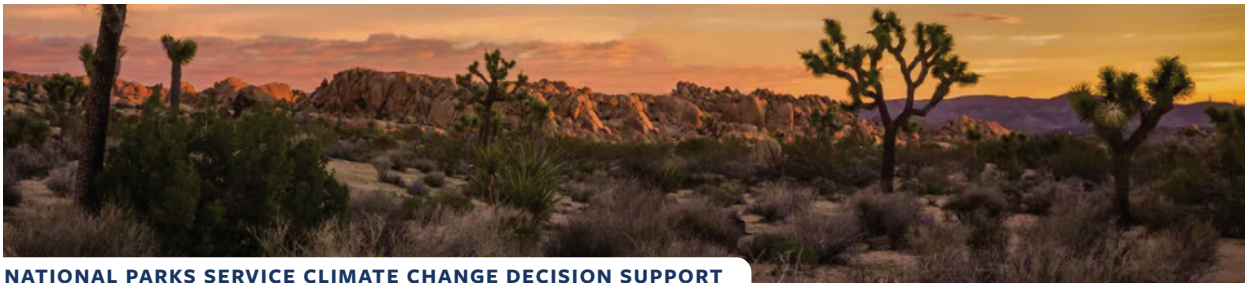
UNLOCKING REGENERATIVE AGRICULTURE PRACTICES AT SCALE



SOLVING THE SNOW PROBLEM WITH REMOTELY SENSED DATA



ENDING PLASTIC POLLUTION. FOREVER.



NATIONAL PARKS SERVICE CLIMATE CHANGE DECISION SUPPORT

PROJECT SELECTION

The work we have engaged in over this past year provides a foundational backbone for Schmidt DSE to continue to grow in scale and impact as we directly address critical environmental challenges while developing and sharing new open ways of working.

A tremendous amount of consideration went into the selection and development of the five initial projects that make up our current portfolio of work. Out of a wide range of criteria that we considered, some of the most critical include:

- **The significance of the problem and need**
Is this a critical and urgent need for the wellbeing of our planet and communities?
- **The interest and willingness of known stakeholders to receive and act upon our work**
Are there people with whom we have a direct connection who can ensure that the new science and information revealed by our work leads to action?
- **A strong foundation of established science and data, but also a lack of this knowledge reaching those most in need**
Is there a critical mass of scientific agreement and understanding that isn't yet reaching those who need it?
- **Our values as an organization**
Does this work, and our ability to engage in it, agree with our values and ethics?
- **The ability for our impact to grow and impact to scale**
Will the new methods and products we develop to take on a challenge be able to reach wider audiences, locations, and problems over time?

Our five core projects, detailed in the preceding pages, meet all of these criteria, and more, and we are confident that our team is well-positioned to make significant contributions that will help take great science the last mile to make environmental data actionable.

In addition to our excitement for the impact potential of each project individually, we are also excited by the topical diversity of this project portfolio and believe that the total of our work at Schmidt DSE on challenges that are of great importance to people, environments, markets, and technology has the potential to have a wide impact across the array of challenges that our planet faces.

OUR VALUES AND PRACTICES

Schmidt DSE strives to be open in the work that we do. Open science is an umbrella term to refer to transparency, accessibility, collaborative development, and sharing of knowledge, but the breadth and ambiguity in the definition often results in an unclear understanding of how 'open' is used in practice.

As we have embarked on our first year of selecting the important challenges we are taking on and engaging in the work to improve environmental conditions, we attempt to define our open work within the context of our values, which often align with open practices, including those articulated by FAIR and CARE principles.

We understand that some communities are unfairly excluded from open practices, and in some cases can be harmed. However, in other cases, open practices also work to counter other forms of inequity and cannibalization of shared resources. Each project is unique with different stakeholders and data sources, therefore we strive to evaluate our decisions in the context of each project. Many decisions are made along the data life cycle from collecting the data to interpreting the results and many choices in the process of handling data come with trade-offs. The design choices we make are based on the collaborators, community, and stakeholders (people and environment) that are affected by the work we do.

Overall, we make decisions on who we work with, how we work, and what we show to the world based on our values outlined at right.



We Value Accessibility

We acknowledge there are inequalities in access to knowledge, including inequalities in socioeconomic factors. The mission of Schmidt DSE is to use data and data handling tools to understand and act upon pressing environmental challenges, as such we focus on accessibility in the form of open software/tools, open data, and open knowledge to handle the data and understand the results. We strive to pursue work that allows open licensing whenever possible. Schmidt DSE aims to build upon open infrastructure, including databases, data formats, open source software, so that others can build upon the work we do.



We Value Transparency

We aim to make the process and products of our work transparent so others can reproduce our work and so that people and communities that were involved or affected by the project can understand and question the decisions that have been made. While it may not be possible or practical to document every single decision that has been made in our work, we are committed to document whatever information we can to help shed light on why we chose the direction that we did. Transparency also allows for extensibility, so others can build off of the work we do, just as we acknowledge and build off the work of others. We choose these values to encourage a community surrounding open data practices and empowerment for all to collaborate.



We Value Data Privacy and Data Sovereignty

In many cases data should be open and freely accessible to everyone, but in some cases we may choose to withhold information that has potential to cause harm. When working with environmental data, harm can take the form of data that exposes sensitive information on the location of endangered species, personal data, geographic area, and/or work that causes cultural harm. We may work with data where laws and rules for a geographic area might affect the way we treat data and will examine and strive to adhere to data sovereignty considerations of the nations and communities we collaborate with. In addition, we aim to reduce extractive behavior of those with power from those with less power. It is our goal to listen, support, and empower those with data to make their own positive impact on environmental challenges.

DECOLONIZING ENVIRONMENTAL DATA SCIENCE

Schmidt DSE is committed to co-developing sustainable, inclusive, and meaningful solutions to environmental and data challenges together with communities. To this end, in addition to our values outlined above, we focused on finding tangible ways where we might decolonize our work and data practices. In particular, we want to ensure that we are considering these important topics from the beginning of our work in order to be mindful of not practicing “parachute science” and mitigating our (racial) bias in (ecological) data work.

We developed a practice of meeting regularly to conduct equity pulse checks as we move through our projects. We have applied these to all active Schmidt DSE projects, taking a close look at each of them and defining considerations from a decolonizing lens (see figure below). We then discuss these considerations as a team and narrow down to specific actions we are going to take to mitigate harm.

In line with our understanding that exciting technical achievements can not happen alone we have been focusing heavily on participatory design. We will continue our work facilitating workshops to understand what our partners want, visit our collaborators in person, and help them obtain grants by supporting them with the writing and application process. We aim to make sure the communities we work with, especially tribes, can determine what information they want us to gather and work with. We aim to listen for problems for which solutions are genuinely of local value; learn from collaborators, communities, and impacted individuals; prioritize that which benefits on-the-ground communities; invest in local partners, their capacity building, and their leadership; and treat our collaborators as equal co-developers and leaders, respect the data sovereignty of our partners, credit all sources of information and data; communicate our work in an accessible and relevant manner; and share, when local partners deem it appropriate, data solutions openly for the benefit of all.

Under our decolonizing initiative, we work to intentionally create space for important team-wide discussion. We’ve produced a number of internal documents tracking our learnings, insights, and best practices; analyzed all our projects under an ethics lens, and followed up with specific action steps to address considerations and concerns. This thoughtfulness has translated to us being able to collaborate at unprecedented speeds with our partners, especially Tribes.

Checking in on our projects

1. Let's unpack our projects. Write down 3 considerations for each project.
 This will help us build the background understanding of the projects we're analyzing, make sure we have all the facts, and surface any assumptions.

2. Read through the considerations listed above. Write your thoughts using stickies.
 ★ Star any stickies or thoughts you'd like us to discuss.

3. Let's discuss!
 Take a look at the follow-up thoughts there. Let's talk about any considerations or follow-up thoughts that stick out! Write down questions and ideas in the above board or below.

4. Discussion wrap-up
 Write any remaining thoughts or questions. We can discuss some of them right now and will loop back to them in a couple of months.

5. Follow-up & next steps
 Let's write down 1-3+ action items based on our earlier discussions. Use a circle (see below) to write them down above, next to the considerations. Let's discuss!

6. Make sure it is actionable
 Let's write it down in Asana and break these steps down even further if needed!

If you need some prompts for suggestions...

- Surface assumptions**
 - Why are we using a particular approach to the project? Is it necessary, sufficient, or simply used because technology "has it"?
 - What are the assumptions of our methodology and the platform/data?
 - What history, social context, and knowledge are we bringing?
 - What assumptions might be in the way?
- Power relations**
 - What type of data is requested?
 - What perspective is our chosen methodology putting forward?
 - How do we see an equity/justice oriented perspective?
 - How might we be affected by the method perspective we request?
- Consider impact**
 - What outcomes/data is our chosen, selected methodology creating? Who does this impact and how?
 - What outcomes/data is our chosen, selected methodology helping? Who does this impact and how?
 - What harms, negative outcomes, or undesired outcomes might occur? (through, not!)
- Examine power & control**
 - What is the control of this project?
 - What are the range of social relations that might produce the data and the methodology?
 - What is embedded through this project? Who benefits the most?
 - Who is harmed or kept the project? Who is excluded?
 - What data has been collected in the project? What have not? Who has not?
- Challenge power together**
 - How might we challenge or resist these values, classifications, theories, and causal power structures?
 - How might we incorporate those other perspectives?
 - How might we be less smart?
 - How might we be better than those others?
 - How are we incorporating the histories of our work to date?

CONCLUSIONS & LOOKING FORWARD

It is a great honor to have the opportunity to dedicate our work to taking on the important challenges outlined in the report. We greatly value all of the support from our funders, advisors, and community that make it possible. We continue to believe that our efforts will help to make a measurable difference in each of the five grand environmental challenges we've outlined, with key milestones in solution delivery forthcoming in each project in the year ahead.



Learn more at dse.berkeley.edu