BEZOS EARTH FUND

SUMMARY REPORT

AI for Climate & Nature Workshop

SALESFORCE TOWER, SAN FRANCISCO, CA, USA

OCTOBER 17-18, 2023

IN COLLABORATION WITH FORESIGHT INSTITUTE

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“We look to you for some guidance, but this is not about the Bezos Earth Fund; It’s about something much, much bigger: how do we apply this incredible breakthrough of AI to address something that is so urgent.”

Andrew Steer

BEZOS EARTH FUND

About Bezos Earth Fund and the AI Initiative

Artificial intelligence (AI) has seen tremendous progress in recent years, and it presents a remarkable opportunity to drive progress in climate and nature, especially when considering AI's capacity to not just decipher and connect data for actionable insights, but to be seamlessly integrated into solutions themselves. The Bezos Earth Fund is delving into the synergies between AI and climate and nature, starting with a comprehensive landscape assessment led by the Earth Fund in collaboration with key partners. As part of that effort, this workshop aims to gather global leaders in AI, climate, and nature to identify the most promising impact areas for AI, informing future research and funding allocation, while also enriching the broader ecosystem by providing critical insights to other funders, decision-makers, and stakeholders invested in sustainable development and environmental stewardship.

The Bezos Earth Fund, established in 2020 with a $10 billion commitment from Jeff Bezos, is a philanthropic initiative focused on addressing climate change and preserving nature within this decisive decade. The fund recognizes the essential role of philanthropy in providing flexible funds, taking calculated risks, and leveraging independent expertise to design effective solutions. As a new philanthropic entity, the Bezos Earth Fund is dedicated to delivering transformational change in response to the urgent environmental crises of our time.

About Foresight Institute

Founded in 1986, Foresight Institute supports the beneficial development of high-impact technology to make great futures more likely. Foresight Institute focuses on science and technology that is too early-stage or interdisciplinary for legacy institutions to support, such as biotechnology, nanotechnology, neurotechnology, computation, and space exploration.Foresight Institute awards prizes, offers grants, supports fellows, and hosts conferences to accelerate progress toward flourishing futures and mitigate associated risks.

About the venue

The workshop venue, named The Institute, is situated at the top of the iconic Salesforce Tower in San Francisco, a hub for world-class innovators spanning art, science, medicine, and technology. As a public benefit corporation with a philanthropic heart, The Institute's mission is to assemble thought-leaders from diverse sectors, aiming to address and provide solutions to contemporary challenges.

"*Imagine a workshop* where we become agents of positive change and transcend our current horizons to catalyze a global innovation community for our planet.

Imagine a future where the synergy between AI and human ingenuity amplifies the scale of solutions in a way that empowers people to reimagine and reshape the very foundations of our relationship with nature and climate, opening doors to new horizons of possibility.

Imagine a world where the fusion of AI with nature and climate is not just a vision, but a reality, where every algorithm written is a promise to safeguard our planet for generations to come."

Noël Bakhtian + ChatGPT
BEZOS EARTH FUND

Executive Summary

The Bezos Earth Fund hosted an 'AI for Climate and Nature' workshop, in collaboration with Foresight Institute on October 17-18 in Silicon Valley, to inform future research and funding allocation, while also enriching the broader ecosystem by providing critical insights to other funders, decision-makers, and stakeholders invested in sustainable development and environmental stewardship. 58 key stakeholders from diverse sectors converged to explore and expand upon the critical intersection of AI with climate and nature.

This workshop invited leading researchers, entrepreneurs, and decision-makers across these domains to pull up their sleeves to explore high impact opportunities, form lasting collaborations, and drive long-term cooperation to leverage AI for the benefit of climate and nature. The workshop identified a multitude of gaps and opportunities for AI to accelerate climate and nature solutions, marking a stride towards harnessing AI's transformative power to address environmental exigencies.

Through a combination of lightning talks, group discussions, and breakout sessions, more than 65 climate-related, 55 nature-related challenges, and 40 AI superpowers were identified. A major outcome over the two day workshop was uncovering 59 opportunity spaces at the nexus of climate/nature challenges and AI capabilities. These are summarized in the figure below. In the future we envisage public usage of this tool (researchers, policymakers, and funders) to leverage ideas and solutions for beneficial long term futures for all.

Opportunities at the Nexus of Climate–AI Nature–AI

AI Capabilities

- Machine Learning Methodologies
- Educational Tools and Capacity Building through AI
- AI-Driven Decision Support and Policy Formulation
- Enhancing Research Workflow with AI
- Automated Monitoring and Data Management
- NLP and Computer Vision for Environmental Insights
- Ethical Challenges and Limitations of AI
- Innovations in Generative AI and Autonomous Systems
- AI for Optimization and Workflow Efficiency

Geopolitical & Global Perspectives
- Carbon Markets and Digital Solutions
- AI's Double-Edged Sword
- Behavioral Change and Decision-Making
- Multiscale Analysis and the Role of Oceans

Data & Information Management
- Natural Language Feedback for Geospatial Models
- Data Curation and Tracking
- Open-Sourced Data Collection & Dissemination
- Addressing Data Gaps

Emissions & Monitoring
- Data Utilization & Emissions Characterization
- Predictive Maintenance & Information Gathering
- Modeling & Metrics

Societal & Behavioral Challenges
- Beyond Technological Change
- Geopolitical Intersections
- Just Transition
- Quantifying Impacts

Planning, Infrastructure, & Technology
- Transportation & Urban Planning
- Infrastructure & Decarbonization
- Technological Advancements
- Efficient Land & Infrastructure Siting

Legislation, Regulation, & Policy
- Legislation, Litigation, and Legal Reform
- Climate Adaptation and Intersecting Sectors
- Sociopolitical Challenges
- Information Biases and Trust

Biodiversity, Extinction, & Ecosystem Impact
- Data Reliance in Decision Making
- Tracking Biodiversity Targets
- Incorporation of Local Knowledge
- Global Commitments and Climate Action

Systems & Holistic Approaches
- Complex Climate Interrelations
- Efficiency and Roadmapping
- Risk, Ethics, and Scalability
- Desiloing for Comprehensive Strategies

Policy, Governance, & Global Commitment
- Biodiversity Loss
- Invasive Species and Disease
- Climate Change Impacts
- Human Practices and Awareness

Financial & Economic Considerations
- Financing Innovation
- Supply Chain & Geopolitics
- Climate Finance Scale
- Economic vs. Environmental Goals

Data, Technology, & AI in Conservation
- Biodiversity Data Infrastructure
- Understanding Ecosystems and Data Challenges
- AI and Conservation
- Advancements and Applications

Education, Communication, & Trust
- Science for All
- Citizen Science Integration
- Trust in the Age of Polarization
- Enhancing Climate Education

Awareness, Education, & Conservation Strategies
- Sustainable Food Production
- Overexploitation and Pollution
- Educational Frameworks and Conservation Status
- Interventions and Advanced Tools

Technological Advancement & Innovation
- Scientific Experimentation & Materials Innovation
- Permitting & Deployment Challenges
- Systems Thinking & Equity
- Commercialization & Consumer Adoption

Research, Innovations, & Future Directions
- Ecosystem Mapping and Assessment
- Decision-Support Needs Across Governance Levels
- Biodiversity Metrics and Energy Flow Models
- Genomic Resilience and Financial Mechanisms

Climate

Nature

Participants then deepdived on specific challenge-solution spaces based on impact, and produced briefs on the the following 8 proposed Spotlights opportunity areas:

Climate

- **A global, accurate, and authoritative account of greenhouse gas flux, separated out by origin and owner.** Develop integrated, authoritative emissions and sequestration information systems that can effectively inform mitigation decision making at multiple scales.
- **AI-accelerated building decarbonization.** Decarbonize buildings by - building-by-building - making recommendations that include: energy efficiency (e.g., heating/cooling), clean energy tech (solar, batteries, heat pumps), and energy forecasting for user decisions, with a focus on equity and justice.

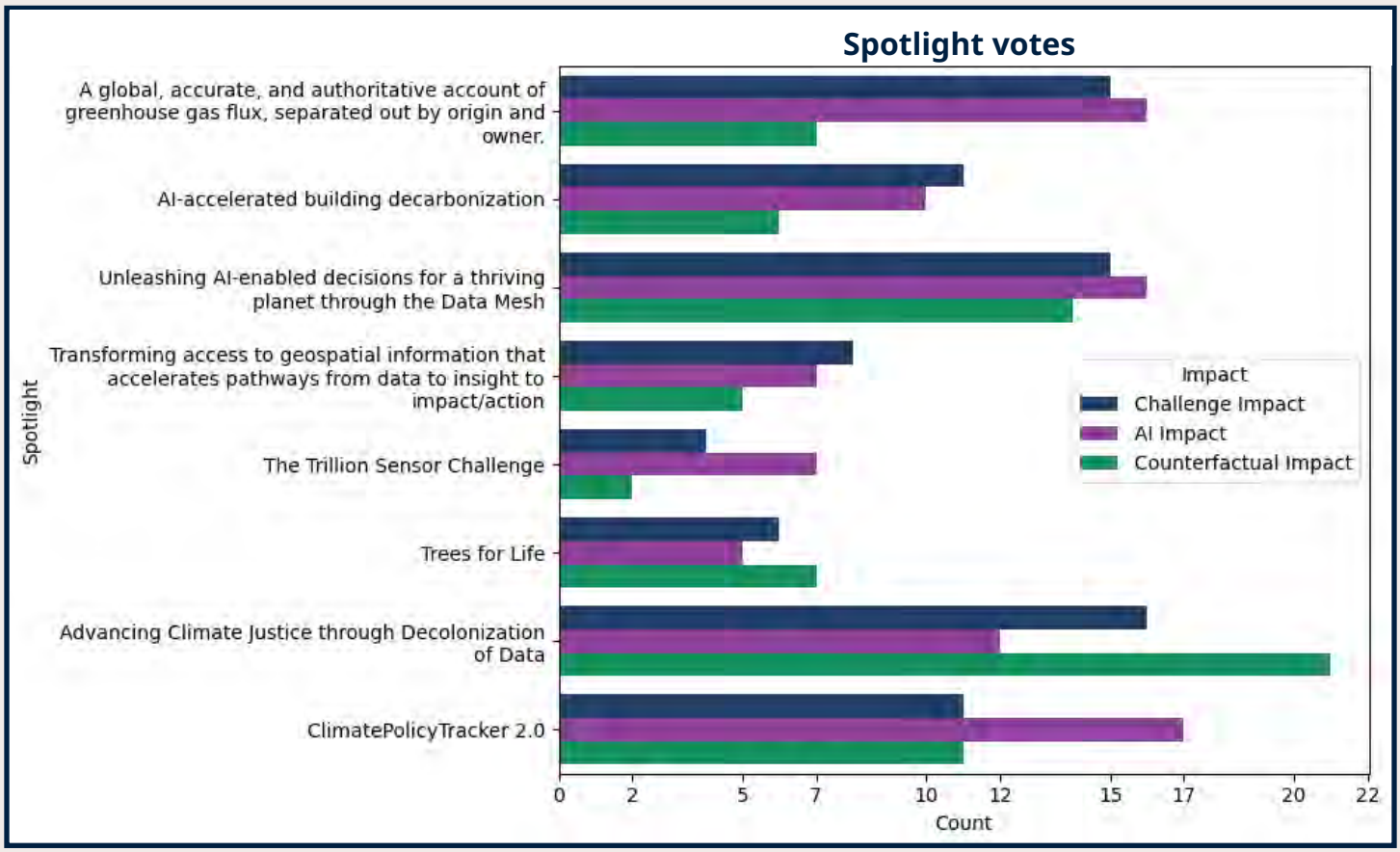
Nature

- **Unleashing AI-enabled decisions for a thriving planet through the Data Mesh.** Build a global "data mesh" that fills the biodiversity "data gap" by connecting hardware, data, people, species, and regions through connecting existing data sources, collectors and holders, and creating a unified way to query the data and deploy analytics/AI solutions.
- **Transforming access to geospatial information that accelerates pathways from data to insight to impact/action.** Enable humans to interact with diverse geospatial data from multiple sources, asking questions and providing feedback to models in natural language.
- **The Trillion Sensor Challenge.** Ubiquitous, intelligent, low-cost sensors and universal sharing for biodiversity to make measurement, reporting, and verification trivial for conservation at any scale, on land or underwater.
- **Trees for Life.** Apply equitable AI in African forest and grassland landscape regeneration to measurably improve community wellbeing and restore biodiversity, and to prioritize the right places to invest for the greatest potential benefit and likelihood of success.

Climate & Nature

- **Advancing Climate Justice through Decolonization of Data.** Realize climate justice at speed and scale by integrating local and indigenous knowledge and lived experience into the data and the science and to inform the evolution of the models/technology.
- **ClimatePolicyTracker 2.0.** Decision-making/decision-implementation tools for a range of different applications including for executives and legislators that meaningfully increases the speed, quality, and credibility of climate and nature-critical decisions.

Based on presentations and group discussion, participants then ranked the Spotlights based on their potential impact across three pivotal areas: impact if the climate/nature challenge were solved, impact of AI on the challenge, and counterfactual impact with respect to other agents in the domain (aka crowdedness of the nexus space). Results are shown in the following plot. This vote revealed the high-impact potential of the Spotlights "Advancing Climate Justice through Decolonization of Data", "ClimatePolicyTracker 2.0", "Unleashing AI-Enabled Decisions for a Thriving Planet through the Data Mesh."



Votes tallied for three different impact metrics for each Spotlight.

An exploration into next-generation AI's untapped potential formed a key part of the dialogue, identifying 47 promising directions, with two distinctive threads emerging from participant responses:

Existing AI Capabilities that can be newly applied to Nature/Climate applications:

- Robust and Specialized AI Models
- Data Fusion and Multimodal Analysis
- AI-Driven Decision Support and Monitoring
- Innovation in Materials and Sustainability
- Enhancing Data Accessibility and Collaboration

Potential for AI Advancements in Support of Climate/Nature:

- Data Efficiency and Variability
- Trustworthiness and Explainability in AI:
- Language and Cultural Inclusivity in AI
- Advanced AI Methods and Human-AI Partnership
- Proactive Management of Unanticipated Consequences

Finally, a dedicated panel and group discussion identified “meta-challenges” acting as potential roadblocks for AI’s impact on climate and nature. These challenges spanned a wide spectrum, from data issues to talent imbalances, and from equity concerns to funding fragmentation.

The Bezos Earth Fund, with its commitment to investing in climate, nature, and justice solutions, recognizes the boundless potential AI holds. Examples already in play, like optimizing battery material discovery and exploring alternative proteins, are just the tip of the iceberg. The challenge lies in broadening the community’s horizons, identifying and promoting those intersections where technology meets environmental needs, and pushing forward with determination and innovation. As experts were invited to step out of individual project mindsets, engage with an expansive view, and think audaciously, they enabled this workshop to take concrete steps towards breaking down silos between experts in AI, Nature, and Climate, as well as academia, government, NGOs, and industry, and to initiate the urgent advances needed in this climate crisis: novel collaborations and critical insights for decision-makers and stakeholders invested in sustainable development and environmental stewardship.

Creativity was inspired by The Institute’s view and space. Closing out Day 2 with new ideas, collaborations, and impact goals.

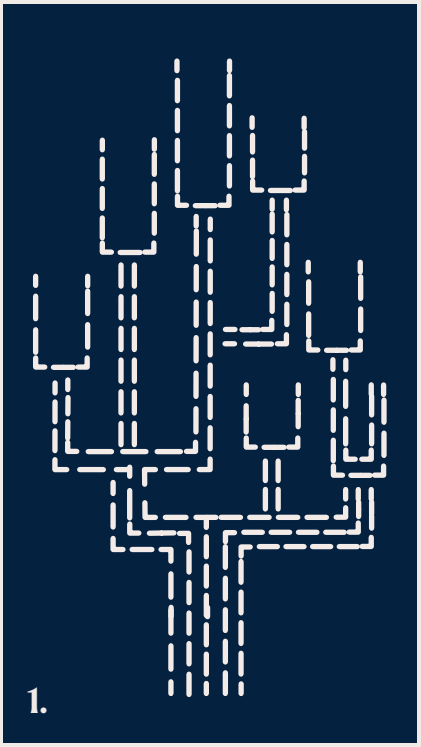
Nancy Harris (World Resources Institute) engaging during a Q&A session.

Uyi Stewart (Data.org) representing his Spotlight team and providing a summary to the whole group on Day 2.

A group break and nature walk in Salesforce Park was an opportunity to discuss ideas heard on Day 1.

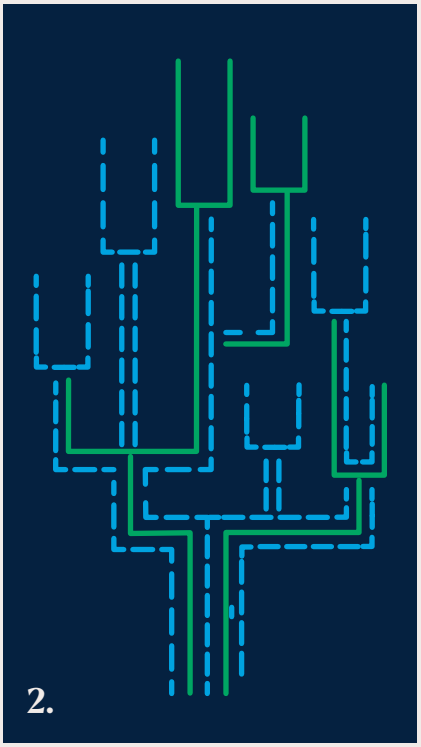
Workshop Goals

The intersections of AI with climate and nature are still nascent but could be of fundamental importance for beneficial futures. As Bezos Earth Fund is exploring high impact opportunities in this space, this workshop serves as a platform for leading researchers, entrepreneurs, and decision-makers from various fields to come together and ideate. The intention is to catalyze meaningful conversations and collaborations across diverse communities—including research, funders, and policymakers. By doing so, we aim to collectively uncover new opportunities, forge lasting partnerships, and promote sustained cooperation, all with the objective of utilizing AI to generate positive outcomes for both climate and nature. The workshop goals include:



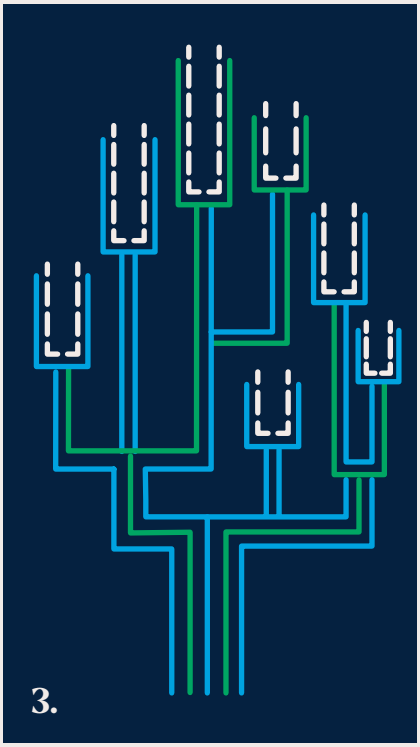
SCAN:
The AI-for-Climate & Nature Domain:

Identify the critical challenge areas within climate and nature where AI's unique superpowers can be leveraged to make a substantial impact.



FOCUS:
Evaluating Opportunities:

Acknowledging the sectors already embraced by startups and industry from the previously identified domains, pinpoint the remaining gaps and opportunities, inclusive of innovative AI applications in areas previously exposed to AI.



FUTURE:
AI Horizons for Scaling Climate & Nature Impact:

Explore potential AI breakthroughs not yet actualized that hold the promise to expedite the implementation of impactful and scalable solutions in climate and nature.

Workshop Format

The workshop spanned two days, each with distinct objectives. On the first day, the focus was on establishing a common context and understanding to provide the foundation for identifying matches between AI capabilities and the highest impact challenges. The session started with lightning keynotes by 10 domain experts who provided introductions to the most pressing issues in Climate and Nature, as well as those sharing information on AI 101 and the latest advancements in AI. Following this informative session, the SCAN phase continued, dedicated to allowing workshop participants to deepdive on pitching and prioritizing challenges and potential AI solutions, thereby identifying the major opportunity and gap spaces at the nexus of climate and AI, and nature and AI.

The second day started with the FOCUS phase, during which working groups engaged in brainstorming sessions centered on the shortlisted nexus opportunity spaces, referred to as "Spotlights", to take time and provide details on a specific climate-AI or nature-AI pairing. Subsequently, in the FUTURE phase, the discussion broadened again to explore the advancements required in AI to better serve the realms of Climate and Nature. Additionally, the conversation delved into the overarching meta-challenges of applying AI capabilities to application areas that demand attention and innovation. The main outcomes of the workshop are:

1. **Elevating Challenges:** Attendees pinpointed over 65 climate-related and 55 nature-related challenges, recognizing their significant impact and relevance.
2. **Highlighting AI Capabilities:** More than 40 AI superpowers were identified. Challenges and superpowers were summarized in the SCAN section.
3. **Identifying Opportunities at the Nexus:** By considering the appropriate application of AI capabilities to challenges, a series of 39 opportunity spaces for climate-AI and 20 opportunity spaces for nature-AI were established.
4. **Spotlights on Promising Areas:** From the extensive list of nexus opportunities, eight challenge-AIcapability pairs, referred to as "Spotlights," were deemed particularly promising for further exploration. Participants spent several hours deepdiving in these areas. Detailed summaries are provided in the FOCUS section.
5. **Ranking and Prioritization:** Participants presented and then ranked the Spotlights based on their potential impact on climate and nature, the capacity of AI in the challenge solutions space, and their counterfactual impact given the existing crowdedness of the field.
6. **Identifying Future Directions:** 47 promising directions for next-generation AI were pinpointed, highlighting their potential to significantly influence nature and climate solutions.
7. **Addressing Meta-Challenges:** The workshop concluded with a discussion on the meta-challenges that are currently obstructing progress in applying AI solutions to the climate and nature ecosystems, fostering a collaborative environment for strategic insights.

"The term 'data' consistently stood out as a central theme throughout the workshop, underscoring the principle that the effectiveness of AI is fundamentally tied to the quality of its underlying data. This implies that without robust and reliable data, there is a risk that AI could amplify existing

biases or engage in problematic behavior." To accurately assess the current state of climate and nature, and provide AI models with thorough and relevant data, there's a pressing need for accessible, comprehensive, and multifaceted data. This stands out as the primary constraint to further innovation.

Access to sections of the raw workshop data is available in the Appendix, to complement the roll-up analysis and themes shared in the report.

Day 1: All Workshop participants gathered in the Salesforce Park.

“It is difficult to take pure AI concepts done in some obscure research space and connect them to core problems that affect people, affect outcomes, and drive solutions.”

Amen Ra Mashariki

DIRECTOR OF DATA STRATEGIES

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Workshop Participants

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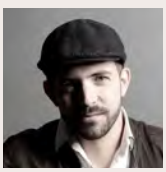

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CHIEF DATA SCIENTIST

Agenda

DAY 1: TUESDAY 17 OCTOBER

TIME	ACTIVITY
09:00-09:30	Arrival & Light Breakfast
09:30-10:00	Participant Introductions
10:00-10:15	Workshop Welcome
SCAN: THE AI-FOR-CLIMATE & NATURE DOMAIN	
10:15-11:50	Presentations: Climate & Nature Challenges
11:50-1:10	Walk & Lunch
1:10-2:25	Presentations: AI Superpowers & Capabilities
2:25-3:25	Collective working session to explore the Opportunity Nexus at the intersection of AI for Climate and Nature
3:25-3:40	Break
FOCUS: EVALUATING OPPORTUNITIES	
3:40-4:30	Collective working session to classify & shortlist opportunities at the nexus of AI for Climate and Nature
4:30-5:00	Spotlight Team Formation
5:00-7:00	Reception

Agenda

DAY 2: WEDNESDAY 18 OCTOBER

TIME	ACTIVITY
9:00-9:30	Arrival & Light Breakfast
FOCUS: EVALUATING OPPORTUNITIES (CONT.)	
9:30-11:30	Focus groups to explore and develop highest priority opportunities
11:30-12:30	Focus groups present their AI for Climate and Nature solutions
12:30-1:30	Lunch
FUTURE: AI HORIZONS FOR SCALING CLIMATE & NATURE IMPACT	
1:30-2:15	Collective working session exploring AI horizons for scaling Climate and Nature solutions
2:15-3:00	Fireside chat and group discussion on Meta Challenges holding back AI application for Climate and Nature impact
3:00-3:30	Next Steps & Closing Remarks
3:30-5:00	Plan Future Collaborations & Socialize

Andrew Steer (Bezos Earth Fund) and Rich Powell (Clearpath Action) sharing ideas during a group input session.

Amanda Staudt (NASEM) and Katie Zacarian (Earth Species Project) inputting data during a group input session.

Cristián Samper (Bezos Earth Fund), Dan Hammer (ODE), and Jorge Soberón (University of Kansas) sharing ideas during a break.

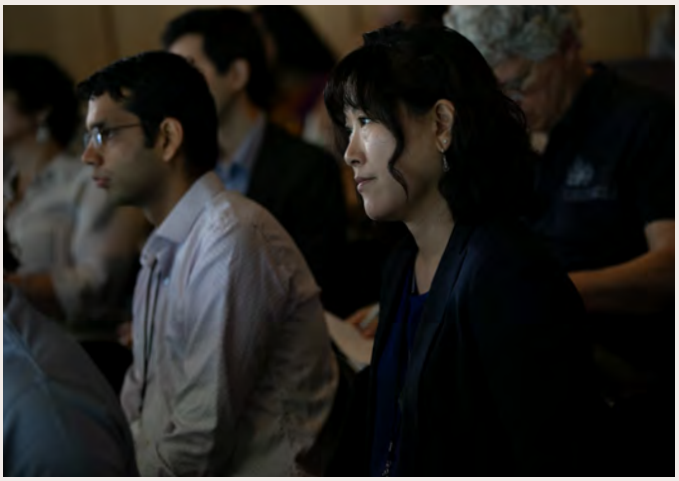
Lauren Bennett (ESRI) providing additional insight during a collective working session.

Noël Bakhtian (Bezos Earth Fund) closing out Day 2 with workshop impacts and next steps.

Allison Duettmann (Foresight Institute) moderating a workshop session.

Tracey Osborne (UC Merced) sharing a new concept during a breakout group.

Carl Boettiger (UC Berkeley) and Tanya Berger-Wolf (Wild Me) presenting a Spotlight summary on Day 2.



Alissa Park (UCLA) and Aditya Grover (UCLA) focusing on a Lightning Talk.

Anna Michalak (Carnegie Institution for Science) and David Tennenhouse (National Science Foundation) deepdived for several hours on Spotlights on Day 2.

Michal Nachmany (Climate Policy Radar) providing insight during a collective working session.

Kofi Nyarko (Morgan State University) providing insight during a collective working session.

Amen Ra Mashariki (Bezos Earth Fund) sharing information on the Earth Fund's AI initiative to help set the workshop context.

“There is bias in where we don’t have data, and it is exactly where the loss of biodiversity is the highest.”

Tanya Berger-Wolf

WILD ME

Scan

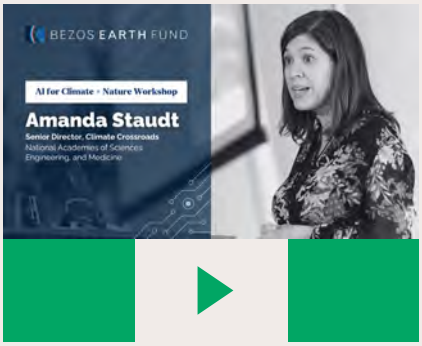
The workshop initiated with an overview of the major open challenge spaces in the climate and nature sectors, aimed at harmonizing the understanding among the diverse experts (including AI experts) present. This was followed by an introduction to AI and its notable 'superpowers', to equip participants with a shared foundation in AI capabilities. This structured approach was crafted to set the stage for subsequent discussions, focusing on aligning AI solutions with the significant challenges identified in the climate and nature domains. Summaries and links to the lightning keynote speakers' recordings are available below.

Lightning Talks: Climate and Nature Challenges

CLIMATE CHALLENGES THROUGH AN AI LENS - MARIA JOÃO SOUSA, CLIMATE CHANGE AI

TACKLING CLIMATE CHANGE WITH MACHINE LEARNING

Machine Learning presents transformative potential in addressing the escalating threat of climate change, an urgency emphasized by continuously rising emissions despite ambitious targets set for 2025. The speaker highlighted an extensive paper reporting a multitude of possible avenues for machine learning to impact climate. The key themes encompassed in the big effort are: harnessing machine learning for data-intensive tasks like processing vast datasets on emissions and deforestation, and deciphering policy documents; forecasting for instance to benefit renewable energy penetration and predicting extreme weather occurrences; enhancing operational efficiency in areas such as building heating/cooling systems; predictive maintenance for instance for railways and methane leak detection; and expediting scientific research by optimizing experiment sequences and fast-tracking computationally intensive climate simulations. However, caution was voiced on the potential of AI to inadvertently increase emissions or its direct environmental footprint through computation and hardware manufacturing processes.



CLIMATE CHALLENGES - AMANDA STAUDT, NATIONAL ACADEMIES OF SCIENCES, ENGINEERING, AND MEDICINE

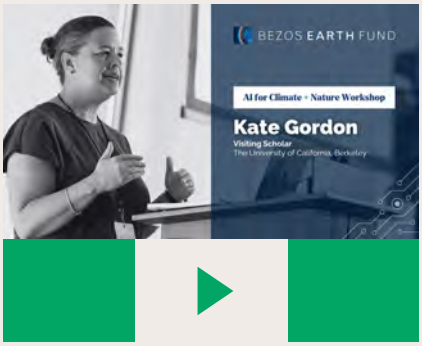
CLIMATE MITIGATION: CHALLENGES, RISKS, AND OPPORTUNITIES

The National Academies' report on climate challenges, "Accelerating Decarbonization in the United States", with an emphasis on climate mitigation and the pivotal challenges, risks, and opportunities it presents, has just been released. The report underscores the escalating greenhouse gas emissions, highlighting a broad understanding of the overall scenario but recognizing a dire need for more granular emission data. Such data collection faces critical challenges, such as tracking and accountability, the need for standardization and trusted accounting systems, and positive feedback loops arising from warming-induced natural emissions, such as the ones caused by wildfires. The report advocates for a net-zero target by 2050, urging a double in non-carbon electricity to 75% by 2030 through expanded solar and wind technology, reduced coal and gas-fired plants, preserved nuclear and hydroelectric facilities, and strategies for residual emissions including carbon dioxide removal (CDR). It recommends adapting infrastructure to use low-carbon electricity, enhancing energy efficiency, increasing electrical transmission capacity by 40% for better renewable power distribution, and accelerating the electric vehicle recharging network expansion.. The expansive report (650 pages!) also identifies themes presenting both challenges and opportunities, such as a gap in the workforce, a lack of transition planning, and the imperative of public engagement. Ultimately, any intervention in the climate crisis necessitates a comprehensive understanding of the Earth as an intertwined system, highlighting the need for advanced tools to accurately model unavoidable secondary effects and ramifications of interventions.

NATURE CHALLENGES - CHAD GALLINAT, CONSERVATION X LABS

GLOBAL DRIVERS OF BIODIVERSITY LOSS AND ECOSYSTEM CHANGE

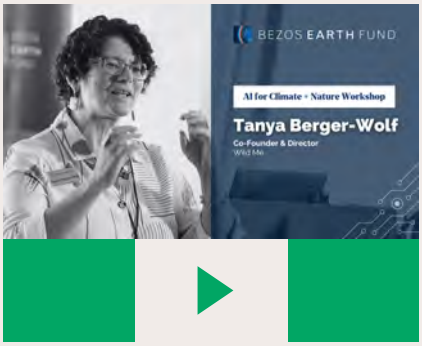
The planet is rapidly approaching a sixth mass extinction, uniquely instigated by one species: humans. Traditional conservation efforts, although significant, fail to counteract this alarming trend, largely due to the exponential rise in problems such as pollution and habitat destruction, contrasted by merely incremental solutions. While the creation of protected areas has seen considerable success, particularly in the preservation of national parks, vulnerable species continue to face decline. This suggests that protection alone is insufficient; addressing underlying economic pressures that contribute to habitat destruction is crucial. A framework is introduced which details the five primary global drivers leading to biodiversity loss: alterations in land and sea use, which result in major habitat disruptions; the rising rate of overexploitation of wildlife; increasing pollution levels; the challenges posed by invasive species and disease; and the pervasive effects of climate change. Each driver presents its own set of challenges, offering insights and sparking the need for innovative approaches to conservation.



CLIMATE CHALLENGES - KATE GORDON, UC BERKELEY

THE CHALLENGE AND OPPORTUNITY OF CLIMATE CHANGE

Addressing climate change necessitates a comprehensive transformation of our energy, economic, and ecological systems. Just the extreme heat events of the last year are estimated to account for $23 billion of climate disaster damage, especially impacting the global South. The speaker emphasized the urgency of shifting from fossil fuels to renewables, with the slogan: “Use electricity, not much, mostly renewable.” Efforts from the Biden-Harris administration were highlighted, including legislative initiatives and strategies to move towards a clean energy industry, focusing on reduction, reuse, and repurposing. Beyond technology, land utilization and ensuring inclusivity for economically marginalized communities in this transition are pivotal. Importantly, climate change exacerbates conflicts on the geopolitical front, and resulting in carbon-intensive conflicts.



NATURE CHALLENGES - TANYA BERGER-WOLF, WILD ME

THE LIVING PLANET, CHALLENGES AND OPPORTUNITIES

The talk called attention to the alarming rate of biodiversity loss, with one million species currently at risk, amounting to 10% of the estimated total biodiversity. Human wellbeing is intricately tied to the health of ecosystems, which are now struggling to recover and respond due to overwhelming environmental stress. The complexity of ecosystems poses a significant challenge, leading to a focus on only parts of the whole. A major issue highlighted is the scarcity of data; out of an estimated 10 million species, only 2.1 million have been described, with 160,000 having complete listings. Over half of these species have deficient data or an unknown trend, and regions with the highest biodiversity are notably data-deficient. The understanding of the drivers of biodiversity loss and their impacts on entire ecosystems remains limited, as does the knowledge of the effectiveness of different interventions. The presentation calls for increased resources, including funding, manpower, tools, and metrics, and emphasizes the necessity of coordinated policy and action based on robust data and continuous monitoring to address the biodiversity crisis effectively.

NATURE CHALLENGES THROUGH AN AI LENS - REGAN SMYTH, NATURESERVE

BRIDGING THE BIODIVERSITY KNOWLEDGE GAP

NatureServe has persistently equipped decision-makers with essential information to combat species extinction and support thriving ecosystems. However, despite recognizing biodiversity loss as a top global risk, a significant knowledge gap persists. Much of the existing information is outdated or inaccessible to policymakers, and this problem is exacerbated by the fact that 90% of all data has been generated in the past 2 years, but a startling 92% of it lacks the capacity for target tracking and reporting towards biodiversity targets. Moreover, this data is often geographically and taxonomically biased, not provided at spatial scales necessary for ground-level action, and frequently remains inaccessible and indecipherable to those seeking to make informed decisions. Startling statistics reveal that 71% of plant species and 67% of animal species haven't been assessed in the last 10 years, highlighting the urgency of the situation. To address these challenges, we need frameworks that can answer fundamental questions about biodiversity—what is it, where is it, how is it doing, and what's changing—enabling us to track trends and future scenarios. Innovative AI solutions hold promise in making this data accessible, understandable, and decision-ready, which is crucial for shaping effective conservation policies in the face of these pressing issues. Yet, challenges loom large: of an estimated 10 million species, only 2.1 million have been described. With many residing in high biodiversity zones, data remains either scarce or inconclusive. This shortfall hinders understanding ecosystem impacts and designing effective, resource-efficient policies.

“Problems are getting exponentially worse, and solutions are incremental.”

Chad Gallinat

CONSERVATION X LABS

Climate/Nature Challenges: Collective Group Discussion & Input

Following the keynote presentations on Climate and Nature, attendees were encouraged to divide into breakout groups and collaboratively identify the most urgent challenges existing within these realms. More than 65 climate-related and 55 nature-related challenges were listed. The insights gathered throughout this process have been incorporated into the "Opportunity Nexus" section of the report.

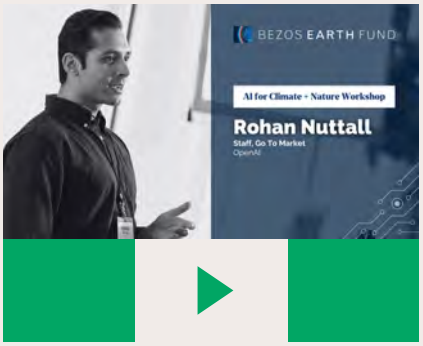
Lightning Talks: AI Superpowers and Solutions

In the realm of AI, the term "superpowers" is often invoked to highlight capabilities that are uniquely transformative and boundary-pushing. But what exactly are these AI superpowers, especially when viewed through the lens of addressing climate and nature challenges? Several experts answered this question in the following talks.

AI SUPERPOWERS - MARCUS NOACK, LAWRENCE BERKELEY NATIONAL LAB

AI SUPERPOWERS: MYTH OR REALITY? A POCKET-SIZED INTRODUCTION TO MACHINE LEARNING

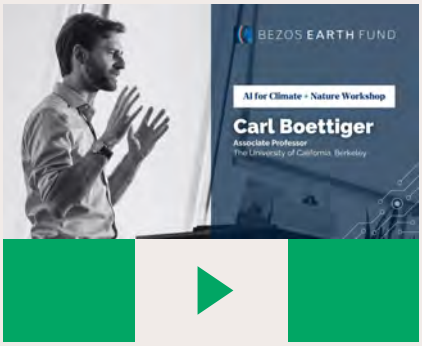
In this talk, we will explore the incredible potential of AI to The principles of Machine Learning have seen incremental advancements over decades, combining data, mathematical techniques such as function approximation with roots tracing back 200 years, and computing capabilities that have evolved from 100 flops per second to exascale levels. At its core, machine learning maps inputs to predictions. Data, in this context, can be unlabeled, representing positions within a space, or labeled, indicating both positions and corresponding function values. The distinction between unsupervised and supervised machine learning is pivotal: while the former seeks underlying structures and often aims for lower-dimensional representations, the latter focuses on prediction. The perception of Machine Learning and, more broadly, AI's "superpowers," stems not from a sudden leap in capability, but rather from increased collaborative efforts in the field. This perspective is exemplified in autonomous experimentation, a form of active learning where the algorithm selectively determines its training data, gravitating towards areas marked by high uncertainty.



AI TOOLS THROUGH A CLIMATE LENS – ROHAN NUTALL, OPENAI

HOW CAN LANGUAGE MODELS ADDRESS CLIMATE CHANGE?

Language models, especially large ones (LLMs), present an untapped reservoir for addressing climate change. Traditional machine learning primarily revolves around domain-specific, numerical data. In contrast, LLMs are general-purpose models trained on diverse data, such as text and images. Noteworthy impacts of LLMs include the "copilot effect," which boosts the productivity of experts when they use LLMs as an assistant. Throughout the lifecycle of climate solutions – from assessment and financing to procurement and construction – there's a potential for LLMs to streamline processes. Notable startups harnessing LLMs in this arena include PACES and Spark, which expedite site selection for renewable projects; Streamline and Blumen, which facilitate grant writing and permitting respectively; Proxy, which aids homeowners in pinpointing relevant retrofits; and Climatebase, connecting individuals with training and companies focused on climate action. The underlying strengths of LLMs such as in-context reasoning, retrieval, function calling, fine-tuning, prompt chaining, and code generation enable these successes. In the grander perspective, with the urgency of climate action, LLMs hold the potential to alleviate operational bottlenecks, by enabling mitigation efforts to scale up.



AI TOOLS THROUGH A NATURE LENS – CARL BOETTINGER, UC BERKELEY

AI FOR NATURE: POWERS, POSSIBILITIES AND PERILS

The transformative potential of AI in conserving nature revolves around three pivotal themes. First, there's an ongoing revolution in biodiversity data collection propelled by AI techniques in computer vision (CV) and supervised learning tasks such as audio and eDNA analyses. While the research and industrial sectors are rapidly integrating these tools, having more data alone isn't the panacea for nature conservation. True impact arises when this data informs decisions. Managing ecosystems is akin to regulating economies; both are riddled with complexities and uncertainties. Within this complex landscape of ecological management, which is highly technocratic and governed by legislation, Reinforcement Learning (RL) emerges as a promising AI tool. Historically, its application has been tactical, but its strategic utilization, particularly in decision-making spheres like fisheries optimization, poses unique challenges. For instance, when AI becomes a policing tool rather than a policymaking aid, concerns about ethics, equity, power, and legitimacy surface. It becomes imperative to integrate political economy expertise into the conversation. Ultimately, the efficacy of AI in conservation hinges not merely on quality data but on how it facilitates informed, unbiased, and strategic decision-making processes.

AI THROUGH AN EQUITY LENS - LAUREN BENNETT, ESRI

AI's role in addressing global challenges needs to be examined through an equity lens. Spatial thinking offers a unique perspective on such issues, emphasizing geography's pivotal role. By adopting both intersectional and spatial approaches, we recognize the necessity of mapping data. Numerous AI projects progress without spatial considerations, and simply identifying gaps in geospatial data can profoundly guide remedial actions. On the intersectional front, it's crucial to discern that much of the data represents outcomes rather than underlying causes. Models trained without this context can yield skewed results. Thus, incorporating data that mirrors root causes and ensuring data disaggregation are vital efforts. Evaluating AI outputs requires critical inquiry into whether proposed solutions might unintentionally perpetuate existing disparities. The very questions AI seeks to answer are inherently laden with biases, and these questions influence the outcomes; the questions we ask matter, as do the objective functions we are trying to solve for For instance, while air pollution might be decreasing overall, it primarily benefits affluent, white communities. True equity and inclusion demand diverse representation at decision-making tables, coupled with genuine empowerment. Fostering accountability and transparency in AI means engaging with varied audiences, from researchers to the general public, ensuring narratives are both informative and compelling. For many decision-makers, algorithmic recommendations have become indispensable for taking action, emphasizing the need for responsible and equitable AI systems.

AI Superpowers: Collective Group Discussion & Input

After the introductory presentations, the expert AI participants curated a comprehensive list, pinpointing over 40 AI capabilities deemed as 'superpowers'. These have been grouped into 34 capabilities as summarized below, with the aid of ChatGPT. For those interested in delving into the original responses, the raw data is available in the Appendix.

AI-Driven Decision Support and Policy Formulation

The transformative role of AI and machine learning in enhancing decision support systems and aiding policy formulation, highlighting both the potentials and the limitations of these technologies.

- **Big Data for Local Policymaking:** Leveraging AI and machine learning to process diverse and extensive datasets, uncovering patterns of movement to inform local policy decisions, such as optimal locations for bike lanes, electric vehicle chargers, and green infrastructure.
- **AI as a Collaborative Tool:** Acknowledging that AI is not a standalone solution for decision support, emphasizing the necessity for a human partnership and interdisciplinary data scientists to effectively leverage AI capabilities.
- **Multi-Objective Optimization:** Utilizing AI-aided optimization algorithms to comprehend trade-offs and identify mutually beneficial solutions across various sectors, including economic, environmental, and social equity, by finding Pareto-frontier solutions.

AI for Optimization and Workflow Efficiency

AI technologies can significantly enhance optimization processes and improve workflow efficiency in various contexts, with a focus on managing uncertainty, applying reinforcement learning to decision-making, and democratizing data access.

- **Managing Uncertainty:** Delving into Uncertainty Quantification to enhance decision-making processes and predictions, ensuring that the potential variabilities and uncertainties in different scenarios are adequately accounted for.
- **Leveraging Reinforcement Learning:** Utilizing Reinforcement Learning for decision-making in dynamic and uncertain environments, particularly in the realm of nature and climate, where agents learn from interactions, mistakes, and rewards.
- **Democratizing Data and AI Access:** Fostering an inclusive environment where access to climate, nature data, and AI capabilities is made available to a broader audience, facilitating more informed and effective decision-making.
- **Enhancing Workflows with AI:** Implementing advanced AI techniques such as retrieval-augmented generation and function-calling to expedite operational and knowledge worker workflows, leading to increased efficiency and productivity.

Automated Monitoring and Data Management

The integration of artificial intelligence in environmental observation and data handling, elucidating on its capability to transform massive datasets into actionable insights and enhance monitoring efficiency.

- **Automated Species Identification:** AI's role in identifying species from images, streamlining biodiversity research and conservation initiatives.
- **Data Management of Sensor-Generated Information:** The utilization of AI to manage terabytes of data produced by diverse sensors, ensuring efficient data processing and usability.
- **Applications in Ecosystem Monitoring and Forecasting:** Leveraging traditional machine learning applications for ecosystem surveillance, species enumeration, weather forecasting, and material design, enhancing the precision and scope of environmental studies.
- **Large-Scale Data Gathering and Environmental Monitoring:** Employing computer vision for comprehensive data collection, alongside Large Earth Observation Models (LEOMs), to meticulously monitor environmental parameters and detect anthropogenic activities, contributing to a holistic understanding of ecosystem health and human impacts.

Educational Tools and Capacity Building through AI

Transforming educational methodologies, focusing on climate and nature-related content, and building capacity for a broader participation in AI-driven solutions.

- **Interactive Educational Tools:** Utilizing AI to create dynamic and interactive tools that engage individuals in climate and nature-related decision-making scenarios, allowing them to witness the real-time, forecasted impacts of their choices.
- **Capacity Building:** Leveraging machine learning, particularly Large Language Models (LLMs), to generate educational content and frameworks, aiming to equip a larger audience with the necessary knowledge and skills to contribute to the development and implementation of AI-powered solutions in nature and climate domains.
- **Enhancing Awareness:** Through interactive tools and educational content, AI acts as a catalyst in raising awareness regarding climate and nature issues, encouraging informed decision-making and proactive participation.

Enhancing Research Workflow with AI

AI and machine learning technologies could streamline and optimize various aspects of the research workflow, particularly in data analysis, task automation, and decision-making support.

- **Behavioral Ecologist Research:** Enhancing data analysis in behavioral ecology through AI-driven tools for signal detection, denoising, handling overlapping signals, multimodal modeling, classification, and identity verification.
- **Automating Mundane Tasks:** Utilizing machine learning to automate repetitive and time-consuming tasks in research, such as report writing and budgeting, thereby freeing up valuable research time.
- **Handling Massive Datasets:** Leveraging machine learning's capability to process and analyze vast, multimodal, and continually growing Earth observation datasets, transforming them into actionable information for decision-makers.

- **Data Cleaning and Causal Inference:** Applying AI for cleaning messy text data, ensuring analysis-ready datasets, and employing causal inference methods to rigorously understand the impact of interventions.

Ethical Challenges and Limitations of AI

The critical aspects of ensuring ethical practices in AI deployment, focusing on integrating equity, identifying situations where AI may not be the ideal solution, and advocating for responsible use through regulation and benchmarking.

- **Promoting Equity through LLMs:** Exploring ways in which Large Language Models (LLMs) can contribute to equity, aiding in critiquing existing systems, and fostering the development of tools that ask the right questions to ensure fairness.
- **Recognizing AI's Limitations:** Understanding scenarios where the implementation of AI might not be advisable, especially in contexts with inadequate infrastructure, to prevent exacerbating existing inequities.
- **Advocating for Responsible AI Use:** Proposing the need for regulations or benchmarking standards for AI models to promote their socially responsible and ethical use, ensuring that the deployment of AI contributes positively to society.

Innovations in Generative AI and Autonomous Systems

Advancements and applications of generative AI and autonomous systems, exploring their potential to revolutionize discovery processes, deepen our understanding of animal communication, and enhance human-machine interactions.

- **Autonomous Experimentation:** Utilizing active learning to automate the discovery process in materials, drugs, and more, significantly accelerating research and innovation.
- **Generative AI in Playback Experiments:** Employing generative AI models to conduct playback experiments, aiding in the unraveling of complexities in social structures, semantics, and syntax within animal communication systems, and finding diverse applications for these scientific discoveries.
- **Human-Centric UI/UX Design:** Implementing user-friendly UI/UX designs that empower humans to act as "decoders," particularly in interpreting satellite imagery embeddings, subsequently reducing the costs associated with creating localized datasets on mining activities and plastic pollution.
- **Controversial Uses and Ethical Considerations:** Acknowledging the controversial potential of AI in designing new microbes or molecules aimed at climate change mitigation or biodiversity restoration, necessitating careful consideration of ethical implications.
- **Pioneering with Active Learning:** Embracing active learning and related data selection techniques for autonomous data exploration, potentially unveiling new avenues of investigation not predetermined by human operators.

Machine Learning Methodologies

Various machine learning methodologies and their applications in AI, highlighting their roles, efficiencies, and innovation in data processing and predictive modeling.

- **Unsupervised ML:** Exploration of neural networks, clustering, dimensionality reduction, and generative AI, showcasing their capabilities in identifying patterns and generating new data.
- **Dimensionality Reduction:** A focused look at techniques to reduce the complexity of data, enhancing model performance and data interpretability.
- **Supervised ML:** Discussion on regression models, Gaussian processes, neural networks, and classification, elucidating their applications in making predictions based on labeled data.
- **Innovative Applications and Efficiency:** Illustration of neural network based foundational models for weather and climate forecasting, spatial AI for global mapping, and knowledge-guided ML to improve model performance in sparse data regimes, all contributing to more efficient and effective AI solutions.

NLP and Computer Vision for Environmental Insights

The transformative potential of Natural Language Processing (NLP) and Computer Vision in extracting valuable insights from vast amounts of environmental data, aiming to streamline workflows and enhance our understanding of the natural world.

- **Advanced Document Analysis with NLP:** Employing Natural Language Processing to read, translate, and extract structured information from documents, perform reasoning tasks, and create intuitive interfaces for end-user interactions, significantly accelerating workflow processes.
- **Model-Based ChatGPT Applications:** Introducing specialized versions of ChatGPT, such as climateGPT and natureGPT, designed to provide expert-level insights and guidance in environmental domains, aiding users in making informed decisions.
- **Interrogating Environmental Data:** Leveraging NLP to enable users to query and interact with environmental data efficiently, fostering a more direct and accessible pathway to knowledge and insights.
- **Facilitating Cross-Language Communication:** Utilizing NLP's translation capabilities to break down language barriers, ensuring that critical environmental information is accessible to a global audience, thereby promoting inclusivity and widespread understanding.

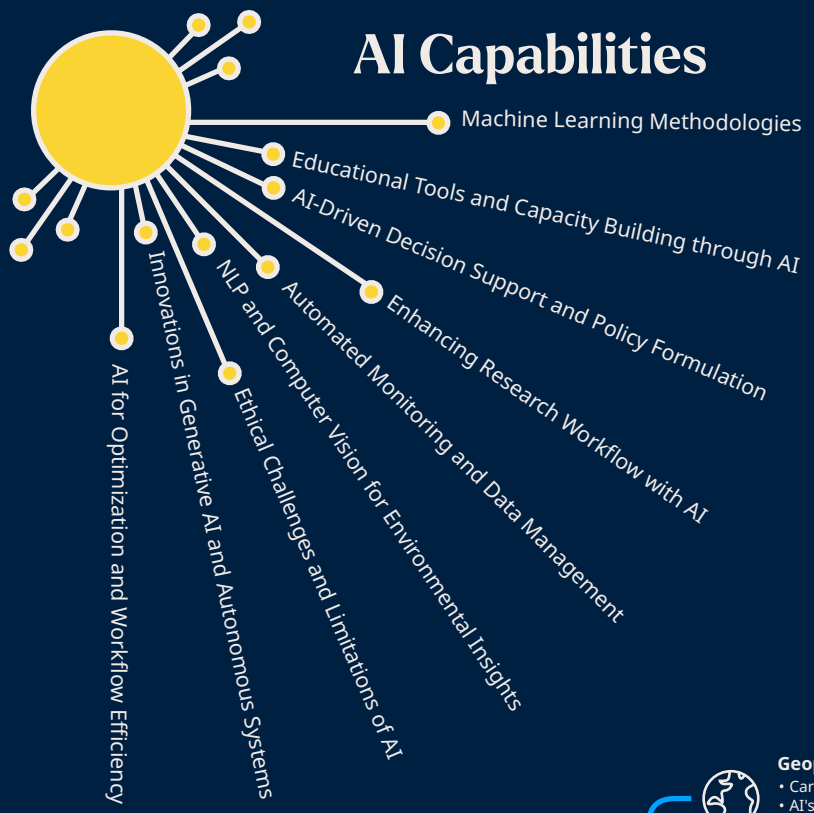
“Local and indigenous knowledge is hard to capture, so we default to what is easy and available. But we must do what is difficult, otherwise tech is going to do more harm than good.”

Uyi Stewart
DATA.ORG

The Opportunity Nexus

After the initial presentations, breakout groups were formed to expand and deliberate on the most pressing challenges in climate and nature. Starting from the list of Nature and Climate related challenges, and AI superpowers identified above, participants were asked to matchmake which AI superpowers would be most suited for each challenge. 40 out of 65 climate challenges and 22 out of 51 nature challenges were paired with an AI superpower. Utilizing ChatGPT after the workshop, the gathered data was categorized based on predominant themes, a concise summary of the opportunity space at the nexus of climate/nature challenges and AI capabilities is provided below. For those interested in delving deeper, the raw data is accessible in the appendix.

Johan Mathe (Atmo.ai) pitches a grand challenge spotlight idea to Aditya Grover (UCLA), Kiran Jain (Replica), and other team mates on Day 2.



Opportunities at the Nexus of Climate–AI Nature–AI

Geopolitical & Global Perspectives
- Carbon Markets and Digital Solutions
- AI's Double-Edged Sword
- Behavioral Change and Decision-Making
- Multiscale Analysis and the Role of Oceans

Data & Information Management
- Natural Language Feedback for Geospatial Models
- Data Curation and Tracking
- Open-Sourced Data Collection & Dissemination
- Addressing Data Gaps

Emissions & Monitoring
- Data Utilization & Emissions Characterization
- Predictive Maintenance & Information Gathering
- Modeling & Metrics

Societal & Behavioral Challenges
- Beyond Technological Change
- Geopolitical Intersections
- Just Transition
- Quantifying Impacts

Planning, Infrastructure, & Technology
- Transportation & Urban Planning
- Infrastructure & Decarbonization
- Technological Advancements
- Efficient Land & Infrastructure Siting

Legislation, Regulation, & Policy
- Legislation, Litigation, and Legal Reform
- Climate Adaptation and Intersecting Sectors
- Sociopolitical Challenges
- Information Biases and Trust

Biodiversity, Extinction, & Ecosystem Impact
- Data Reliance in Decision Making
- Tracking Biodiversity Targets
- Incorporation of Local Knowledge
- Global Commitments and Climate Action

Systems & Holistic Approaches
- Complex Climate Interrelations
- Efficiency and Roadmapping
- Risk, Ethics, and Scalability
- Desiloing for Comprehensive Strategies

Policy, Governance, & Global Commitment
- Biodiversity Loss
- Invasive Species and Disease
- Climate Change Impacts
- Human Practices and Awareness

Financial & Economic Considerations
- Financing Innovation
- Supply Chain & Geopolitics
- Climate Finance Scale
- Economic vs. Environmental Goals

Data, Technology, & AI in Conservation
- Biodiversity Data Infrastructure
- Understanding Ecosystems and Data Challenges
- AI and Conservation
- Advancements and Applications

Education, Communication, & Trust
- Science for All
- Citizen Science Integration
- Trust in the Age of Polarization
- Enhancing Climate Education

Awareness, Education, & Conservation Strategies
- Sustainable Food Production
- Overexploitation and Pollution
- Educational Frameworks and Conservation Status
- Interventions and Advanced Tools

Technological Advancement & Innovation
- Scientific Experimentation & Materials Innovation
- Permitting & Deployment Challenges
- Systems Thinking & Equity
- Commercialization & Consumer Adoption

Research, Innovations, & Future Directions
- Ecosystem Mapping and Assessment
- Decision-Support Needs Across Governance Levels
- Biodiversity Metrics and Energy Flow Models
- Genomic Resilience and Financial Mechanisms

Climate

Nature

Climate-AI Opportunity Space

Data & Information Management

The intricate relationship between climate challenges and the pivotal role of data and information management:

- **Natural Language Feedback for Geospatial Models:** Exploring the potential of leveraging land use data and Large Language Models to ask high-level questions about land use and land cover outputs, optimizing land use decisions without extensive permitting.
- **Data Curation and Tracking:** Stressing the importance of meticulous data curation, tracking, and ensuring its availability. This is vital for accurate analysis and effective decision-making in the face of evolving climate challenges.
- **Open-Sourced Data Collection & Dissemination:** Highlighting the significance of real-time, open-sourced data collection and aggregation. By making decision-relevant data widely available, informed choices can be made swiftly.
- **Addressing Data Gaps:** Recognizing the challenges posed by data gaps at various levels and emphasizing the urgent need to fill these gaps for a comprehensive understanding of the climate scenario and its implications.

Education, Communication & Trust

Given the global nature of climate issues, it becomes imperative to not only disseminate scientific knowledge widely but also ensure it is accessible and actionable at the community level:

- **Science for All:** Highlighting the importance of translating and communicating global scientific findings to community organizations, ensuring that science is not just accessible to the elite but resonates at the grassroots level and vice versa.
- **Citizen Science Integration:** Emphasizing the value of citizen science in integrating local and global data pertaining to climate-related events. The content underscores the significance of incorporating these community-led insights into global scientific assessments and communicating them effectively.
- **Trust in the Age of Polarization:** Addressing the socio-political and geopolitical challenges that can lead to polarization and a subsequent erosion of trust in information and decisions. This section highlights the potential exacerbation of these challenges by technologies like AI and underscores the need for global coordination.
- **Enhancing Climate Education:** Spotlighting the urgency to improve and extend climate education, equipping communities with the knowledge and tools they need to actively participate in climate-related decision-making and advocacy.

Emissions & Monitoring

The multifaceted challenges of characterizing and monitoring emissions in the current climate scenario:

- **Data Utilization & Emissions Characterization:** Leveraging comprehensive data sources for accurate emissions tracking and assessment, with standardized accounting across diverse

organizations and collaborations.

- **Predictive Maintenance & Information Gathering:** Combining proactive methane leak detection with the collection of vital data on deforestation, infrastructure, and policy implications.
- **Modeling & Metrics:** Addressing the limitations of current emissions models, stressing the need for improved metrics for carbon flux and actionable strategies for enhanced sequestration.

Financial & Economic Considerations

The financial and economic dimensions underpinning the global response to climate challenges. Recognizing that a successful transition to a sustainable future requires not only technological and societal shifts but also sound financial strategies and economic frameworks:

- **Financing Innovation:** Spotlighting the importance of advanced market commitments and novel financial models to foster and support innovative technologies and business models throughout all technology readiness levels.
- **Supply Chain & Geopolitics:** Highlighting the challenges and considerations of supply chains in the development of new technologies. The section underscores the geopolitical intricacies that can influence or hinder climate solutions on a global scale.
- **Climate Finance Scale:** Emphasizing the current disparity between the scale of climate finance available and the magnitude of the problem. The discussion accentuates the need for blended finance approaches to bridge this gap and ensure sufficient resources for impactful climate solutions.
- **Economic vs. Environmental Goals:** Addressing the inherent conflicts that can arise between economic prosperity and environmental sustainability. The section calls for a nuanced understanding and strategic balancing of these sometimes divergent goals to achieve holistic sustainable development.

Geopolitical & Global Perspectives

Recognizing that climate change does not respect national borders, it is essential to examine the broader international implications, from the reformation of carbon markets to the nuanced role of AI:

- **Carbon Markets and Digital Solutions:** Highlighting the urgency to revitalize the carbon market for natural climate solutions, with a particular emphasis on inclusivity and equity. There is a noted concern regarding the lack of transparency in Digital Measurable, Reportable, and Verifiable (MRVs) systems, emphasizing the need for enhanced clarity.
- **AI's Double-Edged Sword:** While AI holds significant promise for driving global climate solutions, there's a recognition of its unintended consequences, particularly its energy demands. The section also examines how AI can bridge the gap between community-scale projects and national or global actions, facilitating a more integrative approach to climate solutions.
- **Behavioral Change and Decision-Making:** Delving into the intricate relationship between behavioral change and the implementation of solutions. It questions our understanding of individual decision-making processes and emphasizes the vital role of political and corporate entities in creating conducive environments for informed choices. The interaction between

AI and human decision-making, especially in the context of climate action, is identified as an area requiring further exploration.

- **Multiscale Analysis and the Role of Oceans:** Stressing the necessity to work across various scales when scrutinizing climate issues. This includes addressing challenges from distinct mitigation actions to understanding tipping points in various sectors. The section also draws attention to the oceans, emphasizing their underexplored potential as a solution to climate change and the need for more in-depth research in this area.

Legislation, Regulation & Policy

The critical role of integrating climate science into the legislative process, adapting to changes across various sectors, and navigating the sociopolitical landscape:

- **Legislation, Litigation, and Legal Reform:** Highlighting the necessity of translating intricate climate science, including attribution and potential AI applications, for legal and policy audiences. This involves the ongoing challenge of assimilating emerging information and technologies into both new and existing legislative and regulatory contexts.
- **Climate Adaptation and Intersecting Sectors:** Emphasizing the multifarious intersections of climate adaptation with sectors like health, agriculture, transportation, and coastal resilience. The section also explores the role of AI in enhancing actionable climate information, understanding cross-sectoral impacts, and evaluating the trade-offs between adaptation and mitigation.
- **Sociopolitical Challenges:** Addressing the often contentious landscape of policy development, marked by opposition from vested interests, whether political or industrial. It underscores the need to transition from individualistic perspectives to a more collective approach, considering the broader societal implications.
- **Information Biases and Trust:** Discussing the prevalent status quo bias, where the absence of actionable information results in a resistance to change. The section also highlights challenges related to climate information, especially when tainted by political motivations, emphasizing the importance of building and ensuring trust in climate data and narratives.

Planning, Infrastructure & Technology

The integral role of planning, infrastructure, and technological advancements in addressing climate change:

- **Transportation & Urban Planning:** Emphasizing the importance of forecasting transportation and demographic changes for optimal land use, while exploring the complexities of clean transportation systems. This includes optimizing vehicle-to-grid systems, distributing EV charging infrastructures, and leveraging AI for better routing of zero-emission mass transport.
- **Infrastructure & Decarbonization:** Delving into strategies for deploying greenhouse gas removal solutions and AI-accelerated startups that prioritize trip electrification and hydrogen siting. Additionally, the section highlights the challenges and solutions for decarbonizing power grid systems, managing interconnect requests, and ensuring grid stability and affordability.
- **Technological Advancements:** Discussing the use of technology in approximating time-intensive simulations, accelerating grid interconnect applications, and developing specific versions of colony counting software for plant biotechnology applications.

- **Efficient Land & Infrastructure Siting:** Addressing the need for more efficient land use planning and the strategic deployment of infrastructure, such as EV chargers, to meet the demands of a rapidly changing climate scenario.

Societal & Behavioral Challenges

Technological solutions, while crucial, are insufficient on their own:

- **Beyond Technological Change:** Stating that while technological advancements are vital, addressing climate challenges also requires a keen focus on land use and ensuring equity in all initiatives.
- **Geopolitical Intersections:** Analyzing the complex intersection of geopolitics with climate challenges, especially how war and conflict can exacerbate the adverse effects of climate change.
- **Just Transition:** Emphasizing the importance of ensuring a just transition, where solutions to climate challenges prioritize the well-being and socio-economic stability of all communities, especially the most vulnerable.
- **Quantifying Impacts:** Highlighting the challenges of quantifying the direct and secondary impacts of climate change, especially when considering societal and behavioral aspects that might not always be immediately evident.

Systems & Holistic Approaches

Viewing climate challenges through a systems and holistic lens, understanding that the climate is not an isolated phenomenon but an interconnected web of various components. Recognizing that singular approaches can lead to unintended consequences:

- **Complex Climate Interrelations:** Focusing on the interconnectedness of various components, such as ecosystems and the feedback loop between land, ocean, and climate. This acknowledges the dynamic nature of the climate as a system, where every component can influence and be influenced by another.
- **Efficiency and Roadmapping:** Addressing the importance of improving operational efficiency in various domains, such as heating/cooling and food waste, while also stressing the need for clear roadmaps. With set climate goals for years like 2050 or 2030, it's crucial to have actionable plans, optimizing the deployment of scarce resources, and using socio-technical decision-making tools.
- **Risk, Ethics, and Scalability:** Discussing the relevance of risk modeling, emphasizing the need to act even in the absence of perfect information. The section also touches upon the necessity of embedding ethical considerations into climate mitigation and adaptation strategies, ensuring that any trade-offs are transparent. Furthermore, it highlights the balance between scaling up climate solutions to gigaton levels and implementing localized strategies.
- **Desiloing for Comprehensive Strategies:** Stressing the significance of breaking down barriers – be it between geographies, sectors, or languages. Recognizing that isolated data and decision-making can lead to unintended policy consequences, there's a call for multiscale, multi-objective decision support tools that ensure cohesive and holistic approaches to climate challenges.

Technological Advancement & Innovation

As the world grapples with the pressing need to transition to sustainable practices, technology stands at the forefront, driving change through scientific experimentation, systems thinking, and material science innovations:

- **Scientific Experimentation & Materials Innovation:** Highlighting the acceleration in scientific research, especially in areas like batteries, electrofuels, and alternative non-combustion heat sources like high-temperature nuclear reactor designs. The section further explores innovations in materials science, including the use of self-driving labs for material testing and optimizing battery chemistries.
- **Permitting & Deployment Challenges:** Addressing the need for speeding up the permitting process to deploy clean energy systems efficiently. The section emphasizes the challenges in site selection, ensuring minimal biodiversity impact, addressing local opposition, and navigating "hot spots" of disinformation and policy obstacles.
- **Systems Thinking & Equity:** Emphasizing the significance of adopting a holistic systems approach rather than siloed solutions. By integrating an equity lens into decision-making, root causes of challenges can be more effectively addressed.
- **Commercialization & Consumer Adoption:** Discussing the "valleys of death" in technology commercialization and the challenges in promoting consumer adoption of low-GHG products, services, and alternative transportation modes. The focus is on ensuring that innovative solutions reach the market and are embraced by consumers for a broader impact.

Tenika Walker (NVIDIA) shares information on a start-up in a breakout group.

Nature–AI Opportunity Space

Awareness, Education, and Conservation Strategies

The continuous degradation of natural environments accentuates the necessity for improved awareness, comprehensive education, and refined conservation strategies:

- **Sustainable Food Production:** One of the key areas of concern is food consumption, especially in developing countries. It's imperative to explore and promote alternative, nature-friendly methods of food production that minimize environmental impact and foster a balance between human needs and ecological health.
- **Overexploitation and Pollution:** Overharvesting species, which includes practices such as overfishing and overgrazing, poses a severe threat to biodiversity. Concurrently, pollution, marked by the introduction of contaminants into the natural environment, exacerbates the decline of various ecosystems. These challenges necessitate urgent interventions and policy reforms.
- **Educational Frameworks and Conservation Status:** The importance of effective educational strategies cannot be overstated. Using tools like NatureServe's key questions—What is it? Where is it? How is it doing? What is changing/trending?—can guide the broader public in understanding conservation needs. However, there are existing challenges, such as the outdated Conservation Status Ranks, which means resources might be misallocated, emphasizing the need for regular updates and reviews.
- **Interventions and Advanced Tools:** before diving into conservation initiatives, it's beneficial to discern which strategies might be ineffective, thus minimizing adverse outcomes. Prioritizing areas for restoration, particularly in collaboration with local communities, can enhance the success rate. Additionally, the scalability of tools like bioacoustics for biodiversity monitoring offers a promising avenue, provided they are made accessible and user-friendly for conservationists, irrespective of their technical proficiency.

Biodiversity, Extinction, and Ecosystem Impact

The pressing challenges posed by the rapid deterioration in biodiversity, the looming threat of extinctions, and the far-reaching consequences for ecosystems are becoming increasingly evident:

- **Biodiversity Loss:** We are currently witnessing what some scientists term the 'Sixth mass extinction.' Changes in land and sea use, combined with other human activities, have accelerated the loss of species and their populations, with over a million species now facing the risk of extinction. This is alarming, especially considering that there are roughly 10 million species, with an estimation of 8.7 million ± 1.3 million.
- **Invasive Species and Disease:** The introduction of non-native species has not only led to the loss of indigenous species but has also brought about new diseases that adversely affect the existing ecosystems. It's crucial to note that every species is native to some location, emphasizing the importance of context in these discussions.
- **Climate Change Impacts:** About one-sixth of species globally are being affected by fluctuating temperatures, and a third of ecosystems are on the brink of collapse. As ecosystems shift due

to climate alterations, stewarding natural systems becomes more complicated. For instance, over 90% of coral reefs, vital for over 300 million people and countless species, are projected to vanish by 2100.

- **Human Practices and Awareness:** Many individuals, even those who profess a love for the ocean, are often uninformed about the sustainability of their seafood sources, necessitating more transparency in these areas. Moreover, there's a growing trend of planting exotic species in place of native ones in various landscapes, reducing biodiversity. As ecosystems change, there's an imperative need to update and enhance our ecological and biodiversity models to capture these shifts accurately.

Data, Technology, and AI in Conservation

Harnessing data effectively to aid conservation has become crucial, yet several impediments stand in the way:

- **Biodiversity Data Infrastructure:** A major hindrance in understanding biodiversity loss is data deficiency and bias. While there's a plethora of biodiversity data available through platforms like GBIF, iDigBio, and NEON, much of this data isn't immediately actionable for machine learning or easy querying. There's a pressing need to establish a biodiversity data infrastructure that connects existing sources into a cohesive, albeit decentralized, multimodal data mesh, facilitating the deployment of AI solutions and policy evaluation.
- **Understanding Ecosystems and Data Challenges:** Ecosystems are inherently complex, and our grasp on them remains limited. Most of the data available has been generated recently, yet a significant portion lacks the necessary details for tracking and reporting towards biodiversity targets. Information, often, is either inaccessible or too intricate for decision-makers. This is further complicated by data biases, both geographically and taxonomically.
- **AI and Conservation:** The allure of AI in conservation is undeniable, as highlighted in reports like the AI for Biodiversity report by GPAI. However, it's pivotal to approach it judiciously. AI, with its significant carbon, water, and data requirements, isn't always the best fit. There's a need for systems to validate AI outputs, ensuring their relevance and appropriateness. Moreover, while AI can offer substantial insights, it's essential to understand that not every conservation problem requires foundational AI models.
- **Advancements and Applications:** Emerging technologies, like eDNA, biological sensors, and chemical sensors, show promise in enhancing our conservation efforts. AI is also finding its place in areas like environmental reviews for renewable power plants and housing projects. However, there's an urgent need to identify data gaps and focus sampling efforts more strategically.

Policy, Governance, and Global Commitment

The intricate interplay of policy, governance, and global commitment in addressing nature challenges has become increasingly prominent:

- **Data Reliance in Decision Making:** The premise that good policy necessarily hinges on comprehensive data might be an oversimplification. For example, countries like Nepal have successfully implemented robust forestry policies, even in the absence of exhaustive data. It suggests that while some managerial contexts benefit from detailed data, others can be

effective without it.

- **Tracking Biodiversity Targets:** There's an alarming disparity in tracking biodiversity targets at various levels. Capacity constraints and data deficiencies hinder many departments from effectively monitoring progress. Furthermore, there's a discrepancy between global targets like the Aichi targets and national or local targets, highlighting the need for a clearer alignment of conservation goals.
- **Incorporation of Local Knowledge:** A more inclusive approach to conservation involves the integration of tribal and local knowledge. Such insights provide a richer understanding of ecosystems and potential conservation strategies. However, it's imperative to acknowledge that for many indigenous communities, knowledge isn't just information—it's power. Thus, the process of incorporating this wisdom requires sensitivity and respect.
- **Global Commitments and Climate Action:** Questions arise regarding the adequacy of commitments from global platforms such as the COP. Furthermore, there's a growing sentiment that current climate actions are failing to meet the urgency of the challenges we face. A more proactive approach, considering both upstream and downstream effects of decisions, is vital.

Research, Innovations, and Future Directions

The advancement of research, the birth of innovations, and the contemplation of future strategies play crucial roles in addressing nature challenges:

- **Ecosystem Mapping and Assessment:** A primary concern is the need for comprehensive ecosystem mapping and condition assessment. As of now, global ecosystems have not been mapped adequately in terms of thematic and spatial scales. Moreover, determining effective metrics of condition remains elusive. Given the urgency, we are constrained by a short timeframe, approximately six growing seasons, to gather substantial data for reporting.
- **Decision-Support Needs Across Governance Levels:** It's crucial to understand that decision-making requirements differ based on governance levels. While national authorities may have overarching strategies, the needs at smaller community levels can be drastically different. Customizing support systems and tools to cater to these diverse needs will enhance policy implementation and effectiveness.
- **Biodiversity Metrics and Energy Flow Models:** A contemporary perspective suggests that biodiversity loss should be perceived not just as a tally of threatened species but as a symptom of systemic degradation. To further this understanding, we should focus on stable metrics to quantify biodiversity and subsequently link these to nutrient and energy flow models. Emphasizing detritivore biodiversity, for instance, could provide insights into energy flux within ecosystems.
- **Genomic Resilience and Financial Mechanisms:** In an era marked by rapid climatic shifts, identifying genomic traits to bolster resilience becomes paramount. The pace of optimizing new plant genetics is equally significant in addressing biodiversity concerns. Moreover, there's a pressing need for financial frameworks that cohesively address both climate and biodiversity crises, emphasizing their interconnectedness.

FOCUS

NARROW DOWN

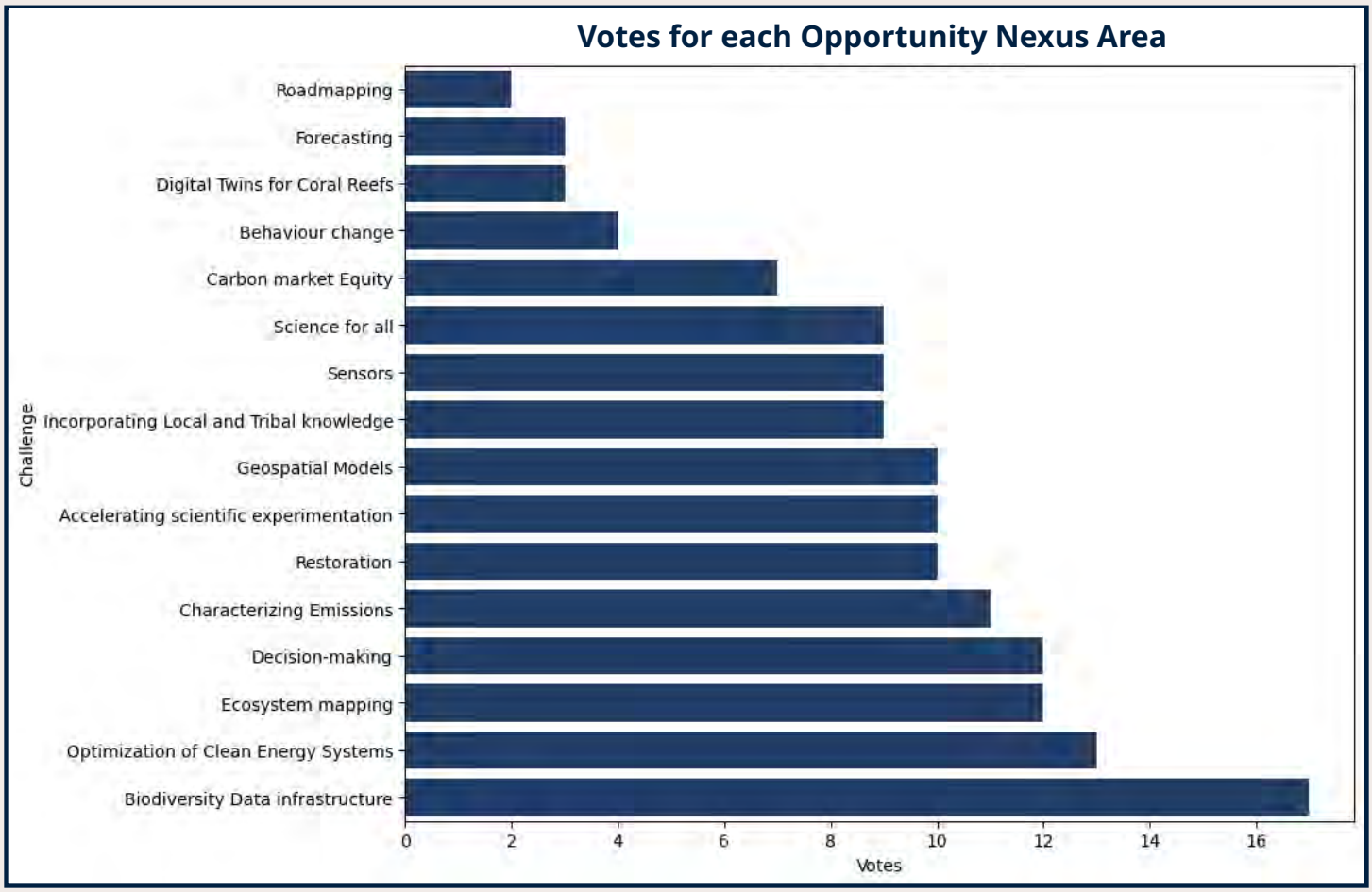
Noël Bakhtian (Bezos Earth Fund) facilitating a vote as a part of the workshop process.

Focus

This section is dedicated to the systematic evaluation of the most promising opportunities within the context of AI's application to climate and nature challenge areas. Building upon the previously identified domains and challenges within this intersection, the workshop guided participants in prioritizing Spotlight areas based on impact valuations, including the extent to which these spaces have already been "taken up" by researchers, funders, established industry, and emerging startups. Note that an area of future analysis could additionally focus on areas in climate and nature already using specific AI capabilities that could be further optimized with newer advances or different AI approaches.

Spotlights

After compiling a comprehensive list of urgent Nature and Climate challenges and pairing them with AI capabilities, as described in the SCAN section, workshop participants were asked to shortlist the most potentially impactful ones to pursue.



This graph demonstrates participant votes for which climate/nature challenge and AI superpower pairings are most promising as Spotlights to deepdive on, on Day 2.

Based on the votes, there was a clear "top tier" that garnered more than 9 votes each, and these were selected as Spotlights. Participants were then invited to select which Spotlight they could contribute the most to with their expertise. The Spotlights "Ecosystem Mapping" and "Geospatial Models" were combined based on inherent similarities. Not enough people joined the "Accelerating Scientific Experimentation" working group, so it was excluded from the Spotlights section of the agenda. As a group, the Spotlight topics were also distributed into clusters: Climate, Nature, and Both.

At this point, each self-selected working group spent a few hours brainstorming the scope, current challenges and potential next steps for the selected Spotlight, framed in terms of Grand Challenges. By utilizing facilitated guidance based on The Heilmeier Catechism, groups deepdived on specific solution spaces and co-created future pathways for accelerating climate and nature solution impact utilizing AI. Through this workshop technique, teams were able to utilize different skillsets and tap into different knowledges areas to answer specific questions relating to limitations to current system, what a new approach looks like (with zero jargon), how will the world have changed if successful, how to measure success, the main bottlenecks to applying this approach, and any unintended consequences. The groups produced collaborative worksheets that have been summarized below.

A crosswalk of which challenges from the breakout list contributed to which Spotlight can be found in the additional Data sheet found in the Appendix.

The grand challenge title and team for each Spotlight is as follows:

- Characterizing Emissions: **A global, accurate, and authoritative account of greenhouse gas flux, separated out by origin and owner.** Members: Alissa Park, Amanda Staudt, Amy Chung-Yu Chou, Anna Michalak, Dan Hammer, David Tennenhouse, Logan McClure Davda, Tenika Versey Walker
- Optimization of Clean Energy Systems: **AI-accelerated building decarbonization.** Members: Aditya Grover, Daniel Schwalbe-Koda, Johan Mathe, Kiran Jain, Kyoko Thompson, Marcus Noack, Maria João Sousa, Noël Bakhtian, Shashi Shekhar
- Biodiversity Data infrastructure: **Unleashing AI-enabled decisions for a thriving planet through the Data Mesh.** Members: Carl Boettiger, Chad Gallinat, Cristián Samper, Katie Zacarian, Regan Smyth, Tanya Berger-Wolf
- Ecosystem mapping + Geospatial Models: **Transforming access to geospatial information that accelerates pathways from data to insight to impact/action.** Members: Ashoka Finley, Evan Tachovsky, Hannah Kerner, Nancy Harris
- Sensors: **The Trillion Sensor Challenge.** Members: Chad Gallinat, Evan Rapoport, George Berg, Jorge Soberon, Kofi Nyarko
- Restoration: **Trees for Life.** Members: Amy Rosenthal, Cristián Samper, Niamh Peren, Steve Brumby, Tom Kalil
- Incorporating Local and Tribal knowledge: **Advancing Climate Justice through Decolonization of Data.** Members: Amanda Eichel, Lauren Bennett, Tracey Osborne, Uyi Stewart
- Decision-making: **ClimatePolicyTracker 2.0.** Members: Gary Ackerman, Geneva List, Michal Nachmany, Mike Burger, Rich Powell, Viki Jan, Victoria Houed

Their findings are summarized in the following section.

“Infrastructure is climate justice.”

Uyi Stewart

DATA.ORG

Climate Spotlights

A GLOBAL, ACCURATE, AND AUTHORITATIVE ACCOUNT OF GREENHOUSE GAS FLUX, SEPARATED OUT BY ORIGIN AND OWNER

About the Spotlight

The initiative seeks to fill a significant gap in understanding and managing greenhouse gas emissions and the processes that offset them. Central to this initiative is the creation of a comprehensive information system that reports on all greenhouse gas fluxes, including CO2, CH4, N2O, and more. This system aims to identify the sources and amounts of these emissions and establish clear attribution. AI plays a pivotal role, helping to reconcile observational differences, identify patterns, and inform expert input.

A vibrant world map highlighting greenhouse gas emissions. Generated with DALL·E.

By comparing emissions data with real-world observations, the AI system offers insights into gas sources and sinks. The objective is to reduce uncertainties in global emissions accounting, provide full coverage, and assign mitigation responsibility. The ultimate goal is to provide a reliable resource for greenhouse gas emissions, aiding in the development of effective mitigation plans and aligning human emissions with the earth's carbon absorption capacity, in line with international accords like the Paris Agreement.

Transformation Due to Success

Current greenhouse gas tracking employs various methods: self-reported inventories, process-based modeling, inverse models, and AI validations. Each method uses only a portion of available data, leading to significant uncertainties. Our innovative approach aims to connect these data fragments using AI to detect patterns across different data sources. We envision a platform, similar to Wikipedia, supported by an extensive data repository that cross-references atmospheric observations.

Success would be a detailed emissions map, enabling informed decision-making across sectors. Key success metrics include improved accuracy, system adoption, comprehensive data coverage, and tailored data scales. While beneficial to the global community, this system would particularly assist governments, businesses, and organizations in emissions oversight. Its adaptability and potential crowd-sourcing features will be essential as environmental issues evolve.

Next Steps

In the upcoming years, our primary emphasis would be on system development, building on

existing work. The first year would focus on landscape assessment: pinpointing existing flux estimate producers, understanding their methods, and cultivating a supportive community. Collaboration between academia and the tech industry is crucial. Governance structures need establishment, with the identification of a credible leader to guide the system's growth and garner widespread support. The NASEM 2022 report highlights several barriers in decision-making based on greenhouse gas emissions data, such as transparency, trust, and funding. Addressing these challenges is paramount.

AI-ACCELERATED BUILDING DECARBONIZATION

About the Spotlight

This grand challenge aims to accelerate and revolutionize the decarbonization of buildings, focusing on strategies such as building-by-building recommendations that encompass energy efficiency, optimized deployment of clean energy technologies, and energy forecasting for tailored individual user decisions and policymakers decision-making. The underpinning ethos emphasizes both equity and justice. Utilizing AI, the goal is to create smart systems that provide tailored recommendations to reduce the carbon footprint of the built system, ensuring these advancements are accessible to all.

A cityscape highlights AI-driven, energy-efficient structures, clean energy tech, and a compass pointing towards a sustainable future. Generated with DALL-E.

By employing smart optimization through AI with a focus on the multi-objective optimization function, a significant narrowing down of energy-saving measures from a multitude of options is achieved, making decision-making efficient. Using a blend of satellite imagery, surveying, and examination of building permits, together with precise energy forecasting, AI recommendation tools will help at a variety of decision-making levels: user-level decision making regarding energy choices and "nudges" relative to day-to-day decisions, community-level decision making such as communication campaigns and suitable and cost-effective clean energy technology deployments, and policy-level decision making based on data collection and mapping to guide incentives and investments. By analyzing costs, breakeven points, and potential energy savings, the deployment of these technologies is optimized, enhancing communication and education regarding energy-saving opportunities, and connecting with policy incentives to ensure affordability and optimized user decision-making, propagating a culture of energy efficiency and fairness across communities.

Transformation Due to Success

In today's world, the transition to clean energy and efficiency is anchored in tax incentives and is often dictated by straightforward data heuristics. A considerable gap exists as many homeowners remain unaware of available clean energy alternatives, such as heat pumps and solar panels. Moreover, there's a palpable challenge in pinpointing poorly insulated buildings on

a grand scale, and identifying the specific needs, building-by-building. Integrating AI into this framework has the potential to be transformative. Not only can AI improve decision making by relying heavily on forecasting, but it can also employ multispectral satellite imagery to meticulously map out buildings that are energy inefficient and nudge users towards adopting more sustainable energy solutions.

Should this approach gain traction and succeed, the potential benefits are immense. Beyond the immediate goal of substantially reducing the carbon footprint of buildings, this method promises tangible improvements in residents' quality of life. Monthly energy bills could decrease, making sustainable living more accessible to many. However, this vision isn't without its challenges. Data privacy concerns, a prevailing societal focus on immediate costs over long-term benefits, and potential equity discrepancies in AI's decision-making processes may pose significant obstacles on the path to realization.

Next Steps

Over the next year, the foremost priority is to assemble a dedicated team to rigorously map the building space and create a framework for more easily and broadly accessible and unified data . The pillars of this venture will be grounded in having well-defined problems complemented by clear metrics of success. A robust infrastructure is paramount, necessitating quality data access, powerful computing capacities, and a cohesive team. To bolster the initiative, getting policymakers on board will be crucial. Their support can promote the establishment of standards akin to those in countries like France, where homeowners are obligated to meet particular efficiency criteria before leasing their properties.

Looking ahead to the next five years, a reflection on lessons from various domains, including climate, AI, and beyond, will be invaluable. One looming challenge is navigating the intricate realm of data privacy, especially when dealing with hyper-localized information. Ensuring that data access is both expansive and harmonized will be central to this mission, and reconciling these requirements with privacy concerns will be a defining aspect of the initiative's success.

Nature Spotlights

UNLEASHING AI-ENABLED DECISIONS FOR A THRIVING PLANET THROUGH THE DATA MESH

About the Spotlight

The "PlanetNet" challenge is an initiative aimed at revolutionizing biodiversity and climate monitoring. Instead of just another data repository, it aspires to create an intricate "data mesh" that seamlessly integrates an array of existing data sources, from hardware and datasets to human expertise and species information. This extensive framework will merge data from renowned collectors and repositories like GBIF, iDigBio, NEON, and others.

PlanetNet's digital sphere hovers above a diverse landscape, intricately connected by data lines, representing the fusion of nature, technology, and global collaboration in data-driven research. Generated with DALL-E.

The ultimate goal is to provide an efficient platform for accessing, querying, and leveraging analytical/AI tools. This will enable global and regional communities to readily access vital data, aiding them in devising and refining robust biodiversity and climate strategies. By integrating with advanced machine learning platforms and ensuring strategic partnerships, PlanetNet aims to remain a public resource with steadfast backing.

Transformation Due to Success

Today, addressing biodiversity challenges is hampered by the fact that there is limited data available. Additionally, the scarce amount of data that has been collected, is scattered and inconsistent, which again is problematic. This fragmentation poses significant hurdles to harnessing AI's transformative potential for ecological ventures. Repetitive tasks such as data collection burden stakeholders, leading to inefficiencies. Despite the urgency for AI-driven data analysis, the fragmented nature of the data presents challenges. PlanetNet aims to tackle this by setting up a potent data infrastructure, mirroring the successful AI transformations seen in other sectors.

By capitalizing on distributed and federated data queries and service deployment, and aligning with the urgency of biodiversity loss, the initiative focuses on harnessing existing data, instead of creating another repository. Successful outcomes would mean a scenario where decisions are based on evidence, where progress on ecological goals is not just monitored but achieved. The broader impact envisions a world where stakeholders can effortlessly access and deploy AI on biodiversity data, fulfilling objectives across ecological assessments and corporate biodiversity tracking.

Next Steps

Several challenges lie ahead, including securing sustained funding and establishing robust governance structures. Bridging the gap between diverse stakeholder groups, from researchers to policymakers, is crucial. Building partnerships requires strategic outreach to access data resources and motivate stakeholders to overcome data-sharing barriers. Governments and industries should champion biodiversity data openness, potentially through an international task force.

Alongside these efforts, establishing a global network of AI labs is essential for tool development, metrics, and capacity building. Some perspectives, such as insights from environmental DNA experts and indigenous data rights, remain underrepresented. Over the first year, the emphasis would be on implementing a proof-of-concept using existing datasets. The subsequent five years would see the initiative mature, with a key focus on aligning with and achieving the Global Biodiversity Framework (GBF) 2030 Targets, addressing the previous shortcomings with the Aichi 2020 Targets.

TRANSFORMING ACCESS TO GEOSPATIAL INFORMATION THAT ACCELERATES PATHWAYS FROM DATA TO INSIGHT TO IMPACT/ACTION

About the Spotlight

This ambitious challenge seeks to revolutionize the way humans interact with multifaceted geospatial data sourced from various origins. The primary aim is to empower users to quickly and effectively engage with generative models trained on this data using natural language queries. The ultimate vision is to move beyond the traditional, restrictive interaction with maps and offer a more dynamic experience. Users will no longer be confined to a set of predefined categories curated by GIS experts with potential biases. Instead, they can gain insights from geospatial data using queries tailored to their individual needs and understanding.

A dynamic geospatial interface comes alive as diverse users engage with it using natural language, marking a transformative shift from traditional static maps to interactive, user-centric explorations. Generated with DALL-E.

Transformation Due to Success

The current geospatial data interaction landscape is dominated by thematic maps, mostly designed by the scientific community. These maps use a singular classification system based on satellite images or model predictions. This traditional method often results in misunderstandings among stakeholders due to the specific context in which the information on the map is presented, disconnected from the actual data. Addressing specific queries related to this data typically demands specialized GIS analysts, limiting the types of questions and insights generated and often leading to slow, inefficient outcomes.

Technologically, the initiative proposes the fusion of Large Language Models (LLMs) and Generative Models to create a user-friendly interface. This would allow users, irrespective of their expertise, to engage with geospatial embeddings. By utilizing zero-shot and few-shot learning, the goal is to dynamically create custom maps and insights based on minimal domain-specific labeled data points. A mark of success would be the widespread use of these tailored maps and insights by communities, corporations, and journalists for informed decision-making. However, the journey poses significant challenges, including advancements in multimodal learning, uncertainty quantification, and multilingual Natural Language Processing. Ensuring the system's effectiveness without facilitating malicious use is also a priority, emphasizing the need for robust quality assurance and control.

Next Steps

To transform this vision into reality, a detailed roadmap for the next one to five years has been outlined. The initial focus will be on developing a prototype using Global Forest Watch (GFW) data. After the prototype's completion, a closed beta phase will be launched to assess its impact and user experience against existing methods. Key aspects to be evaluated during this phase include the system's efficiency in improving user interaction with GFW data compared to traditional interfaces and a cost analysis comparing the new approach with the baseline. The beta phase will also assess the speed and accuracy of the information retrieval process.

Additionally, insights from diverse domains like climate, nature, or AI will be studied to identify lessons that can refine the approach. This multi-disciplinary review aims to offer a comprehensive perspective, ensuring the strategy is adaptive and robust. Through these systematic steps, the initiative intends to methodically reshape the way geospatial information is accessed and used, aiming for a swift transition from data acquisition to actionable insights and decisions.

THE TRILLION SENSOR CHALLENGE

About the Spotlight

The "Trillion Sensor Challenge" aims to integrate vast, smart, and affordable sensors into both land and marine ecosystems. This initiative's primary goal is to simplify the Measurement, Reporting, and Verification (MRV) essential for conservation efforts at any scale. By increasing sensor variety, the initiative seeks to improve AI data acquisition, enhancing transparency and trust in conservation outcomes. A key element is its global inclusivity, aiming to democratize big data beyond traditionally data-rich regions like the US and Europe.

Sensors harmoniously integrate with nature, smartphones aid in data collection, and cloud icons emphasize privacy, all symbolizing the unity of technology, nature, and global conservation collaboration. Generated with DALL-E.

The initiative aims to grasp each ecosystem's vitality, focusing on individual species' behaviors. The plan involves a global network

of mainly low-cost sensors, emphasizing privacy through edge-based and federated learning. A unique approach involves passive data collection via smartphones, reducing data upload costs and promoting a task-based economy, especially beneficial for those in emerging markets. The concept of Biodegradable Circuitry & Sensors, inspired by biomimicry, introduces energy harnessing from living organisms through minimal sensors, symbolizing the unity of technology and nature.

Transformation Due to Success

Presently, the sensor domain faces challenges like limited data sharing initiatives, battery life issues, data transfer complications, ocean sensor biofouling, and theft. Additionally, most sensor development is led by scientists, resulting in costly and specialized devices. The initiative envisions overcoming these challenges using edge-based AI, energy harvesting for sensors, and hybrid networks enabling mesh networking. This could transform any nearby smartphone into a data hub, promoting a citizen science approach.

The initiative also anticipates a gig economy model where individuals can earn by collecting data in specific areas, supported by AI-optimized sensor distribution. Success would offer invaluable insights into ecosystems and biodiversity health for various stakeholders. Potential issues like privacy, e-waste, and data misuse emphasize the need for a comprehensive approach, ensuring the initiative's conservation and inclusivity values remain intact.

Next Steps

The strategy for the next one to five years begins with understanding the needs of ecologists, conservationists, and policy experts. The next phases involve setting protocol standards, establishing data sharing platforms, and emphasizing robust prototyping and logistics for product field testing. Initially, high-cost Commercial Off-The-Shelf (COTS) products will validate the initiative's impact before moving to affordable solutions.

Exploring large-scale production is crucial for financial viability and long-term sustainability. Insights from military and DARPA initiatives on microelectronics and IoT integration with AI can provide valuable guidance. The world of robotics offers perspectives on pervasive computing in natural settings. Lessons from the Trillion Trees initiative emphasize avoiding a one-size-fits-all approach, which might result in data collection gaps. Such interdisciplinary insights are essential for a comprehensive, resilient initiative approach.

TREES FOR LIFE

About the Spotlight

The "Trees for Life / Project Lorax" initiative aims to utilize equitable AI to promote the restoration of forests and grasslands in Africa. Beyond ecological goals, the initiative focuses on enhancing community welfare and reviving regional biodiversity. Its central challenge is to select investment areas under the AFR100 initiative for optimal restoration benefits. Simply put, the initiative seeks regions with both significant restoration needs and potential, ensuring local communities lead and benefit from the initiatives, while rejuvenating regional biodiversity.

A distinctive feature of this initiative is its emphasis on community-focused restoration, determining

which trees to plant where and collaborating with communities for mutual benefits. This signifies a balance between ecological goals and community well-being, combining AI advancements with a deep understanding of community desires.

Transformation Due to Success

For "Trees for Life / Project Lorax", success revolves around a deep understanding of current landscapes and transformative strategies. Present data from CIFOR/ICRAF provides some tree suitability insights, but issues like high tree mortality rates and limited long-term community benefits persist. The lack of information on effective landscape restoration, ideal species configurations, and the often detrimental use of non-native species like eucalyptus present challenges.

A thriving African rainforest, where community-led restoration, advanced technology, and nature converge in harmonious unity. Generated with DALL-E.

To address these issues, the initiative suggests several innovative solutions, including Hyperspectral Imaging (HSI) for reforestation monitoring, machine learning for endemic species planting, and computational agroecology. Other strategies include sustainable micro tree nurseries, bioacoustic monitoring for biodiversity, and AI-equipped edge sensors for restoration precision. Overall, success means restoring vast forest areas across Africa, carbon sequestration, biodiversity enhancement, and improved local livelihoods. Yet, challenges like accessing local knowledge, sourcing native tree species, and technological infrastructure for spatial data and machine learning models remain. Engaging with local communities and aligning technological solutions with their interests is essential for a holistic success approach.

Next Steps

To realize "Trees for Life / Project Lorax", the first step is understanding the primary users' essential questions - the local communities in restoration areas. This foundational step ensures an understanding and user-focused approach. An agile, Human-Centered Design (HCD) approach will then be used to develop new products and tools addressing these specific issues. This flexible and iterative method ensures the initiative meets community needs and can adapt to changing on-ground realities.

Over the next one to five years, this approach would facilitate interaction between initiative leaders and community stakeholders, guaranteeing effective and community-accepted solutions. The agile, feedback-driven method, combined with the HCD's user-centric focus, outlines a forward-thinking, empathetic path towards the initiative's goals. This strategy emphasizes collaboration, adaptability, and community involvement, crucial for the complexities of landscape restoration and community well-being.

Climate and Nature Spotlights

ADVANCING CLIMATE JUSTICE THROUGH DECOLONIZATION OF DATA

About the Spotlight

This initiative aims not just at technological progress but at enabling local communities to incorporate traditional knowledge with modern data science to champion climate justice. At its heart lies the ambitious goal of quickly and broadly achieving climate justice by integrating local and indigenous insights into the scientific and technological framework that guides climate action. A significant gap exists in the current approach: vast indigenous knowledge, especially regarding forest carbon markets and water management, remains unutilized and unacknowledged in contemporary data and science. The initiative seeks to remedy this by adopting a comprehensive approach, enhancing both the quality and inclusiveness of data that directs climate justice efforts.

Indigenous communities weaving luminous knowledge threads with digital data, epitomizing the blend of ancient wisdom, modern technology, and a commitment to climate justice. Generated with DALL-E.

The initiative's strategy is clear and impactful: address the shortcomings in current climate and nature data, mainly its detachment from indigenous knowledge and its lack of a holistic view. The plan involves using AI to enable localized data collection, access new knowledge sources, and combine existing knowledge systems, all within a responsible AI framework mindful of cultural contexts and potential risks. The ultimate aim is to establish a monitoring system rooted in a comprehensive understanding of climate and nature, thus promoting a model of 'Advancing Climate Justice through Decolonization of Data'. By merging age-old wisdom with cutting-edge technology, the initiative intends to drive a climate justice movement that is both knowledgeable and inclusive.

Defining success

This initiative's success criteria focus on addressing the current challenges in community engagement and knowledge assimilation. Currently, Community Engagement Meetings and Community-Based Organizations serve as channels for specific experiences and insights. However, there's a notable absence of mechanisms to convert this often complex, qualitative knowledge into actionable strategies for model integration, policymaking, and resulting solutions. The innovative approach proposed leverages AI to fill this void. Utilizing voice recognition and natural language processing (NLP), the initiative plans to capture knowledge from places where it's primarily shared orally, analyze it, and incorporate it into existing data and models. The goal is to create an integrated data ecosystem that aligns with indigenous AI views.

Success for this initiative goes beyond just technological integration—it aims for broader societal and planetary impact. True success will be evident when indigenous groups see their perspectives reflected not just in data but in the resulting solutions and investments. This representation is expected to lead to decision-making that is more aware of the root causes of the climate crisis, its varied impacts, and cultural contexts. By potentially pushing the boundaries of NLP and emphasizing the importance of citizen science for accurate data gathering, the initiative hopes to infuse future AI investments with a language rich in local and indigenous knowledge. Yet, this ambitious initiative faces hurdles: the complexity of data, the need for human involvement, and the challenge of ensuring local communities and stakeholders see value in a collaborative solution. Moreover, care is being taken to avoid potential pitfalls like misusing indigenous knowledge, diminishing trust, and widening the digital divide, which could counteract the goal of achieving climate justice by decolonizing data.

Next steps

To turn the proposed approach into actionable results, a clear roadmap for the near and mid-term future is essential. The first step involves narrowing the initiative to a Minimum Viable Product (MVP) to hone its primary features and test the initiative's viability. Once this is achieved, the MVP will be introduced to select sectors, providing crucial feedback. Working alongside community groups during this phase ensures not just a trial run, but also fosters community involvement and ownership. These initial deployments are expected to yield case studies that can guide the initiative's expansion across various sectors and regions.

Additionally, analyzing similar initiatives in related areas can offer valuable insights. For instance, the "Decolonizing Water" initiative at the University of British Columbia, though not tech-centric, might provide guidance on community engagement and incorporating indigenous knowledge. Even if such initiatives don't align technologically with this initiative, their approach to respecting and integrating indigenous insights can be instructive. By carefully studying these related initiatives and drawing from their successes and challenges, the initiative can strategically avoid potential issues, strengthening its aim to achieve climate justice through thoughtful data decolonization.

CLIMATEPOLICYTRACKER 2.0

About the Spotlight

The initiative, dubbed WIRE-E, ClimatePolicyTracker 2.0, and CP2 (Climate Policy Co-Pilot), aims to connect decision-making with practical, on-ground climate and nature-focused actions. Its core mission is to develop preliminary decision-making tools that serve a range of purposes including assisting elected officials, legislators, and regulators in their decision-making roles, and enabling the public and regulated entities to hold policymakers accountable and choose appropriate initiative sites. The initiative's primary goal is to improve the speed, quality, and trustworthiness of climate and nature-related decisions, thereby enhancing the reputation of decision-makers. It utilizes real-world data to create a reliable platform for informed decision-making.

A smartphone displays climate insights, symbolizing the intersection of technology and informed policy decisions for environmental action. Generated with DALL-E.

The initiative aims to employ AI, and specifically Large Language Models, to address challenges in the creation and execution of laws and policies related to climate, energy transition, infrastructure, and nature. For example, a proposed AI application for U.S. regional transmission organizations intends to streamline the national interconnect queue, freeing up significant clean energy resources from bureaucratic constraints. ClimatePolicyTracker 2.0 serves as a user-friendly interface connecting a live global map of climate and nature regulations with their real-world impacts, supported by a thorough set of evidence-based decision-making tools. The initiative's broader applications include AI-generated preliminary decision documents, new regulations, plans for clean energy transitions, and adaptive land use. By integrating a "Data Commons" and using AI to process and display both textual and visual policy data, the initiative aims to foster an environment of informed, timely, and efficient decision-making in the realms of climate and nature, potentially guiding the world towards a sustainable future.

Defining success

Current policy-making in the field of climate and nature decisions is often stagnant and biased towards preserving existing practices rather than adopting evidence-based approaches. Policymakers, analysts, and researchers face the daunting task of navigating vast amounts of documentation to find relevant information, often relying on weak evidence or isolated examples. Although tools like Climate Policy Radar and the EPA's assessments in the US exist, the potential of AI to enhance their utility is untapped. Furthermore, commercial solutions that could improve this situation are largely unaffordable, further deepening inequalities.

This initiative proposes a novel method by embedding AI into the core of policy creation, evaluation, and execution. The goal is to transition from a slow, anecdotal decision-making process to a

dynamic, data-informed, and inclusive one. Success for this initiative includes effective policy changes, efficient policy enforcement, and the strategic allocation of financial resources for climate and nature objectives. Tackling key challenges like making laws more machine-readable, ensuring AI reliability, and maintaining transparency and responsibility in AI-aided decisions are foundational to this effort. The proposed AI co-pilot concept emphasizes a collaborative dynamic between human decision-makers and AI systems, promoting well-informed decisions while upholding human responsibility. Enhancing structured data connections between textual and database resources, similar to Climate Policy Radar's efforts, is seen as vital. Although there are technical and ethical hurdles to overcome, this initiative offers a revolutionary approach to climate and nature-related policy-making, potentially setting new benchmarks in this essential field.

Next steps

To successfully integrate AI into policy-making, especially in climate and nature-focused areas, a clear roadmap has been outlined for the upcoming year and the next five years. A top priority is to secure sufficient funding to form a competent team and gather necessary resources. Simultaneously, collaboration and community involvement are vital, ensuring a broad spectrum of insights and a strong initiative foundation. It's crucial to involve policymakers, the primary users of the proposed AI tools, to ensure the tools meet their needs and preferences.

Raising awareness among stakeholders and the public is also essential. This includes educating them on the advantages of AI in policy-making and promoting a sense of ownership and acceptance. Gaining community trust and creating an environment open to feedback is vital to ensure the AI tools are embraced and not viewed with skepticism. This inclusive approach aims to position the AI tools as trusted partners in enhancing policy transparency, efficiency, and effectiveness in crucial areas like climate and nature conservation. By following this plan, the initiative aims to transform the policy-making process in a well-informed, inclusive, and meaningful way.

“The questions we are asking are not neutral, and we will perpetuate systems of oppression because we are not asking the right questions.”

Lauren Bennet

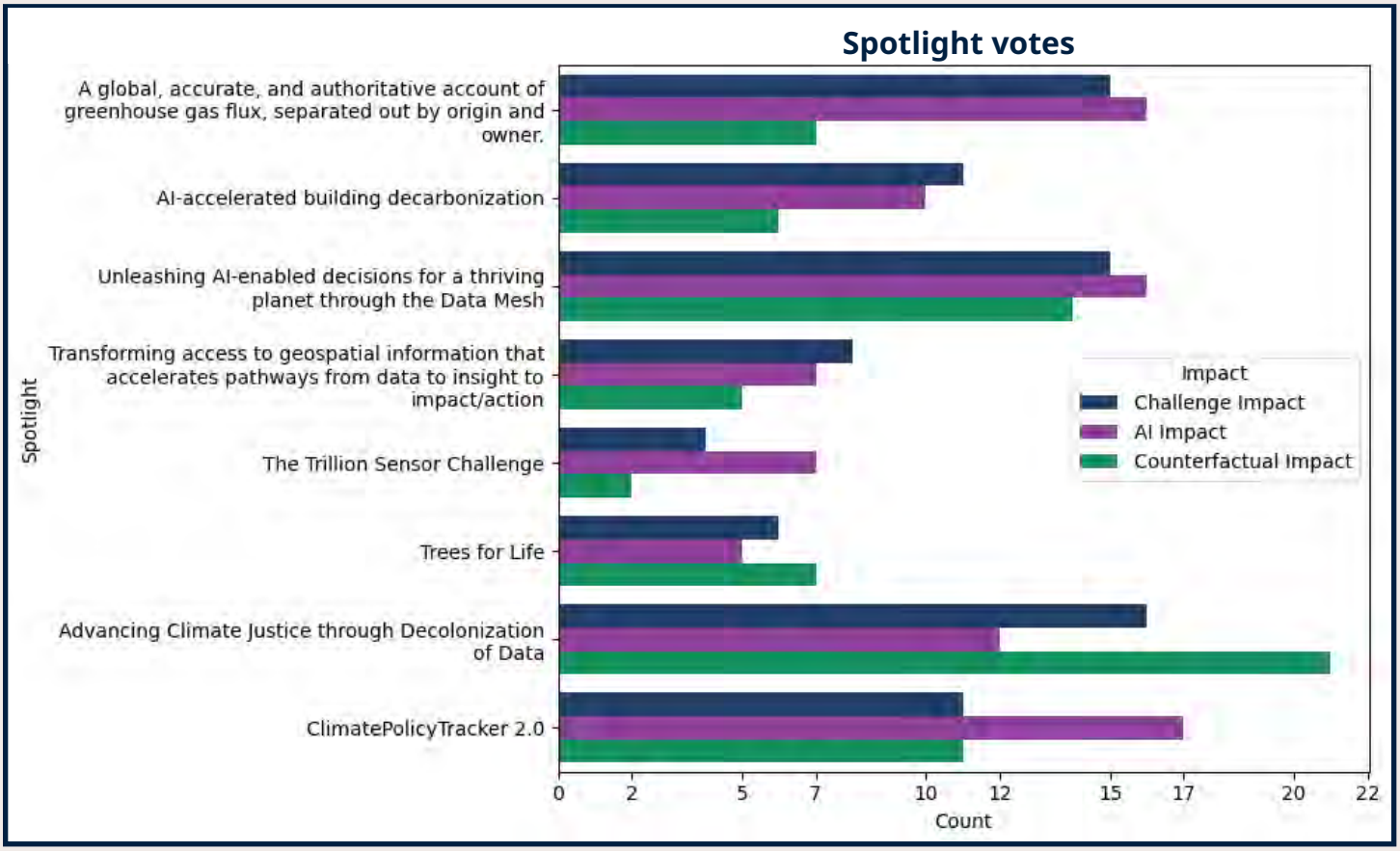
ESRI

Quantifying Impact

Participants were asked to evaluate the potential impact of each Spotlight. The evaluation was based on three distinct criteria:

- **Challenge Impact**, which gauged the overall impact should this Climate or Nature challenge be solved;
- **AI Impact**, assessing the significance of AI to the solution space for the Climate or Nature challenge; and
- **Counterfactual Impact**, considering the current saturation or "overcrowdedness" of the field, it measured the added value of pursuing this specific Spotlight.

For each criteria, participants were asked to vote for the top three Spotlights with highest impact in that category, based on their domain of expertise. The results are presented in the following plot.



Votes tallied for three different impact metrics for each Spotlight.

Anna Michalak (Carnegie Institution for Science), Tracey Osborne (UC Merced), and Rohan Nuttall (OpenAI) inputting data and ideas into the collaborative notes during the workshop.

While each of these projects already represent the top picks of the group for future work, the following three projects were voted the most impactful by workshop attendees: “Advancing Climate Justice through Decolonization of Data”, “ClimatePolicyTracker 2.0”, and “Unleashing AI-Enabled Decisions for a Thriving Planet through the Data Mesh.” The top votes were:

Challenge Impact:

Most Votes: Advancing Climate Justice through Decolonization fo Data
Second Most Votes (Tie): (A) Unleashing AI-enabled decisions for a thriving planet through the Data Mesh & (B) A global, accurate, and authoritative account of greenhouse gas flux, separated by origin and owner.

AI Impact:

Most Votes: ClimatePolicyTracker 2.0
Second Most Votes (Tie): (A) Unleashing AI-enabled decisions for a thriving planet through the Data Mesh & (B) A global, accurate, and authoritative account of greenhouse gas flux, separated by origin and owner.

Counterfactual Impact:

Most Votes: Advancing Climate Justice through Decolonization of Data
Second Most Votes: Unleashing AI-enabled decisions for a thriving planet through the Data Mesh

FUTURE

ACTIONABLE STEPS

Victoria Houed (U.S. Department of Commerce) shares insights on the Meta-Challenges panel.

“We’re already using A.I., but we’re just scratching the surface.”

Andrew Steer

BEZOS EARTH FUND

Future

Within this section, we explore the uncharted territory of AI's potential impact on climate and nature conservation. We aim to determine if there exist unrealized AI advancements that could accelerate the scale-up in high-impact solutions for climate and nature challenges. Simultaneously, we assess the meta challenges that may hinder the realization of these solutions. By examining both AI's horizon of untapped potential and the broader obstacles in its path, we seek to provide a comprehensive view of the AI-specific paths that must be tackled in support of the climate and nature communities in the coming years.

Steering the next generation of AI in support of climate and nature

When answering the question "What is the next generation of AI to be developed, specifically in support of the climate and nature communities?", participants proposed 47 distinct directions. The answers reflect two predominant threads. Firstly, there is a clear interest in adapting and applying existing AI technologies specifically to climate and nature challenges. Secondly, there is a call for expanded research and innovation in already existing technologies and methodologies that hold potential for significant contributions to these fields.

In the first category - existing AI technology that is yet to be applied to climate and nature challenges - the main themes that emerged are:

- **Robust and Specialized AI Models:** Emphasizing the development of robust AI for improved out-of-sample generalization, with specific call-outs for foundational models tailored to climate and nature data (e.g., climateGPT), acoustic models for low-resourced languages, and models trained on animal and ecological signals. These models are expected to handle a wide array of tasks from behavioral ecology research to bioacoustics data analysis, ensuring generalizability across diverse domains.
- **Data Fusion and Multimodal Analysis:** There's a significant focus on foundation models that can perform data fusion for the typically heterogeneous climate and nature datasets, which do not conform to standard language or vision datasets. This includes the application of models like CLIP for multimodal data analysis, encompassing vocal and behavioral labels, spectrograms, and raw data.
- **AI-Driven Decision Support and Monitoring:** The list highlights the need for decision support systems for climate and nature policy dynamics, models for supply chain tracking to ensure sustainable sourcing, and recommendation LLMs to propose and guide the application of solutions. Additionally, there is an emphasis on developing early warning systems to monitor ecosystem health and detect signs of degradation or species population changes.
- **Innovation in Materials and Sustainability:** AI models are sought for their potential to identify new, circular materials, contribute to building more sustainable infrastructure, and

provide transparency in carbon and biodiversity data for environmental markets. This includes developing new materials for buildings, transportation, and infrastructure.

- **Enhancing Data Accessibility and Collaboration:** Encouraging the use of self-supervised ML methods in areas with scarce labeled data, turning various objects into data input sources, and fostering collaborative feedback loops for taxonomy alignments. These efforts aim to align with both indigenous knowledge and accepted scientific classifications, improving data accessibility and accuracy.

Within the second category - existing AI research directions that if developed further would significantly accelerate solutions climate and nature challenges - the main themes are:

- **Data Efficiency and Variability:** This includes developing AI methods that can perform well in data-scarce situations, such as Physics-Informed Neural Networks, and those that are spatial-variability aware to account for differences across locations. There's also a need for quicker and more affordable methods to generate substantial training data.
- **Trustworthiness and Explainability in AI:** This entails a focus on responsible AI that addresses key issues such as fairness, accountability, transparency, and ethics. Ensuring that AI models are audited, verified, and translated correctly to produce meaningful and useful results in real-world applications is crucial. This also includes the integration of ethics and safety practices, and potentially regulation, to ensure responsible use.
- **Language and Cultural Inclusivity in AI:** There is a noted requirement for multilingual Natural Language Processing (NLP) to move beyond predominantly English-centric models and address biases towards the global North, ensuring more inclusive and accurate translations.
- **Advanced AI Methods and Human-AI Partnership:** Exploring the potential of Quantum AI for processing extreme volumes of information, the utilization of knowledge-guided Machine Learning, and the combination of AI with natural laws through hybrid methods. This also encompasses multi-modal learning to handle heterogeneous data inputs and outputs, and establishing robust Human-AI partnerships for enhanced interaction, feedback, and contextual understanding.
- **Proactive Management of Unanticipated Consequences:** This involves developing AI guards, such as checklists and statistical confidence considerations, to mitigate potential harm and efficiently identify and address unanticipated consequences of AI applications.

Panel: Meta-Challenges to AI for Climate & Nature

Day 2 closed with a panel and discussion on the meta-challenges faced in applying AI capabilities for climate and nature impact. The panelists included **Ali Farhadi (AI2), David Tennenhouse (National Science Foundation), Uyi Stewart (Data.org),** and **Victoria Houed (U.S. Department of Commerce)**, with **Allison Duettmann (Foresight Institute)** moderating. The broader workshop attendee group warmly shared additional insights to the given questions throughout this session during the discussion sessions.

“Are our [AI] models and proposed solutions going to maintain existing inequities? It is an important question we need to keep asking ourselves.”

Lauren Bennet
ESRI

A central theme in addressing the challenges of integrating AI with efforts for climate and nature revolved around data. Concerns about data quality, biases, and the pressing need for superior metrics and effective gathering methods were highlighted. There's a notable disparity in the talent pool, with a vast expanse of climate experts compared to a limited AI expertise base. This has led to a perceived disconnect between the vast knowledge of climate issues and the intricate workings of AI, especially in the dynamic startup ecosystem. Furthermore, the scarcity of AI expertise, the high costs associated with computing, and subsequent equity challenges related to accessibility emphasized the complexity of the issue at hand.

For example, a concern raised during the session was the prohibitive running costs of AI for those in the global south, who are often at the forefront of climate change effects. Moreover many of these tools are developed in languages and frameworks that are not accessible to those on the frontlines, such as rangers, who require immediate and actionable insights.

The urgency for increased transparency, participation, and accountability in the AI domain was evident. Historical shifts, such as the democratization of knowledge, underscored the importance of accessibility and inclusivity in deploying AI for climate solutions. While startups were hailed as innovation hubs, there were cautions about the potential pitfalls of AI, including unintended consequences or misuse. Mitigating these risks without stifling innovation emerged as a priority.

Finally, the fragmented and redundant nature of funding initiatives was a recurring topic, alongside calls for cohesive, long-term commitments to the cause. Despite the prevailing interest in the field, there seems to be potential for broader engagement that remains untapped. Questions were raised about the equitable representation of marginalized communities, especially those from the global south. The consensus was clear: the present times demand decisive and efficient action in leveraging AI for addressing the monumental climate challenge.

A panel discussion on the meta-challenges of applying AI to nature and climate.

Closing remarks

This workshop convened diverse experts and stakeholders to systematically identify gaps and capitalize on opportunities at the intersection of AI with climate and AI with nature. The discussions initiated here mark the commencement of an extensive, necessary dialogue in a decade crucial for addressing the profound challenges climate change and degradation of the natural world present. The enormity of these challenges necessitates a departure from solitary efforts, urging a collaborative, cross-sectoral approach. The workshop underscored the imperative of weaving together the climate, nature, and AI ecosystems, establishing a foundation for practical AI-driven solutions that also consciously prioritize equity and justice.

In reflecting on the broader impact and achievements of this workshop, it is evident that significant strides were made in dismantling silos between climate, nature, and AI sectors, fostering a unique and influential nexus. The workshop has successfully brought together diverse sectors and thematic leaders, yielding novel connections for future collaborations, fostering innovative ideas to influence participants' future work, and setting the stage for potential collaborations on highlighted challenge-solution pairs. As a collective, we addressed the pivotal questions, providing guidance and resources for researchers, funders, and policymakers worldwide, ultimately accelerating solutions and impact for the most pressing climate and nature challenges.

The Bezos Earth Fund and Foresight Institute warmly thank the global climate, nature, and AI leaders who joined us for this momentous event, bringing fresh insights, a mutual passion for solutions, and a focus not only on isolated ideas but on nurturing an integrated ecosystem with shared goals. Based on the energy and outcomes of this workshop, our collective outlooks is that the future is promising should we continue to drive progress forward together.

Acknowledgements

This workshop could not have taken place without the care and incredibly hard work by many who worked from the sidelines to ensure a successful event. We express our gratitude to Bezos Earth Fund team members **Jen Manaloto, Claire Pfitzinger, Miranda Mullins, Rocío Lower, Dan Schoenfeld,** and **Erin Jones** for their significant support. Our thanks also go to Foresight Institute's **Allison Duettmann**, **Niamh Peren** and **Lydia La Roux** for their collaboration on workshop design and moderation, together with affiliates **Linda Petrini** and **Clare Rickard** for their contributions.

Appendix

DATA

Data is available at: AI for Climate and Nature Workshop – Report Data. The document contains the climate challenges, nature challenges, AI capabilities, and votes.

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