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The Case for a Digital Ecosystem for the Environment



STORY HIGHLIGHTS

- Big data sets and new technologies can be brought together to create new knowledge products that can provide environmental insight in near real-time.
- Now is the time to reimagine and supercharge environmental governance and public-private partnerships by using big data, frontier technologies and data analytics to target our action and investments.
- We need to build on and leverage existing partnerships and practitioner communities to ensure the digital ecosystem for the environment is inclusive and does not overlap or duplicate existing activities.

Working in the environmental field and on natural resources management often puts us in a position where we are making decisions and investing financial and human resources – based on assumptions, anecdotal evidence or incomplete data. However, today we have at our fingertips a combination of global environmental data, technologies and data science tools and techniques that have the potential to create insights that can underpin a sustainable future and profoundly transform our relationship to the planet. These insights can underpin policy and decisions that lead to action and impact, an imperative today.

Now is the time – a pivotal moment in environmental history

Data adds tremendous value to how decisions are made in our daily lives. We can forecast the weather, compare products and services based on user reviews, as well as understand risk and reduce uncertainty for items, such as insurance premiums or financial investments. When it comes to the environment, much of the information needed to make decisions on a global level is not available in a consistent and rapid manner over time. This leaves us with no sound basis for targeting our actions, measuring the impact of our actions on the environment or developing adaptation responses.

Based on a recent [UN Environment report](#), 68% of the 93 Sustainable Development Goals (SDGs) indicators covering the environmental dimensions of sustainable development under the 2030 Agenda cannot be measured due to a lack of data. However, big data sets and new technologies can be brought together to create new knowledge products that can provide environmental insight in near real-time. These include satellites and drones, cloud computing, artificial intelligence, the internet of things, blockchain and a range of open source software and mobile phone applications. We are at a pivotal moment in environmental history where the way in which we deploy these technologies offers the possibility to measure and protect our environment – a feat that we have failed to accomplish over the past forty years. In many ways we need to make a big bet on technological salvation precisely because nothing else has really worked.

People may wonder how we can take such a positive outlook when the chorus from the scientific community is that humanity has around 10 years left to fundamentally change the way we consume natural resources and protect the environment to avoid climate catastrophe, resource scarcity and the 6th global extinction of species. These findings are compounded by population growth and increases in per capita resource consumption and carbon emissions. Moreover, our global environmental governance frameworks are not keeping pace with the rate of technological change – taking longer to negotiate and implement than the lifespan of different versions of the iPhone.

Ten years isn't a lot of time to transform our social, political and economic systems to achieve sustainable development. However, the challenge is no longer out there in some distant future – it is happening on our watch – in our lifetime. This is our problem to solve, our responsibility, our success or our failure. This may seem daunting or inflict a feeling of paralysis in terms of where to start, but we should see this time pressure as a source of motivation for individual and institutional leadership.

We must admit that business as usual approaches to global environmental governance are not working and that those approaches themselves require more scrutiny and reengineering. Now is the time to reimagine and supercharge environmental governance and public-private partnerships by using big data, frontier technologies and data analytics to target our action and investments. Our vision is to bring together partners and expert communities to generate environmental insights that governments, the private sector and citizens can use to protect our planet, our prosperity and our global peace. Solutions must be geared to work at a scale, pace and level of incentives that matches the social, economic and technological forces that are leading to environmental decline. They must directly challenge and bring greater transparency to the existing financial systems that benefit certain actors and organizations who offer products that cause damage to our environmental systems. We must create the incentives that catalyze change in their supply chains and product designs while also helping them to find new business models that harness more environmentally and socially responsible activities.

How do we create change?

The members of the [UN Science Policy Business Forum](#) working group on Big Data, Analytics and Artificial Intelligence were tasked to think through what a global digital ecosystem for the environment might look like. What partnerships would be needed? What are the key benefits, risks and governance issues? This group of companies, academics, member states, intergovernmental organizations and civil society actors was asked to leverage their collective knowledge to first conduct this initial scoping and then develop a vision and implementation plan for realizing a global digital ecosystem for the environment. Some tough questions were being posed during their deliberations.

How can such a system help fundamentally influence and direct government policy, consumer behavior and global markets towards sustainability in the “remaining” 10-year window? Can humanity navigate the geopolitical and economic challenges of environmental data governance? How can public and private sector actors jointly generate global public goods while avoiding data and technology monopolies and governance processes that lack transparency, inclusion and accountability. If power is increasingly based in data and digital social networks, what is the strategy to leverage and support those networks in driving transformations to deliver global sustainability?

The first [flagship discussion paper](#) of the working group was issued and adopted in March 2019 in the margins of the 4th meeting of the UN Environmental Assembly. We had the opportunity to participate in the process and co-author the paper. For both of us, it was the most fascinating process we have engaged with in our respective UN careers. But for the discussion paper to be transformed into a global road map by 2020, it will require coordinated global action, leadership and trust amongst public and private partners. Some of the key messages of this discussion paper are discussed below.

Why we need big data, algorithms and artificial intelligence

The planet desperately needs the best data, technology and processing power that humanity has to offer. If we cannot manage what we cannot measure, big data and frontier technologies can help decision-makers understand if we are on track, as well as assess different tradeoffs and model policy options. Available data was a major limiting factor in the recent global modelling of environmental policy options in the [6th Global Environment Outlook](#). But first, we need to identify what information is already available and where we can use existing big data and technology to fill information gaps. Then, we need a global effort to stimulate additional data collection, by governments, companies, academics and citizens – in order to ensure that we have the right information for the right decision.

New data streams and technologies such as open data cubes are offering high resolution spatial data to monitor environmental change over time. It is critically important to not only map negative trends, but also determine where investments are needed in mitigation, management or restoration to fundamentally change those trend lines. We must celebrate and scale solutions, not only track declining trend lines and failures.

We also need data and insights on supply chains, natural capital stocks and carbon intensity to inform financial markets and investors about environmental risks and opportunities linked to companies and their products and services. This can range from water, energy and material inputs to disaster risks to infrastructure and suppliers. There is a major transparency benefit to be gained in terms of understanding which companies are contributing to planetary solutions and sustainability and which are not. Blockchain has the potential to add a traceability benefit in terms of tracking global inputs as well as certification and performance standards that have been applied.

Using data science, artificial intelligence and machine learning to increasingly nudge consumers to more sustainable products and more actively consider the environmental footprint of product

supply chains has the potential to change behavior. There are already examples of finding innovative ways to gamify and reward green and low carbon consumption using [fintech and mobile apps](#).

How do we engage people and companies?

Social media has an increasing level of power and influence on attitudes, perceptions and political outcomes. How can it be leveraged in a more strategic way to direct citizen action towards sustainability? How can people be mobilized to collect data on ecosystems, biodiversity and the state of our environment using crowdsourcing and citizen science? How can we get people living in cities to understand the value and beauty of the natural world in order to take action to protect it?

Mobile phones and other data collection technologies now give all citizens the power to connect, be informed and act on environmental problems. How can we use technology to help people understand the implications of biodiversity loss, environmental degradation and climate change in a hyper-local way? We need to help people understand local environmental risks and trends as easily as they understand local weather reports. How is your home exposed to localized air and water pollution and what are the health risks? What environmental risks might impact your favorite park, wildlife species, or natural areas?

We need more aggressive strategies to ensure that messages about the environment are based on science and facts rather than “fake news”. We need to understand how effective stories can be told in ways that trigger an emotional response and catalyze action in the real world. The world is not yet using available environmental data and frontier technologies in a strategic and integrated manner to influence markets and consumer behavior, stimulate awareness and action through social media and create policy change. But this is within our reach.

We need partnerships to build the infrastructure for a digital ecosystem for the environment to bring together data, algorithms and insights as a global public good. This will require interoperability across platforms, data sharing, and data

governance, combined with investments in data collection and infrastructure to bring together data with algorithms with software with cloud computing – ideally all based on open source technologies. Data should be accessible, open and analyzed in a way that links to policy, markets, consumer behavior and social media.

What are the risks?

Given these potential benefits, international organizations, civil society groups, academics and governments are already scrambling to partner with the major holders of data and technology (i.e. technology companies). However, in the rush to access data, we should consider the motivation of companies, their underlying business models and their potential intention to lock-in clients to proprietary software creating dependency. Currently, much of the big data and technological advancements are held by a handful of companies. This not only creates imbalance in terms of who has access to use data to make decisions, influence markets and determine investments, but it also creates concerns in terms of privacy. As we go forward in partnerships with technology companies, we need to keep the adage in mind that there is no such thing as a free lunch. The same is true in new partnerships with the largest global industrial and energy firms, where transparency and transformation is crucial to achieving our goals for sustainable development. We need to understand where motivations overlap, or conflict, and when partnerships are appropriate. We also need to construct more agile partnership agreements that allow for either party to exit when values no longer align.

As companies release a swarm of satellites, drones, sensors and mobile applications to index all natural resources on earth, it is important to also take a step back and ask how this wealth of data and potential power will be governed. If information is power, then those who control access to information and processing capacity hold more power than other stakeholders. How the insights from this big data will be mined and sold is an important question – especially if they are subjected to normal market dynamics and major asymmetries in technical and financial capacities between public and private sectors.

Our natural resources and environment are the source of our livelihoods and well-being, yet data on our natural resources is currently being freely collected and used by a handful of technology firms. The landscape of global information and power is fundamentally different as a result. It is likely that few nations realize how much potential leveraging this data and processing power will give companies over their economies. It is critical that all countries build their capacity to engage in this new digital economy to avoid the massive risks and asymmetries that could follow if they do not.

Some fundamental questions need to be asked as we begin to build up global public goods at a planetary-scale by private sector actors. This is unfamiliar territory for everyone. But if we are placing the act of monitoring the health of the planet and directing policy priorities in a combination of public and private hands, we need to think through new governance models. We need to understand what incentives, safeguards and standards are needed to ensure that environmental data and processing power are used to help humanity solve long-term global environmental challenges rather than see them diverted as a result of the short-term mentality and profit motive that is intrinsic to financial and capital markets.

As we take forward a vision for building a global digital ecosystem of environmental data, algorithms and insights, three key risks need to be mitigated. First, we need to empower governments and people to be able to understand and use data and to hold the holders of data accountable, as opposed to having data held mostly by a few companies in a few countries. How will the massive global data catalogues amassed by some firms be governed in a way that maintains a global public good as opposed to a private good? How do we advocate for issues related to data privacy, data sharing and provide a watchdog function? Second, we need mechanisms to ensure the quality of data and algorithms to ensure public trust. This includes a commitment to transparent methods as well as publishing open algorithms when possible. This is critical to prevent poor quality analysis as well as the malicious generation and spread of fake environmental data that could be used to manipulate policies, markets and public option. Finally, frameworks to protect

individual privacy, data security and intellectual property are fundamental.

One of the largest governance challenges to address is that national and international regulatory processes move on different timelines compared to technological innovation. As a result, new forms of agile governance are needed. Countries should agree on a basic set of international norms and values that can guide the development of the technology sector and that can help to ensure it contributes positively to global public goods. Companies should establish clear ethics policies and internal monitoring mechanisms that can help identify conflicts of interest and resolve ethical dilemmas.

A new social contract is also needed between the private and public sectors – where the cost of doing business and the social license to operate is predicated on a basic level of sharing derived data products where they can contribute to a global public good. Other financial and tax incentives are also needed for stimulating private sector actors to share key data at the lowest cost when it is needed as part of a global public good. Disclosure requirements should be carefully considered regarding business models that finance global public goods.

How do we get there?

The difference between utopian and dystopian environmental outcomes from frontier technologies is in our hands. The future is what we make it. The technology itself is agnostic but instrumental. The [discussion paper](#) identifies the following to be the foundation for pursuing a digital ecosystem for the environment and for achieving sustainable development:

- Citizens must be engaged and empowered to use data and information to improve their own lives, communities and environment while also holding leaders accountable. Citizen science initiatives need to be both scaled and institutionalized in a manner where they become sustained and trusted data streams.
- Countries must create a policy environment that promotes open data and a culture of data integration, use, innovation

and governance in order to deliver tangible benefits to their citizens as well as monitor their own progress towards the SDGs and multilateral environmental agreements.

- We need to move from awareness about big data and frontier technologies to understanding in terms of practical applications that can be scaled by non-technical users and decision-makers. We also need to harness the power of data, AI and mobile apps to nudge consumer awareness and behavior towards sustainability.
- We need public-private partnerships in order to leverage private sector expertise and infrastructure in data science, cloud computing and artificial intelligence, to share data and to promote the use of technology for global public goods.
- Environmental data custodians must make their data sets as open and inter-operable as possible, allowing data to flow across digital ecosystems using web services and APIs. Environmental organizations should adopt a common global data strategy, assigning specific leadership rolls to different actors and agreeing on the core global public good data sets that are needed to monitor the health of the planet and progress against different global agreements.
- We need to curate and release global data analytics on environmental risks that have the power to influence global markets and investments towards more sustainable resource management solutions.
- We need to build on and leverage existing partnerships and practitioner communities to ensure the digital ecosystem for the environment is inclusive and does not overlap or duplicate existing activities. We also need non-governmental organizations to increase their engagement on this topic and perform a critical watchdog function.
- The UN should take a leadership role and make a longer-term investment in terms of convening stakeholders around a common vision for developing a global digital ecosystem for the environment, including new and innovative partnerships with all key actors. The UN should help broker partnerships that meet multiple criteria and

demonstrate how data can be transformed into action as well as global efforts to fill key data gaps. The UN also needs to take a more proactive role to promote open data, open source software, interoperability of data, and to provide guidance on which global data sets are the “best available”.

UN Environment should continue to invest in developing the vision for a World Environmental Situation Room and continue building open source software platforms for spatial data such as MapX. Partnerships are also needed with other UN actors to scale-up existing applications such as the UN Biodiversity Lab with UNDP and EarthMap with FAO. Increased coordination is also needed with platforms such as Resource Watch by the World Resources Institute to leverage respective strengths, share data and avoid fragmentation.

The international community has an important choice to make in how these technologies are used to save lives and livelihoods, respect human rights and protect the planet. Ultimately, the environmental revolution that must be catalyzed by frontier technologies is equally about a revolution in environmental transparency – which actors are leading the way towards a sustainable future, and which continue to adopt practices that undermine life on earth.

We are optimistic about the future. We have new opportunities to better engage with Governments and the public and to demand a new social contract with technological companies. We as a global community have the power to hold governments and companies accountable and to ensure that leaders create change. With the right data to make crucial decisions in the decade ahead, we can all be on the right side of human history.

This article was authored by [David Jensen](#) and [Jillian Campbell](#), UN Environment.