Lands of Opportunity

Unleashing the full potential of natural climate solutions

The Nature Conservancy

#Nature4Climate

About this document

This document is intended to inform and support decision makers as they look to understand and maximize the opportunity that natural climate solutions can provide, across both public and private sectors. It does this by building on a strong scientific framework for action on natural climate solutions, and using case studies throughout to provide proof-points such decision makers could leverage. It aims to be sufficiently broad so that actors across all key geographies and biomes can identify the best strategies for their own areas.

Acknowledgments

It builds on the work of decades of study in land use by organizations too numerous to mention. Particular thanks goes to: James Madison University, Woods Hole Research Center, The Cary Institute of Ecosystem Studies, TerraCarbon, Cornell University, Resources for the Future, Colorado State University, World Resources Institute, Conservation International, the University of Minnesota, the University of Florida, Wetlands International, the University of Vermont, Vivid Economics and Poyry. Generous funding has been provided by the Doris Duke Charitable Foundation and the Children's Investment Fund Foundation.

Contact: info@nature4climate.org

Published: November, 2017

Front image: Robert Walls, part of the chocker setters/ rigging crew at Ellsworth, choke logs to be yarded at the preserve. ©Chris Crisman

Inside double image: Field biologists prepare to collect specimens in Dye Creek Preserve, part of the Lassen Foothills project where restorative land management and conservation-compatible ranching techniques are administered by The Nature Conservancy on behalf of the state of California. © Ian Shive

Back inner image: Nealla Frederick, Eastern Caribbean Conservation Planner with the Conservancy holds a young red mangrove shoot, in Levera National Park. © Tim Calver

Foreword

We will not find an adequate response to climate change if we ignore how we manage the lands of the world—our forests, farms and coasts.

The science is clear. The land is responsible for a quarter of global greenhouse gas emissions. But if better managed, it can provide more than a third of the carbon reductions needed to keep warming well below 2°C, the target agreed at the Paris climate talks. The imperative of realizing these carbon reductions becomes even more pronounced if we are to limit warming to 1.5°C.

Renewable energy, energy efficiency and cleaner transport are vital as well. But, the truth is that we cannot prevent the worst of climate change without having all solutions on the table. We need clean energy and natural climate solutions.

With the development of remote sensing and soil bio-geochemical models, we are only now beginning to fully grasp the potential of the land to address climate change. We call the range of opportunities, 'natural climate solutions'. They are economic, scalable, and crucially they are available now and almost everywhere on the planet. They offer co-benefits, including rural regeneration, improved food and water security, coastal resilience and biodiversity protection, and can help communities adapt to climate change.

Realizing the potential of natural climate solutions will not be easy. Forests, farms and coasts vary greatly in size, type and location. The lives of hundreds of millions of individuals are tied up with them in many different ways. Strategies such as restoring forest cover or improving soil health require a different set of actions from reducing tropical deforestation or reviving mangroves.

But as with energy, there is a broad set of opportunities that if pursued concertedly can help to take us in the right direction. Progress is already being made. The number of commitments to natural climate solutions has grown rapidly at the international, national and subnational level. There have been great advances in measuring and monitoring greenhouse gas fluxes in landscapes. New financing mechanisms for carbon and other ecosystem service payments are emerging, some accessing mainstream capital markets on a sizable scale.

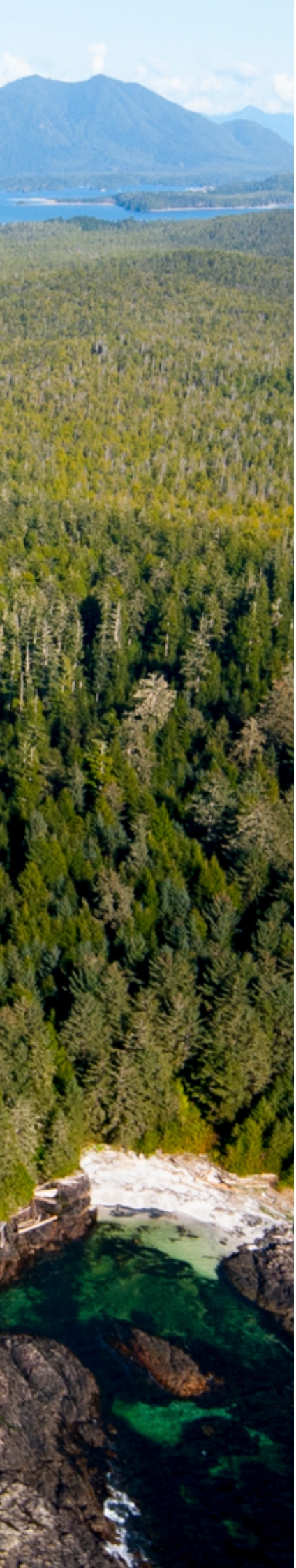
Many groups have been active individually in natural climate solutions over the years particularly the conservation movement. But we've always known that the size of the task demands the combined action of multiple parties—governments, civil society, businesses, indigenous peoples and other communities. The urgency of the challenge and the opportunities the land sector offer make it time to finally unify fragmented efforts. Together we'll be able to unlock the full potential of natural climate solutions across the world, and catalyze funding for better land use in the process.

The science tells us we have no time to waste. Please join us in consolidating this front against climate change.

Justin Adams

The Nature Conservancy,
Global Managing Director Lands

The Nature Conservancy



Contents

Left: An aerial view of Clayoquot Sound, on the west coast of Vancouver Island in the Canadian province of British Columbia. © Bryan Evans

What are natural climate solutions?

Cutting emissions from all sectors is essential, including land use. Natural climate solutions are proven ways of storing and reducing carbon emissions in the world's forests, grasslands and wetlands. Better stewardship of the land also has impact on other critical environmental, social and economic benefits, which are less well understood. These solutions are available immediately, are scalable and can transform key sectors of the global economy, such as forestry and agriculture.

A peer-reviewed study, led by scientists from The Nature Conservancy and 15 other institutions[1], and published in the journal *Proceedings of the National Academy of Sciences* (PNAS), expanded and refined the scope of land-based climate solutions previously assessed by the United Nations' Intergovernmental Panel for Climate Change (IPCC)[2]. The PNAS paper says that natural climate solutions can deliver 37% of cost-effective carbon dioxide mitigation needed by 2030 for a greater than 66% chance of holding global warming below 2°C this century.

These solutions are available immediately, are scalable and can transform key sectors of the global economy, such as forestry and agriculture—as well as having many other social and environmental benefits.

Fishing guide and Yurok tribal member, Pergish Carlson in northern California. © Kevin Arnold

Natural climate solutions

Natural climate solutions help reduce carbon emissions and store more carbon in the landscape. These solutions are often complex and interconnected: one needs a holistic view across and within landscapes to see the overlaps. They can deliver both significant adaptation and mitigation benefits.

CONSERVATION OPPORTUNITIES

Avoided habitat conversion: Rising demand for food and other natural resources has seen the large-scale conversion of natural habitats such as forests, grasslands, scrublands and wetlands for agriculture and aquaculture. Infrastructure and urban development add further pressure. Habitat conversion releases carbon otherwise stored in plants and soils. It also diminishes the capacity of land to function as a carbon sink, as rich ecosystems are degraded or lost altogether.

Blue carbon: 'Blue carbon' is stored or sequestered in the soil or biomass of coastal wetlands such as saltmarshes, seagrass meadows and mangrove forests, or is carbon released by the destruction of those ecosystems. These can store up to four times more carbon than terrestrial forests per unit area[3]. Conserving and restoring these valuable environments can significantly improve carbon mitigation and localized resilience to the impacts of climate change, as well as securing people's livelihoods. These measures also help increase protection for coastal communities threatened by storm events. While traditional gray infrastructure like levees and seawalls are common, nature can provide some of the most cost-effective protection: just 100 meters of mangrove trees can reduce wave height by 66 percent.

Indigenous leadership: Indigenous peoples living traditional lifestyles commonly have a rich understanding of the environment. They are custodians of the lands across which they have hunted, gathered and farmed for generations. The contribution they can make in delivering sustainable land management practices for both protection and economic production benefit is considerable.

SCALING FORESTRY & WOOD PRODUCTION

Improved forestry: Smarter ways of managing plantations and other working forests can improve their productivity, just as they can benefit the climate. Removing competing vegetation, more sensitive logging practices and longer cycles between harvests can promote tree growth. These and other enhanced natural forest management practices can be applied across the 1.9 billion hectares of production forest globally[4].

Reforestation & restoration: The rich and dense ecosystems of tropical and temperate forests are highly effective carbon sinks. Turning less productive and otherwise unused lands into forests and enriching existing forest cover can capture and store gigatonnes of carbon dioxide.

Demand for sustainable wood: Demand for timber is set to double or even triple through to 2050[5]. Ensuring that sustainable forestry meets this demand can create and enhance valuable carbon sinks, while generating jobs and economic growth.

Fire management: Every year, wildfires clear millions of hectares of woodland and other vegetation, releasing huge amounts of carbon into the atmosphere. The number and severity of fires increases with rising temperatures. Controlled burning, including traditional fire management by indigenous groups, where possible reduces the frequency of catastrophic fires, while helping to reduce fire risk to people and nature. Timber can also help displace carbon-intensive alternatives, from concrete in construction to plastics in packaging.

AGRICULTURE THAT WORKS FOR PLANET AND PEOPLE

Soil health: There is a high correlation between soil health and agricultural resilience. Soils store significant amounts of carbon. The amount varies according to farm practices and the biological health of soils. But the degradation of soils undermines the productivity of farmers and resilience of croplands. Correspondingly, enriching soils through smarter agricultural practices such as more efficient use of fertilizers can deliver a triple win: greater carbon retention, higher crop yields and lower costs.

Zero-deforestation supply chain: The vast majority of goods – from food to furniture – require natural materials in the supply chain. Demand for consumer goods has been a principal driver of deforestation. Working with companies to eliminate the use of uncertified sources of timber helps keep precious carbon stores intact and creates opportunities for climate-smart approaches to producing materials.

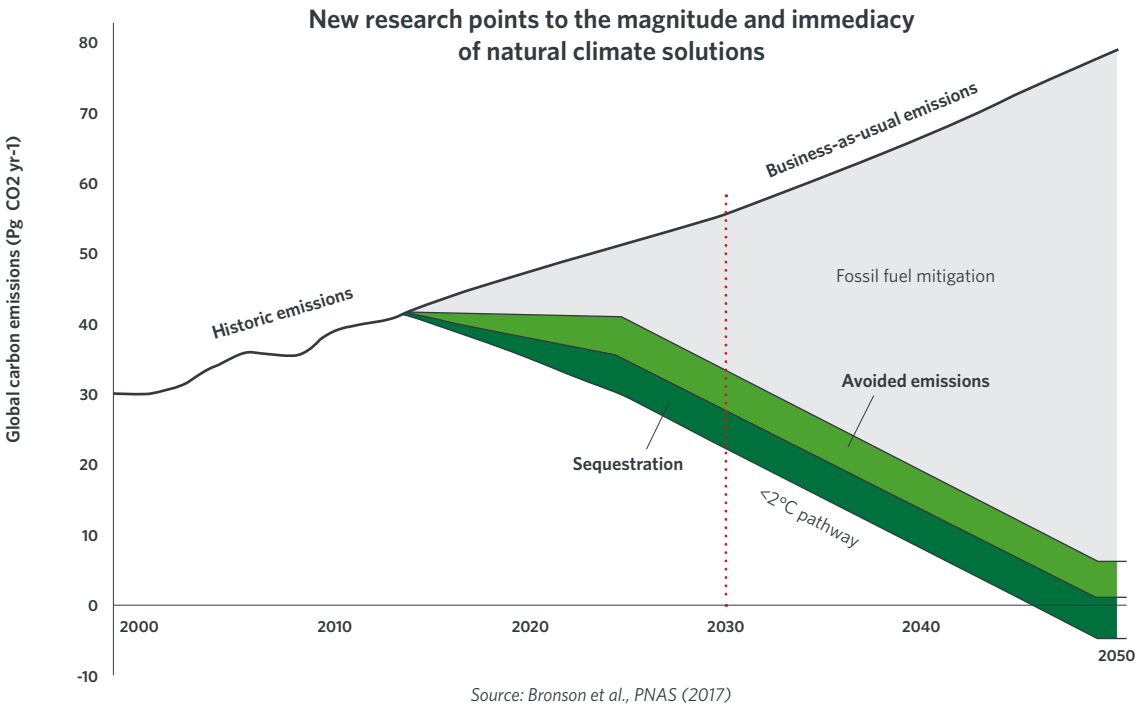
Food production and waste: A third of all food produced is wasted, amounting to about 1.3 billion tonnes a year[6]. The greenhouse gas emissions from food waste are greater than those of any country with the exception of China and the US[7]. In addition as global population and incomes rise, demand for meat grows. The livestock sector is a net emitter, responsible for an estimated 14.5 percent of all man-made greenhouse gas emissions[8].

Rapid decarbonization of energy sector alone is insufficient

The Paris agreement stands as a huge achievement in the response to climate change—despite the proposed US withdrawal. Successful delivery of the Paris goals requires governments to honor their existing commitments, to adopt new opportunities to reduce emissions, and to move on these as quickly as possible.

For years, renewable energy, energy efficiency and cleaner transport have been the principle means of decarbonization. They have also seen considerable progress. We would however need emissions from fossil fuels to be net zero by 2040 to meet the Paris climate goals—a desirable but perhaps near-impossible event.

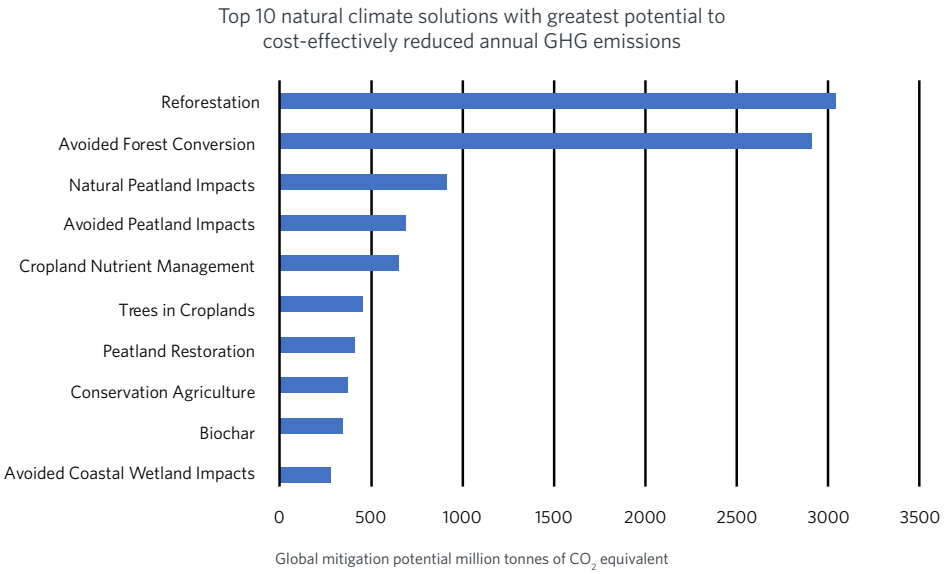
Attention is therefore turning to land use. To date, the focus has mainly been on reducing emissions, but there is a growing recognition that we can do more to realize the carbon capture and storage potential of our land. Accounting for cost constraints, the PNAS paper calculated that natural climate solutions could reduce emissions by 11.3 billion tonnes per year by 2030—equivalent to halting the burning of oil or the combined emissions from the US and European Union. One-third of this cost-effective natural climate solutions mitigation can be attained at or below $10 a tonne of carbon, cheaper than emerging technologies such as bioenergy and carbon capture. Without cost constraints, natural climate solutions could deliver emissions reductions of 23.8 billion tonnes of carbon dioxide equivalent per year, close to a third (30%) more than previous estimates. The graph below shows how natural climate solutions can contribute 37% of the necessary emissions reduction on a cost-effective basis.



Source: Bronson et al., PNAS (2017)

For natural climate solutions to fully meet their climate change potential, we need to rethink the way we manage the land and our demand for products from the land, including food and wood.

The biggest natural climate solution: more trees



The PNAS paper found that trees have the greatest potential to cost-effectively reduce carbon emissions. According to the FAO, 3.9 billion hectares or 30.6% of total land area is forest. Avoided conversion of forests represents a quarter of the economic carbon reduction potential of natural climate solutions. The three largest options for increasing the number and size of trees (reforestation, avoided forest loss, and better forestry practices) could cost-effectively remove 7 billion tonnes of carbon dioxide annually by 2030. Restoring forests on the 225 million hectares of formerly forested lands that are suitable for reforestation and avoiding further loss of global forests, are the two biggest opportunities.

Agriculture, which covers 11% of the world's land surface according to the FAO, is also important. Changing the way we farm could cost-effectively deliver 22% of emissions reductions.

Wetlands are less extensive than agricultural or forest lands, covering 0.7-0.9 billion hectares or 4%-6% of the world's land surface, but they hold the most carbon per hectare and offer 14% of potential cost-effective natural climate solutions. Avoiding the draining and conversion of peatlands, is the largest of these opportunities. Peatlands are estimated to hold one quarter of the carbon stored by the world's soils, yet approximately 770,000 hectares are lost globally each year, in particular for palm oil cultivation. The researchers found that their protection could secure a store of 678 million tonnes of carbon emissions equivalent a year by 2030.

There is a growing recognition that we can do more to realize the carbon capture and storage potential of our land. Natural climate solutions can contribute 37% of the necessary emissions reductions on a cost-effective basis.

Expanding market-based mechanisms

Accounting principles are already established to determine carbon fluxes from forestry, and some other land uses, and the UNFCCC has agreed a REDD+ mechanism that enables countries to secure payments for emission reductions across these landscapes.

The amount of carbon finance available to natural climate solutions nevertheless remains low. Even just looking at the forestry sector, a recent report[9] showed that the current funding for REDD+ of around $500 million a year falls far short of the $30 billion a year or so which is required.

There are however several green-shoots on the horizon, with a number of potentially large scale international and national mechanisms being developed, alongside potential finance from the corporate sectors such as aviation and shipping industry schemes.

Going beyond tropical forest protection

Forest cover is increasing in temperate regions but in the tropics it is still disappearing at alarming rates, mostly due to agricultural expansion. In 2014, the world lost another 9.9 million hectares of tropical forests[11] . For good reason, climate action on land use has tended to focus on tropical deforestation.

However, the PNAS paper shows that the need to conserve and expand forests can and must go beyond tropical forests alone. Success depends in large part on better forestry and agricultural practices, particularly reducing the amount of land used by livestock. A smaller livestock footprint would release vast areas across the globe for trees to grow back and can be achieved while safeguarding food security. The five countries where forests could reduce emissions the most are Brazil, China, India, Indonesia and Russia. We have the opportunity to go bigger and broader with natural climate solutions—in every country in the world, and almost every biome.

An aerial view showing deforestation for cattle ranching at São Félix do Xingu, Brazil. © Haroldo Palo Jr.

Promise of rural regeneration

Degraded lands offer little economic productivity. But by implementing sustainable land-use practices, it is possible to protect and avoid the degradation of soils, leading to increased carbon sequestration and storage over the long term. This can also help protect jobs and bring them back to rural areas.

A 2015 study of the 'ecological restoration' sector in the US examined the economic benefits derived from environmentally-driven improvement of lands, primarily to meet state or federal government policy requirements. Based on an analysis of 14 privately-funded projects, the study found they supported as many as 33 jobs per $1 million invested[12].

At the national level, a follow-up study showed the restoration sector directly employs 126,000 workers and generates approximately $9.5 billion in economic output annually. This is more jobs than coal mining (79,000), logging (54,000) or steel production (91,000)[13].

The potential to bolster rural employment if restoration practices are adopted more broadly is huge. Overall, research commissioned by TNC estimates that natural climate solutions could contribute $25-90 billion in annual value added by 2030—without factoring in a carbon price.

In the US, the restoration sector directly employs 126,000 workers and generates approximately $9.5 billion in economic output annually.

Ryan Adler, choker setter, in the logging yard at the Ellsworth Creek Preserve, WA. © Chris Crisman

Demand leverage

As the study of the opportunities of land use grows, it is becoming clearer that demand-led approaches that change the way we manage our lands could significantly help to address climate change.

With the world population forecast to reach 9.7 billion in 2050, demand for wood is expected to triple[14] and demand for food to grow by 70%[15]. To keep up, $80 billion of investment is expected per year in agriculture, and $70-160 billion a year in forestry[16]. These investment flows are significant as they offer opportunities to align capital investment with more sustainable production of food and timber, reducing greenhouse gas emissions at low cost.

For example, there is potential for incentives to increase the use of sustainable wood products significantly. In construction, new engineered construction materials like cross-laminated timber (CLT) are stronger than steel or concrete and boast a significantly smaller carbon footprint. Replacing half of the steel, concrete and brick used globally with CLT and similar technologies could avoid as much as 3 gigatonnes of CO_2 equivalent in emissions per year. Studies are only just starting to show the extent to which demand for forest products could lead to a material rise in reforestation projects.

Sustainable wooden office building.

Co-benefits of natural climate solutions

In 2017, the French and British governments banned sales of new diesel and gasoline cars and vans from 2040, largely for health reasons. There is growing awareness that better land use can also produce health benefits, for example through cleaner water or air, in addition to carbon emission reduction or climate adaptation benefits. Concerns about personal health create demand for organic products—which in most cases improves soil health.

There are other social and ecological benefits of improved land use. The attractiveness of nature for recreation is spurring an expansion of eco-tourism and protection of natural habitats worldwide.

These wider social, environmental and economic benefits explain why natural climate solutions are central to achieving half of the UN's 17 Sustainable Development Goals.

The wider social, environmental and economic benefits of natural climate solutions explain why they are central to achieving half of the UN's 17 Sustainable Development Goals.

An orangutan and baby in Tanjung Puting National Park in Borneo, Indonesia. © Katie Hawk

Feeding and supplying a growing population sustainably

It is expected that existing natural forests will not be able to support future demand for forest products. This might mean yet more destruction of forests and theoretically their complete destruction. To meet demand, there is however an opportunity for large-scale reforestation on the 2 billion hectares of deforested or degraded lands globally[17]. Well-thought through investments in reforestation and increased plantations can help to protect remaining natural forests. The approaches need to be complementary.

In agriculture, climate change is increasingly seen as one of the biggest concerns of farmers, in particular those affected by drought or flooding. While the sector is often highly fragmented, there is growing understanding that it can make a major contribution to reducing emissions. Smarter application of chemical fertilizer, for example, improves crop yields while reducing runoff and nitrous oxide emissions that have 300 times the global warming impact of carbon dioxide. Other effective interventions include planting trees among croplands and improved livestock management.

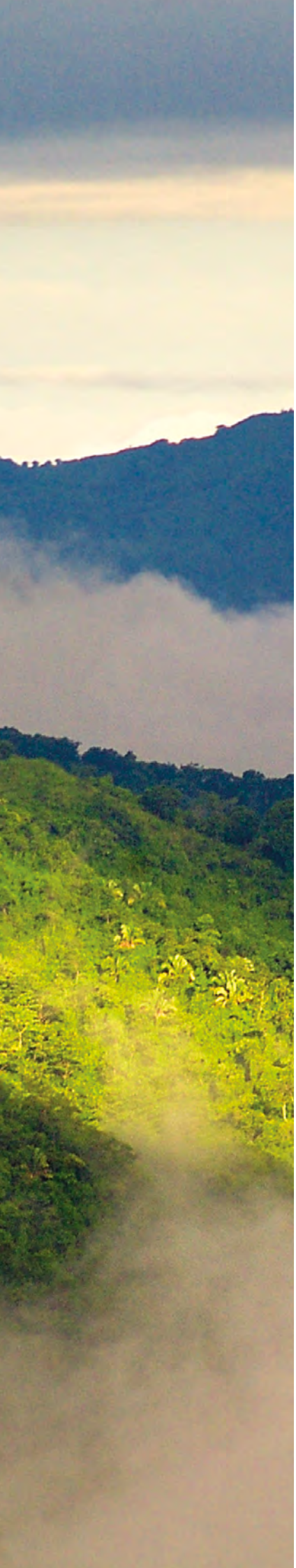
Derivert Tilionord inspects a mango tree that was planted as part of an agroforestry project in Haiti. © Bridget Besaw

Engaging the private sector

Environmental NGOs helped lay many of the foundations for climate action on land use, supporting demonstration projects all over the world and helping to develop the policy frameworks that have underpinned international efforts.

For too long, however, land use has been seen as the preserve of the environmental movement, while many countries have regarded conservation and protection as limiting much-needed economic development. Protecting and conserving nature is certainly critical to natural climate solutions. But natural climate solutions serve multiple purposes, including helping to create economic opportunities as agriculture, forestry and coastal businesses are major sources of income and employment in many countries and attract significant investment. By engaging with the private sector—as laid out in the following pages—natural climate solutions can further enhance the economies of these sectors. In addition, natural climate solutions can create opportunities in other sectors such as finance and insurance.

Soybeans being unloaded at Cargill's port facility in Santarem, Pará, Brazil. © Steve Niedorf



Why now: the time is ripe

Leaders all over the world—whether from government, the private sector, finance, academia or civil society—are increasingly rising to the challenge of climate change and spurring action on natural climate solutions. This section provides a snapshot of where and how momentum is building, in the following ways:

1. **Political leadership at the international, national and sub-national levels**
2. **Private sector leadership:**
    a. Zero-deforestation supply chains
    b. Constructive climate role for forestry
    c. Opportunities for agriculture
    d. New wave of 'naturetech' enterprise
    e. Unlocking new financial flows for land use
3. **Strong models of indigenous and local community development**
4. **Strong scientific underpinning**

"Land use is a key sector where we can both reduce emissions and absorb carbon from the atmosphere. The latest research shows how we can massively increase action on land use—in tandem with increased action on energy, transport, finance, industry and infrastructure—to put emissions on their downward trajectory by 2020. Natural climate solutions are vital to ensuring we achieve our ultimate objective of full decarbonization and can simultaneously boost jobs and protect communities in developed and developing countries."

Christiana Figueres, Convener of Mission 2020 and former head of the UN Framework Convention on Climate Change

Tropical dry forest during the wet season at the Karen Mogensen F. Reserve (Peninsular Biological Corridor in northeastern Costa Rica). © Sergio Pucci

1. POLITICAL LEADERSHIP AT NATIONAL AND SUB-NATIONAL LEVELS

More than 120 countries or about 75% of the signatories to the 2015 Paris agreement included natural climate solutions in their Nationally Determined Contributions (NDCs). Measures included emissions reductions across agriculture, land use change and forestry, with countries often drawing on a combination of these approaches[18].

There has also been strong support for international initiatives on natural climate solutions. The 2011 Bonn Challenge to restore 150 million hectares of degraded and deforested lands globally by 2020 marked a key moment of global resolve. This was followed by the 2014 New York Declaration on Forests, which committed signatories to halt global deforestation by 2030. 36 countries are signatories, along with 56 sub-national governments.

The World Bank's Forest Carbon Partnership Facility (FCPF) has 47 developing countries participants, and supports REDD+. In 2016, the Democratic Republic of Congo and Costa Rica became the first two countries to present fully-fledged emission reductions programmes to the fund. They are now on track to receive results-based payments for forest conservation efforts[19].

The 10 years of REDD+ have seen marked successes and innovation. It has arguably been the most important policy for land use emissions and forest conservation. However, its impact has been limited because the necessary compliance regulation and financial commitments have not yet materialized.

Some governments have set up specialist units to tackle specific land use challenges. Indonesia, for example, has created the Central Peat Restoration Agency to protect and restore peatlands. The Indian government has set aside $6 billion for states to invest in forest restoration[20].

Political will and action are also evident at the sub-national level. To date, 35 states and provinces from 9 countries have come together to form the Governors Climate and Forests Taskforce (GCF) to reduce tropical deforestation and fight climate change.

California's 'Forest Carbon Plan' recognizes forests as the 'largest land-based carbon sink', and will complement other natural climate solutions, such as improving levels of carbon held in soils, reducing agricultural greenhouse gas emissions and restoring or enhancing wetlands and mountain meadows.

Governor Brown of California is convening a Global Climate Action Summit for September 2018. The summit aims to mobilize non-state actors to support and implement the Paris agreement. Natural climate solutions can be expected to be a central theme.

Some governments have set up specialist units to tackle specific land use challenges. Indonesia, for example, has created the Central Peat Restoration Agency to protect and restore peatlands. The Indian government has set aside $6 billion for states to invest in forest restoration.

Right image: Cattle on a Santa Vitoria Farm in São Félix Do Xingu in the Brazilian Amazon. © Kevin Arnold

2. PRIVATE SECTOR LEADERSHIP

a. Zero-deforestation supply chains

Forest areas have been shrinking for hundreds of years, but the rate of net forest loss has approximately halved since 1990[28] despite recent increases in some regions. Collaborative action across supply chains with significant corporate input and leadership has helped to drive this trend.

The Consumer Goods Forum (CGF), set up in 2010, laid the foundations for zero-deforestation supply chains, with commitments from 366 companies. At the World Economic Forum in January 2017, 20 of the world's largest commodity companies committed to increase transparency and traceability to make good on their commitments[29]. This builds on strong foundations already in place at a sectoral level. In Brazil, in 2006, major soybean traders who controlled 92% of Brazilian soy production signed the Soy Moratorium. This meant they would not purchase soy grown on deforested lands in the Brazilian Amazon[30]. Since then, soybean production on deforested lands has fallen from 30% to approximately 1%.

Zero-deforestation cattle agreements signed by major meatpacking companies have also helped to reduce deforestation in Brazil. The Sustainable Beef: From Farm to Table project led by TNC in the Brazilian state of Pará, for example, has helped to reduce deforestation in the São Felix do Xingu municipality by over 80% since 2009 by increasing cattle density[31].

Recognizing the value and urgency of scaling up existing sectoral approaches, the Gordon and Betty Moore Foundation launched the Collaboration for Forests and Agriculture (CFA) in 2015. This is a multi-year project to help establish zero-deforestation as standard practice in the global beef and soy production sectors. The CFA has an objective of saving 5 million acres of forest from habitat conversion across Argentina, Brazil and Paraguay by 2020. Designed to complement corporate pledges to remove deforestation across supply chains, it aims to trigger an industry shift by improving monitoring and intensifying beef production, among other measures.

Public-private initiatives such as these hold the potential for Brazil alone to double its food production without habitat loss. They can also be replicated internationally. The Tropical Forest Alliance 2020, for example, is a global umbrella partnership seeking to remove deforestation from the sourcing of commodities such as palm oil, soy, beef, and paper and pulp—in response to the CGF commitments.

b. Constructive climate role for forestry

Few industries have as many opportunities or incentives to align natural climate solutions with their business models as forestry. The timber, pulp and paper industries are already adopting more sustainable practices, investing heavily in new planting and exploring large-scale restoration.

Certification of timber supply chains is also key. There are, for example, more than 190 million hectares of Forest Stewardship Council-certified forests in over 80 countries. Other schemes include the Sustainable Forestry Initiative (SFI), the American Tree Farm System (ATFS) and the Programme for the Endorsement of Forest Certification (PEFC).

The US has examples of emerging bright spots where forestry can be part of the climate solution. With only isolated patches remaining of North America's largest expanse of floodplain forest, the Lower Mississippi Valley offers fertile ground for a series of tree-planting and forest restoration projects that will capture carbon dioxide across this massive river basin. The Lower Mississippi Valley Grouped Afforestation Project (LMVGAP) is projected to sequester approximately 517,980 metric tonnes of carbon dioxide over 70 years. Carbon-offset credits provide most of the funding.

Because much of the land in the region is only marginally productive, landowners are often willing to sell or reforest their lands. Companies like Natural Capital Partners (NCP) are working with them to protect woods and plant new trees, sharing revenue generated from carbon credits. The project also allows limited sustainable logging, generating additional benefits for landowners. NCP aims to ultimately restore 1 million acres of deforested lands, realizing carbon savings of 200 tonnes of CO_2 equivalent per acre. Other firms also working in the region include GreenTree and TerraCarbon. The United States Fish and Wildlife Service and the Lower Mississippi Valley Conservation Committee, a coalition of state-level natural resource offices in the region, support this work.

In addition to sequestering carbon, these new forest lands provide habitat for wildlife in the region, such as the Louisiana black bear—a subspecies that habitat loss nearly drove to extinction. The reforested lands also reduce runoff into nearby streams and rivers, trapping the nutrient pollutants that cause the hypoxic 'dead zone' in the Gulf of Mexico.

Reduced-impact logging—a set of logging practices for removing only high-quality timber while minimizing ecosystem impacts—is another example of how to successfully reduce carbon emissions. Loggers can leave hollow trees standing, for instance, if they are unusable for timber, and if the trees are left alive they will continue to absorb large amounts of carbon. Different methods of removing harvested timber can also spare more of the ecosystem.

Practices of this sort can reduce carbon emissions by more than 30% and preserve biodiversity benefits without cutting jobs or timber production[32]. They can also help landowners to continue earning revenue from forests in contrast with, for example, clearing land for palm or agriculture.

In Indonesia for example, TNC has been working in the Berau district with the government and logging concessions for more than 15 years, assessing and supporting timber yields, while protecting biodiversity (including mangroves), ecosystem services and human well-being.

A young Louisiana black bear collared by Louisiana Department of Wildlife and Fisheries. © Carlton Ward Jr.

c. Opportunities for agriculture

Healthy soils are the cornerstone of life. Yet soil quality is being degraded on a massive scale globally, in no small part because farming practices inadvertently increase erosion and nutrient runoff, and reduce soils' capacity to store water and carbon.

Through work on its interdisciplinary Rethink Soil roadmap initiative[33], TNC estimates that improving soils on more than half of soy bean, wheat and corn croplands in the US, could generate environmental and social benefits valued at $7.4 billion annually by 2025 and mitigate 25 million metric tonnes of greenhouse gas emissions. Benefits to farmers in the Corn Belt alone would reach $1.2 billion annually.

TNC has also been working with agricultural businesses in Ohio to change the way farmers use fertilizers. The voluntary 4R Nutrient Stewardship Certification Program—created with state agri-business associations, The Ohio State University and Michigan State University—has seen more than 5,600 farmers learn how to apply the right fertilizer, at the right rate, at the right time and in the right place.

Other states are taking note. New York, Oklahoma, Maryland and California are working to improve the health of soils across their territories. In June 2017, Hawaii became the first US state to enshrine in law its ambition to achieve the Paris climate goals, which includes an emphasis on soil carbon. Recognizing the potential climate benefits and seeing an opportunity to boost farm incomes, the state has set up a Carbon Farming Task Force, 'to identify agricultural and aquacultural practices to improve soil health and promote carbon sequestration'[34].

Scaling-up best practice use of fertilizers could reduce nitrous oxide emissions equal to 1.8 gigatonnes of carbon dioxide worldwide, and save farmers $102 billion in the process[35]. The French government's '4 pour 1,000' Initiative aims to spread best practice on soil health around the world.

Tim Smith, Eagle Grove, Iowa. Photo courtesy of Iowa Soybean Association for Soil Health Partnership.

d. New wave of 'naturetech' enterprise

As we saw with the expansion of renewable energy, entrepreneurialism can become a huge future engine of innovative economic growth. While miniscule compared to what has happened in the energy sector, there are signs that a wave of new 'nature tech' enterprise is on its way.

For example, in Brazil, Agrosatellite produces geographic mapping tools that assist with planning agricultural production in tandem with conservation, while Applied GeoSolutions in the US uses remote sensing and soil bio-geochemical models to develop high-resolution analyses of carbon stock changes in the soil.

Naturetech is also being applied to forestry. Amsterdam-based Land Life Company aims to restore 2 billion hectares of degraded land worldwide with its 'Cocoon' planting technology. This biodegradable product ensures higher survival rates for trees without requiring irrigation or maintenance, even in arid conditions, and at a tenth of the cost of traditional tree planting.

Efficient use of scarce resources is another area for innovation. In Israel, start-up CropX has developed cloud-based software that can boost crop yields by focusing on saving water and energy. Using in-field sensors, the software automatically delivers the correct amount of water to each plant, instead of watering an entire field each time.

Opportunities such as these, and others, which harness the financial and technical resources and innovation of the private sector, can accelerate the transition towards the requisite scale of natural climate solutions.

Frame from Nature4Climate's "What are natural climate solutions?" film. © The Nature Conservancy

e. Unlocking new financial flows for land use

Unlocking new flows of capital has long been recognized as essential to addressing climate change, although renewable energy, energy efficiency and clean transport together receive about 30 times the investment of natural climate solutions[36]. However, financial innovation is helping to transform climate finance, as new mechanisms are developed to reduce emissions, support sustainable development and produce reliable financial returns.

The green bond market, for example, has grown in value from $11 billion in 2011 to a projected $130 billion in 2017. Yet 86% of this investment goes to the energy and transport sectors, with agriculture and forestry attracting just 0.9%. Poland issued the first sovereign green bond in 2016—a €750 million issue—to help the country meet its climate change targets, including investments in afforestation, forest maintenance and sustainable agriculture. Further development of the green bonds market is required, alongside ensuring a larger proportion of natural climate solution projects are financeable at scale—primarily by ensuring solid cash flows are in place to support a bond.

Governments could also finance investments in natural climate solutions by issuing 'Sustainable Land Bonds', where the cost of borrowing could be reduced by earning results-based payments for reduced emissions. This requires enhanced coordination across ministries, especially Finance, Planning, Environment, Agriculture and Forestry so as to invest in a systemic way, rather than on a project-by-project basis.

Opportunities to open up new flows of investor capital are diversifying fast in bankable sectors such as agriculture and forestry. The growth of carbon pricing across a range of sectors and countries can underpin this, creating space for new entrants able to bring technologies to market—for example to boost yields or develop new uses for timber—and develop projects backed by emissions credits.

3. STRONG MODELS FROM INDIGENOUS COMMUNITIES

Some 60 million indigenous people live in forests globally, and they are crucial partners in the natural climate agenda[38].

Wherever access to resources is rationed, through ownership rights or quotas placing upper limits on resource use, natural climate solutions are often a part of daily life[39]. Secure community rights are also highly correlated with sustainable forest management worldwide. In Brazil, just 1% of illegal deforestation took place on indigenous lands in 2014, compared to 59% on private lands[40].

In Australia, one of the most successful examples of NCS in practice has been the reinstatement of traditional fire management practices across by Indigenous communities. In line with ancient Aboriginal practice, small fires are lit regularly to reduce the risk of much larger fires releasing far greater amounts of carbon dioxide. A savannah burning project run by the North Kurrawarra, Nyura Mala Aboriginal Corporation, was recently approved to receive carbon credits under the Australian government's Emissions Reduction Fund[41]. The first carbon credit—earned from burns conducted in April 2017—are intended to pay for fire management of the 3,000 square kilometer area. In total, traditional fire management projects are now in place across 40 million hectares of Australia—an area almost three times the size of New York State—which is preventing close to 14 million tonnes of carbon going into the atmosphere while generating revenue of $163 million for communities.

Forests in Canada store over 200 billion tonnes of carbon dioxide and are home to more than 1 million First Nations indigenous people[42]. TNC is working with the Kitasoo/Xai'Xais, Heiltsuk, Nuxalk, and Wuikinuxv Nations there to develop new models for sustainable resource management[43]. A carbon management programme in Manitoba and Alberta aims to capture between 400,000 and 800,000 tonnes of carbon annually, generating economic benefits for indigenous communities.

John Daly, an aboriginal elder, conducts an early dry-season controlled burn at Fish River Station in Australia's Northern Territory. © Ted Wood

4. STRONG SCIENTIFIC UNDERSTANDING

The science of monitoring, reporting and verification (MRV) of greenhouse gas emissions underpins all action on climate change. The complexity of the relationship between land use and climate change can make this more complicated than comparable sectors such as energy or the built environment. In land use, MRV uncertainties have been shown to be greater than 50%[44].

More reliable capture, sharing and analysis of data is helping to address this challenge. Today we have the unprecedented ability to monitor and measure carbon flows much more precisely on a planetary scale and in almost real time, increasing the body of knowledge essential for robust MRV and putting data to practical use over and above conventional greenhouse gas life cycle analysis.

One example is the Copernicus Programme, a partnership between the European Commission and the European Space Agency. It is the world's biggest single earth observation program, providing mostly free data on marine and coastal environments, land cover and forests.

Another initiative is WRI's Global Forest Watch, which draws on the latest data, technology and tools to inform decision-making and analysis on forestry issues. Services range from a real-time forest fire monitor, through to mapping of natural commodity production. In Brazil and Paraguay, The Nature Conservancy and its partners in the Collaboration for Forests and Agriculture project (World Wildlife Fund, National Wildlife Fund and the Gordon and Betty Moore Foundation), are using decision support systems to help the soy industry implement zero deforestation commitments.

Today we have the unprecedented ability to monitor and measure carbon flows much more precisely on a planetary scale and in almost real time.

A reconstruction forest monitoring group (from the local Village Conservation Council) work on the edge of the Lore Lindu forest, Indonesia, planting trees and carry-out forest monitoring work. © Bridget Besaw

2018: Year for action

In 2020, governments will meet to update their commitments to curb greenhouse gas emissions for the first time since the Paris agreement. The extent to which they increase their ambition will point to the scale of ambition of the international community to address climate change.

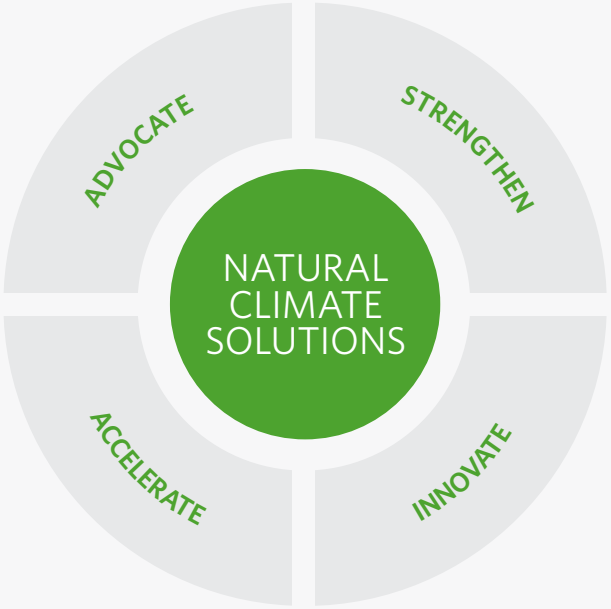
The process starts in 2018 with a 'facilitative dialogue' in Poland. At this point subnational actors—local and regional governments and companies—will also have demonstrated how far they can move to mitigate emissions. 2018 will therefore be a key year in the history of climate change. It will also be important for land use, since it is playing catch-up with the other main areas of climate action.

1. ADVOCATE

- Advocate deployment of natural climate solutions by national and subnational governments, and applaud government leaders who take action.
- Engage key stakeholders including the general public, on the importance and benefits of natural climate solutions, alongside other efforts to decarbonize the global system.

2. STRENGTHEN

- Encourage scientific and economic research addressing important data gaps on natural climate solutions, and to build knowledge hubs that support best practice.
- Build the business case for forest-friendly development, while ensuring real-time data on habitat change.
- Strengthen land rights of indigenous peoples and other communities.



3. ACCELERATE

- Support funding for natural climate solutions through carbon finance, ensuring this also supports climate adaptation for vulnerable communities.
- Direct mainstream finance to encourage the agriculture and forestry sectors to deploy natural climate solutions at scale—by cutting sectoral emissions, removing deforestation from supply chains, and improving soil health and grazing practices.

4. INNOVATE

- Support the forestry sector in embracing and accelerating reforestation and sustainable timber practices through innovation, new markets and enhanced demand for sustainable products.
- Support the growth of the emerging 'Naturetech' sector.

Left image: A Black Mangrove seedling pushes up through the mud. © Tim Calver

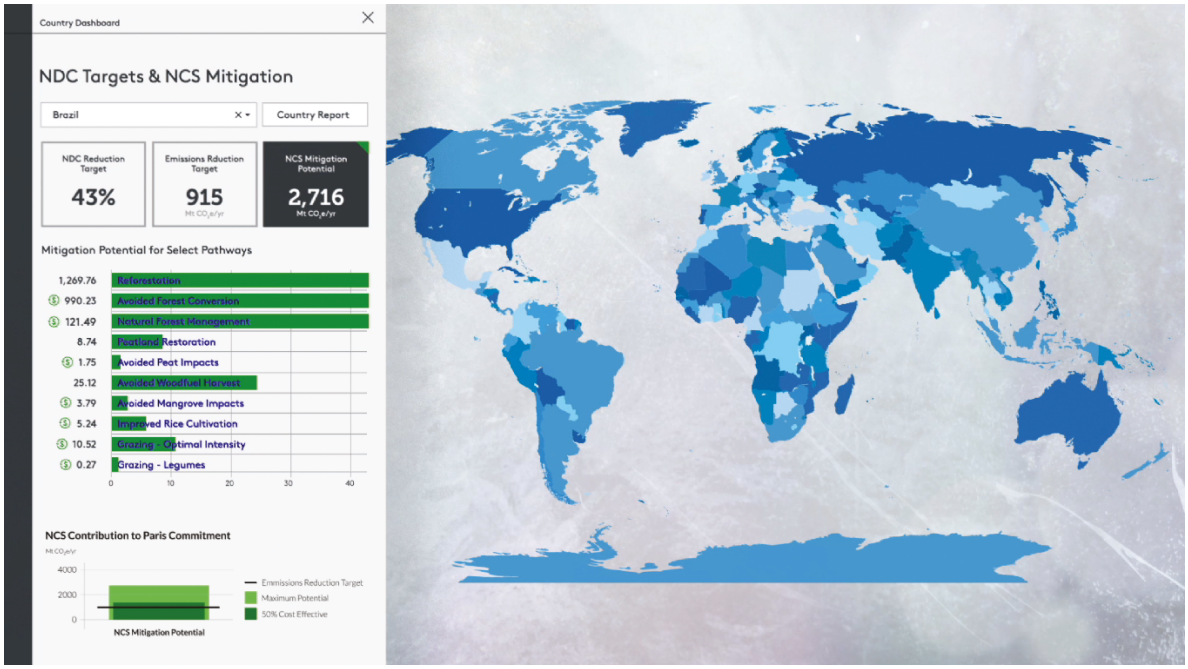
The Nature4Climate Platform

As we have seen, we must bring land use into the central discourse on climate action—catalyzing funding and action. No one organization can do this alone. Over the last two years, we have been developing scientific analysis and broader case studies to show the full breadth of opportunity that natural climate solutions represent. The purpose of the Nature4Climate platform is to increase the contribution of natural climate solutions as a response to the challenge of climate change.

THE GOALS OF THE PLATFORM ARE AS FOLLOWS:

1. Elevate the profile of natural climate solutions.
2. Broaden land use efforts so that they are comprehensive, multi-sectoral and international.
3. Catalyze action from governments and the private sector to deploy natural climate solutions.

The aim is to change the conversation on land use from beyond conservation efforts. The size of the task demands the combined action of multiple parties – governments, civil society, businesses, indigenous peoples and other communities. The urgency of the challenge and the opportunities offered by the land sector mean that the time is now ripe for unifying our efforts.



Above: Frame from Nature4Climate's "N4C Mapper" film. © The Nature Conservancy

Right: The Nature Conservancy works with logging companies in Indonesian Borneo to help the forest provide resources for people while protecting important habitat for orangutans. © Nick Hall

References

[1]Other institutions involved are the Ministry of Agriculture, Government of Brazil, Commonwealth Scientific and Industrial Research Organization (CSIRO), World Resources Institute, Woods Hole Research Center, Cary Institute of Ecosystem Studies, TerraCarbon LLC, Resources for the Future, Wetlands International, Ohio State University, Cornell University, Colorado State University, University of Minnesota, University of Maryland, University of Florida, James Madison University, CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), the Gund Institute for the Environment, University of Vermont, University of Aberdeen, The Ohio State University, Wetlands International. The study was generously funded by the Doris Duke Charitable Foundation.

[2]IPCC https:// /pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_chapter11.pdf

[3]W Murray et al, (2011), Green Payments for Blue Carbon Economic Incentives for Protecting Threatened Coastal Habitats, Nicholas Institute for Environmental Policy Solutions Report, NI_R_11-04.

[4]The Nature Conservancy http://naturalclimatesolutions.org

[5]WWF http://d2ouvy59p0dg6k.cloudfront.net/downloads/living_forests_report_ch4_forest_products.pdf

[6]FAO http://www.fao.org/docrep/014/mb060e/mb060e.pdf

[7]FAO http://www.fao.org/docrep/018/i3347e/i3347e.pdf

[8]FAO http://www.fao.org/news/story/en/item/197623/icode/

[9]CodeREDD, "REDD+ Market Review", (2017)
Todd BenDor, T. William Lester, Avery Livengood, Adam Davis, Logan Yonavjak (2015) http://onlinelibrary.wiley.com/doi/10.1111/rec.12206/abstract

[12]Todd BenDor, T. William Lester, Avery Livengood, Adam Davis, Logan Yonavjak (2015) http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0128339

[13]Todd BenDor, T. William Lester, Avery Livengood, Adam Davis, Logan Yonavjak (2015) http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0128339

[14]WWF http://wwf.panda.org/?207367/Industry-key-to-conserving-forests-as-demand-for-wood-projected-to-triple-by-2050

[15]FAO http://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf

[16]PROFOR https://www.profor.info/knowledge/private-financing-sustainable-forest-management-and-forest-products-developing-countries-%E2%80%93

[17]WRI http://www.wri.org/resources/maps/atlas-forest-and-landscape-restoration-opportunities

[18]Climate Focus and IIASA "The Land Sector in a 1.5 degree world", not yet released
[19]World Bank http://www.worldbank.org/en/news/feature/2016/06/22/taking-climate-action-from-paris-to-the-rainforests

[20]Center for Global Development https://www.cgdev.org/blog/indias-big-climate-move

[28]Food and Agriculture Organization of the United Nations, http://www.fao.org/resources/infographics/infographics-details/en/c/325836

[29]WRI http://www.wri.org/news/2017/01/release-partnership-launches-increase-transparency-and-traceability-across-supply

[30]H. K. Gibbs, L. Rausch, J. Munger, I. Schelly, D. C. Morton, P. Noojipady, B. Soares-Filho, P. Barreto, L. Micol, N. Walker. (2015). Brazil's Soy Moratorium. Scie nce. DOI: 10.1126/science.aaa0181

[31]The Nature Conservancy. Sustainable production in Brazil: Collaboration to conserve forests and enhance livelihoods. (Case study)

[32]The Jakarta Post http://www.thejakartapost.com/news/2014/11/10/can-world-eliminate-tropical-deforestation-next-15-years.html

[33]https://global.nature.org/content/rethinking-soil

[34]State of Hawaii http://governor.hawaii.gov/newsroom/governors-office-news-release-governor-joins-u-s-climate-alliance-will-sign-bill-aligned-with-paris-agreement/

[35]Paul Hawken (2017) Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming

[36]Climate Policy Initiative, Global Landscape of Climate Finance 2015 https://climatepolicyinitiative.org/wp-content/uploads/2015/11/Global-Landscape-of-Climate-Finance-2015.pdf

[38]Collaborative Partnership on Forests http://www.cpfweb.org/32825-0c3cd8211ec6ccb8cae04bf30e975a362.pdf

[39]Convention on Biological Diversity https://www.cbd.int/development/doc/cbd-good-practice-guide-forestry-booklet-web-en.pdf

[40]Funai http://www.funai.gov.br/index.php/comunicacao/noticias/2914-terras-indigenas-apresentam-o-menor-indice-de-desmatamento-na-amazonia-legal

[41]The Guardian https://www.theguardian.com/australia-news/2017/jul/23/indigenous-australians-carbon-farming-canada

[42]The Nature Conservancy http://www.tnccanada.ca/our-work/canada-boreal-forest-carbon.xml

[43]The Nature Conservancy http://www.tnccanada.ca/connect/our-stories/great-bear-rainforest-grizzly-bear-report.xml

#Nature4Climate