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THE RESTORATION ECONOMY: WHY TREES ARE THE NEXT GROWTH OPPORTUNITY

ANGELI MEHTA reports on private-sector efforts to replenish natural capital by rehabilitating degraded land

The restoration of natural capital is known as the restoration economy and it is growing fast, according to research by the World Resources Institute and The Nature Conservancy, which suggests investors searching for the next growth opportunity could find it in trees. Over 25% of the world's land area has been degraded over the past 50 years – a loss that costs us over $6.3trn a year.

Restoration projects employed 126,000 Americans in 2014, almost 60% more than were employed in coal mining. A 2015 study estimated that the US restoration economy generated $9.5bn in annual economic output.

One young company featured in the WRI report is Chicago-based EcoPlanet Bamboo. It aims to take the pressure off natural forests by developing select species of bamboo that will provide a source of timber and fibre for various industries. It also has a wider social purpose to create natural capital projects that will be accessible to smallholders.

In Nicaragua, EcoPlanet Bamboo is planting bamboo on degraded land that was once rainforest – destroyed to make way for agriculture, then cattle. A pulping facility will begin operations next year, to make tissue and toilet paper. This will →

Restoration projects employed 126,000 Americans in 2014 almost 60% more than were employed in coal mining

cut the country's reliance on imports. After the first year of operations, the business in Nicaragua will be self-sustaining, suggests co-founder Camille Rebelo.

She says EcoPlanet Bamboo is creating permanent jobs for communities: "These are multi-generational projects … In Nicaragua that [means it is creating jobs for] 90-120 years if managed correctly."

"Bamboo is different to a forestry crop, where you get lots of jobs in the first couple of years, but low levels of employment until you chop," says Rebelo. In contrast, "bamboo needs a lot of management in the first five to six years so employment is high on the field level ... then onto manufacturing".

EcoPlanet Bamboo is also piloting a closed-loop biorefinery to make moulded pulp for disposable containers to replace plastics and styrofoam. An agreement with Mantis hotels group means it will move its luxury hotels away from single-use plastics when EcoPlanet's production is up and running.

EcoPlanet Bamboo also has a plantation in South Africa, where the first product is high-end charcoal for air and water purification systems. Plantations are being developed in Ghana, and in Rwanda, where the government has a strategy to develop a bio-economy.

Rebelo sees a huge potential for natural capital projects that are joint public-private partnerships. There is now a willingness amongst NGOs, she asserts, to work with →

Given the difficulties of valuing natural capital, is there any danger of creating an investment bubble?

the private sector. "If NGO money kick-starts a project and pushes it one or two years closer to return, you can leverage huge amounts of private sector investment." Rebelo says there's no reason why capitalism shouldn't be "the driver for environmental and social stewardship".

Last month the Tropical Landscapes Finance Facility issued a $95m bond to finance a sustainable natural rubber plantation on heavily degraded land in Indonesia. The financing, which was arranged by BNP Paribas, will fund a joint venture between tyre-maker Michelin and the Pacific Barito group for "climate smart, wildlife friendly and socially inclusive" production of natural rubber. Working with WWF, the companies have set aside high-carbon value forest, as well as wildlife conservation and wetland zones. It is expected to support 16,000 fair-wage jobs when the plantation is mature.

"While not without its own challenges, this transaction is proof that financial institutions can generate socially beneficial outcomes when we really work hard," said Eric Raynaud, CEO, Asia Pacific, and member of the group executive committee at BNP Paribas.

"This complex structuring arrangement also demonstrates that our institutional investor clients have the appetite to invest in projects and companies that combine commercial and financial performance with clear environmental and social purpose and impact."

Given the difficulties of valuing natural capital, is there any danger of creating an investment bubble? Sofia Faruqi, lead author of the WRI report, argues this is unlikely. "If anything, investors massively undervalue natural capital." Perhaps efforts by governments will help deliver change. ■

THE RESTORATIVE STRATEGIES

MARK HILLSDON reports on how companies are approaching nature based solutions across their supply chain to tackle climate change

Landscape restoration could potentially sequester up to 1.7 gigatons of CO2 every year, according to the International Union for Conservation of Nature, meaning that next to transitioning away from fossil fuels, restoring our landscapes is the most important thing we can do to address the climate crisis.

However, it's not just about increasing protection for biodiverse ecosystems that are already on the conservation radar, says Andrew Deutz, director of international policy at the Nature Conservancy (TNC); "The harder bit is figuring out how do we sustainably manage the rest of the planet that's not formally protected?"

These are the productive areas, he says, that produce food and water and provide the space for the infrastructure needed by transportation and energy. And in the next decade or so, he says, the world is looking to build another $100tr of infrastructure to help meet the SDGs, in short doubling the current global built environment.

"That could be a huge driver for environmental degradation or, if we're careful with our siting, and we use it to fund biodiversity offsets… then it actually becomes a huge environmental driver. ➔

"The fundamental principle that we are trying to drive is net gain," he says. "Every activity that every major actor is doing should somehow contribute to improving the state of nature."

BIODIVERSITY OFFSETS

Somewhat ironically, says Deutz, in the US the biggest threat to intact landscapes is the build-out of renewable energy and the creation of a new transmission infrastructure. TNC wants to see a similar system of biodiversity offsets in place as those used when a new highway is built, and an equivalent piece of land is ecologically improved or restored.

TNC is also looking at ways in which former mining sites can be used for new green power plants, taking advantage of degraded land of low biodiversity value, as well as the ready-made transportation infrastructure.

"We need to build out renewable energy... but we don't want to do it in a way that's going to damage biodiversity," he explains. "We want to think about siting that infrastructure in a smart way which has minimal impact on the environment and then whatever impact it does have requires that there's an offset that leads to a net gain approach."

> *"Every activity that every major actor is doing should somehow contribute to improving the state of nature*

Naturally, the Rainforest Alliance's (RA) focus is on the role that trees can play in all this. The NGO champions natural climate solutions (NCS), actions in the agriculture, forestry and other land-use sectors that can help to reduce greenhouse gas emissions by enhancing carbon sinks in natural ecosystems.

"Policy makers and business leaders must create and enforce ambitious policies and incentives to prevent deforestation, foster reforestation of degraded land, and support the sustainable management of standing forests in the fight against climate change," says RA CEO Han de Groot.

The biggest threat to forests is the global push for food security and the need to feed an ever growing population; agriculture accounts for 80% of tropical deforestation alone. Yet in July, new research from the Swiss university ETH Zurich showed that planting billions of trees worldwide on land that wasn't built on or used for framing, was by far the most cost-effective way of tackling the climate crisis.

Forests regulate ecosystems, protect biodiversity, and have an unrivalled ability to absorb and store carbon, with trees collectively capturing more than a hundred billion tons of C02 from the atmosphere each year, says the RA,. "The most powerful and cost-efficient carbon-capture technology the world has yet seen are forests," adds de Groot.

WILD HARVESTING

The Body Shop sources a wide range of high value raw materials from forests, such as marula oil, brazil nuts, honey and beeswax, much of it through its Community Trade initiative. ➔

> *Farmers were being exploited by the world trade system... they weren't being given a fair price for what they were doing*

"Farmers were being exploited by the world trade system," explains Christopher Davis, Body Shop's international director of corporate responsibility and campaign, "they weren't being given a fair price for what they were doing."

Body Shop works to develop a direct relationship with its suppliers and communities, providing them with a market and paying a 'community premium' that can be invested in schools and health care to build-up the resilience of the community.

In return, says Davis, Body Shop gets a greater insight into the quality of the raw materials, and what happens along the supply chain. They can also tap into the knowledge of local people and discover the potential new ingredients the forest has to offer. But regeneration of the land as well as the community is very much part of the programme, too.

Many of these forest ingredients are simply picked from the standing forest, says Davis. "By wild harvesting you don't need to farm, you work with local people to collect the crop, and the processing is usually done by hand… It's an artisan programme but on a significant scale.

"Wild harvesting means that you are working and operating in an environment which remains unchanged; by adding economic value to nature... it gives local communities a much stronger rationale to keep the forest up rather than taking it down." ➔

Body Shop's other key forest programme revolves around protected and regenerated wildlife corridors within damaged landscapes called Bio-bridges. They are being used to link biodiversity hotspots, helping endangered species to reconnect, as well as playing an important role in safeguarding the forest canopy, and allowing trees to soak up CO2. Working with the World Land Trust, the UN Biodiversity Centre and local partners, over 41 million m2 are now protected in Vietnam, Indonesia, Malaysia and north-east India.

Bio-bridges are a very visual form of restoration, says Davis: "they bring our customers closer to nature." He also talks about a 'multiplier effect' with the Body Shop brand helping to raise awareness with consumers and generate funds, while also encouraging governments to become involved with projects in their own backyards.

Davis concedes there is a philanthropic edge to Bio-bridges, but: "we also wanted to see if there was some way we could add value to the forest from a trade perspective so, particularly in Vietnam, we've done a lot of biodiversity studies to see whether or not there are ingredients for cosmetics that we can source from these areas.

"We're trying to add value to standing nature... and one of the outputs of protecting biodiversity is a standing forest that absorbs carbon

"We're trying to add value to standing nature," he says, "and one of the outputs of protecting biodiversity is a standing forest that absorbs carbon."

SUSTAINABILITY BONUS

With operations in dozens of countries around the world, involving a huge range of raw materials, Nestle is in a unique position to show the importance of landscape restoration both in tackling climate change, and as a way of securing its own supply chain.

In the UK, the company has a long-term partnership with the co-operative First Milk, paying dairy farmers a 'sustainability bonus' for each litre of milk as recognition of the practical measures they have taken to enhance natural assets on their land.

The payment gives farmers the incentive and means to scale up their existing efforts to protect the environment, paying for hedge planting, dry stone wall repairs and fencing to protect watercourses from bankside erosion. These measures also help to improve the farm's resilience to climate change and protect against the potential spread of disease.

Robin Sundaram, Nestlé UK and Ireland's milk buyer and sustainable sourcing lead, believes the Milk Plan could usher in a new era of sustainable farming across the UK, with the next phase set to tackle soil health. "As a food company, we are entirely reliant on agriculture and all agriculture is dependent on soil," he says.

While arable farmers have always understood the importance of good soil content, it's a relatively new concept for dairy farmers, continues Sundaram, but they: "are now beginning to see how managing their soil can have long-term benefits on the quality of grass and therefore the quality of their milk, welfare of their cows and reduction in costs."

Together with partners that include the Rivers Trust, Nestlé is also developing a pilot in Cumbria known as the Landscape Enterprise Networks (LENS). The project not →

> *They pay millions every year to clean up water courses because of agricultural run-offs (but) it will cost them a lot less if they can stop the water being polluted in the first place*

only puts a value on natural assets, but helps to pay for them too, says Sundaram. It recognises that different industries have different requirements from those natural assets, and then allows companies to fund farmers to do work which brings them tangible benefits.

Take United Utilities (UU), he says: "they pay millions every year to clean up water courses because of agricultural run-offs (but) it will cost them a lot less if they can stop the water being polluted in the first place."

UU are now funding farmers to improve and enhance natural assets such as planting new trees and hedgerows and improving fencing. "If they can incentivise farmers to put in the right activities on the ground to stop the pollution in the first place, then that's a massive benefit to them."

While businesses such as UU see instant benefits from their investments, continues Sundaram, for Nestle the benefits are much longer term, such as positive impacts on communities and better soil for farmers, which secures the company's ability to supply its products.

This can make it harder to justify costs and expenditure, he continues, but: "businesses are going to have to go that way anyway, so we may as well be at the forefront."

On the other side of the Atlantic, the idea of paying to protect natural assets is also being explored by TNC. The Mesoamerican Reef System extends the Yucatan Peninsula and, explains TNC's Deutz, absorbs 97% of incoming wave energy during a major storm. This is a significant benefit to hotels that sit along the beachfront and which are part of Cancun's $20bn tourism industry.

Working with Swiss Re, TNC has developed what Deutz believes is the "world's first insurance product for a natural asset." The Coastal Zone Management Trust is paid for by the local tourist tax, and covers the reef's upkeep, repair and insurance. "It →

recognises that nature provides benefits, and provides a way to actually pay for that," he says.

WATER STRESS

The natural asset that is set to suffer most from continued global warming is water and landscape restoration is also being used to conserve this vital resource. Earlier this year Heineken relaunched its water strategy, positioning watershed health at the centre of a triangular approach involving water efficiency, water circulatory and water stewardship.

Water is a precious resource for a business such as Heineken, with 95% of beer made up of water, and the other ingredients – barley, hops and yeast – all dependent on a high quality water supply. Protecting the watershed and access to it for local communities is also an important part of its licence to operate.

By 2015, says Blanca Juti, Heineken's chief corporate affairs officer, two-thirds of the world could be living in water stress, with 26 of the company's breweries already operating in areas of water scarcity.

"How companies can contribute to restoration and regeneration is the central question that we need to solve

"Until now, breweries have focussed on water efficiency and treating waste-water," explains Juti, "these are areas we can control…. But in water scarce areas, for a watershed to be healthy, consuming less water and cleaning it may not be enough… if we all use water but we don't put back what we take, the watershed will start to dry."

Heineken has four breweries in Spain, one of Europe's most water stressed countries. Working with the Andalusian government and the NGO Commonland, the company has helped to restore four degraded lagoons in the Donana wetlands, one of the largest biodiversity areas in Europe. Both the soil structure and water filtration has been improved, and the landscape replanted with endemic trees, helping to return over 420,000 m3 of water each year to the environment.

In Mexico, Heineken has supported land restoration schemes to help solve the problem of flooding. In Monterrey, explains Blanca Pérez, sustainability manager at Heineken Mexico, the watershed: "is very exposed to climate change, so we experience big floods and then long periods of drought."

As part of the Monterrey Metropolitan Water Fund, Heineken has planted over half a million trees, which are absorbing more than 450 million litres of water a year, helping to mitigate flooding, improve water filtration and generally raise awareness about water, says Perez.

By 2030, she continues: "Each year more than two million trees will be helping with rain filtration, climate stabilisation and biodiversity recovery – and providing a lot of inspiration to other companies who are following our lead."

"How companies can contribute to restoration and regeneration is the central question that we need to solve," adds Deutz. "What do companies need to do… so we get the right outcomes and we still get all the goods and services we need to drive the economy and meet the SDGs? It is the central question for sustainable development over the next decade." ■

A Nicaraguan farmer who is using rainwater harvested during the rainy season to irrigate food crops.

NEIL PALMER/CIAT

TURNING AGRICULTURE FROM CLIMATE CULPRIT TO CARBON SINK

MARK HILLSDON reports on how the idea of increasing the capacity of soil to absorb CO2 emissions is gaining traction around the world

In 2015, the International Year of Soils, Maria Helena Semedo, a deputy director at the UN's Food and Agriculture Organization, famously commented that the world's topsoil had become so degraded that it could only support another 60 harvests.

Decades of deforestation, monoculture, and poor farming practices, often over-reliant on chemical inputs, had stripped the land of all its goodness. It's estimated that 75 billion tonnes of fertile soil are lost to land degradation every year, leaving Earth, which is still expected to feed an ever-growing global population, in a parlous state.

Last month, the United Nations' Food and Agriculture Organization (FAO) warned that more than than 90% of all the Earth's soils could be degraded by 2050 if we continued on the same path.

At Ethical Corporation Responsible Business Summit in March, Satya Tripathi, assistant secretary-general at UN Environment, said that by over-using fertiliser: "We jettisoned soil biology and focused on soil chemistry … [and] completely destroyed the soil ecosystem, so that in most parts of the world, we hardly grow anything." ➔

DNRC

In Kenya, the Drylands Natural Resource Centre works with 600 smallholders on agricultural and agroforestry best practice.

This idea of soil as something that could sequester carbon dioxide began to gain traction at the Paris Summit in 201

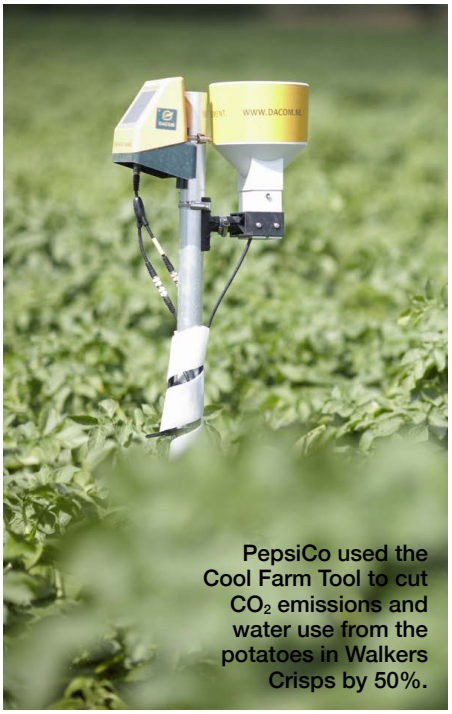
Last year, the World Business Council for Sustainable Development (WBCSD) launched The Business Case for Investing in Soil Health, a report that included a call to action for businesses to explore greater supply chain co-operation, public-private partnerships and landscape alliances that could help spread costs and risks of land remediation.

There is also a greater realisation that as well as playing a central role in food security, healthy soil can also help in the fight against climate change. The Earth is a huge carbon sink, with soil holding three times more carbon than the atmosphere, but this carbon is now being allowed to escape.

Nevertheless, André Leu, a director of Regeneration International, believes that by taking a few fairly simply steps not only can we keep this carbon locked underground, but we can add to it, too. "We can change agriculture from being one of the major contributors to climate change to becoming one of the major solutions," he says.

This idea of soil as something that could sequester carbon dioxide began to gain traction at the Paris Summit in 2015, when scientists explained that if we could change agriculture so that farms are actually increasing the amount of carbon in the soil, by four parts to every 1000, that would be the equivalent of locking up all man-made greenhouse gas emissions. This became the 4 per 1000 initiative, which is now backed by 35 countries and over 1000 organisations.

In their current state, the world's soils are far from being a solution to global warming. But regenerative, or restorative, agriculture can change this, by encouraging farmers to adopt a mixture of techniques that improve soil health and promote plant growth. →



COOL FARM ALLIANCE

PepsiCo used the Cool Farm Tool to cut CO_2 emissions and water use from the potatoes in Walkers Crisps by 50%.

PERU COCOA ALLIANCE

Long-term contracts allow these cocoa farmers in Peru to practice agoforestry.

What we want to show is that these systems do make farms more profitable. We can increase yields and resilience

No tilling, and a lack of soil disturbance, is one way of keeping carbon in the soil, while cover cropping, which helps prevent soil erosion, crop rotation and tree planting, are also used. "These are the kinds of practices that keep carbon in the soil, underground, and out of the atmosphere," says Daniella Malin, deputy general manager of the Cool Farm Alliance (CFA), a partnership of retailers, manufacturers and NGOs. "[But] the core of regenerative agriculture is soil and organic matter… that's the foundation of everything."

Many NGOs are now running composting workshops for smallholders, showing them how they can turn farm residues, which would often have been burnt, into something they can dig into the soil to replenish its nutrients. The CFA has been working with coffee farmers on different ways of managing waste too, and has developed new methods of turning pulp from coffee production into a rich, natural fertiliser.

CFA is also behind the Cool Farm Tool, a greenhouse gas calculator that can measure carbon production from the use of fertilisers and fossil fuels, but also estimate the amount of carbon that the land and crops are sequestrating, to provide a net carbon figure.

Large agribusinesses such as PepsiCo, Danone and Unilever have used the tool to meet their corporate commitments, and from next year they will be able to further measure their progress with the launch of a new Science Based Targets Network. This will allow companies and cities to set targets for the inter-related systems of land, biodiversity, freshwater and the oceans across their value chains.

Smallholders are also applying the CFA tool as a way of monetarising their sustainable practices, with climate-friendly farming often a way of gaining easier access to ➔

DUXX/SHUTTERSTOCK

What we are talking about is the transformation of the old system, which has brought us a lot but is now killing the planet

finance and loans. Leu believes it is critical that regenerative agriculture is made as attractive and hassle-free as possible for farmers. "What we want to show is that these systems do make farms more profitable," he explains. "We can increase yields, lower production costs and, really importantly, increase resilience to the adverse effects of climate change."

Among the businesses Regeneration International works with are health firm Mercola and clothing company Patagonia, corporations which Leu says are actively promoting regenerative agriculture, as well as sourcing materials from regenerative systems. "At the end of the day, landowners or farmers have to make a living," he explains, "and if we can set up market-based systems that can help farmers earn a good living while they're regenerating their farms and landscapes, that will make a big difference."

ENCOURAGING INVESTMENT

According to Jeremy Oppenheim, a principal at the Food and Land Use Coalition (FOLU), the support of agribusiness is one of three fundamental ways of creating the incentives that are needed to encourage more long-term investment into regenerative agriculture.

The first, he says, is for food companies to enter into long-term agreements with farmers to reduce chemical loading and increase regeneration in the soil. It's already happening in places, he adds, with the likes of Danone, and some of the cocoa companies, "entering into long-term contacts precisely to achieve these outcomes," and to give farmers a greater degree of financial stability.

In the same way, he says, banks could provide lower cost credit to farmers that use the right practices. "It's not just a piece of corporate social responsibility, it's brilliant banking," he says, "because ultimately they see those farmers as lower risk." It's an approach that is working in the Indian state of Andhra Pradesh.

The third area is subsidies. FOLU estimates that around 80% of the $500bn spent on agricultural subsidies each year goes to the wrong people. As well as ending up in the pockets of agribusinesses, rather than farmers, Oppenheim says, "a lot of the subsidies are effectively linked to production, so the more you produce, the more subsidy you get." In some parts of the world the subsidy regime is also connected to inputs, when farmers are paid to use more fertiliser and pesticides. "So there's a huge opportunity not to spend more, but spend better," says Oppenheim.

Partnerships are a key element to all these ideas. In Colombia, FOLU is working with local stakeholders, the private sector and a range of government ministries to reduce the use of harmful agrochemicals, which have been damaging the health of people and the land. The initiative includes returning to traditional practices and using naturally derived inputs, and has won the support of several private firms. Fertiliser company Yara International is now providing extension services to farmers who employ sustainable practices, for instance, while biosolutions firm EcoFlora is supporting them with the use of bio-inputs.

The project is also helping Colombian farmers to tap into international markets that put a greater emphasis on food safety standards, deforestation commitments and the growing consumer demand for responsibly sourced produce. ➔

The half-hectare smart shade house in Australia allows vegetables to flourish in a controlled environment.

WIDE OPEN AGRICULTURE

Wide Open Agriculture is working to transform the Australian wheat belt, a vast arid landscape of abandoned towns, degraded soils and an ecosystem in crisis

In September, at the UN Secretary-General's Climate Action Summit, FOLU is launching a major report that sets out the economic case for the transformation of food and land use systems. It will focus on the political and economic opportunities of shifting food and land-use from being a major contributor to climate change and inequality, into a source of balanced economic growth, human health and a flourishing natural environment.

CONNECTING LANDSCAPES

Commonland is another key player in landscape regeneration. The not-for-profit was set up by Willem Ferwerda after he realised that while a thousand hectares could be preserved by a local NGO, around it were a million hectares that had been converted from rainforest to palm oil.

Commonland's approach combines and connects natural and economic landscape zones, he explains. "What we are talking about is the transformation of the old system, which has brought us a lot but is now killing the planet."

The system is based on four returns, three landscape zones, and 20 years, which is the amount of time it takes to restore a degraded landscape, he explains.

People and community play a key role in Ferweda's vision, so the returns include inspiration, which gives people hope and a sense of purpose; social capital; natural capital, such as biodiversity and soil quality; and financial capital, which is sustainable and long term.

To realise this, he continues, three different landscape zones need to be established, each with a different emphasis. On the one hand is the natural zone, where →

30 SECOND READ

Healthy soil can help in the fight against climate change. Soil holds three times more carbon than the atmosphere. It is estimated that increasing the amount of carbon in the soil by four parts to every 1000 would be the equivalent of locking up all man-made GHG emissions.

However, poor farming practices have stripped the land. It's estimated that 75bn tonnes of fertile soil are lost to land degradation every year. But regenerative agriculture techniques such as no tilling, crop rotation and tree planting can improve soil health.

The Food and Land Use Coalition (FOLU) has called on food companies to enter into agreements with farmers to reduce chemical loading and banks to provide lower cost credit to encourage regenerative practices.

In Colombia, FOLU is helping Colombian farmers tap markets that value responsibly sourced produce. In Australia, Commonland is aiming to transform the country's wheat-belt and is also aiming to regenerate 500,000 hectares around Port Elizabeth in South Africa.

investment is aimed at restoring nature and biodiversity, in return for forestry and tourism. At the other end is the economic zone, where there is an acceptance of real estate and agriculture, in return for crops and economic development. In the middle is a combined zone, a buffer, where restoring the landscape would be important, alongside agroforestry and orchards. Importantly, all three zones would be actively involved in absorbing carbon.

Commonland works in some of the most climate-stressed areas in the world, including the Mediterranean, South Africa and Australia, where they look to breathe new life into degraded landscapes.

Ferwerda certainly doesn't lack ambition and, working with Wide Open Agriculture, he has plans to transform the Western Australian wheat belt, a vast arid landscape of abandoned towns, degraded soils and an ecosystem in crisis, into a new sustainable food belt.

Ideas for achieving this include farming practices based on innovative water management, measures to restore the soil and biodiversity, huge greenhouses to allow for the growth of fruit and vegetables, and plans to encourage immigrants – the "new Australians" – to move to the area and re-establish businesses, farms and whole communities. There are also plans to scale-up and encourage investment by listing on the Australian Stock Exchange.

Ferwerda is confident the finance is there, too. Having spoken to a number of investors, he discovered that many were searching for sustainable projects where their long-term investment could make a difference, but until now there simply wasn't a pipeline of initiatives to support.

Commonland is also working in South Africa, in partnerships with NGOs, local farmers, businesses, and government, to bring back life to 500,000 hectares of land around Port Elizabeth. Among the initiatives launched to restore this important food production area is a move away from traditional goat farming to more sustainable, profitable farming practices, and a partnership with a major corporate to reforest the area.

Elsewhere, dozens of other NGOs are forging partnerships with the private sector to revitalise degraded land. In Kenya, the Drylands Natural Resource Centre (DNRC) works with over 600 smallholders on agricultural and agroforestry best practice, and has so far planted over 100,000 new trees. In the central Africa state of Niger, farmer-managed natural regeneration (FMNR) has revived more than 200 million trees across 5 million hectares using simple techniques to regrow trees and shrubs, and integrate them back into farming systems to improve soils.

What links so many of these projects is that they involve re-introducing simple, often traditional farming techniques. "This is the other wonderful thing about it," says Leu. "There are multiple techniques that farmers can pick and choose from… (but) it can be done without having to make any major modifications to their farms or equipment.

"This is resonating with farmers because it is so doable, it makes sense, it's achievable." ■

Community members sort xate, a non-timber forest product that provides an alternative source of income in the biosphere reserve

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NATURE IS THE BIGGEST PROVEN TECHNOLOGY TO ADDRESS CLIMATE IMPACTS

Rainforest Alliance's ANA FORTIN highlights how sustainable forestry practices by communities have led to a net increase in forest cover in the Maya Biosphere Reserve in Guatemala

Around World Environment Day we hear many devastating stories about habitat loss, species decline and biodiversity collapse. But there is also some positive news to highlight, for instance, on natural climate solutions.

Deforestation may be on the increase around the world, but in some areas, the story is different thanks to the commitment and incredible work of community groups that take care of the forest through sustainable practices.

Take, for instance, the Maya Biosphere Reserve in Guatemala, where Rainforest Alliance has a decades-long partnership with indigenous and rural communities.

Between 2016 and 2017 the net forest cover increased, for the first time in 17 years, gaining 1,087 hectares of forest, according to a new report authored by USAID, CONAP (Consejo Nacional de Areas Protegidas), Wildlife Conservation Society, and others.

Why is this good news beyond the local communities and environment? Because we need to wield forests' power to fight climate change. →

According to the Intergovernmental Panel on Climate Change (IPCC) report released last year, we must limit global warming to 1.5C if we're to avoid the most catastrophic consequences of climate change. How we best do that is a matter of contention – but one uncontested truth in the race against climate change is that we must do everything we can to absorb the CO2 in the air.

The IPCC estimates that between 100 and 1,000 gigatons of CO2 will need to be removed from the atmosphere to keep global warming within 1.5 degrees.

Why is this good news beyond the local communities and environment? Because we need to wield forests' power to fight climate change.

According to the Intergovernmental Panel on Climate Change (IPCC) report released last year, we must limit global warming to 1.5C if we're to avoid the most catastrophic consequences of climate change. How we best do that is a matter of contention – but one uncontested truth in the race against climate change is that we must do everything we can to absorb the CO2 in the air.

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Forests play an essential role in this, due to their carbon-storing abilities, and are widely recognised as the most important natural carbon sinks, preventing gas from returning to the atmosphere for hundreds of years. Every year, trees collectively suck in more than a hundred billion tons of carbon dioxide from the atmosphere, which is around 60 times the weight of all the humans currently on the planet, while one tree can store around 22kg of carbon dioxide in one year.

But more than seven million hectares of forest are lost every year, an area larger than Sierra Leone. Much of deforestation is driven by permanent land use change for the production of commodities, including beef, soy, palm oil and wood, as well as forestry, agriculture, wildfire, and urbanisation.

Trees aren't just suffering at the hands of deforestation. Many species and forest ecosystems aren't well-equipped to fight the changes brought on by climate change, meaning that forest fires, pest outbreaks and drought are becoming increasing threats for trees' health and numbers.

Technological advances such as bioenergy with carbon capture and storage (Beccs) might eventually have the potential to play some part in helping to limit global warming. But while some experts are placing emphasis on negative emissions technologies to solve climate change, others are urging us to rethink how effective this approach can be.

Some scientists doubt, for example, that biomass is carbon-neutral, and argue that the carbon dioxide released from burning trees isn't recaptured by new trees for many years, after it has contributed to global warming. Other technological solutions, including direct air capture, are so expensive that there are only a few start-ups in the world currently using the technology. ➔

Birdlife is protected in the Maya Biosphere Reserve

TIKAL NATIONAL PARK

Natural climate solutions can help achieve more than one-third of the Paris target, since trees absorb around a third of all human carbon emissions

Natural climate solutions, on the other hand, can help achieve more than one-third of the Paris target, since trees absorb around a third of all human carbon emissions. They can both mitigate climate change and help farmers to adapt and build resilience so that they can protect their livelihoods and continue contributing to the global food supply.

These solutions, including conservation and restoration of forests, and improved land management practices also provide cleaner water, cleaner air and more fertile soil on a local level, which farmers rely on, and helps to stabilise local microclimates. Yet, they currently receive only about 2.5% of public climate financing, which is about one 10th of the investment in renewable energy and energy efficiency.

Forests and land use can play a huge role in humanity staying within the 1.5C target of global warming, but this will require huge efforts to scale-up forest protection and restoration. Sadly, the recognition of their importance co-exists with a lack of political and business will to take the action required to stop our forests being destroyed and eliminated.

At every point during humans' time on the earth, forests have furthered our survival. From providing the raw materials to produce boats that helped pre-industrial populations discover the world to giving generations life-saving medicines.

Now, they're one of the best hopes we have to mitigate global warming. The Maya Biosphere Reserve in Guatemala is just one tangible example proving that people and nature can thrive in harmony. ■

Land Life is reforesting near the Minawao refugee camp in North Cameroon

LAND LIFE

GROWING CONCERNS: THE COMPANIES INNOVATING TO COOL THE PLANET

ANGELI MEHTA profiles Land Life, TerViva, and Komaza, three startups that are finding growth opportunities in planting the trees scientists say are urgently needed to combat climate change

Over 4000 years ago, farmers in North Africa worked out that they could irrigate their seedlings by burying clay pots filled with water – wasting not a drop and directing the water to where it was needed.

Amsterdam-based Land Life Company has adapted this solution for the modern era to boost the survival chances of young trees as it harnesses climate and soil data, together with plant science, to work on the reforestation our planet so urgently needs. This autumn alone, it will plant 300,000 trees in Texas and in Spain – surprisingly, Europe's fastest growing desert.

Land Life is one of 14 companies that feature in a report by World Resources Institute (WRI) and The Nature Conservancy, The Business of Planting Trees, on the private sector's response to demand for land restoration solutions by initiatives such as the African Forest Landscape Restoration Initiative. (See, Fightback against deforestation in Africa focuses on small farmers)

Land Life's commercial director, Rebekah Braswell, explains that its Cocoon technology is made from recycled paper pulp, made watertight by a wax coating, and is light and stackable. ➔

"The Cocoon is how we started: we needed a tree incubator," she says. "Then you realise you're part of a broader value chain, so we started tinkering a bit with the seedlings, then got more rigorous with the analysis of planting."

Chief technology officer Arnout Asjes adds: "We're in this to plant as many trees as possible, but not blindly."

Satellite data enables Land Life to see what grew in years past, which alongside soil analysis, looking at what kinds of animals there are, and talking to local farmers, helps inform planting decisions. By meticulously logging the location of every tree planted and following up its growth, and overlaying this with climate and soil data, the company has built a huge knowledge base – to which it can apply machine learning and artificial intelligence (AI) with the eventual aim of getting a good feel for the planting design – all from the office, says Asjes.

"The company has built a huge knowledge base – to which it can apply machine learning and artificial intelligence

It's also spun out its wireless soil moisture measurement technology to create another company, Sensoterra.

The Cocoon has come into its own in North Cameroon, where Land Life, in partnership with the UNHCR, has been working with refugees and locals since September 2017 to reforest over 100 acres of badly degraded land in and around the Minawao refugee camp, where an influx of over 60,000 people fleeing Boko Haram from neighbouring Nigeria has denuded the land of its forest.

As well as its positive environmental impact, the effort is providing jobs and food, and, importantly, a means to build bridges with the local host community.

On the other side of the globe, Land Life has embarked on a major project to help offset the emissions of fleet management firm LeasePlan, which wants to have zero net emissions from its serviced car fleet by 2030, and its own employees' fleet by 2021.

As part of that effort, Land Life will be planting 40,000 trees this autumn in Texas: a mixture of 40 species in a balanced planting plan that will capture carbon dioxide and encourage biodiversity.

TERVIVA

Another company featured in the WRI report is US-based TerViva, which is restoring degraded farmland in Florida and Hawaii by planting an orchard tree called Pongamia, which has a lifespan of at least 25 years, and can be grown with little or no irrigation.

In Florida, a greening disease is leading farmers to abandon citrus groves, while in Hawaii cost and competition are forcing growers to turn their backs on sugar cane, so they need another crop.

Naveen Sikka and his co-founders alighted on Pongamia almost 10 years ago. Since then, the company has invested $15m (£11.5m) to build its plant science team and a library of high-yielding cultivars, which have been tested in different soils and climates. ➔

TerViva's Pongamia tree requires little irrigation

IAN SCHILLER/TERVIVA

> *We pay farmers very significantly above the market price for the wood we harvest*

Pongamia is nitrogen-fixing, and has huge carbon sequestration potential. It can also be used as a biofuel and is 90% less greenhouse-gas emitting (well to wheel) than soy bean oil, says Sikka. The seeds produce 10 times as much oil per acre, and three to five times the protein content compared with soy.

Up until now, the oilseeds have been inedible. But, working with researchers at Texas A&M University, TerViva has identified the bioactive compounds that make them unpalatable and developed techniques to remove them. Once TerViva has extracted the oil for conversion into biodiesel, the residue, or "seed cake", can be used to produce animal feed or fertiliser.

Sikka explains the economics: farmers get an upfront payment when they deliver the crop for processing by TerViva, and a share of the profits once the processed oil and protein are sold. It estimates farmers will make a profit of around $900 per acre. Over the next year or so it will plant 2000 acres: "That may not sound much but it's a lot for a tree crop – and especially for a brand-new tree crop," he adds.

KOMAZA

Kenyan-based Komaza, meanwhile, has helped thousands of smallholder farmers plant 2.5 million trees over the past 10 years. Next year, it will significantly scale up, planting another 1.3 million in 2019 alone, to provide a sustainable timber supply that will tackle both rural poverty and deforestation. Without a sustained planting effort, dry woodlands in Kenya – and indeed across Africa – will be wiped out because of soaring demand for wood for fuel.

Komaza, a Swahili word that roughly translates as "to encourage growth", provides farmers with all the physical inputs: seedlings, fertilizers, water barrels, as well as →

KOMAZA

Komaza provides farmers with physical inputs and training

the training to help them prepare the land and plant on time. "We want to make it as easy as possible for smallholders," founder Tevis Howard says. "There's no downside risk – if the trees die because of drought, pests, or even if they [the farmers] are lazy – it's us who lose."

The company harvests the whole tree, for now either eucalyptus or melia (a valuable mahogany-like wood), save for the leaves and the tops of the trees, which can be used for firewood.

"We pay farmers very significantly above the market price for the wood we harvest," says Howard. Over time the trees increase the soil moisture to the benefit of other crops, while seasonal leaf litter helps to rebuild depleted topsoil. The firm plans to add more species to diversify against pests and disease. Over the next 10-15 years he hopes Komaza can scale across the drylands of Kenya and into more fertile regions of the African continent.

Some of Komaza's, and TerViva's initial funding came from private family foundations. One of TerViva's backers is Jeremy Grantham, co-founder of Boston investment manager GMO, and whose family foundation set up climate research centres at Imperial College and the London School of Economics.

Earlier this year, Grantham berated corporates for their short-sightedness over the perils of climate change. But, as the 40 scientists who signed a statement on avoiding global warming above 1.5 degrees set out last month, protecting and restoring the world's forests could realise 18% of the emissions reduction needed.

It was a clarion call to other would-be TerVivas, Komazas and Land Life companies, and to the businesses that could back them. ■

Changing practices upstream is helping deal with nutrient runoff into Nairobi's water supplies

TNC

WE NEED MORE COMPANIES TO WORK WITH US TO SOLVE WATER INSECURITY AT ITS SOURCE

PepsiCo is one of more than 100 firms that are working with cities and The Nature Conservancy to invest in nature-based solutions to water stress, but if we are going to going to bring clean drinking water to 1 billion people we need many more partners, argues TNC's ANDREA ERICKSON

New York City faced a challenge in the 1990s: the city needed a new water filtration system to serve its nearly 8 million people. But the prospect of spending $6-10bn on a new water treatment plant, and another $100m on annual operating costs, was daunting. So, city officials took a closer look at the source of their water: the Catskill Mountains.

Water from the Catskills flows through 120 miles of forests, farmlands and towns to reach New York City. When that landscape is healthy, it acts as a natural purifying system, but certain development and agricultural practices can result in impaired water quality. For city officials, reaching out to local farmers and landowners and compensating them to restore and conserve their lands in the watershed, combined with some land acquisition, proved to be significantly cheaper than building and operating a new treatment plant.

New York's example showed the benefits of public-private partnerships in such situations, and demonstrated that unlocking nature-based solutions can be cheaper, more efficient and produce additional benefits compared to conventional "grey", built infrastructure. This was the moment of inspiration for water funds. ➔

More than 40% of source watersheds worldwide have been degraded by development, resulting in impaired downstream flows

Water funds are a collective investment vehicle in which stakeholders collaborate to implement nature-based source water protection. Downstream water users invest in upstream land and water management practices, compensating upstream land managers for restoration activities and better management of agricultural land. Rural landowners and communities can benefit economically from these investments as well. Mutual benefits are the hallmark of successful water funds.

Given that more than 40% of source watersheds worldwide have been degraded by development, resulting in impaired downstream flows, nature-based source water protection can be one of the most effective ways to improve water quality and quantity for urban areas. A study by The Nature Conservancy (TNC) estimated that four out of five cities could improve water quality using nature-based solutions, and potentially 1,000 cities globally would see a positive ROI based on reductions in total utility expenditures. Furthermore, these solutions often deliver other forms of value, such as increased agricultural yields, improved community health and carbon sequestration.

One example is the Upper-Tana Nairobi Water Fund, which addressed the challenge of severe erosion and nutrient runoff into Nairobi's water supplies by helping upstream farmers implement practices that both reduce erosion and increase agricultural yields. Today, such activities in the watershed help sustain the water supply for 9.3 million people and will generate an estimated $21.5m in long-term benefits for local communities and businesses.

Since TNC launched its first water fund in Quito, Ecuador, in 2000, we've established 34 water funds around the world, with 30 more in development throughout Latin America, North America, Africa, and Asia. But this is not enough. By 2025, at least two-thirds of the world's population will likely be living in water-stressed areas. The question we face now is: how do we implement these solutions at the scale needed to truly make a dent in global water insecurity?

It's not enough for TNC to keep developing water funds, though we will. We also need more partners in the public and private sectors to invest in these practices. ➔

Businesses with high water needs have an enormous interest in ensuring they have stable water supplies

Utilities are one of those key partners, especially companies, like Veolia and Suez, with an international presence. Veolia, for example, is exploring how changing agricultural practices and ecosystem enhancements can ensure more sustainable water supply. Suez, meanwhile, is incorporating wetland restoration into its practices to improve water quality and reduce operating costs. In addition, there are many examples of visionary local utilities actively investing in both green and grey infrastructure to deliver sustainable water to the communities and cities they serve.

Of course, it is agriculture and industry – not domestic use – that represents the vast majority of water consumption. Businesses with high water needs have an enormous interest in ensuring they have stable water supplies and can have an equally enormous impact on global water security. Consider the example of PepsiCo. All along its supply chain and production processes, PepsiCo depends on reliable water supplies, and the company has accordingly established an integrated approach to watershed management, including partnerships with TNC to restore watersheds in Latin America and the United States.

To date, more than 100 corporations have invested more than $38m in water funds. Having more private-sector actors invest seriously in nature-based solutions – and having city and state regulators increasingly realize the benefits of these solutions and incorporate them into government oversight – can help us move the needle on these challenges. On top of that, we can protect ecosystems that deliver a range of other services, including climate mitigation, increased agricultural yields and improved community health. This goes beyond providing clean water: it's about fundamentally improving sustainable human development around the world.

Nature can deliver better water security for more than one billion people. It's an ambitious goal – but with the right partnerships and stakeholders involved we can have a measurable, positive influence on planetary health overall. ■

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