

RESTORE LAND, RESTORE CLIMATE

Why farmer managed natural regeneration is our
secret weapon in the fight against climate change



THIS MEANS THE WORLD

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Front cover: Communities in Khariar, India, are taught methods to regenerate land suffering from decreasing groundwater levels and reduced soil fertility, giving their children confidence in the future.
Luke Aslaksan © 2022 World Vision

There is an untapped solution to fight climate change by capturing carbon.

By embracing it we could also feed the planet.

“There are more than two billion hectares of degraded land with potential to be regenerated. Using nature-based techniques such as FMNR we can fight some of the biggest threats of our age. We have nothing to lose and so much to gain.”

– Tony Rinaudo, Australian agronomist and pioneer of Farmer Managed Natural Regeneration.

FMNR TRANSFORMING COUNTRY ...



The increase in tree cover through FMNR is visible in this series of images of the one hillside, taken over a period of 10 years, in Talensi District, Ghana. Restoring the land in the area reduced the impact of drought as trees served as windbreaks to protect crops and top soil. © World Vision Ghana

... AND PEOPLE'S LIVES

Climate change and unsustainable agricultural practices have reduced productivity and increased the vulnerability of already marginal rural populations in West Africa. Communities in the Talensi District, located in the environmental fragile dryland area of northern Ghana, were suffering annual rainfall decreases, disappearing forest cover and loss of soil fertility. A community project in the

area implementing FMNR had extraordinary results – the reforestation of land was captured in 2010, 2014 and 2020 (see images above), illustrating a transformation that had far-reaching positive impacts on the lives of those in the area. Families' food production and availability improved and their household incomes increased and became more diverse.

EXECUTIVE SUMMARY

There is an untapped solution which combats climate change, improves access to water and food, helps prevent conflict and lifts rates of child education, all at the same time. It is revolutionary but simple, local but scaleable, affordable but rich in benefits. And yet it receives only two to three per cent of climate finance globally.¹

The solution: trees. Especially, the use of trees to restore degraded landscapes.

One quarter of the world's land area has been degraded. The consequence? A warmer planet. A planet stripped of its capacity to sustain itself, where food and water systems in an increasing number of countries are at breaking point. The folly of deforestation to grow more food is now plain to see. However, more than two billion hectares of this degraded land has the potential to be restored. And the restoration of just half of that degraded land is key to addressing the defining mega-challenges of our time.

By storing carbon and creating cooler micro-climates, tree restoration is the secret weapon in our fight against climate change.

By increasing crop yields and replenishing water tables, increased tree cover dramatically improves food and water security.

By building community resilience and easing inter-communal tensions over scarce resources, natural regeneration promotes peace and prevents conflict.

By restoring land, we help restore climate.

The most powerful and sustainable way to restore trees at scale is Farmer Managed Natural Regeneration or FMNR – a game-changing technique pioneered by World Vision's Tony Rinaudo to regenerate landscapes. FMNR involves creating a movement of farmers to locate, prune and nurture existing shoots from tree stumps and give them the space and protection needed to rapidly grow back into a tree. At scale, this technique literally transforms barren landscapes into lush, productive environments.

FMNR is more than a technique – it is a community development process that is both locally-led and global in nature. This is its beauty. FMNR has been practised in 29 countries and restored at least 18 million hectares of land. Since 2006, World Vision's FMNR programs have sequestered over 300,000 tonnes of carbon dioxide in Ethiopia alone.²

The facts:

- Restoring tree cover can provide 23 per cent of the emissions reductions needed before 2030.
- World Vision FMNR projects in South Western Ethiopia sequester 7 to 20 tonnes of CO₂ per hectare each year.³
- Shade from trees can increase crop yields by 50-70 per cent, critical for feeding a growing global population.
- Water absorbs into the soil under trees at 67 times the rate at which it absorbs into soil under grass, and this reduces run-off, limits flooding, and recharges groundwater supplies.
- The economic benefits of environmental restoration are 10 times higher than the costs.

While there is nothing more critical or pressing than aggressive cuts to global greenhouse gas emissions, scientists have underscored that nature-based solutions such as FMNR are some of the most effective ways to achieve climate mitigation by 2030. The latest Intergovernmental Panel on Climate Change found that three nature-based actions – reducing the destruction of forests, restoring them, and carbon capture through better agricultural practices – are among the top five most effective strategies for reducing emissions by 2030.³

The brutality of climate change is of course being felt right now. Those countries most impacted by global warming are, perversely, least responsible for these significant changes to our planet. FMNR and other nature-based solutions have been identified as critical to helping communities adapt to the relentless rise in global temperatures and its devastating

1 <https://www.unep.org/resources/state-finance-nature>

2 <https://fmnrhub.com.au/projects/soddo-forestry-project>

3 <https://www.ipcc.ch/assessment-report/ar6/>

consequences. More frequent and brutal droughts and floods require long term solutions that can help break the endless cycle of famine. The short term interventions that follow are critical, but always insufficient. A massive scaling-up of investments in nature-based solutions represents part of the onus developed countries must bear for the serious loss and damage they are responsible for.

There is tremendous potential for governments to become leaders in natural climate solutions like FMNR through their aid and development programs, unleashing the power of nature to combat climate change and promote human development by restoring degraded land at scale.

Every child has the right to a healthy and sustainable environment. No group is more vulnerable to environmental harm than children, and they have the most to gain from natural regeneration efforts like FMNR.

Climate change imperils their human rights, including their fundamental rights to food, water, education and a healthy environment. Research into the direct and indirect impacts of FMNR has shown it is associated with a range of powerful (and surprising) benefits for children, including better nutrition, higher rates of school attendance, and improved safety, especially for girls.

We owe it to current and future generations to do everything we can to protect their right to a healthy environment. *Restore Land, Restore Climate* affirms our inter-generational responsibility to restore the planet to a place where the next generation (irrespective of where on the planet they are born) is able to realise their fundamental right to food, water and a safe and healthy environment.



Nature-based solutions such as FMNR are a vital part of regeneration measures by these Kenyan farmers. They are standing in a demonstration plot, which is part of the Drylands Development Programme. *Nick Ralph © 2018 World Vision.*

INTRODUCTION: RESTORE LAND, RESTORE CLIMATE BY RESTORING NATURE

Key points:

- Nature-based solutions are under-utilised in the fight against climate change, comprising only 1-3 per cent of climate finance flows.
- Farmer Managed Natural Regeneration is a game-changing but simple technique, pioneered by an Australian agronomist, already regenerating landscapes at a scale that can be seen from space.
- Governments can be leaders in natural climate solutions through its aid program by restoring degraded land at scale, combating climate change, food insecurity, water scarcity and poverty at the same time.

Restore Land, Restore Climate offers a ‘nature-positive’⁴ blueprint in the fight to tackle climate change and its related mega challenges. If we truly want to go beyond limiting the damage caused by climate change, then nature needs to be seen as part of the world’s critical infrastructure. For the sake of our collective future, we must not only ‘protect’ nature, we must also restore it. We must restore degraded landscapes and broken ecosystems. Enriching biodiversity is no longer simply an environmental slogan, but an economic imperative.

This report is an important contribution to this transformation, advocating for a massive scale-up of nature-based solutions. Trees and forests are the lungs of the world. Their capacity to abate carbon from the atmosphere is a significant weapon in the fight to keep global warming below 1.5 degrees. We must preserve existing forests from ongoing destruction. But we must also restore the world’s ecosystems, through a massive greening movement. Farmers are key to this ambition. Farmers carry the weight of the globe’s insatiable expectation for food and water. Farmers sit at the centre of the great existential question of our age – the apparent paradox of feeding the world and saving the planet at the same time.

The title of this report speaks to that new paradigm for feeding a more populous world in the 21st century. At the heart of this report is the recognition that the interests of farmers and the interests of environmentalists are indivisible. The urgent need to adapt to and mitigate the worst effects of a rapidly changing climate demand that increasing food production levels do not come at the expense of the environment, but rather contribute to and complement global efforts to save the planet.

The measures we highlight below speak to a new and different kind of Green Revolution. The revolution we seek is one that builds on the success of past green revolutions, but one that also learns from its mistakes and, critically, lives up to its name of being ‘green’. We are calling for a green revolution that is driven by nature-based solutions (NBS) – models of food production underpinned by an enabling environment to lift yields in sustainable ways; models which build climate resilience; models which abate carbon in the atmosphere.⁵ World Vision’s flagship Farmer Managed Natural Regeneration (FMNR) approach is the NBS model we will be elevating through this report, while also recognising the importance and applicability of other NBS. Our goal is to ignite and support a movement that will contribute to the regeneration of degraded land at scale.

4 www.naturepositive.org

5 Recognising we want to increase carbon in other places like the soil and biomass.

RESTORE LAND, RESTORE CLIMATE



- One quarter of the world’s land is degraded.
- More than two billion hectares of this degraded land can be restored – an area larger than South America!
- There are proven techniques to regenerate forests, without planting a single tree.
- Restoring nature can achieve one third of the emissions reductions needed by 2030.

Nature is our secret weapon in the fight against climate change.
The numbers prove it...

23% Forests can provide 23% of the emissions reductions needed before 2030

10x Benefits of restoration are ten times higher than the costs

Restoring degraded land has a range of benefits beyond climate action



Reduces soil temperatures and boosts crop yields



Improves water retention and water security



Upholds a child’s right to a healthy environment



Prevents conflict by reducing stress points

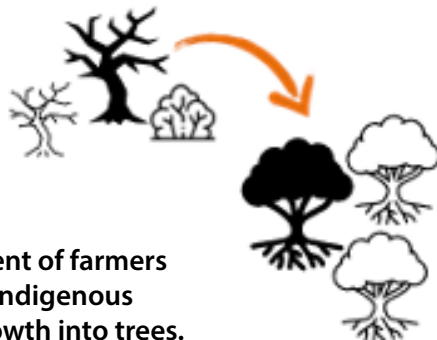


Respects First Nations knowledges and practices

We already have proven tools to restore land, at scale...

Farmer Managed Natural Regeneration (FMNR) is one technique which World Vision’s Tony Rinaudo pioneered.

It involves creating a movement of farmers to select and prune existing, indigenous shrubs, to accelerate their growth into trees.



Signature achievements so far:

- Reforested 18+ million hectares
- Active in 29 countries
- Regeneration visible from space
- Eight times cheaper than planting trees

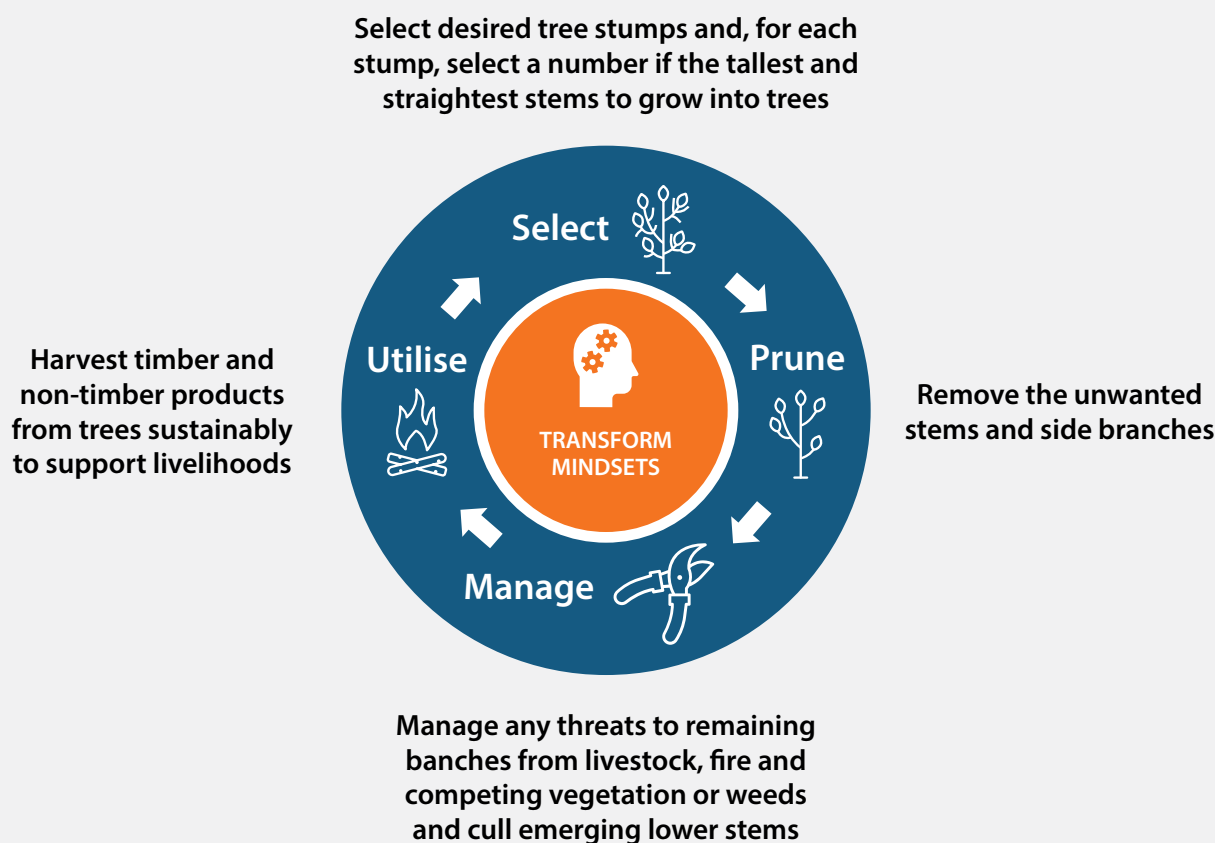
The trees and soil on regenerating land are simply the best carbon capture and storage technologies on Earth.

THIS MEANS THE WORLD

COMMUNITIES AT THE HEART OF NATURAL REGENERATION

Farmer Managed Natural Regeneration (FMNR) is a community led process regenerating trees from their living stumps and roots. Pioneered by World Vision's Tony Rinaudo, FMNR is a simple, low-cost technique which involves locating, pruning and nurturing existing shoots from tree stumps and giving them the space and protection needed to grow back into a tree.⁶ Unlike other restoration approaches FMNR requires no inputs other than the machetes or knives farming families already possess. Using this simple technique, deforested land can be quickly and effectively regenerated. Within 18 months to two years, communities can start enjoying the benefits, such as improved soil and new income sources.

The process of Farmer Managed Natural Regeneration



With more concentrated growth, trees flourish – soil improves, crops grow faster, trees produce more timber for building and fuel, and communities grow more resilient to climate shocks. Ecosystem functions return and, with them, biodiversity. Tree canopies provide essential services for soil protection and roots encourage rainwater infiltration. More tree cover reduces the soil temperature and allows the soil to hold more moisture, re-humidifying the landscape. Importantly, it directly tackles climate change by sequestering carbon dioxide.

It's far more cost-effective, and less time-consuming than planting trees – which is why farmers who practise it are such great supporters.

FMNR is estimated to have reforested more than 18 million hectares of the world's land. The beauty of FMNR is that is more than a technique – it is a movement where farmers come together with their communities to protect and restore nature as a society-wide project.

6 <https://fmnrhub.com.au/>

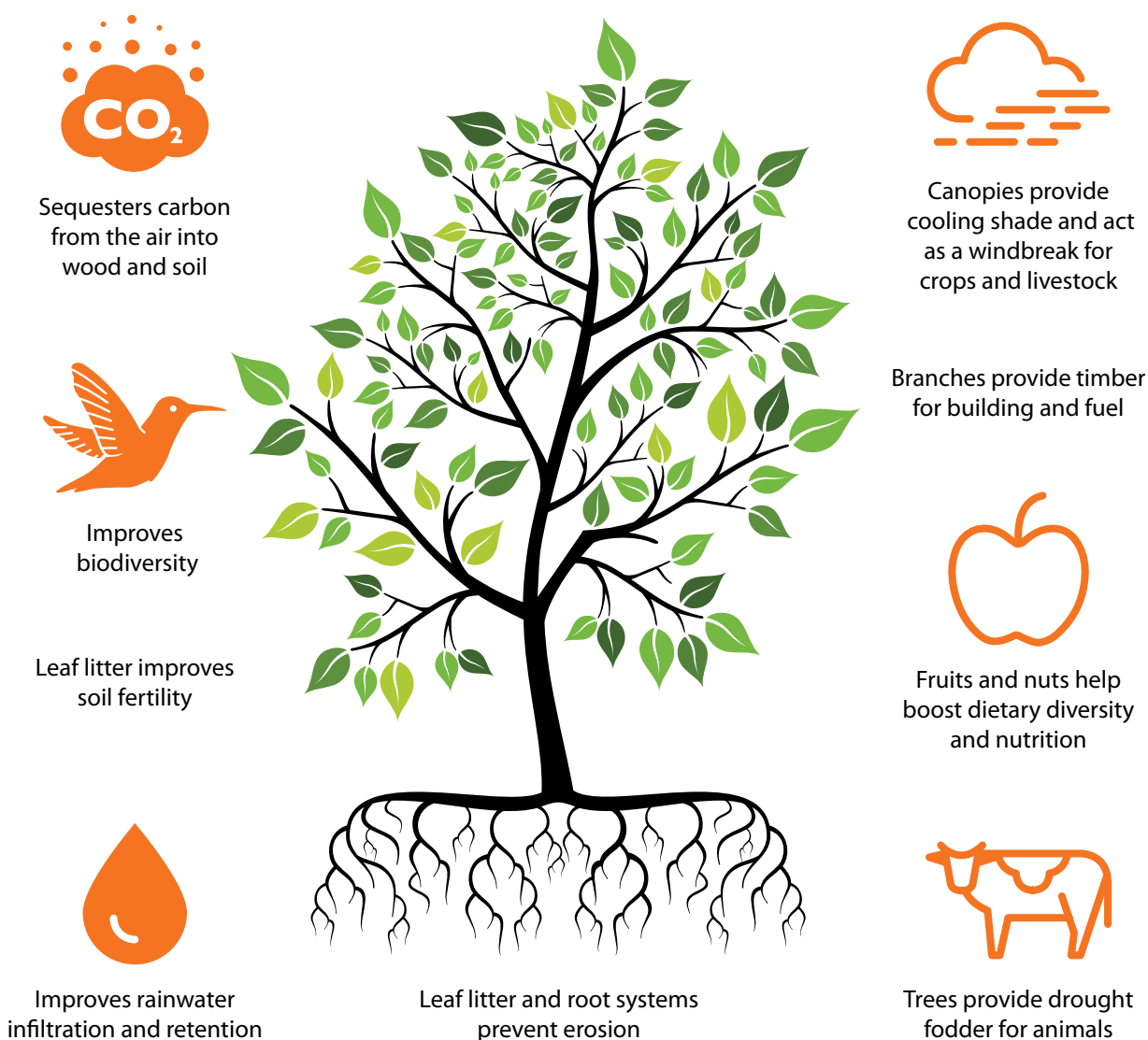
THE 'F' IN FMNR

Farmers are vital to the success of FMNR. This is because trees in these degraded landscapes do not regenerate by themselves – they need to be protected from animals and humans, and they need pruning to encourage the recovering trees to direct their flush of growth into height and structure, rather than leaving the trees to turn into bushes. This is most sustainably achieved through farmers, the people locally who directly benefit from natural regeneration.

Experience also shows that it is not sustainable (or beneficial) to protect an area by excluding the human communities that live nearby and depend on them. Communities that actively engage in managing tree resources and benefit from them directly are much more likely to follow and enforce tree management by-laws.

That is why local smallholder farmers are at the centre of FMNR. Farmers and communities are encouraged to select, regenerate and manage those species which best meet their objectives, be it soil fertility, fodder, wild foods, land restoration, timber or biodiversity. Pruned materials can be collected or sold as firewood and fodder, creating livelihood opportunities.

Figure: Benefits of tree regeneration⁷



⁷ Another benefit is improved access to timber and non-timber forest products & value chains such as honey to diversify family income sources



THE ROOTS OF FMNR

The FMNR technique of regenerating trees has been practiced throughout history by many local and indigenous communities around the world. The global recognition of the practice was set in motion in the 1980s when it was pioneered by Tony Rinaudo (pictured) and the farming communities of Niger as a method for large scale landscape restoration. Tony and his team initially planted thousands of trees, only to see them perish after failing to establish in the harsh landscape. That was until they stumbled across a remarkable discovery – what appeared to be useless desert bushes, were in fact the stumps of mature trees felled years earlier.

“It dawned on me how useless it all was,” Tony said.

“In every direction there were no trees. But then these shrubs caught my eye, and I suddenly realised this wasn’t a shrub but a tree trying to regrow.”

With this revelation, Tony pioneered a simple pruning technique – FMNR – that has since benefitted six million people across Africa and Asia. Tony was awarded the Right Livelihood Award in 2018, also known as the Alternative Nobel Prize, ‘for demonstrating on a large scale how drylands can be greened at minimal cost, improving the livelihoods of millions of people.’⁸

ABOUT THIS REPORT

This report puts forward the business case for prioritising natural regeneration efforts to combat climate change while also supporting community development in poor countries. It outlines the wide-ranging benefits of natural regeneration, including its ability to sequester carbon at scale, improve food and water security, and build community resilience to cope with shocks. Importantly, natural regeneration shows how these objectives can be achieved in a way consistent with Indigenous

land management principles, building on traditional knowledge and restoring climate and ways of life.

These points apply to any donor country and national government looking to step into a leadership role on climate change. Governments have an opportunity to unleash the power of nature to combat climate change by restoring degraded land at scale. Nature-based solutions are underutilised in the fight against climate change.

8 <https://rightlivelihood.org>

OVERVIEW: MAPPING THE CHALLENGES AND THE OPPORTUNITY

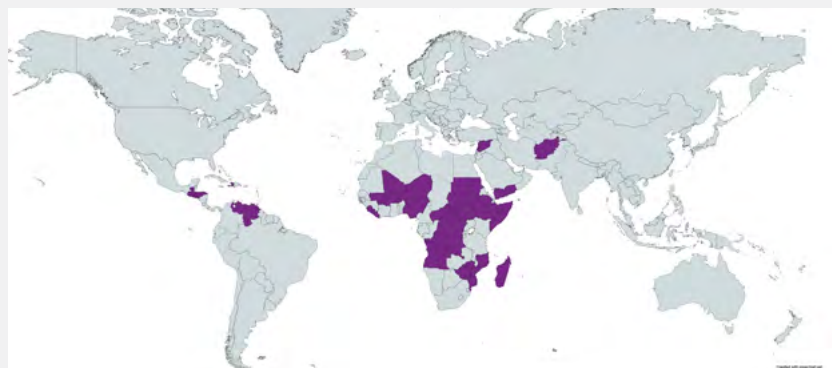
THE WORLD IS FACING A COLLISION OF MEGA CHALLENGES

The first map shows the world's hunger hotspots, where tens of millions of people are one step from famine. The second map shows water scarcity, now and into the future. The third map shows the countries most vulnerable to climate change impacts. The overlap is astonishing and the implications deeply concerning. But there is a fourth map – highlighting the opportunities for land restoration.

Broadly speaking, the areas of the world which are the most hungry, thirsty, and vulnerable to climate change, are the same areas where there is tremendous potential for landscape restoration. As this report explains, restoring degraded land through FMNR and other natural regeneration techniques has great potential to help address the mega challenges of our time – storing carbon, increasing crop yields, replenishing water tables and building community resilience. By restoring land we restore climate.

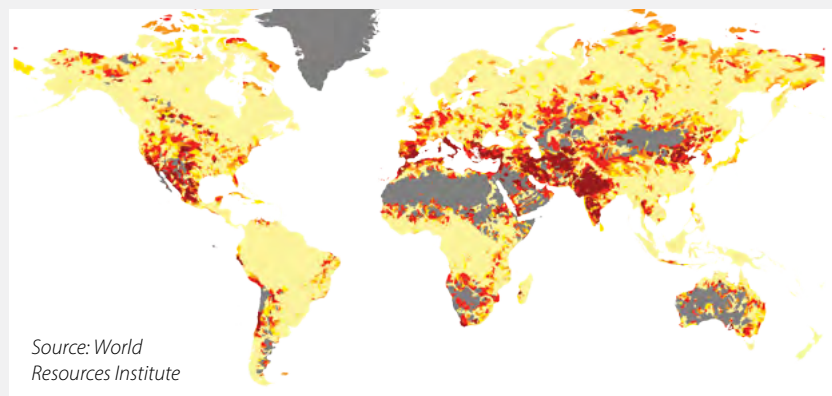
1. Hunger hotspots⁹

20 countries with populations at risk of starvation (World Food Programme, 2022)



2. Water stress¹⁰

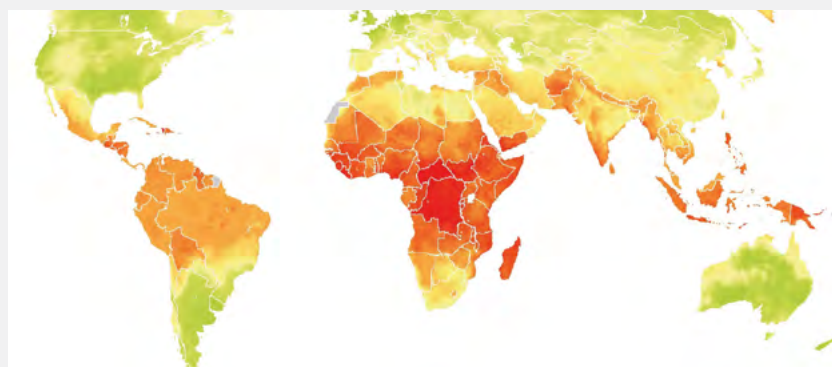
Showing the 17 countries experiencing extremely high water stress. Deep red depicts extremely high, diminishing to low in light yellow. Light grey depicts arid and low water use areas, while deeper grey areas have no data available.



Source: World Resources Institute

3. Vulnerability to climate change¹¹

Assessment of the vulnerability of human populations to extreme climate events and changes in climate over the next 30 years (Maplecroft, 2016) All countries are vulnerable to and affected by climate change. Those with most resources and capacity to adapt are coloured green. Countries coloured yellow, orange and red reflect their increasing vulnerability.



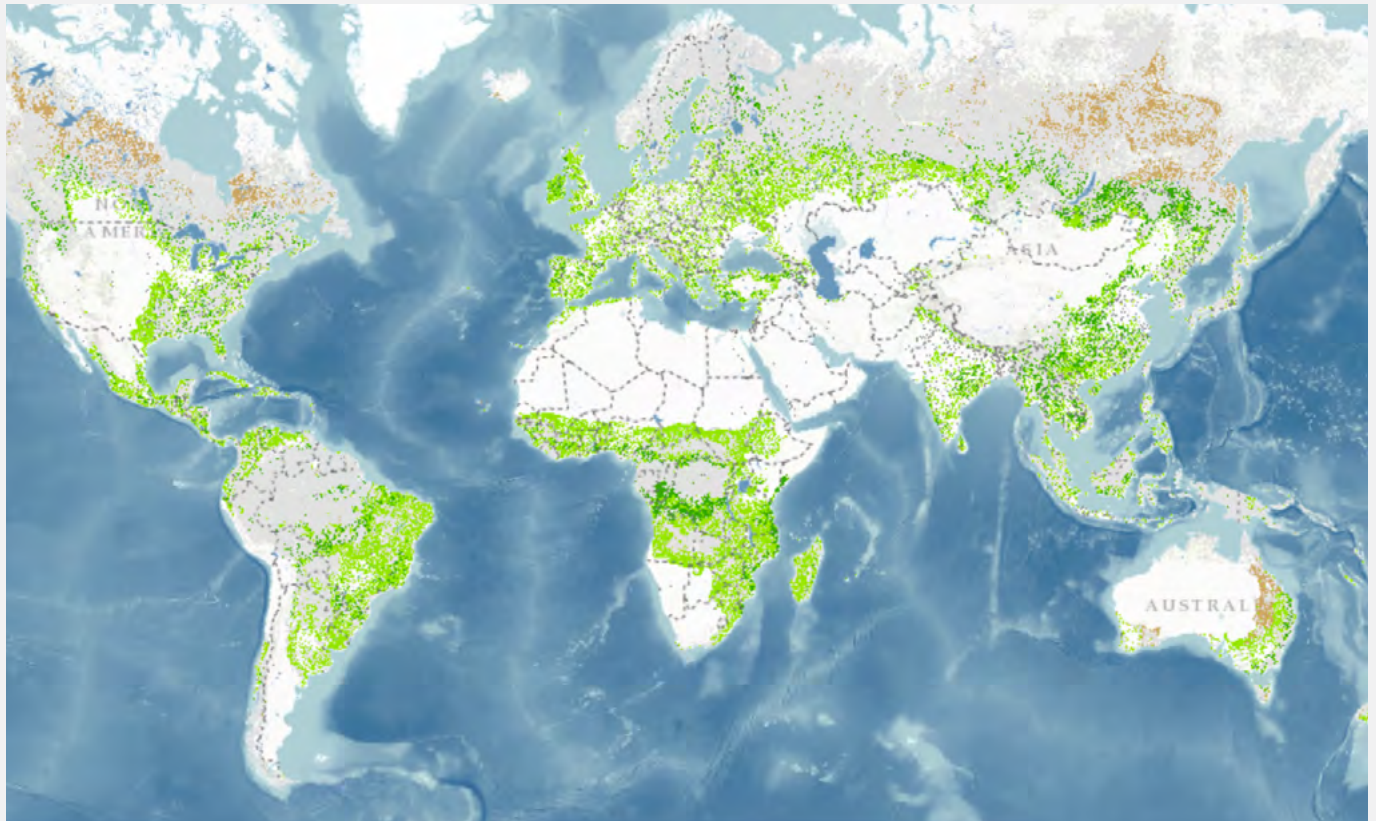
⁹ <https://www.wfp.org/publications/hunger-hotspots-fao-wfp-early-warnings-acute-food-insecurity-june-september-2022>

¹⁰ <https://www.wri.org/aqueduct/tools>

¹¹ <https://reliefweb.int/report/world/climate-change-vulnerability-index-2017>

4. Landscape restoration opportunities¹²

More than two billion hectares of degraded land that has the potential to be restored (2017)



***“No research program
– no matter how well funded
– would have come up with
this idea, because it expertly
combines the subtleties of
location-specific tree selection
with farmer-specific opportunities
and constraints.”***

– Richard Stirzaker, principal research scientist,
CSIRO, Australia’s national science agency.

¹² <https://www.wri.org/applications/maps/flr-atlas/#> and <https://statics.teams.cdn.office.net/evergreen-assets/safelinks/1/atp-safelinks.htm>

CHAPTER 1:

RESTORE LAND, RESTORE THE CLIMATE

Key points:

- The IPCC warns that greenhouse gas emissions must peak by 2025 to limit dangerous levels of warming. It also found that three nature-based actions – reducing the destruction of forests, restoring them, and carbon capture through better agricultural practices – are among the top five most effective strategies for reducing emissions by 2030.
- Restoring trees and forests can provide 23 per cent of the emissions reductions needed before 2030.
- One quarter of the world's land is degraded. But more than two billion hectares of this degraded land can be restored.

ABOUT THE SCALE OF THE CHALLENGE (AND THE OPPORTUNITY)

The Intergovernmental Panel on Climate Change recently released a series of landmark reports as part of its Sixth Assessment on climate change science. The latest report sounded a 'red alert' and found greenhouse gas emissions must peak by 2025 to limit dangerous levels of warming.¹³

It was yet another affirmation from the world's leading scientists that the world is warming at a speed that we are running out of time to contain. With that warming comes more droughts, more fires, more floods, more famine, more displacement, more conflict. While developed countries have the resources and capacity to adapt, it is vulnerable communities least responsible for climate change who are expected to bear the brunt of its impacts.

However, the IPCC identified a narrow window to avoid the worst consequences of climate change by dramatically scaling up our level of climate ambition.

The IPCC concluded three actions – reducing the destruction of forests and other ecosystems, restoring them, and sequestering carbon through agriculture – are among the top five most effective strategies for mitigating carbon emissions by 2030.¹⁴ The IPCC found nature-based solutions “can deliver large-scale greenhouse gas emission reductions and enhanced removals”.

While one quarter of the world's land area has been degraded, the World Resources Institute estimates more than two billion hectares of this degraded land has the potential to be restored, offering huge potential to sequester carbon at scale.¹⁵ The Glasgow Leaders Declaration on Forests and Land Use, adopted by more than 100 governments at COP26, reaffirmed the importance of 'conserving forests' and 'accelerating their restoration'.¹⁶

At present, only a very small percentage of climate finance (one to three per cent) is allocated to nature-based solutions.¹⁷ This must change. The benefits of environmental restoration are 10 times higher than the costs. Delaying action on ecosystem restoration by 10 years would more than double the social cost, rising to approximately US\$15 trillion (equivalent to around 17 per cent of global GDP in 2019).¹⁸ Postponing action represents an unconscionable deferral of financial distress on to the next generation. Indeed, as the recent Dasgupta Review from Cambridge noted, the difference between acting now and acting later is equivalent to 9 per cent of global GDP, or almost 40 per cent of the GDP of the United States in 2019.¹⁹

13 <https://www.ipcc.ch/assessment-report/ar6/>

14 As above.

15 <https://www.wri.org/applications/maps/flr-atlas/#>

16 <https://ukcop26.org/glasgow-leaders-declaration-on-forests-and-land-use/>

17 <https://www.unep.org/resources/state-finance-nature>

18 <https://www.gov.uk/government/publications/final-report-the-economics-of-biodiversity-the-dasgupta-review>

19 As above.

CASE STUDY:

THE TWIN BENEFITS OF FMNR – CLIMATE RESILIENCE AND CARBON CREDITS IN ETHIOPIA

In Humbo, a drought and flood-prone district in the south-west of Ethiopia, FMNR is restoring formerly degraded landscapes, fostering climate resilience while also contributing to livelihoods and the income of communities thanks to carbon finance.²⁰

BEFORE:

Land in many areas of Ethiopia, like the highlands of Humbo in the country's south-west, are severely degraded. Pressure on the land had increased significantly over the previous two decades. The 'tragedy of the commons' emerged: communal forest areas became over-exploited by growing populations, due to overgrazing and over-cutting fuelwood. High levels of deforestation caused

landscape degradation, with even small amounts of rain causing soil erosion and flooding. Groundwater reserves, the main supply of drinking water for 65,000 residents, dwindled. Before the FMNR project, 85 per cent of those in the Humbo areas lived in poverty, with an average per capita annual income of less than US\$100. Most people were fully or highly dependent on external food aid.

AFTER:

Humbo is now a green, thriving landscape, which not only supports local food production but also generates income for the local community through carbon credits.

In 2005, World Vision Ethiopia introduced to farmers the FMNR technique and other complimentary techniques to restore their degraded land and protect their water supply. Farmers were organised into cooperatives to practice regeneration techniques on communally owned hillsides. Local communities and authorities signed agreements to close off these areas and permitted forest restoration via FMNR only. Six years into the project, the community (historically dependent on food-aid) was able to sell 106.7 tonnes of grain to the World Food Programme as a result of natural tree regeneration. FMNR has also reduced flooding and increased the productivity and fertility of the land. Regenerated forests have changed the micro-climate – farmers say the air is now cooler. The groundwater has replenished with several springs recovered. Cropped land suffers from less flooding, erosion and siltation. More than 2700 hectares of degraded forest has been protected, restored and sustainably managed.

Over time, the natural regeneration project attracted finance and Humbo became World Vision's first carbon-finance project and the first of its kind in Africa.

Through the Clean Development Mechanism,²¹ the World Bank's BioCarbon Fund invested in the Humbo project for 12 years, purchasing carbon credits generated through FMNR-activated forest restoration. In the 30-year period for capturing carbon credits, more than 870,000 tonnes of CO₂e will be removed from the atmosphere, the equivalent of removing more than 9600 passenger vehicles from the road each year, making a significant contribution to mitigating carbon emissions.²²

Carbon funds were returned to the communities. By 2018, more than US\$500,000 were received through the World Bank's BioCarbon Fund from the sale of carbon offsets. The World Bank's purchase agreement ended and the project transitioned to Gold Standard for the Global Goals. This meant credits were available for purchase through the voluntary carbon market, further extending the carbon income for cooperatives. These cooperatives invested in social assets, including eight flour mills and nine grain stores, 240 solar panels, a truck to deliver produce to market, and access to micro-credit services to over 1200 households for investment in different businesses.

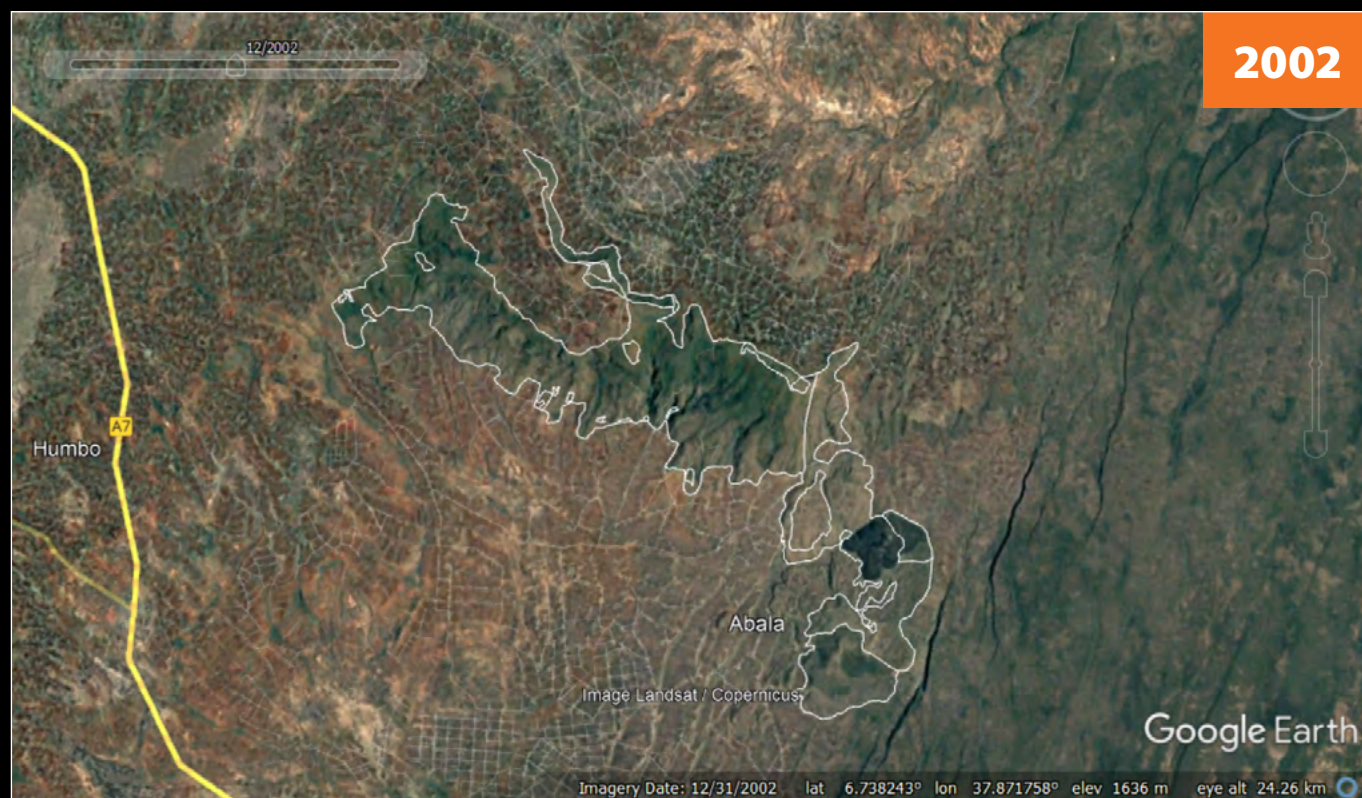
20 https://www.bond.org.uk/sites/default/files/resource-documents/bond_-_nbs_case_studies_-_v4.pdf

21 Poverty Alleviation and Environmental Restoration Using the Clean Development Mechanism: A Case Study from Humbo, Ethiopia by Douglas R. Brown, Paul Dettman, Tony Rinaudo, Hailu Tefera, Assefa Tofu :: SSRN

22 <https://www.ntc.gov.au/sites/default/files/assets/files/Carbon-dioxide-emissions-intensity-for-new-Australian-light-vehicles-2019.pdf>

CLIMATE ACTION YOU CAN SEE FROM SPACE

Farmer Managed Natural Regeneration of native species and enrichment planting using high-valued timber species have been integral to land restoration in Humbo, Ethiopia. In this community reforestation program, the success has been clearly captured by these two satellite images 12 years apart. More than 2700 ha of degraded land has been regenerated since restoration activities started in 2006. The work by local forestry cooperatives, supported by World Vision, has brought hope to communities whose environment can now sustain them. They no longer rely on external food aid.



TREES AS CARBON SINKS

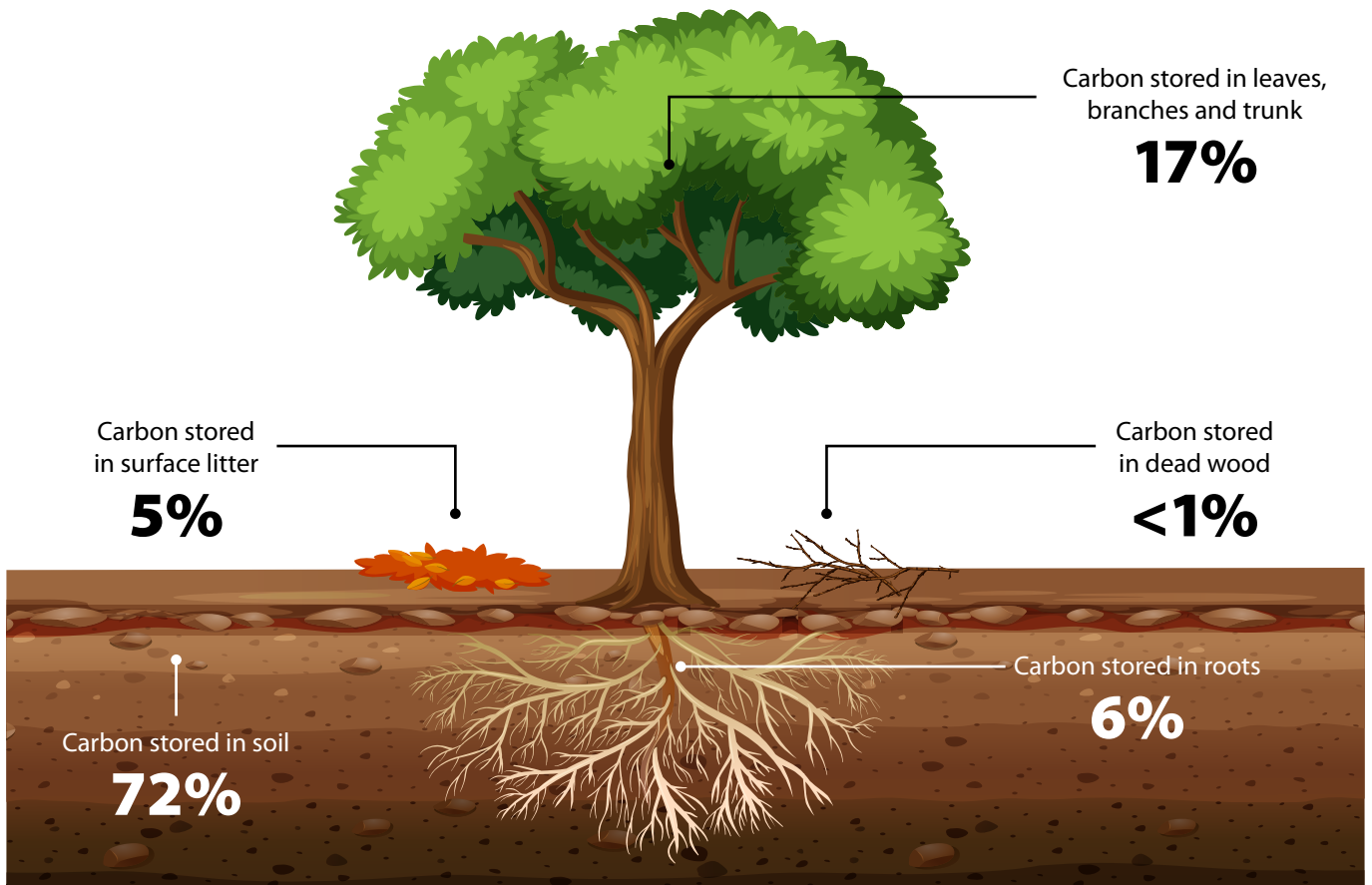
To avoid dangerous climate change, we must capture vast amounts of carbon dioxide from the atmosphere, and drastically cut emissions. Regenerating degraded land is key to carbon drawdown, as it removes carbon from the atmosphere by storing it in trees and soil. Wood is an incredible carbon sink because it is largely made of carbon, it lasts for years (sometimes decades) as a standing, functioning tree, and takes a long period to break down after the tree dies, by which stage other trees often grow in its place. The soil underneath the trees stores huge amounts of carbon. **In combination, the trees and soil on regenerated land represent the best carbon capture technology in the world.**

Restoring degraded landscapes to regain their ecological functionality has been identified as an 'unparalleled opportunity' and 'proven measure' for fighting the climate crisis and ensuring food security, water supply

and biodiversity. It is estimated that restoring 350 million hectares of degraded land (as per the Bonn Challenge) could generate US\$9 trillion in ecosystem services and take an additional 13 to 26 gigatons of CO₂-equivalent gases (CO₂e) out of the atmosphere between now and 2030.²³

FMNR is a particularly effective way to increase the sequestration of carbon. It is estimated that forest landscapes restored with FMNR can sequester between six and 20 tonnes of CO₂e per hectare per year, while agricultural land managed with FMNR can sequester between one and two tonnes of CO₂e per hectare per year.²⁴ In Humbo and Soddo, Ethiopia, FMNR rebuilds livelihoods for communities in formerly degraded landscapes, and creates significant revenue for community development and household incomes through the sale of carbon credits (see case study).

Figure: Where carbon is stored in a typical temperate forest



*Ratios vary depending on soil type, vegetation and climate.

23 <https://fmrhub.com.au/>

24 As above.

THE REAL VALUE OF NATURE

The World Economic Forum has found that US\$44 trillion of the world's economic value generation (over half the world's total GDP) is moderately or highly dependent on nature.²⁵ The risks to companies from nature loss are profound, but underplayed. Healthy soils, clean water, pollination and a stable climate are pre-requisites for the economic viability of some of the world's largest industries – agriculture, construction and food and beverages.²⁶ The supply chains of many of the world's most profitable industries have 'hidden dependencies' on the health of natural ecosystems.²⁷

The exposure of so much of global business to the severe consequences of nature loss exposes the folly of harm to our natural environment being considered an externality – a negative environmental consequence with little flow on effect for the wider economy. That is dated and dangerous thinking. Many businesses are starting to value 'natural capital' and with that an understanding of the real value of the world's biodiversity is emerging.²⁸

"Businesses can formulate specific pathways to help 'bend the curve' of nature loss and damage within the decade by slowing down and halting biodiversity loss, then restoring nature and – as a massive co-benefit – contribute to achieving net-zero emissions by mid-century through smart nature-based solutions, all in the same package. There is potential for a win-win-win for nature, climate, people and the economy, but the science is telling us we must start this urgent transition now."

– Dominic Waughray, Managing Director at the World Economic Forum.

The development of 'natural capital' markets (be they carbon credits or biodiversity schemes) are unleashing private capital investment into Nature based Solutions and accelerating the scaling up of landscape restoration. But this must all be undertaken with extreme caution and with a regulatory eye, constantly, on the integrity of these schemes and their benefits for local communities. Governments have a critical role to play in ensuring these markets are underpinned by the pillars of integrity and inclusion.²⁹ They must be win-win by both restoring ecosystems and delivering a return for local communities.³⁰



Laura Reinhardt © 2018 World Vision

25 <https://www.weforum.org/press/2020/01/half-of-world-s-gdp-moderately-or-highly-dependent-on-nature-says-new-report/>

26 As above.

27 As above.

28 <https://www2.deloitte.com/au/en/pages/about-deloitte/articles/banking-natural-capital.html>

29 Ecosystem Marketplace Insights Brief – State of the Voluntary Carbon Markets Brief 2022 Q3'.

30 As above.

CHAPTER 2:

RESTORE LAND, RESTORE FOOD SECURITY

Key points:

- Feeding the world and averting run-away climate change are often seen as competing priorities, but nature-based approaches such as FMNR can help do both at once.
- Shade from trees can increase crop yields by 50-70 per cent, which is critical as the world grapples with the challenge of increasing agricultural output in the next 30 years to feed a growing population.
- Smallholder and family farmers are responsible for 80 per cent of the world's food production and many live and work on degraded land, so engaging farmers is key to restoring land at scale and improving food security.
- In Niger, for example, about 2.5 million people are now more food secure as a result of FMNR which has seen five million hectares of degraded land restored.

A FALSE DICHOTOMY: FOOD SECURITY VERSUS THE ENVIRONMENT

The world is facing two era-defining challenges right now: a global hunger crisis and a climate crisis.

Global hunger has exploded due to a perfect storm of record food prices, conflict, COVID-induced economic recessions and climate change. In 2022, 50 million people in 45 countries are on the edge of famine.³¹ The global goal of zero hunger by 2030 looks ever more elusive.³² The rapid breakdown of global food systems in the short term has also shed light on the fundamental challenge of feeding the planet in the longer term.

How the world responds to heightened levels of hunger and food insecurity while the global population continues to grow could be the defining challenge of the 21st century. By 2050, the global population is expected to hit 9.8 billion people – an increase of two billion in 30 years.³³ To feed this many people, experts suggest agricultural output must double in the next 30 years.³⁴ Traditionally, this kind of agricultural increase would dramatically increase carbon emissions, and the raft of approaches aiming to increase food production would do enormous harm to the natural environment.³⁵

In recent decades, the expansion of agriculture and food systems has been at the expense of the natural environment.

One-third of the world's forests have been lost to agriculture, half of this occurring in the past 100 years; 90 per cent of the world's savannahs, grass and shrub lands are now used for grazing.³⁶ Almost half of the world's habitable land is used for agriculture and 70 per cent of all freshwater use globally goes to agriculture.³⁷ As a result, expanding food production is often seen as competing with environmental conservation efforts. But this need not be the case.



The world will need to double its agricultural output to feed the expected population increase. Nick Ralph © 2018 World Vision

31 <https://www.wfp.org/global-hunger-crisis>

32 http://www.fao.org/3/cb4474en/online/cb4474en.html#chapter-2_1: While global food insecurity has been on the rise since 2014, the increase in 2020 was equal to that of the previous five years combined.

33 <https://sdg.iisd.org/news/world-population-to-reach-9-9-billion-by-2050>

34 <https://www.sciencedirect.com/science/article/pii/S0305750X20300802>

35 For example, the old reliance on clearing new land or forests for new farming areas, the old tendency to eliminate trees, the prevailing expectation that low-income countries will need to adopt the food production systems – i.e. high inputs / economies of scale – of high-income countries. But these options do not exist in low-income countries, and in any case, these production systems are proving to be unsustainable.

36 <https://www.fao.org/3/ca9825en/ca9825en.pdf>

37 Global numbers summarised here: <https://ourworldindata.org/deforestation>

A 'NO REGRETS' MODEL TO FEED THE WORLD AND SAVE THE PLANET

FMNR can improve food security while complementing global conservation. The relationship between farmers and the natural environment is key to what must become a global movement if we are to both feed the world and save the planet.

Smallholder and family farmers produce 80 per cent of the world's food,³⁸ and many live and work on degraded land. The beauty of a natural regeneration approach like FMNR is that it is scalable, allowing it to be managed and led by farmers, and ensuring farmers directly reap the benefits of more productive and arable land.

Introducing FMNR along with other low-cost sustainable agriculture practices has improved food security and climate resilience for smallholder farmers and their families.³⁹ This integrated approach contributes to diversified food options, improved access to food and nutrition, increased crop yields and improved livestock production. For example, in Niger, FMNR made a significant impact in sustaining or increasing crop yields, and in some

communities, contributed to more than halving 'hungry months' (when food supplies are exhausted) from over six months to three months or less (see case study). A World Vision project in Chad recorded a dramatic increase in sorghum due to implementing the FMNR approach.

"This year is very exceptional for me because I have been able to get enough sorghum. I cultivated one hectare and harvested 15 bags of sorghum. Generally, I could get three to five bags when working this land in the past. This would have been impossible if I was not taught the new FMNR technique of land management."

– Khadidja Gangan, 35-year-old mother of six, Chad

NATURAL REGENERATION AND FOOD SECURITY

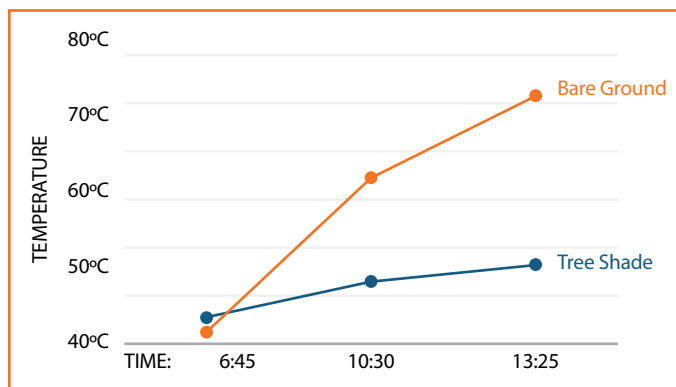
By providing shade, increasing water retention, reducing erosion and cooling the soil, regenerated trees can increase yields from crops, grass and livestock, improving food security.

Many crops are already growing at the upper limits of their thresholds in a warming climate. In many places, crops stop growing in the middle of the day because it is too hot. This hinders productivity and leads to lower and less nutritious yields. The good news is that shade from trees can increase crop yields by 50 to 70 per cent and sustain growing communities.⁴⁰

Shade is vital for cooler, healthier livestock. One study found that just 15 per cent of shade reduced air temperatures by approximately 10°C and soil temperature by 35°C (in midday in West Africa at the peak of summer).⁴¹ Most species perform best at temperatures between 10 and 30°C. Cattle, sheep, goats, pigs and chickens reduce their feed intake 3 to 5 per cent with each degree above 30°C.⁴² This can slow their growth and development.

The following chart shows dramatic temperature differences in the village of Oursi, Burkina Faso, in areas shaded by trees compared to those on bare ground.

Soil temperature reductions from tree shade⁴³



The study concluded: "In addition to reducing heat-trapping emissions, restoring vegetation where it has been lost or depleted benefits soil health and landscape productivity, which increases crop yields and fodder for livestock, bolstering food security." World Vision case studies from West and East Africa and the Indo-Pacific confirm natural regeneration can lead to higher yields, even on smaller plots of land.

38 <https://ourworldindata.org/smallholder-food-production>

39 Slash-and-burn farming used to be an option for land management but that this practice, and the outdated belief that a good farm is a clean tree-less farm is no longer sustainable and is leading to soil infertility. Trees are beneficial in farming systems. <https://www.aciar.gov.au/media-search/blogs/agroforestry-helps-farmers-make-greener-land-and-better-life>

40 <https://files.wri.org/d8/s3fs-scaling-regreening-six-steps-success.pdf>

41 As above.

42 As above.

43 www.greenbiz.com/article/Surprising-new-study-shows-deadly-feedback-loop-of-soil-warming | Greenbiz

CASE STUDY:

BREAKING THE CYCLE OF LAND DEGRADATION

BEFORE:

Much of Niger's land was degraded. Between the 1950s and 1980s, most trees and shrubs in the agricultural zone of Niger were destroyed. This exacerbated the effects of recurring drought, strong winds, high temperatures, infertile soils and the impact of pests and diseases on crops and livestock, which made the land an increasingly hostile place simply to live and work – never mind to grow food. Combined with rapid population growth and poverty, these problems contributed to chronic hunger and periodic acute famine.

AFTER:

Decades later, once barren landscapes are lush with green trees as a result of large-scale FMNR adoption over two decades. About five million hectares have regenerated, spurring on an agricultural and economic revolution – and that is not an overstatement. Average on-farm tree density increased from four trees per hectare in 1984 to 40 trees per hectare. In turn, greater tree coverage increased soil fertility, reduced soil temperatures and created a more favourable micro-climate for crops and livestock.

FMNR significantly increased crop yields and, in some communities, contributed to reducing the number of 'hungry months' when food supplies are exhausted. The hunger period dropped from in excess of six months to three months or less. Research conducted in Maradi District in Niger between the period of 2006 and 2009 found FMNR-adopted areas produced 173kg of millet and 77kg of other crops such as sorghum, cowpeas, peanuts and hibiscus per hectare. In contrast, areas that did not adopt FMNR only produced 149kg of millet and 10kg of other crops per hectare.

As a result of this restoration, cereal yields doubled or more per hectare in some places,⁴⁴ contributing to Nigerien farmers producing 500,000 more tons of cereal per year than in the 1970s and 1980s.⁴⁵ As a result, 2.5 million people are now more food secure.⁴⁶

Nearly four decades after the initial adoption of FMNR, the Niger Government claims there are 10 million hectares of farmland under some level of FMNR management and many farmers have witnessed the transformation from vicious cycles of degradation, poverty and hopelessness to a virtuous cycle of restoration, a degree of self-sufficiency and hope. Additionally, the dramatic transformation that occurred in Niger is inspiring restoration initiatives and movements across Africa and parts of Asia.



Daouda Djibo, from Guessé Sinsan in the Tillabéri region inherited degraded land and struggled to provide for his family because of poor crops. He was advised to practise FMNR to help the land regenerate and since then its productivity has increased significantly. © 2021 World Vision Niger

44 Pye-Smith.C. 2013. The Quiet Revolution: How Niger's farmers are re-greening the parklands of the Sahel; ICRAF Trees for Change no.12. Nairobi; World Agroforestry Centre.

45 Reij, C., Tappan, G., Smale, M. 2009. Agro-environmental transformation in the Sahel: another kind of "Green Revolution". IFPRI Discussion Paper 00914. International Food Policy Research Institute, Washington DC

46 As above.



Sammy Ouma (front left), his wife Nereah (front second left) and their children are excited about their harvest of maize. They attribute the good harvest to practicing FMNR on their one-acre farm. Susan Otieno © 2021 World Vision.

FOOD ON THE TABLE FOR NEREAH AND HER CHILDREN

A few years ago, eating three meals a day was a dream for Sammy Ouma, his wife, Nereah, and their eight children.

Though Sammy and his family did their best on their one-acre farm, in Nyatike, western Kenya, they would get no more than two 90kg sacks of maize to last them several months before the next planting and harvest season. An acre of land ought to have produced about 15 sacks of 90kg.

“We had a lot of problems. We would eat once a day or at times even sleep hungry because the farm was not productive,” Sammy said.

In 2018, at the peak of their frustration, he and about 10 of his village members questioned, for how long they would have to keep buying food. Most had no other sources of income and relied on their farms.

“Changing the environment is not one man’s job. Everyone has to be involved,”

– Sammy Ouma

Sammy and his friends blamed poor rains for their minimal harvests. “We were certain, we had no rain because we had no trees,” he said.

He and his friends who shared similar concerns started Nyatike Mirema Community Forest Association. Today, the group’s membership has grown to 50 members with a main objective of restoring their environment.

“Changing the environment is not one man’s job. Everyone has to be involved,” he said.

In the same year, World Vision and its partners trained the group on FMNR through the Regreening Africa Project, that seeks to reverse land degradation by incorporating trees into croplands, communal land and grazing land. The project aims to improve food security and increase resilience to climate change for smallholder farmers such as Sammy by teaching about FMNR and other best agroforestry practices.

“I learnt that when a farm has trees, when you grow food, it will not dry up as easily as a farm with no trees

because there is more moisture on the ground,” he said.

The family began taking care of the shrubs and small trees on their farm, to encourage their growth, including pruning branches, a key practice in FMNR.

“We prune our trees twice a year, every six months and we sell the branches for firewood and also make charcoal from the branches,” Sammy explained of the deliberate move to encourage tree growth instead of continuous cutting down of entire trees for firewood and charcoal.

The family’s farm now has a variety of indigenous trees, flourishing pawpaw, guava, mango trees and moringa oliefera, popular for its health benefits.

Days of going to bed hungry is now a distant memory for Sammy and his family. As they embrace and practice FMNR techniques, the family is hopeful of many more plentiful harvests, increased income and sustainable access to firewood in a sustainably managed environment.

CHAPTER 3:

RESTORE LAND, RESTORE CHILDREN'S FUTURES

Key points:

- Every child deserves a healthy and sustainable environment. No group is more vulnerable to environmental harm than children, and they have the most to gain from natural regeneration efforts.
- Research into the direct and indirect impacts of FMNR has shown it is associated with a range of powerful (and surprising) benefits for children, including better nutrition, higher rates of school attendance, and improved safety, especially for girls.
- Climate change is an issue of intergenerational justice. Since 2018, about 10 million people, mostly children and young people, from 260 countries have joined school climate strikes to demand greater action on climate change.

A PLACE TO THRIVE

Every child deserves a healthy and sustainable environment.⁴⁷

Deforestation, climate change and unsustainable agricultural and development practices are degrading natural ecosystems, and threatening children's right to a healthy environment. Nature-based solutions, including reforestation, landscape restoration, indigenous land management practices, and rehabilitation of coastal

ecosystems can stabilise the local environment, improve water availability and land productivity, and create healthy places for children to thrive. In this sense, natural regeneration techniques such as FMNR uphold a child's right to a healthy environment.

FMNR AND CHILDREN'S WELL-BEING

Natural regeneration more broadly, and FMNR in particular, is linked to a wide range of benefits for children.

Participants in FMNR projects are more likely than non-participants to report being able to provide well for their children. By improving yields and the productivity of land, FMNR creates or expands livelihood opportunities for families.⁴⁸ The bottom line is increased income, which means greater resources for families to invest in children's health, food, education and housing. FMNR also has surprising indirect benefits for child nutrition, school engagement, mental health and children's safety, making it a powerful tool for improving outcomes for children, at scale.



Viko and her sister, Hindim, in Uganda comparing who has the ripest tomatoes after harvesting. Derrick Kyatuka © 2021 World Vision

47 Resolution 48/13 adopted by the Human Rights Council on 21 October 2021: <https://documents-dds-ny.un.org/doc/UNDOC/GEN/G21/289/50/PDF/G2128950.pdf?OpenElement>

48 <https://fmnrhub.com.au/>

WHY NATURAL REGENERATION MEANS THE WORLD FOR WOMEN AND GIRLS

In many communities around the world, women and girls are responsible for collecting firewood for cooking and heating.

Where landscapes are degraded, women and girls must often walk increasingly long distances to find firewood, taking many hours from their days. These errands force some girls to skip school classes.

FMNR increases wood supply and reduces the time women need to collect firewood. From the beginning of FMNR projects women are able to use the pruned stems and branches. This means they have more time to invest in their livelihoods and/or care for their children, and girls can focus more on their education.

Because of the centrality of women in natural-resource management and firewood harvesting, World Vision FMNR projects ensure women are included in training, committee formation and decision-making. By promoting gender inclusiveness, FMNR provides a platform for women to take increasingly important

roles in agriculture production and community decision-making. For example, in Senegal, FMNR was implemented in a gender-sensitive way and it resulted in a shift in the balance of power towards women. In an FMNR project in East Sumba, Indonesia, women were elevated to full, joint participation in decision-making with men and many now manage their own income-generating farms. When women's control over resources is increased, as occurs in many FMNR programs, it can create significant benefits for child nutrition and health.

“We have enough firewood at home that can take us the whole term... I do not have to go to look for firewood from the forest, which is 5 km away. I no longer come home as early as 2pm to fetch firewood but stay in school until 4pm studying.” – Kibe, Kenya



Better nutrition

Tree regeneration through FMNR indirectly boosts child nutrition by improving the production of wild fruit, edible leaves, nuts, and fungi. By attracting bees, birds and animals, regenerated landscapes can lead to more honey and sources of meat. In the Talensi district in dryland northern Ghana, 83 per cent of all new trees regenerated through FMNR were edible fruit-bearing species.



Greater school attendance and engagement

Evidence shows school attendance increases in FMNR communities. Mr Cheplegu Kigen, a teacher at Emarangishu Primary School in Kenya, said school enrolments increased since FMNR took off in the community because the “majority of our children no longer stay at home searching for food or going far to fetch firewood.”⁴⁹



Improved mental health

Access to a healthy environment does wonders for children's mental health. For example, a World Vision, multi-country FMNR evaluation across dryland West Africa found, where the project succeeded in mobilising communities to reintroduce trees into the agricultural landscape, “children were positive about their community and the future of farming.”⁵⁰ On the other hand, in areas where tree coverage continued to decline, children expressed a pessimistic future for farming.”⁵¹

49 Education of children and girls in particular is listed in the top 3 climate solutions by Project Drawdown - <https://www.drawdown.org/about>

50 www.science.org/doi/10.1126/sciadv.aax0903

51 As above.

CHILDREN AS CHAMPIONS OF NATURAL REGENERATION

World Vision takes a creative approach to engaging children in FMNR and promoting FMNR in schools – involving group discussions, poetry writing, essay competitions, dances and drama performances.

Through these activities, children increase their understanding of trees, crops and the environment and they often pass on these lessons to their families at home, driving a movement of people to care for the environment. Teaching children the benefits of FMNR influences parents and educates the next generation of farmers, whose involvement is critical to the long-term enterprise of regenerating nature.

In Kenya, for example, FMNR has been taught in schools and instilled children with increased confidence and security about their future.⁵² In Senegal, children's involvement in FMNR has led to increased uptake and understanding among their parents.⁵³

“Right now, we are ignoring natural climate solutions. We spend 1000 times more on global fossil fuel subsidies than on nature-based solutions.”

– Greta Thunberg, 2019 ⁵⁴

YOUTH ACTION

The devastating truth about the climate crisis is that the youngest and poorest in the world will suffer the most. Rising to the challenges, children and young people in Kenya are helping regenerate their homeland to fight climate change – with incredible results.

World Vision takes a creative approach to promoting FMNR in schools by supporting school clubs. The children increase their understanding of trees, crops and the environment and they return home to teach these lessons to their families.

FMNR champion Ruth Jerotich, 23, was inspired towards climate action during her school years and now teaches youth and young adults how to repair the environment.

“People are beginning to understand the importance of conserving trees. Those who used to destroy forest to get firewood for burning charcoal have stopped. This has greatly reduced deforestation. Instead of cutting trees they now go round the community, restoring indigenous trees through the FMNR technique.”

Ruth said since FMNR was introduced tree cover had increased, rivers had filled up so children didn't have to collect water from far away and they now had enough food to eat even in dry seasons.

“Without food, many would just sleep, since they felt really weak,” Ruth said. “We have been suffering from long drought spells, with crops drying and livestock dying due to insufficient rainfall. Our rivers had also dried due to the low forest cover and siltation in our water bodies.



Ruth Jerotich has seen her community in Baringo County, Kenya, transform since FMNR regenerated their land. Her work championing environmental conservation and restoration is inspiring more young people to take climate change action. © 2021 World Vision Kenya.

“I was desperate to change this. So I have been teaching the people how to conserve trees ... I am happy that my efforts are beginning to bear fruit. Due to the increased tree cover resulting from FMNR, soil erosion has reduced.”

Her message to children around the world was simple: “Keep doing the little things to change the environment. We are beginning to see the change, so we can't give up.”

“I have no doubt that increased tree cover will help the world tackle the adverse effects of climate change. I have seen it first-hand.”

– Ruth Jerotich

52 <https://fmnrhub.com.au/projects/fmnr-east-africa-kenya>

53 <http://fmnrhub.com.au/wp-content/uploads/2013/09/SFLEI-End-project-evaluation-FINAL.pdf>

54 <https://www.theguardian.com/environment/2019/sep/19/greta-thunberg-we-are-ignoring-natural-climate-solutions>

CLIMATE JUSTICE, CHILDREN AND INTERGENERATIONAL EQUITY

Climate change is creating a crisis for children. The regions of the world most vulnerable to the impacts of climate change tend to have proportionately large and rapidly-growing child populations.⁵⁵ Children, especially from the most vulnerable and marginalised backgrounds, are more exposed to and disproportionately affected by climate change than any other group, despite being the least responsible for it. This is the injustice of climate change.

Drought, floods, extreme weather events, rising temperatures, and desertification directly undermine a broad spectrum of children's rights, from access to food and safe water, to housing, education, and – too frequently – their right to survive and thrive. There is a real risk that climate change could reverse 25 years of gains made in child health and reducing child mortality.⁵⁶ Girls and boys are at greater risk of a wide range of climate-related impacts, such as increases in vector-borne diseases, under-nutrition, diarrheal diseases and heat stress, more so than adults.⁵⁷

The 2015 Paris Agreement acknowledges climate change is a “common concern of humankind.” It states that action to address climate change should respect, promote and consider the rights of children alongside the rights of indigenous peoples, people with disabilities and other marginalised groups.⁵⁸

Although they are often not given space to participate in making decisions about their environment, children and youth are increasingly raising their voices because they understand environmental emergencies are issues of intergenerational justice. Since 2018, when Greta Thunberg (then 15 years old) held her first school strike, more than 10 million young people from 260 countries have joined school climate strikes to demand greater action on climate change.

The best interests of children should be front and centre in all policymaking, but especially in addressing climate change given children have the most at stake.



55 <https://www.ohchr.org/sites/default/files/WorldVisionInputs2.pdf>

56 [https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196\(20\)30274-6/fulltext](https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(20)30274-6/fulltext)

57 As above.

58 <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>

CHAPTER 4:

RESTORE LAND, RESTORE WATER

Key points:

- By 2025, two-thirds of the world will be living under “water-stressed” conditions with 1.8 billion people experiencing absolute water scarcity.
- Restoring degraded land is a key solution to buffer the extremes of climate change – too much and too little rainfall. Water absorbs into the soil under trees at 67 times the rate at which it infiltrates into soil under grass, and this reduces run-off and erosion, limits flooding, stores water in the soil and recharges groundwater supplies.
- Over 75 per cent of the world’s renewable water supplies is provided through forests and about 40 per cent of rainfall over land originates from plants.

WATER SCARCITY AND CLIMATE CHANGE

Water covers 70 per cent of our planet. However, fresh water – what we drink and use to wash, clean, cook and irrigate our farms and gardens – is incredibly rare.

Only 3 per cent of the world’s water is fresh water, and two-thirds of that is locked away in frozen glaciers or otherwise inaccessible.⁵⁹ Freshwater is critical to life on this planet. Without water, there is no realisation of so many other fundamental human rights – life, health, and indeed food all require the sustenance of water.⁶⁰

Water scarcity is rising. Today, 1.1 billion people worldwide lack access to water, and 2.7 billion people find water difficult to access for at least one month of the year.⁶¹ About 400 million people lack access to adequate and hygienic sources of water in Africa alone.⁶² Aquifers around the world are being depleted at a faster rate than replenished, as demand for agriculture and other water-intensive activities increases.⁶³ Protracted droughts, exacerbated by climate change, are draining the world’s groundwater and the increasing frequency and intensity of rainstorms is doing little to make up for the loss in the world’s freshwater supply.⁶⁴ By 2025, it is estimated 1.8 billion people will live in countries or regions with absolute water scarcity, and two-thirds of the world’s population could be living under

water stressed conditions.⁶⁵ By 2045, water scarcity will be responsible for the displacement of 135 million people.⁶⁶

The situation is particularly stark in Sub-Saharan Africa, home to the largest number of water-stressed countries of any region. Based on a monthly analysis of 50,000 weather stations worldwide to measure rainfall, researchers found the incidence of very dry months has increased by 50 per cent in Sub-Saharan Africa due to climate change.⁶⁷ Disturbingly, this is in a world that is one degree warmer than pre-industrial levels. The impact from predicted increases of two to three degrees is terrifying.

The graphic below shows how climate change is expected to affect water scarcity through to 2100. Hundreds of millions of people will experience new or aggravated forms of water scarcity. Even two degrees of warming – the international target – will leave 485 million exposed, so dramatically improved availability and management of water will be critical.

59 <https://www.worldwildlife.org/threats/water-scarcity>

60 Resolution A/RES/64/292. United Nations General Assembly, July 2010. General Comment No. 15. The right to water. UN Committee on Economic, Social and Cultural Rights, November 2002

61 <https://www.worldwildlife.org/threats/water-scarcity>

62 <https://www.brookings.edu/blog/africa-in-focus/2021/07/23/addressing-africas-extreme-water-insecurity/>

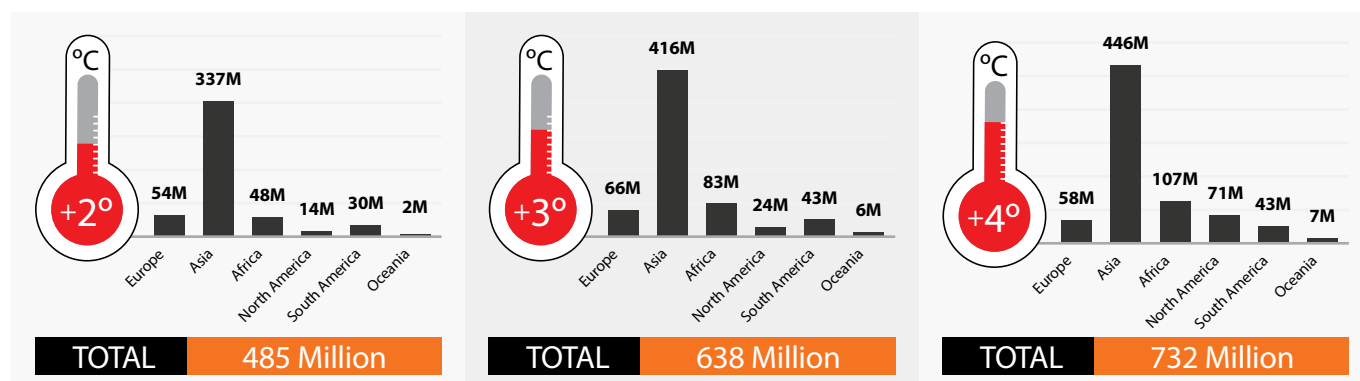
63 <https://www.newsecuritybeat.org/2015/06/nasa-data-reveals-major-aquifers-depleting-faster-recharge/>

64 <https://www.worldwildlife.org/threats/water-scarcity>

65 <https://www.un.org/waterforlifedecade/scarcity.shtml>

66 <https://www.un.org/en/observances/desertification-day>

67 <https://www.reuters.com/article/us-climatechange-africa-drought-idUSKBN10C1PT>

Figure: Additional people facing new or aggravated water scarcity under different climate scenarios⁶⁸

WATER SCARCITY AND CHILDREN

Water crises are children's crises. Around 450 million children live in areas of high or extreme water vulnerability. This means they do not have enough water to meet their needs. Every day, over 700 children under five die from diarrhoea linked to inadequate water, sanitation and hygiene. By 2040, almost one in four children will live in areas of extreme water stress.

RESTORE FORESTS, RESTORE WATER TABLES

For generations, it has been assumed trees soak up valuable water resources, especially in arid areas.

Protecting tree coverage and securing water for livestock or crops were seen as competing interests. In most cases, they are mutually reinforcing. Multiple studies have since shown moderate levels of tree cover increase water tables, and the removal or degradation of trees does not improve water access but rather increases the risk of drought.

Trees and forests are fundamental to a sufficient and safe global water supply. Forests regulate water flow and filter the water that enters our natural water systems – rivers, lakes, streams and groundwater. A US study found every US\$1 spent on protecting a forest watershed can save US\$7.50 to US\$200 in new water treatment and filtration facilities due to the ability of trees and root systems to filter water.

Trees improve water retention in the soil. Root systems, fallen leaves and organic material on the forest floor slow down water and allow it to enter porous soil, reducing run-off and erosion and recharging groundwater. Water soaks into soil beneath trees at 67 times the rate that it soaks into soil under grass.⁶⁹ Water flows deep into the ground down channels formed by tree roots. The soil there is like a sponge, a reservoir which absorbs water and then releases it slowly.

Trees transpire water into the atmosphere, contributing to the formation of clouds and rain. Over 75 per cent of the world's renewable water supplies are provided through forests.⁷⁰ On average, 40 per cent of rainfall over land originates from evapotranspiration from plants.⁷¹ That figure is even higher in regions with significant forest cover.

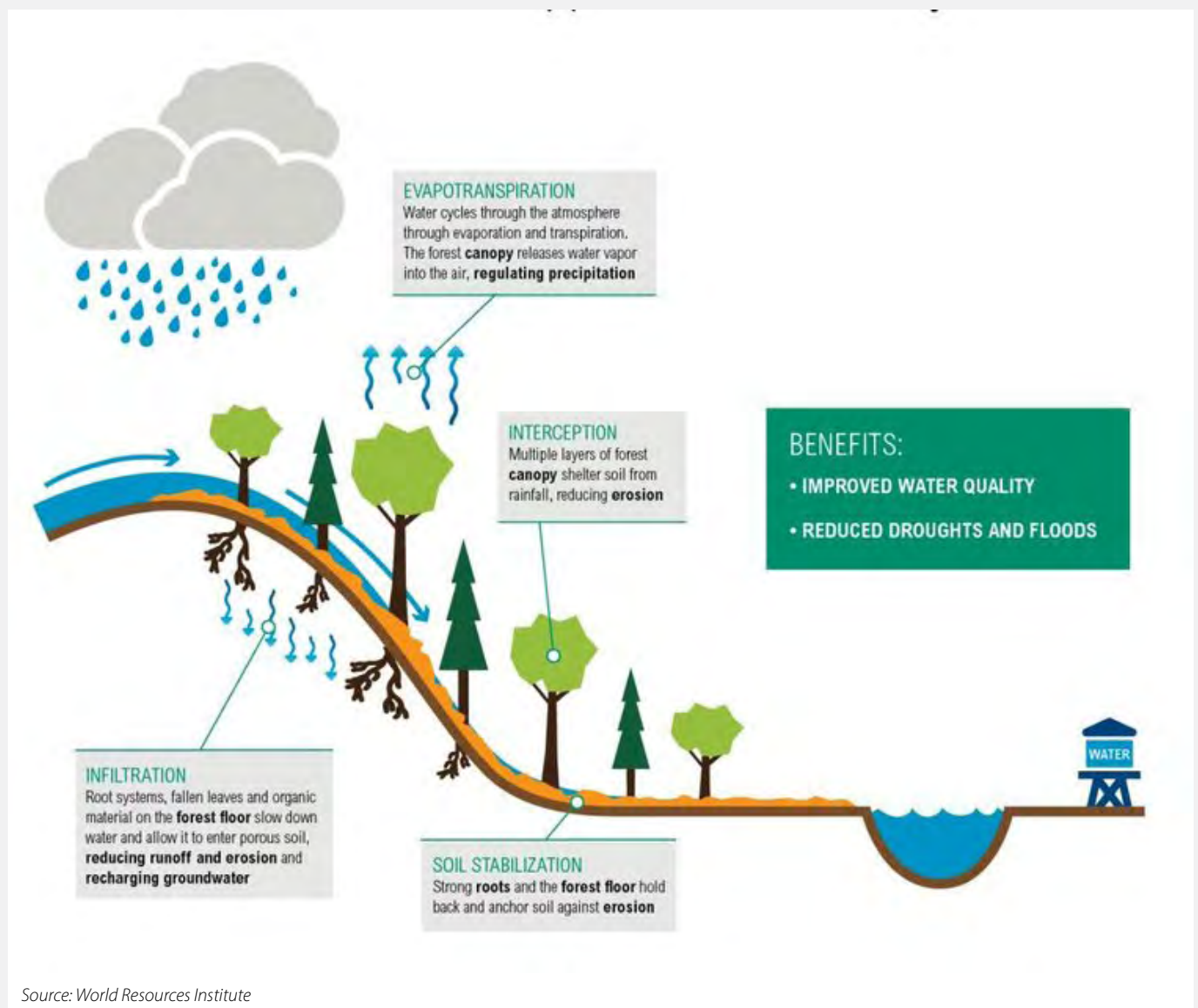
⁶⁸ <https://www.euractiv.com/section/development-policy/infographic/how-climate-change-will-affect-global-water-scarcity-by-2100/>

⁶⁹ <http://www.theguardian.com/commentisfree/2014/jan/13/flooding-public-spending-britain-europe-policies-homes>

⁷⁰ <https://www.fao.org/policy-support/tools-and-publications/resources-details/en/c/1439629/>

⁷¹ As above.

Figure: How tree coverage improves water security⁷²



THE SOIL BECOMES THE DAM

By the simple acts of restoring tree cover, keeping the soil covered and increasing soil organic matter, water can be ‘banked’ in soil and water tables can be recharged – the soil becomes a natural water reservoir.

Key to achieving this is soil organic matter. This biologically-active component of soil improves water infiltration and storage, while also supporting biological activity and providing nutrients for plants to grow. Soils high in organic matter act more like sponges, absorbing excess water during high rainfall events and slowly releasing that moisture over time during periods of no

or little rain. The restoration of trees is critical to increase soil organic carbon (from mulch, leaf litter and roots) and subsequently improve the water-holding capacity of soils. For every 1 per cent increase in soil organic carbon, an additional 168,000 litres of water can be stored per hectare.⁷³ On the other hand, soils that are compacted and low in organic matter lead to surface run-off.

72 <https://www.wri.org/insights/forests-near-or-far-can-protect-water-cities>

73 <https://www.thomaselderconsulting.com.au/news/news-carbon-farming/carbon-farming-practicalities/>

CASE STUDY: REJUVENATING WATER TABLES AND SPRINGS IN NIGER AND ETHIOPIA

Where FMNR has been conducted at scale in Niger and Ethiopia, there has been a material increase in the level of water tables. And springs which had dried up long ago started to flow perennially again.

Tigray region is one of the most water insecure regions of Ethiopia. However, since Tigrayan communities have combined soil and water conservation measures with the natural regeneration of trees, the hills and valleys where FMNR is practiced have become some of the most water secure areas in the country. In Abreha Weatsbha, for example, the community stopped overexploiting vegetation on local hills and instead dug contour banks and promoted natural regeneration through FMNR. Over time, more water soaked into the ground, recharging water tables. In just two years, the water table rose from nine metres below the surface to less than three metres. In several places, the water table rose to such an extent that it is even coming out of the ground under pressure. Community leader Aba Hawi

calls this approach “water banking”. He says: “We make our deposit in the hills and withdraw it in the valley.” Now, even in drought years, the community grows two to three crops per year through irrigation by drawing on their “deposit”.

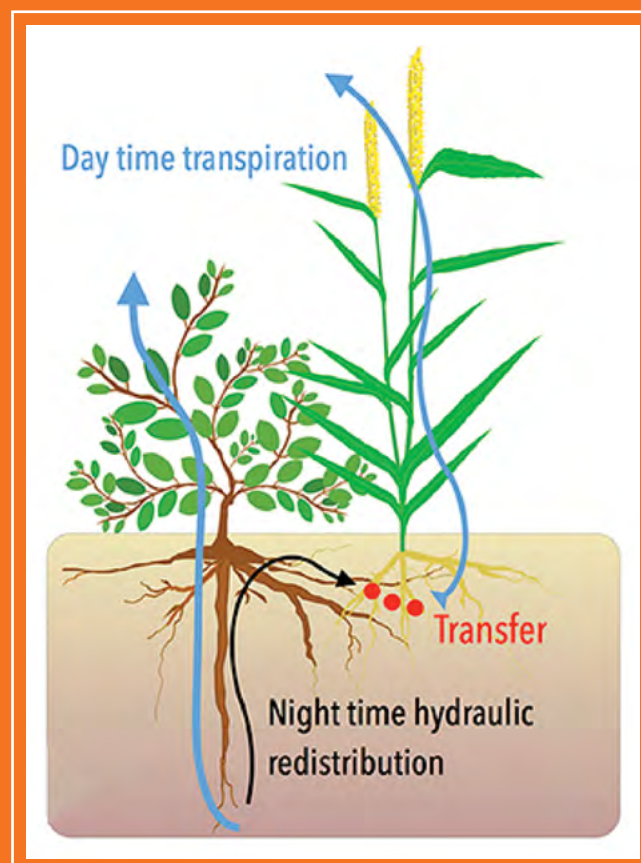
It was a similar story on Mount Damota in Southern Ethiopia. Years of heavy deforestation contributed to most of the springs in the area drying up completely, or only flowing after heavy rains. Within a few years of applying FMNR to regenerate trees on 500 hectares of land, 12 formerly dry springs returned and one completely new spring appeared. Nine of these water springs now flow permanently throughout the year, providing water security for a previously water scarce community.

TREES AS NATURE’S IRRIGATORS

Scientists in Senegal have discovered certain tree species act as irrigators through a process called ‘hydraulic redistribution’.⁷⁴

They found trees’ tap roots drew water from deep layers of the soil during the day and leaked some of that moisture into the shallow soil layers at night, essentially irrigating surrounding vegetation. Shallow-rooted crops planted near such trees benefitted from the increased soil moisture the trees provided. In this sense, trees can act as ‘natural irrigators’ for crops, improving water security and food security at the same time.

Bio-irrigation has tremendous potential to buffer against droughts and ensure productivity in regions with erratic rainfall. Treating trees as irrigators and soils as sponges can give farmers and communities a greater appreciation of natural regeneration and its wide-ranging benefits.



⁷⁴ Diagram source Bogie NA, Bayala R, Diedhiou I, Conklin MH, Fogel ML, Dick RP and Ghezzehei TA (2018) Hydraulic Redistribution by Native Sahelian Shrubs: Bioirrigation to Resist In-Season Drought. <https://www.frontiersin.org/article/10.3389/fenvs.2018.00098>



Scholastica and Justin's children splash water in the river that "never used to be there". Sarah Ooko © 2020 World Vision.

RIVER RUNS AGAIN FOR DRYLAND FARMERS AND THEIR FAMILY

Canopies of acacia trees give shelter from the scorching sun and sweltering heat at Justin's home in Mogotio, in Baringo County, Kenya.

Within the compound, a meandering river with clean water flows in different sections of the land.

This landscape around Justin's home about a decade ago was very different.

"The land you see here was largely bare. It looked like a desert, with thickets and bushes here and there," he said.

"Even this river never used to be there. Once in a while, after the rains, we would see a stream that would disappear shortly thereafter, leaving us with no water."

The main contributors to the environmental degradation were deforestation and the overgrazing of livestock over many years. This left the land bare and unproductive.

"With no pasture nearby, I had to walk for a long distance to look for available grazing lands," he notes.

Things changed when Justin embraced FMNR. Justin is among the many farmers in the country's dry land areas that have reaped the immense environmental and economic benefits of the technique.

Through FMNR, he was able to revive the indigenous acacia trees in his land and it turned around their fortunes.

"They helped to prevent erosion and make the soil fertile. This has encouraged the growth of grass on my land. I now have enough for my cattle," he says.

To sustain livestock feeds all year round, Justin always ensures that he has saved as hay some of the grass from when they have plenty during the rainy season. Aside from the hay, the bark of acacia trees are a good source of livestock fodder during dry spells. They are drought resistant and stay standing, long after other vegetation has dried up. "During drought periods, we cut the barks of the trees, which are highly nutritious and give them to our animals," says Scholastica, Justin's wife.

The sustainability of feeds and good management practices has improved livestock productivity, tripling the quantity of milk that the family gets from its cattle.

"...they [indigenous acacia trees] have helped to prevent erosion and make the soil fertile."

– Justin

"My children used to drink black tea. But now they drink tea with milk because we get enough for home consumption and for selling too," Scholastica said.

Justin no longer needs to travel far in search of pasture for livestock.

During pruning, the chopped branches of acacia trees are usually used as manure to fertilise the soil. This has boosted crop yields leading to bumper harvests of maize, beans, fruit trees, vegetables and other plants in the family's farm.

"We usually have food all year round and surplus to sell. My children are healthy," said Scholastica.

CHAPTER 5:

RESTORE LAND, RESTORE PEACE

Key points:

- Natural regeneration is a powerful, but underutilised, way to promote peace and prevent conflict, especially at the local level.
- Climate change is acting as a ‘threat multiplier’ in already fragile parts of the world, exacerbating resource competition, supercharging displacement and migration, and intensifying existing community tensions. These multiplier effects are expected to worsen as the climate warms further.
- Natural regeneration efforts like FMNR have a ‘cooling’ effect not only on the climate, but on community tensions by reducing resource competition and fostering social cohesion, such as between nomadic herders and farmers.

NATURAL REGENERATION AS A FORM OF PEACEBUILDING

Restoring the environment can prevent natural resource conflict.

Restoring the environment can prevent natural resource conflict. The process of community-driven natural regeneration itself – inclusive assessments of available resources, planning of equitable, sustainable use by different parties, and establishment of nonviolent systems to deter and penalise rulebreakers – helps to divide resources more fairly, preventing the creation of grievances and triggering events that can cascade into violent conflict.

In discussions around potential solutions to the challenges of violent conflict and forced displacement, protecting

environmental assets and ensuring their equitable use has not traditionally been front of mind for policymakers as a form of conflict prevention. But, as this chapter shows, natural regeneration has eased community tensions and supported peacebuilding in various contexts, including in fragile settings. Protecting and restoring ecosystems and forests is therefore no longer the exclusive concern of environmentalists, or farmers for that matter, but also for those concerned with advancing national and international peace and security.



Sarah Ooko © 2021 World Vision

A SAFER PLACE TO LIVE

Women (pictured) in Baringo County, Kenya, revived indigenous trees on their farms through FMNR, boosting grass growth as fodder for their livestock. They say they are no longer vulnerable to animal attacks, sexual abuse and conflict from warring communities previously experienced when they would go into the forest in dry season to look for pasture for their animals.

CLIMATE CHANGE AND CONFLICT

For many national security experts, climate change is considered a ‘threat multiplier’.⁷⁵ Rather than directly causing conflict, the impacts of climate change exacerbate existing conflict triggers, such as resource competition, migration, and economic inequality. In some cases, climate impacts may be the ‘tipping point’ that pushes fragile communities into social breakdown and disruption, and ultimately armed conflict.

In October 2021, the US National Intelligence Assessment identified three principal risks between now and 2040 arising from the consequences of climate change.⁷⁶ It predicted:

- Climate change will exacerbate instability in fragile states
- Climate change will fuel a rise in inter-state resource competition
- Climate change will trigger diplomatic tensions as a consequence of increasing displacement/migration flows within and between countries.

Conflict-prone Central Africa and the low-lying island nations of the Pacific are identified as two “regional arcs of vulnerability” where climate change is expected to exacerbate existing grievances, fuel insecurity, and cause humanitarian crises.

In recognition of the impact climate change is having in the Asia-Pacific region, the Australian Government has similarly announced a national climate and security risk assessment. This is consistent with calls made by the Australian Security Leaders Climate Group, comprised of former senior military leaders, “that climate change now represents the greatest threat to the future and security of Australia.”⁷⁷

NATURAL REGENERATION AND RESOURCE COMPETITION

Through the restoration of vital ecological processes, FMNR can transform a situation of resource scarcity into surplus, even in the harshest of environments. As once barren landscapes are revitalised, availability of land and water resources increases, improving opportunities for crop production and livestock rearing. With improved access comes reduced competition and disputes over productive land, including between neighbouring farmers and between farmers and pastoralists. Despite its simplicity and low cost, FMNR can restore degraded ecosystems and, by doing so, reduce some common triggers for communal conflict.

Most financially poor people in developing countries depend on land and water for their incomes (for example in agriculture, pastoralism, and fishing), however, the impacts of climate change (such as longer periods of extreme heat, increasing rain variability, and more frequent and severe weather events) can erode and even destroy assets and livelihoods. As agricultural yields, grazing land, fishing stocks, and water diminish, so do incomes. In the absence of income alternatives, there is a greater risk that people use violence to protect or to access dwindling resources. Natural regeneration offers an alternative – a solution which means people can retain their livelihoods and share in more abundant resources.

75 <https://thehagueinstituteforglobaljustice.org/climate-change-as-a-threat-multiplier-for-human-disaster-and-conflict/>

76 US National Intelligence Council (2021): https://www.dni.gov/files/ODNI/documents/assessments/NIE_Climate_Change_and_National_Security.pdf

77 <https://reneweconomy.com.au/climate-greatest-threat-to-australias-security-ex-defence-chief-says/>

NATURAL REGENERATION AND SOCIAL COHESION

Multiple evaluations of FMNR have found that it improves trust, mutual understanding, and cooperation among community members, including in conflict affected areas. This is because FMNR is so much more than a technical practice. It is a transformational, participatory process with community engagement and empowerment at its heart. FMNR is built around a collective action approach which includes forming groups, communal visioning and action planning, and developing shared bylaws and ways of working. Furthermore, the environment is a shared resource which has the potential to unite disparate groups within a community. By meaningfully engaging in these social development processes, community members can establish and strengthen interpersonal relationships and networks with others, openly and safely discuss grievances and concerns in a communal forum, and work collaboratively to identify shared solutions to common problems.

FMNR has particular relevance for the challenge of mass displacement. First, by addressing resource scarcity, natural regeneration solutions like FMNR can also help to prevent and slow the forced migration of communities within and between countries by addressing key push factors, such as severe and prolonged food and water insecurity.⁷⁸ Second, FMNR as a community-driven approach can be a powerful tool to address and resolve tensions between displaced and host communities, while simultaneously working to



This community farmer group in Kenya is trained in technologies such as rainwater harvesting, zai pits, agroforestry, micro dosing, small-scale irrigation, on-farm FMNR, soil conservation, contour bunds, and fertility enhancement. Nick Ralph © 2018 World Vision.

ensure that the natural resource base can accommodate the new arrivals.

While a primary outcome of FMNR is a change in mindset – shifting individual and communal attitudes to address the causes and consequences of environmental degradation – a secondary and complementary outcome of this process is improved social cohesion. By bringing communities to work on the shared project of environmental restoration, the FMNR process can enhance horizontal social cohesion by building trust and a sense of interdependence and common destiny among community members.

CONFLICT RESOLUTION THROUGH SUSTAINABLE MANAGEMENT OF TREES IN GHANA

– A testimony from Abu Ananga, a 57-year old Fulani herdsman who benefitted from an FMNR project in Ghana

“FMNR has promoted peaceful co-existence between we the Fulani herdsman around Akara and the people of the Akara area in Garu. Previously we (the herdsman) had to travel long distances in search of fodder for our cattle. This caused daily disputes between us and farmers of this part of Garu as a result of our cattle destroying crops as we search for fodder. Humiliation was like our daily food as insults kept on pouring on us which sometimes led to a fight with the farmers. But now, we are glad to have abundance of fodder at Akarateshie Natinga where we can easily move our cattle to graze without destroying crops from people’s farm and picking up quarrel with them.

Incomes from the sales of our cows have also increased tremendously as the presence of the fodder has helped to increase the sizes of the animals we now take to the market to sell. All I can say to this person called World Vision is thank you and God bless you for touching the lives of my family and myself indirectly with your project.”

78 <https://fmnrhub.com.au/conflict-resolution-sustainable-management-trees-ghana>

CHAPTER 6:

RESTORE LAND, RESTORE FIRST NATIONS STEWARDSHIP

Key points:

- First Nations communities and Indigenous Peoples have practiced nature-based solutions for millennia.
- First Nations communities manage one third of the earth's land surface, 80 per cent of global biodiversity, and 40 per cent of conservation areas. Deforestation rates are two to three times lower in States with legally recognised land tenure for indigenous communities.
- Natural regeneration efforts should be scaled up in ways which build on Indigenous knowledge.

Nature-based solutions are not new. In fact, First Nations or Indigenous Peoples have practiced nature-based solutions (or ecosystem-based management) for millennia. For many First Nations communities, sustainability and connection to the earth and all living things are core to their identities, cultures and ways of life. Caring for country is fundamental to who they are.

Modern environmental values that respect land and sea and emphasise sustainability are increasingly drawing upon the traditional knowledge and belief systems of First Nations communities. For example, the Intergovernmental Panel on Climate Change recently highlighted the role that Indigenous knowledge systems play in adaptation and mitigation,⁷⁹ and the IPBES Global Assessment confirmed that nature is declining less rapidly in lands and forests stewarded by Indigenous Peoples.⁸⁰ Land and sea are of intrinsic spiritual value to First Nations communities

– this reverence has made them exemplars of environmental protection.

Who better to lead the regeneration effort than the communities that have made a practice of a 'do no harm' approach to the environment for millennia? There is a huge opportunity to learn from First Nations and Indigenous communities as part of the project of environmental restoration. Indigenous Peoples' traditional knowledge and knowledge systems are key to designing a sustainable future for all.

FIRST NATIONS COMMUNITIES AS CUSTODIANS OF NATURE

There are approximately 370 million Indigenous Peoples today representing thousands of languages and cultures.⁸¹

Despite constituting only 5 per cent of the global population, First Nations Peoples steward between 13 per cent and 20 per cent of global lands.⁸² Indigenous-held territories represent 40 per cent of protected areas globally and contain an estimated 80 per cent of globally remaining biodiversity, stewarding nearly one-fifth of the total carbon sequestered by tropical and subtropical forest.⁸³

A recent analysis of forest landscapes found that there was a higher proportion of intact forests on Indigenous Peoples' lands (10.9 per cent) than on other lands (6.8 per cent).⁸⁴ This was confirmed by a country-based comparison, which

found that over one third of the world's remaining intact forests are located on Indigenous Peoples' lands.

Moreover, deforestation rates are two to three times lower in areas with legally recognised land tenure for Indigenous communities – a reflection of the effectiveness of First Nations communities as stewards of the environment. A 12-year study in the Bolivian, Brazilian, and Colombian Amazon found deforestation rates in Indigenous territories were two-to-three times lower than in other similar forests (see graph). Even though indigenous territories cover 28 per cent of the Amazon Basin, they only generated 2.6 per cent of the region's carbon emissions, according to the study.⁸⁵

79 www.ipcc.ch/srccl/faqs special report on climate change and land.

80 <https://ipbes.net/news/Media-Release-Global-Assessment>

81 https://www.un.org/esa/socdev/unpfi/documents/5session_factsheet1.pdf

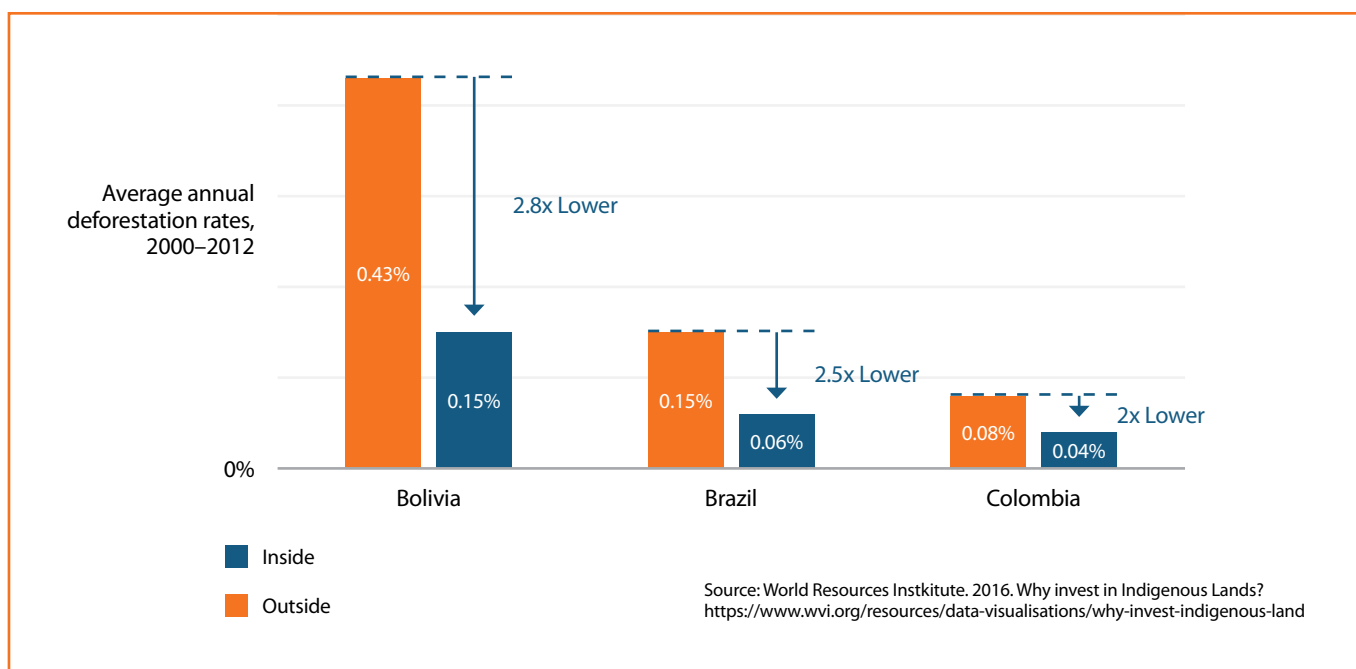
82 Seddon, N. Nature-Based Solutions in Nationally Determined Contributions. University of Oxford: IUCN (2019) <https://portals.iucn.org/library/node/48525>

83 Vogel, B.; Yumagulova, L.; McBean, G.; Charles Norris, K.A. Indigenous-Led Nature-Based Solutions for the Climate Crisis: Insights from Canada. *Sustainability* 2022, 14, 6725. <https://doi.org/10.3390/su14116725>

84 <http://www.researchgate.net/publication/338412873> - Importance of Indigenous Peoples' lands for the conservation of Intact Forest Landscapes

85 www.fao.org/americas/publicaciones-audio-video/forest-gov-by-indigenous/en/

Deforestation rates, inside and outside indigenous woodlands



FIRST NATIONS AND CLIMATE CHANGE

First Nations communities are on the frontlines of climate change. They are directly suffering the impacts of global warming on the ecosystems or landscapes they inhabit, which is especially traumatising given their close relationship with the environment and its resources. The story of climate change and its legacy of loss and damage is in many ways a modern story of Indigenous dispossession. Desertification, rising sea levels, destruction of traditional sources of food and water – increasingly common stories that speak to

the direct assault of climate change on First Nations communities' ways of life, indeed their very right to exist.

While Indigenous Peoples are at the forefront of experiencing the problem of climate change, they are well familiar with the solution – living in balance with nature. First Nations ways of knowing, being and doing are grounded in sustainability and connection, both to people and to country, which are critical for addressing climate change.

THE STATE OF OUR ENVIRONMENT – INDIGENOUS VOICES

In Australia, the 2021 State of our Environment Report (released in June 2022) for the first time included historic First Nations input, including as co-lead authors. The results paint a bleak picture of the current state of Australia's environment.⁸⁶

Australia has lost more mammal species than any other continent, and has one of the highest rates of species decline in the developed world. Almost half the country is now used for grazing and the areas committed to forestry and cropping having increased. More than 6.1 million

hectares of primary native forest (an area more than six times the size of suburban Melbourne) had been cleared since 1990. Changes in land use mean Australia has the third largest cumulative loss of soil organic carbon in the world behind China and the US, a change that has serious implications for global warming.

Indigenous protected areas make up nearly half the national reserve system, but Indigenous people have poor access to finance and other critical support needed to manage their country.

⁸⁶ Australia State of the Environment 2021 <https://soe.dcceew.gov.au/>

FMNR AND FIRST NATIONS

In many places around the world, indigenous people used vegetation management practices strongly reminiscent of FMNR. Having “clean” agricultural fields for example was a concept introduced by many colonisers, where first nations or indigenous agricultural systems may have involved more complex integrated agroforestry and rotational harvesting regimes, where timber and tree products were harvested as needed, and allowed to regrow again, according to community agreements.

Traditional systems of managing and regrowing trees in agricultural landscapes like this are still in use today in places like Malawi, where more than 3 million hectares of land is managed with naturally regenerated trees.

Landscape restoration should be community led, and prioritise the support and scale up of first nations or indigenous land management practices that meet local ecosystems needs first.

A FIRST NATIONS-LED APPROACH

As we elevate the importance of nature-based solutions throughout this report, we are calling at the same time for the deeper integration of First Nations principles into the management of natural resources. For that to happen, First Nations people and traditional owners must sit at the decision-making table, determining how we meet the great challenge of climate change.

Where it hasn't been done already, governments should confer legal recognition and protection to Indigenous Peoples' lands through measures such as forest titling programs, which limit new colonization and enable First Nations Peoples to care for their lands. No group has more at stake, and no group has more to offer. The modern alliance we are calling for between farmers and environmentalists must include the voices of First Nations and traditional owners of land and sea.



Meyagari Group, in one of Kenya's driest counties, has seen their land transform from dusty bare ground to lush field with pastures.
Wesley Koskei © 2020 World Vision.

RESTORE CLIMATE

– OUR RALLYING CALL

Farmer Managed Natural Regeneration has been underutilised in the fight against climate change.

We must fully unlock the potential of nature to help address the mega-challenges of our time:

- **Climate change**
- **Food and water insecurity**
- **Conflict**

Governments and the private sector can become global leaders in natural regeneration methods such as FMNR.

The environmental, social and economic value of restoring nature is undeniable.

Join our scale-up of FMNR.



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