

A BETTER WORLD

— VOLUME 8 —



Actions and Commitments in support of the Sustainable Development Goals

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Keeping the 1.5C hope alive

Sean Nicklin, Editor, A Better World

The last decade was the warmest recorded in history. Climate change is affecting the global community in every nation across the world. It impacts lives and livelihoods, especially of those in vulnerable conditions.

Climate change continues to exacerbate the frequency of natural disasters, such as massive wildfires, droughts, hurricanes and floods. It has brought about greater weather extremes and rising sea levels, and the effects are felt worldwide.

From 2000 to 2018, the greenhouse emissions of developed countries and economies in transition declined by 6.5 per cent. However, the emissions of developing countries rose 43 per cent in the period between 2000 and 2013. In 2019, at least 120 of 153 developing countries had undertaken activities to formulate and implement national adaptation plans.

One result of the Covid-19 pandemic was that greenhouse gas emissions reduced, as lockdowns that were introduced

to thwart the spread of the virus led to a massive fall in travel. But this was only short-term respite. As we emerge from the pandemic, we are returning to previous habits.

Greater action is required to combat the devastating impacts of climate change.

New technologies, increased financial investment and greater focus on sustainable development will help. The 17 interlinked Sustainable Development Goals (SDGs) are designed to be a “blueprint to achieve a better and more sustainable future for all”. Established in 2015 by the United Nations General Assembly, the SDGs are intended to be achieved by 2030.

The official mission statement of SDG 13 is: “Take urgent action to combat climate change and its impacts”. There are five targets of this SDG, covering a range of issues surrounding climate action. The first three are ‘output’ targets: Strengthen resilience and adaptive capacity to climate-related disasters; integrate climate change measures into policies and planning; build knowledge and capacity to meet climate change.



Climate change has brought about greater weather extremes and rising sea levels



Images: COP26



Speakers at COP26 in Glasgow included, clockwise from top, UN Secretary-General António Guterres, UK Prime Minister Boris Johnson and HRH The Prince of Wales

The remaining two targets are ‘means of achieving’ targets: To implement the UN Framework Convention on Climate Change, to promote mechanisms to raise capacity for planning and management.

The United Nations Framework Convention on Climate Change (UNFCCC) is the primary international, intergovernmental forum for negotiating the global response to climate change. UNFCCC states that the annual Conference of the Parties (COP), serves two main purposes:

To review the implementation of the Convention, the Kyoto Protocol and the Paris Agreement, respectively, and to adopt decisions to further develop and implement these three instruments.

Specific objectives are also set for each COP. Prior to COP26, four goals that needed to be achieved were set out. These were:

- Secure global net zero by mid-century and keep the 1.5C (above pre-industrial levels) target for temperatures within reach, by accelerating the phase-out of coal, curtailing deforestation, speeding up the switch to electric vehicles and encouraging investment in renewables.
- Adapt to protect communities and natural habitats, by enabling and encouraging countries to protect and restore ecosystems, and building defences, warning systems and resilient infrastructure and agriculture to avoid loss of homes, livelihoods and even lives.

CLIMATE ACTION

- Mobilize at least US\$100 billion in climate finance per year by 2020.
- Work together to deliver at COP26, by finalizing the Paris Rulebook and accelerating action to tackle the climate crisis through collaboration between governments, businesses and civil society.

The COP26 international climate conference took place in Glasgow in late 2021. After 13 days of negotiations between nearly 200 countries, the Glasgow Climate Pact was signed, and the Paris Agreement's Rulebook was completed.

One real milestone moment of COP26 was a global agreement to phase down the use of unabated coal. The Glasgow Climate Pact is the first to explicitly mention coal, making it an ultimately successful outcome for the UK and other countries that have curtailed their use of coal.

Developing nations were provided with assurances for greater access to climate financing for both mitigation and adaptation, including greater support beyond the US\$100 billion annual funding currently promised. As this is only a fraction of the investment required for the climate crisis, combined with the fact that developed nations have failed to meet existing financing promises thus far, poor and vulnerable nations face an uncertain path to adaptation. Further, the failure of COP26 to secure a 1.5C world has left small island nations already facing the impacts of climate change understandably worried about their future existence.

While historic commitments were made in COP26 to get to a 1.8C world, delivering on these commitments will require significant effort by countries, sectors and corporates. The overall outcome was a small but positive step in the right direction towards keeping the 1.5C hope alive.



Images: United Nations



Significant efforts are required across the world to keep temperatures within the target of 1.5C above pre-industrial levels

Moving from rhetoric to action: African Development Bank's leadership in financing climate adaptation in Africa

*Balgis Osman Elasha, James Kinyangi, Fekadu Shimelis, Sonia Borrini and Fadekunayo Adeniyi
African Development Bank*

Africa is warming faster than the rest of the world. The surface temperature on the continent has increased more rapidly than the global average, and this is expected to continue in the future as well.

The UN's Intergovernmental Panel on Climate Change's sixth assessment report found that climate change is causing an increase of mean temperatures and hot extremes, more frequent marine heat waves, and a faster rate of sea-level rise. At the same time, the frequency and intensity of heavy precipitation events are projected to increase almost everywhere in Africa. The Sahara, the Horn of Africa and Central Africa are projected to have heavier precipitation and corresponding increases in pluvial flooding, while the Southern and Eastern Africa are projected to experience higher tropical wind speeds and more Category 4-5 cyclones. Sea-level rises will continue, contributing to increases in the frequency and severity of coastal flooding and accelerated coastal erosion.

This relatively higher exposure of Africa superimposed with the sensitivity of the economy, livelihoods, and infrastructures of the region and low adaptive capacity of its population means that Africa's vulnerability to climate change will certainly and progressively continue impacting its progress towards the Sustainable Development Goals. These impacts are felt economy-wide and estimates of the cost range between US\$7 to US\$15 billion per year. The cost of climate actions, as presented in the intended nationally determined contributions (NDCs) submitted by 53 African countries, is estimated at US\$3.5 to US\$4 trillion by 2030. Furthermore, the costs of adaptation for Africa are estimated to amount to US\$35 billion by 2050 and could be as high as seven per cent of the continent's GDP by 2100. Reactive and anticipatory adaptation measures will certainly entail substantial cost to Africa, though the cost of inaction is expected to be immense.

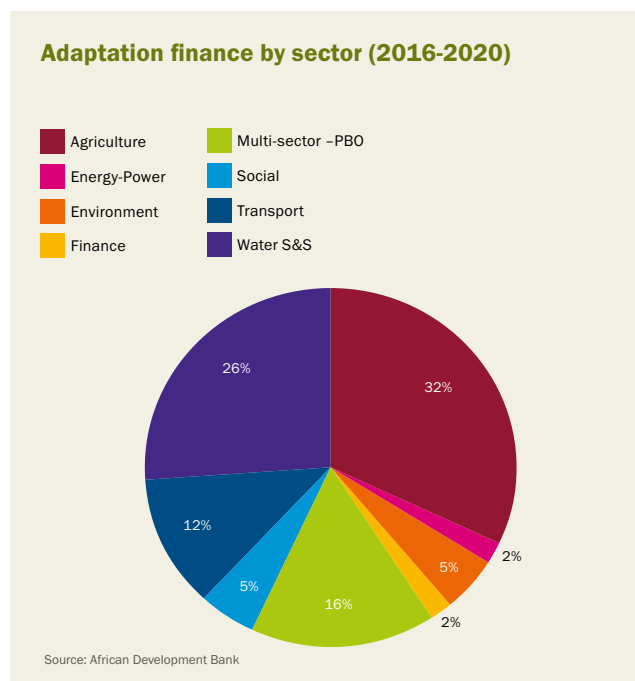
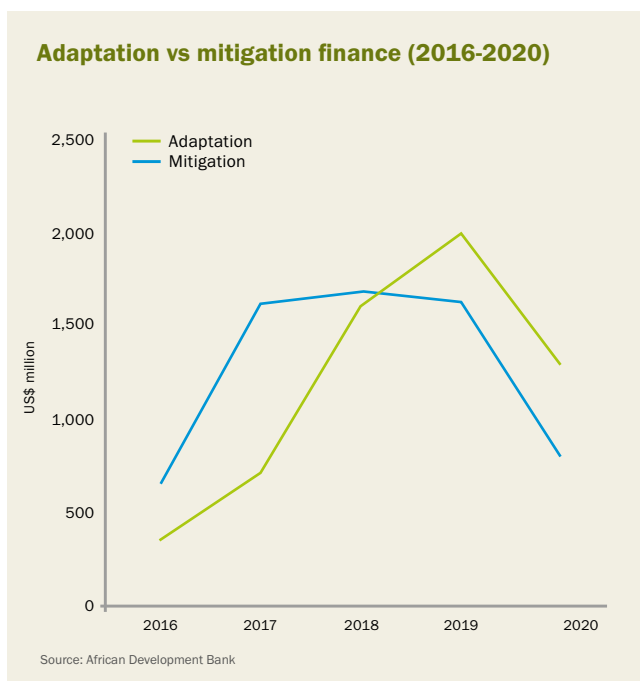
AfDB's leadership of Africa's response to climate change
African Development Bank (AfDB) holds a unique position as the leading pan-African development finance institution and as a trusted partner among the regional member countries, making it instrumental for Africa's climate response.

Its measures and initiatives to accelerate Africa's transition to a resilient and green economy are broadly directed to upstream, midstream and downstream actions. AfDB launched its systematic response soon after the UN Rio+20 conference in 2012, issuing a 10-year strategy in which the green economy was embedded as one of two strategic objectives. Subsequently, AfDB issued a green growth framework to guide Bank-wide actions. It further consolidated its priorities into High 5 Agendas: Power Africa, Feed Africa, Industrialize Africa, Integrate Africa and improve the quality of life of every African. Through the implementation of the High 5 Agendas, AfDB is committed to supporting the climate actions of African countries. The Bank also created the Climate Change and Green Growth Department to spearhead its efforts on climate change and green growth.

AfDB's climate action over the last decade is guided by two medium-term climate action plans, the first and second Climate Change Action Plans (CCAP1 and 2), which covered objectives for 2011-2015 and 2016-2020, respectively. CCAP2 was predicated on four pillars and aimed to consolidate the Bank's lead role in addressing climate change in Africa.

The first pillar aims to boost adaptation and climate-resilient development in Africa by assisting regional member countries to effectively integrate adaptation into key economic sectors and help realize the adaptation aspirations set out in their NDCs, as well as to ensure a link with the Sendai Framework for Disaster Risk Reduction 2015–2030. The second pillar aims to promote mitigation and low-carbon development in Africa. AfDB recognizes Africa's minimal contribution to global emissions. Nevertheless, the Bank strongly believes that ensuring low-carbon trajectory through, among other things, maximizing investments in clean energy, sustainable management of natural resources, and deploying technological solutions, will ensure the long-term sustainability of economic and social progress of the region.

The third pillar aims to scale up financing for climate action in regional member countries. AfDB is committed to allocate 40 per cent of its total annual approvals and various sources as climate finance by 2020 and to maintain the same post-2020. Cognizant of the critical role of adaptation in Africa, the Bank further set an objective of closing the



historical disparity between adaptation and mitigation. The fourth pillar aims to enhance that positive regulatory and policy environment which provides the context for climate actions and is widely acknowledged as being an instrumental precursor for action in Africa.

Accordingly, AfDB has made efforts during the last decade to have an impact on the ground and create high impact systems and structures that will influence the ecosystem for green and resilient economy in the region. Notably, it has created the African NDC Hub, the African Financial Alliance on Climate Change, the Africa Energy Market Place, the Desert to Power Initiative, the Power Africa initiative, and the Green Bond Program. Moreover, the Bank continued forming partnerships, including with the Global Centre for Adaptation, Global Green Growth Institute and others. For example, the partnership with the Global Centre for Adaptation has resulted in the hosting of an African Regional office and the launching of a programme to accelerate adaptation action in Africa, which, among other goals, aims to mobilize US\$12.5 billion by 2025, on top of the AfDB commitment to mobilize the same.

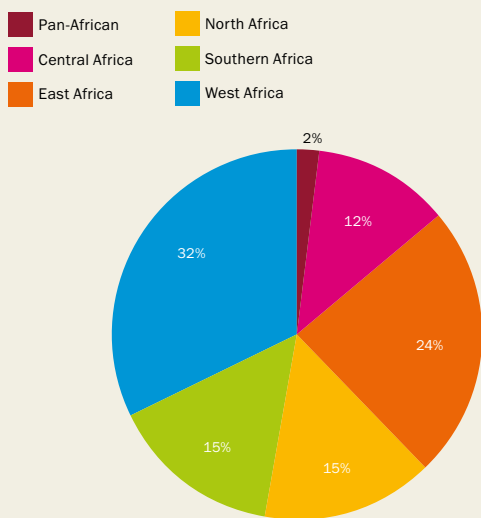
AfDB also directed substantial resource to climate action. It has made US\$24.3 billion of investment as climate finance during the last decade. Over the course of CCAP 2, for instance, the Bank has made US\$12.3 billion in climate finance available, with an equal split between mitigation and adaptation, reversing the situation during CCAP 1. Notably, AfDB is the only multilateral development bank where adaptation finance has been exceeding mitigation finance since 2018. During the implementation of CCAP 2, the Bank has approved over 250 targeted investments, with climate finance accounting for 50-100 per cent of the approved amount. Over the same period, AfDB has approved an additional 250 projects and programmes with built-in climate actions. During the implementation of CCAP1, meanwhile, the Bank approved approximately 260

projects with climate-relevant components. Delivering on these commitments is primarily propelled by anchor flagship programmes, such as Climate-Smart Agriculture, the Desert to Power Initiative, Africa Disaster Risk Financing, the ClimDev Special Fund, and investment in the water sector, as well as the Bank's Strategy for Addressing Fragility and Building Resilience. More importantly, AfDB adopted climate informed design for all projects approved by the bank, on top of committing targeted investment.

Adaptation and resilience will continue to be a priority in major policy and investment decisions at AfDB. This is enshrined in the new climate change and green growth policy, strategy and action plan. Climate change is mainstreamed in all Bank operations to ensure climate resilience and lessen the need for interventions to mitigate the impact of greenhouse gas emissions. The evidence suggests that due to this shift, the disparity between adaptation and mitigation finance was progressively closed from 36 per cent adaptation finance in 2016 to parity in 2018. Adaptation finance surpassed mitigation finance in 2018 and accounted for 63 per cent of climate finance in 2020. Moreover, the Bank's adaptation finance was directed to climate actions in seven sectors, most significantly to agriculture (32 per cent) and water supply and sanitation (26 per cent), where the two sectors accounted for 58 per cent of the total adaptation finance for the period 2016-2020. During this period the Bank allocated climate finance of about US\$1.903 billion to agriculture and US\$1.574 billion to water and sanitation sectors.

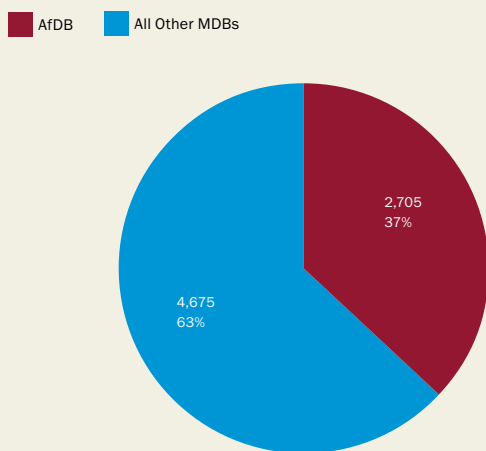
Some of the examples of adaptation projects in the agriculture and water sector include the Baixo Limpopo Irrigation and Climate Resilience Project in Mozambique; the Kandadji Ecosystems Regeneration and Niger Valley Development Programme in Niger; the Support Project for the Development of Value Chains in the Fisheries and Aquaculture Sector in Equatorial Guinea; the Water Valorization

Adaptation finance flow by regions from 2016 to 2020



Source: African Development Bank

Climate finance flow to SSA from AfDB and other MDBs in 2019



Source: African Development Bank

for Value Chain Development Project in Senegal; the Inclusive and Sustainable Development Program for Agricultural Sectors in Morocco; the Cabinda Province Agriculture Value Chains Development Project in Angola; Building Resilience for Food Security and Nutrition in Chad's Rural Communities Programme; the Post Cyclone Idai and Kenneth Emergency Recovery and Resilience Programme for Mozambique, Malawi and Zimbabwe; the Muvumba Multipurpose Water Resources Development Program in Rwanda; the Cotonou Stormwater Drainage Programme in Benin; the Thwake Multi-Purpose Water Development Program in Kenya; and, the Rural Drinking Water Supply Programme in Tunisia.



Image: ESKWOM

Sere Wind Farm, South Africa

Furthermore, the AfDB's approved adaptation finances is allocated to the climate actions in the river region and to regional programmes, 83 per cent of which are in sub-Saharan Africa, with West Africa and East Africa accounting for 56 per cent of all approved adaptation finance over the period of 2016-2020. This is clearly in line with the relatively higher climate change vulnerability observed in West and East Africa. While the Bank is a leader in terms of its emphasis on adaptation finance, the contribution to the overall climate finance is also remarkable. Overall, the Bank's climate finance accounted for about 37 per cent of the 2019 reported climate finance from all multilateral development banks (MDBs).

Key results from 2019 and 2020

One of the key results from climate adaptation financing was delivered through the Feed Africa operation completed in 2019 and 2020, which benefited about 36.7 million people, of whom 17.6 million are women, through improvements in agricultural productivity. Approximately 7,018 kilometres of feeder roads were built or rehabilitated, about 16,500 hectares of land were put under improved water management and around 100,000 people were enabled to use improved farming technologies. Operations completed in 2019 and 2020 have benefited 728,000 people, with new electricity connections delivering a 2.3-million-ton reduction of carbon dioxide emissions and providing access to reliable, affordable and modern energy services, which is envisaged to boost adaptive capacity of households and community through productive use.

Climate adaptation action on the ground — the case of Mozambique

Mozambique is ranked among the most vulnerable countries in Africa and is highly exposed to frequent extreme natural



Image: CIF

Xina One Solar Project, South Africa

events such as heavy rain, flooding, tropical cyclones, droughts and landslides, increasing livelihood vulnerability due to low adaptive capacities. Between 2000 and 2019, the average climate-related economic loss in Mozambique is estimated at 13 per cent of total GDP, equivalent to US\$46 million dollars. Furthermore, Mozambique lacks the appropriate physical and social climate resilience infrastructure and institutional capacity for disaster risk preparedness. By supporting the government of Mozambique in enhancing national climate resilience capacities in line with the country's NDC, the Bank is actively engaged in investing in short-, medium-, and long-term climate resilience measures.

Short-term investments include the Post Cyclone Idai and Kenneth Emergency Recovery and Resilience Program, through which AfDB has disbursed US\$46.47 million in enhancing agricultural productivity and resilience, rehabilitating socio-economic infrastructure and strengthening the national institutional capacities in disaster risk reduction and management.

Meanwhile, in order to enhance communities' long-term climate and livelihoods resilience, AfDB has mobilized US\$21.15 million through the Sustainable Land and Water Resource Management Project (SLWRMP) to help in promoting adaptation activities that improve watershed management and sustainable land management practices in drought-prone areas of the Gaza province. This includes US\$15.9 million from the Climate Investment Fund Pilot Program Climate Resilience. The SLWRMP has provided enhanced irrigation infrastructures, market infrastructure for agro-processing and promoted farm diversification, and increased production and food security. It has also strengthened communities' capacity to address interlinkage challenges for the adverse impact of climate change, rural poverty, food insecurity and land degradation. The project has improved the livelihoods of more than 59,000 people,

54 per cent of which are women, in Guijá, Mabalane, Chicualacuala, Mas-sagena and Mapa districts.

Also in the Gaza province, AfDB has contributed through the Baixo Limpopo Irrigation and Climate Resilience Project (BLICRP) in Xai-Xai district to increased value addition for agricultural commodities while enhancing climate resilience infrastructure development such as an agro-processing center, Magula pumping station and rural road rehabilitation. This represents a total estimated investment of US\$44.08 million, including a US\$15.98 million contribution from the Strategic Climate Fund — Pilot Program for Climate Resilience. The project has also contributed to build farmers capacities in adopting climate smart agricultural practices, positively impacting 8,000 smallholder farm families and 210 emergent farmers. It has also created a total of 115,752 jobs, with 52 per cent of direct beneficiaries being women.

Meanwhile, in improving climate change governance in Mozambique and enable private sector participation in climate risk financing especially in drought-prone agro-climatic zone areas, the Bank is providing institutional technical assistance for the Government of Mozambique to develop a Climate Resilience Strategy and Drought Insurance Scheme in the arid and semi-arid zones of Mozambique.

Lessons learned and looking forward

The two consecutive climate action plans have brought about good progress towards the AfDB's contribution to climate resilience and enhanced climate action in development interventions through sound climate mainstreaming.

This means that the Bank has made significant progress on climate finance commitment, moving from nine per cent in 2016 to 35 per cent in 2019 and 34 per cent in 2020, reversing the historical disparity between climate adaptation and mitigation finance through deliberate efforts. This contrasts with



Images: AfDB



The Baixo Limpopo Irrigation and Climate Resilience Project in Mozambique

global investment, in which less than 30 per cent of climate finance was allocated to adaptation in the same period.

AfDB is also leveraging its resources to mobilize external climate finance from various sources of funding, including multilateral and bilateral funds. For instance, it mobilized US\$360 million in 2018. The Bank can further exploit its resources to mobilize climate finance at scale, including fostering private sector participation.

AfDB, guided by its new climate change and green growth policy, strategy and action plan, will consolidate its role in the regional enablers such as the Africa NDC Hub; Adaptation Benefit Mechanism, African Financial Alliance for Climate Change, and Africa Adaptation Acceleration Program to further propel climate action in the region.

Despite the disruptive impact of the Covid-19 pandemic on the global economy, business and operations, AfDB, through

its Covid Response Facilities in regional member countries, was able to respond to the pandemic shocks and take the opportunity to enhance climate resilience. This includes mainstreaming climate change into the pandemic response packages, which accounted for 34 per cent of the 2020 annual approvals. Meanwhile, to sustain such responses and build back better, there is a need for adopting an integrated approach by supporting socioeconomic resilience and disaster response while building institutional capacities and promoting transformative change across the public, local communities and the private sector.

Continuous engagement with regional member countries and continental bodies is an important element for achieving climate actions on the ground and leveraging on AfDB's comparative advantage and footprint in the region and in countries.

China's Xiamen City: building a Sponge City to cope with urban water problems resulting from climate change

*Yanwei Wang, Ningpeng Dong and Chao Mei
China Institute of Water Resources and Hydropower Research*

Climate change is posing a significant impact on natural ecological systems and human society. Since the 1980s, the temperature of China's mainland has been constantly increasing by 0.51C per decade, with some cities witnessing growing incidences of cloud bursts and local floods, posing huge pressures on the urban drainage system and therefore affecting the normal operation of cities. Building sponge cities would help mitigate such problems as water resources, water security, water environment and water ecology.

Xiamen is one of the pilot cities for the Sponge City development in China. The so-called 'Sponge City' is a special Chinese concept for urban storm water management which has been piloted in 30 cities all over the country since it was officially put forward in 2013. The Sponge City development advocates the natural storage, infiltration and purification of storm water in the hope that cities could maximize the role of ecological systems for storm water regulation, in absorbing, storing, infiltrating and cleaning the storm water when it rains, release and reuse the water when needed. In this way, cities would have the capacity to cope with environmental changes and resilience to natural disasters, so that the risk of climate change could be mitigated with human proactive adaptation to water. Meanwhile, the green infrastructure and its role for storm water storage would help improve the

carbon sinking of the urban ecological system and therefore contribute to reducing greenhouse gas emissions and facilitate carbon peaking and neutrality.

According to the implementation plan for the Sponge City development of Xiamen, six types of projects are built respectively for the purposes of infiltration, retention, storage, purification, reuse, and drainage:

- 'Infiltration' projects mainly refer to the construction or upgrade of green roofs, permeable pavement and natural ground with the aim to reduce run-off and clean up the initial rainwater pollution.
- Projects for 'retention' refer to the bioswales and vegetative swales which could postpone the run-off peaking.
- 'Storage' projects include the protection, restoration, renovation and use of rivers, lakes and wetlands for the collection, storage and regulation of storm water. The main function of such projects are to reduce peak flows to facilitate the later reuse of storm water.
- 'Purification' projects mainly refer to the sewage treatment facilities and pipelines, river channel rectifications, gentle ecological slope protection and bay dredging, which are aimed to reduce the nonpoint source pollution and improve the urban water environment.
- Projects for 'reuse' include sewage reuse facilities and storage ponds to mitigate water scarcity and to reduce emissions through water saving.



Sponge City's permeable pavements help reduce run-off



Images: IWHR

- ‘Drainage’ projects mainly refer to the pipeline renovation for rain-sewage shunting and the drainage improvement at low-lying areas in order to combine the role and effects of the vertical urban space, the artificial machines and facilities, the artificial drainage facilities, the natural river channels, the ground surface drainage and the underground pipelines and channels.

A typical case for the application of the above-mentioned Sponge City practices is the residential community, Yangtang, in the Xiang’an district of Xiamen, in Fujian, China. Located in the downtown area of Xiang’an, the Yangtang residential community covers an area of 620,000 metres squared, in which diversified Sponge City measures and technologies are adopted in line with the specific situation of each location including pavements, architectures and landscapes. The roads and streets in the community are mostly permeable pavement with bioswales and vegetative swales of certain widths built along the pavement to jointly reduce the discharge and pollution of run-off.

The buildings in the community are mostly built with green roofs and have drainage systems connected to rainwater gardens and rainwater collection facilities, which could not only reduce the rainwater discharge, but also mitigate initial rain pollution and store rainwater for reuse.

A ‘rain fed creek garden’ is built nearby the community as the overall inlet of the local rainwater, contributing to the storm water retention and regulation, run-off purification and rainwater collection of the community. In the meantime, the park makes the landscape of the community more beautiful and habitable.

Through the Sponge City development over the past years, the black and odorous water bodies in Xiamen city have been eliminated. Frequent waterlogging in seven locations has been resolved and the total water area of the city has been increased from 3.12 kilometres squared to 4.29 kilometres squared, with an annual storm water reuse volume totalling 1,763,300 tons. The specific goals for the Sponge City development have been achieved, namely no waterlogging from small rainfall, no flooding in heavy rains, no black and odorous water bodies, and the urban heat island effect eased.



Green roofs and rainwater collection tanks, which store water for reuse

To further promote the Sponge City development and reasonably evaluate its social effect, the research team of IWHR carried out a survey in the case study city to understand local awareness about the pilot project and people’s opinions on the effects of the project. The survey showed that 73.46 per cent of citizens are very supportive of the Sponge City development. They are fully aware that there might be some inconvenience during the construction period but they still hope that the Sponge City measures could help improve their living environment through waterlogging treatment, waterbody purification and landscaping works. The positive response from the majority of the local people proves to a certain degree that the concept of Sponge City development has been widely accepted and recognized by urban residents, which is mostly due to people’s demand for high quality eco-environment nowadays. Many citizens say that with the overall improvement of people’s day-to-day life, living environment and water resources become more important to them and they wish to live in a beautiful environment with clear water and blue sky which gives them more sense of happiness. The Sponge City development is the key way to improve the eco-environment in urban areas. Through the relevant reconstruction and upgrade, the pilot community now has cleaner water and a better environment without waterlogging, giving people a happier life.

The media reports and project evaluation of the government in recent years also show a remarkable effect of the Sponge City development in Xiamen. In particular, there have been no extreme urban flooding events from a series of heavy rains over the past years, demonstrating an increase in disaster resilience and the carbon sinking capacity of the city. This shows an increasing ecological and social benefit, providing the residents with a growing sense of achievement and happiness. The project also accumulates a great deal of experience in terms of run-off control, pollution mitigation and storm water reuse.

Against the backdrop of global climate changes and rapid urbanization, Xiamen has taken Sponge City development as the major measure to cope with the varying environment, to solve the climate-change-induced urban water problems in an integrated way. The achievements of this case show us a new solution to water problems such as urban flooding,



Images: IWHR



The rain-fed creek and rainwater garden in the park



Images: IWHR

environment pollution and water scarcity, and also provide us with some important enlightenments upon climate change mitigation for other cities in the world.

Enlightenment I: urban water resilience

It is necessary to improve the urban water resilience against climate change on multiple levels. An individual city is incapable of reversing the effects of climate change, or of completely eliminating its potential impact. Therefore, efforts should be focused on mitigation, adaptation and regulation measures, and the key is to improve the climate resilience of urban water from multiple levels and perspectives for which the Sponge City development is just the right way to do so. In the pilot city of Xiamen, diversified sponge measures are adopted for the lakes, landscapes, pavements and residential communities to constitute an integrated sponge system with the comprehensive functions of storm water storage, regulation and slow release, providing the city with the features of a sponge that can store water in flood and release in drought. Such sponge features exemplify the so-called resilience with which the urban water would have a higher threshold value and lower fragility to climate change. The cities would therefore have a better capacity to achieve the sustainable use and development of water resources.

Enlightenment II: urban development

The Sponge City concept should be integrated into the whole process of urban development. The case study project here is just a pilot, but the Sponge City development is by nature an integrated concept of urban water resolution and a mode of urban development. The essence of such mode is a low-impact, adaptive, nature-based, and integrated approach of urban development. Therefore, sponge measures in certain project construction or real estate development is not enough. The concept should be integrated into the whole process of urban development from planning to designing, construction, operation, management and further expansion. During this process, the human interference shall be minimized and nature-based solutions and ‘quasi natural designs’ should be adopted in most possible occasions. The Sponge City concept should be deeply implanted in citizens’ minds and become the natural behaviour of residents and city managers. With such a concept embedded in all the aspects and processes of urban construction and development, the urban space will be harmoniously shared by humans and rainwater, nature and society. A city that is able to achieve the rainwater storage, infiltration and purification in a nature-based way just like the sponge could be established.



The coastline of Xiamen

Images: Xiamen Daily, 2019 January

Tackling causes and consequences of climate change through partnerships in Vietnam

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With its long coastline and high population densities, Vietnam is recognized by the World Bank as one of the countries most exposed to detrimental climate change effects, particularly in terms of the rise in sea levels, saline intrusion, loss of land and property, changing ecosystems and food insecurity.

In Thua Thien Hue (TT Hue) province in central Vietnam, a collaborative effort that began in 2013 is helping communities to build resilience and better cope with the impacts of — and changing conditions caused by — climate change.

TT Hue in Vietnam's north-central region is home to 1.13 million people, as well as Southeast Asia's largest lagoon, measuring 220 square kilometres. The province is prone to climate-related hazards, including storms, floods, droughts, coastal and river erosion, and salinization of the soil and lagoon water. These hazards are increasing in frequency and intensity, leading to ever greater risks and impacts on people's lives and livelihoods. Government data has found that over the last 21 years 572 people in the province lost their lives due to weather events, and the economic cost of climate-related impacts is rising exponentially.

Perhaps the most visible impact of climate change in TT Hue is the level and speed of erosion of the province's beaches and dunes. In various coastal communes, local

leaders have reported a loss of 500 metres of inhabited land in the last 10 to 15 years, forcing communities to vacate their ancestral lands.

The Vietnamese government's current policies, strategies and plans on climate change and green growth reflect its awareness of climate threats to livelihoods, assets and ecosystems. These also support the country's role as a strong international ally and climate advocate, and an early signatory to major international climate agreements, including, most recently, a commitment at the 2021 United Nations Climate Change Conference to become a net-zero emissions economy by 2050. In his speech to the conference, however, Prime Minister Pham Minh Chinh reminded the world that in order to do so quickly and effectively, and to help people in countries like Vietnam to become more resilient and able to cope better, much international support will be needed.

TT Hue is one example of how direct international climate cooperation at the subnational level can work effectively and create meaningful impact. In 2013, TT Hue initiated a partnership with the government of Luxembourg to collaborate on the causes and consequences of climate change. That partnership has been divided into three sections, with two focusing on adaptation, and one on mitigation. The partnership is supported by the Luxembourg Development Cooperation Agency (LuxDev) and, since 2018, has been



Image: LuxDev

Sea level rise, recurrent floods and storms are contributing to coastal erosion, with communes rapidly losing land and assets to the ocean, like here in Tan Thanh village, Quang Cong commune



Image: LuxDev

Specially designed dykes offer shelter for up to 100 fishing boats from damage during floods and typhoons, hence protecting local fishing folks' main economic assets and securing their livelihood

Protecting and restoring a critical ecosystem

For over eight years, the climate partnership in TT Hue has helped organize and strengthen fishery associations (FAs) in localities in and around the Tam Giang-Cau Hai lagoon.

These professional associations were set up to improve the understanding and skills of fishermen and aquaculture farmers, to ultimately increase the protection and restoration of the lagoon as a vital natural resource and ecosystem that supports thousands of households.

Following the revision of the Law of Fisheries in 2017 and with the collaborative efforts of LuxDev and the TT Hue Sub-Department of Fisheries, FA members were educated in relevant legal matters and drafted their own local regulations to prevent over-exploitation of the lagoon and prevent further damage to its ecosystem. They were also taught how to farm newly introduced climate-resilient varieties, and were given materials, such as concrete poles to demarcate fishing zones, patrol boats to ensure compliance with local rules on the lagoon's waters, and young fish to nurture in protected zones.

As a result, Fisheries Conservation Zones in TT Hue are now better managed, Aquatic Resource Conservation Zones are restructured in line with the revised Law on Fisheries, regular water-testing indicates a significant improvement in water quality, there is evidence of a gradual restoration of the lagoon ecosystem, and fishermen and aquaculture farmers feel more confident that current regulations will help to ensure long-term sustainable livelihoods.



Images: LuxDev



funded directly by the Climate and Energy Fund, as Luxembourg's first international climate investment.

Luxembourg technical support is working directly with and within the provincial government's planning department, in close collaboration with all relevant provincial, district and city government agencies, mass organisations and communities, professional associations, and the private sector. That institutional setup has been a key driver of the effectiveness of the investments and interventions, as it led to full harmonization and alignment with government policies and plans and allowed for guidance and steering from within. Further, strong community participation in planning, implementation and monitoring of the interventions and a specific focus on women and girls, for example through work and gender action plans in collaboration with the Women's Union, have been other drivers of success, as they led to strong ownership and sustainability, and a clear gender perspective.

Luxembourg's support to TT Hue in climate change mitigation took the form of a pilot project in energy efficiency, with the aim of reducing carbon dioxide emissions and mitigating global warming. That support consists of three intervention areas, in hardware, software, and one related to measurements applying United Nations Framework Convention on Climate Change (UNFCCC) standards. Following cost-benefit analyses of various kinds of energy efficiency interventions, high-energy conventional lighting was replaced with low-energy LED lighting in 54 schools and on 18 roads in Hue City. The partnership also launched a range of information, education and communication initiatives to increase people's understanding of the causal relationship between energy use,

global warming and climate change, and to accelerate the transition to sustainable energy sources in a country where most electricity is generated by fossil fuel power plants. Further, Luxembourg and TT Hue government agencies also engaged in pioneering work to develop systems and strengthen government capabilities to measure, report and verify the impact of mitigation interventions in terms of carbon dioxide emission reductions. This is critical work as that carbon dioxide reduction, measured in line with UNFCCC guidelines and requirements, is to be registered as a (first) formal contribution to Vietnam's international global warming commitments, as well as its longer-term net zero goal.

Luxembourg's current support to TT Hue — in helping people and authorities adapt to the consequences of climate change — has taken a wide-scoped, comprehensive approach that focuses on resilience to climate vulnerabilities and securing the livelihoods of over 300,000 people. Small-scale infrastructure proposals by communities have been assessed and selected based on objective criteria and technical data. The 94 projects that have been developed so far have provided greater protection to around 35,000 households and their productive assets. These include: boat shelters, to protect fishermen's main assets from damage caused by heavy storms; river embankments, drainage pumps and canals, to better protect and manage the impact of frequent major floods; the enhancement of nursery facilities to function as emergency shelters during major weather events; and bridges and sluices, to prevent the further salinisation of paddy fields, which is a major and growing problem in many parts of Vietnam.

Raising awareness and developing skills have been key to Luxembourg's support to TT Hue, in helping people and local

Children in focus

The burden of climate change is not spread equally, and some people are more vulnerable to its impacts than others. Children from poorer households are particularly affected, which is why the collaborative climate interventions in TT Hue have addressed their specific vulnerabilities and needs.

Since 2013, in collaboration with the Vietnamese Department of Education, students at district schools participated in climate change and disaster risk reduction training, as well as extracurricular environmental classes. In primary schools, climate change painting competitions were organized, and thousands of children participated in swimming lessons to receive their basic certificates. This is particularly important as floods have become more frequent and severe in recent years, and drowning is the most common cause of death for children under 14 years old. In secondary schools, many climate change contests have been organized and 17 student action groups were formed to encourage sustainable initiatives in school communities.

In Hue City, where conventional lighting in 54 schools was replaced with LED lighting, hundreds of science teachers received training on the role of energy efficiency in climate change. In addition, 33 student energy efficiency action groups were established to accelerate changes in behaviour to reduce energy use and the associated costs.

It is very encouraging to see how positively young people in Vietnam have responded to learning about climate change. It also brings new hope, as they are not only the generation to take the burden of climate change, but they are also the ones that will soon be able to do something about it.



Images: LuxDev



authorities to better understand climate change, how it manifests itself, what can be expected going forward, what people can do to mitigate the associated risks and how they can adapt to the rapid changes caused by it. For example, local authorities have been provided with a range of disaster risk reduction capacity interventions as well as material support in early warning systems and equipment for emergency and rescue teams. Teachers and students in rural primary and secondary schools have been enthusiastic participants in a range of extracurricular teaching and action-oriented practical activities (see 'Children in focus'). And as for productive activities and livelihoods, adaptation interventions have primarily focused on protecting natural resources and restoring vital ecosystems. For example, project partners have worked with the fishery associations (FAs) in and around the Tam Giang-Cau Hai lagoon for many years, with some exceptional results (see 'Protecting and restoring a critical ecosystem'). Since 2018, partners have also been working on a plan to establish an organic agriculture value chain, as a new growth industry for the province and the region. This is in response to an urgent need to protect natural resources, primarily soils and water resources, from the ever-increasing use and misuse of chemicals in all sub-sectors of agriculture, as well as to the rapidly increasing demand of safe and healthy food from the Vietnamese public.

The partnership and its various projects have led to some unusual results. An external evaluation of the adaptation

project scored the intervention in the highest quintile on all evaluation criteria from the Organisation for Economic Co-operation and Development. A randomized control trial (RCT) comparing project areas with similarly vulnerable non-project areas in another district, before and after interventions and over a five-year timeframe, found major differences in household incomes, as well as in coping capacity and damage in times of serious weather events.¹

Some of the outcomes of the partnership have been classified by external evaluators as 'power results' — outcomes that go beyond what would normally be expected in any best-case scenario. An example is the revised Law on Fisheries passed in the National Assembly in 2017, which now holds the FAs responsible for the co-management of aquatic resources and activities (see 'Protecting and restoring a critical ecosystem').

The Luxembourg-TT Hue climate partnership continues to this day, and larger interventions to be supported by international climate finance are being prepared. It has demonstrated what can be achieved in a relatively short time and shown that alignment with local policies and strategies, institutional set-up and support, and community-driven approaches are critical for sustainability in the long run.

While there are likely major challenges for TT Hue and similar coastal provinces in Vietnam still to come, many early lessons can be learned from the province and applied elsewhere, to prepare, protect and support communities facing an uncertain future.

Accelerating Climate Action in Latin America

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Fundación Avina is a global organization that drives processes that are designed to change systems. Rooted in the Global South, we make an international impact through collaborative efforts that promote human dignity and care for the planet. Climate action is one of our key priorities, alongside democratic innovation and a regenerative economy.

Fundación Avina's climate-action strategy promotes collaborative processes that catalyse, accelerate, and scale multilevel, multisectoral, and inclusive mitigation and adaptation solutions. We contribute towards the transition of a low-emission and climate-resilient future by building stakeholder and institutional capacities, promoting an inclusive, more robust and participatory climate governance, and implementing mitigation and adaptation solutions

in specific territories and sectors. We value traditional knowledge and foster technology innovation.

We envision a future in which countries in Latin America and the Global South develop leadership and innovation processes in climate action, leading transformational changes towards a 50 per cent reduction in emissions by 2030 and adaptation on the same scale.

Our climate-action programme has three lines of work including capacities for action, governance and solutions for combating climate change.

Capacities for climate action

Our work seeks to strengthen stakeholder capacities for adaptation and mitigation actions at distinct levels of intervention in government and non-government sectors in Latin America, the Caribbean, and, most recently, Africa.



Construction of a 52,000 litre plate cistern, water-reuse system, with vegetable garden and orchard in Massaranduba, Poçoão in the Brazilian semi-arid region



Image: Fundación Avina

Stakeholder engagement with local community representatives in Marajo, Brazil

We strengthen leadership roles among stakeholders and build capacities to implement climate action, such as how to mobilize and access climate finance. For example, under the “Resilient Andes” initiative in the Andean Region of Peru, Bolivia and Ecuador, we are fostering capacity-building processes and sharing knowledge, focused on the role of microfinance and its relevance to funding climate change action. Another example is the regional project Dialogue Between Peers, in which we are encouraging peer-to-peer learning, coordination, coherence and cooperation among various levels of government in several Latin American countries. This facilitates the implementation of their national determined contributions (NDCs) and other climate commitments established under the Paris Agreement.

In addition, Fundación Avina supports a broader ecosystem of stakeholders that are relevant for the climate change agenda at local, regional and global levels. We contribute towards increasing stakeholder capacities to engage in decision-making processes concerning the best strategies for implementing local climate impact solutions. For example, through the Voices for Just Climate Action programme, we partner with local organizations in the Amazon and Chaco region on issues related to the co-creation of a climate agenda. This work involves increasing opportunities to strengthen their storytelling, communications skills and advocacy capacities so that they may directly influence decision-making processes over their territories. During COP26,

Txai Suruí, a Brazilian indigenous youth leader, who is a member of the advisory council for the programme, spoke about the importance of giving power back to indigenous communities. Her impactful speech was heard all over the world and covered widely by the press.

The overall understanding of climate knowledge gaps, barriers and needs is crucial for effective climate action. To this end, through our global Impulsouth initiative, we are supporting processes to map these elements through active research.

Climate governance and mobilization

Our climate-action programme’s second line of work focuses on improving climate-governance processes to make them more inclusive and participatory, while supporting civil society and citizen mobilization.

Fundación Avina’s work, which collaborates in building climate-governance spaces that are multilevel, diverse and inclusive, has resulted in increasing levels of ambition in climate-action implementation. By participating in these spaces, youth, women, indigenous peoples and other marginalized groups are better positioned to influence the climate decisions that affect their lives.

At a global level, Fundación Avina contributes to developing and strengthening a polycentric, climate-governance system through the Global Climate Action Agenda. For example, we advised between 2019–2021 UN high-level

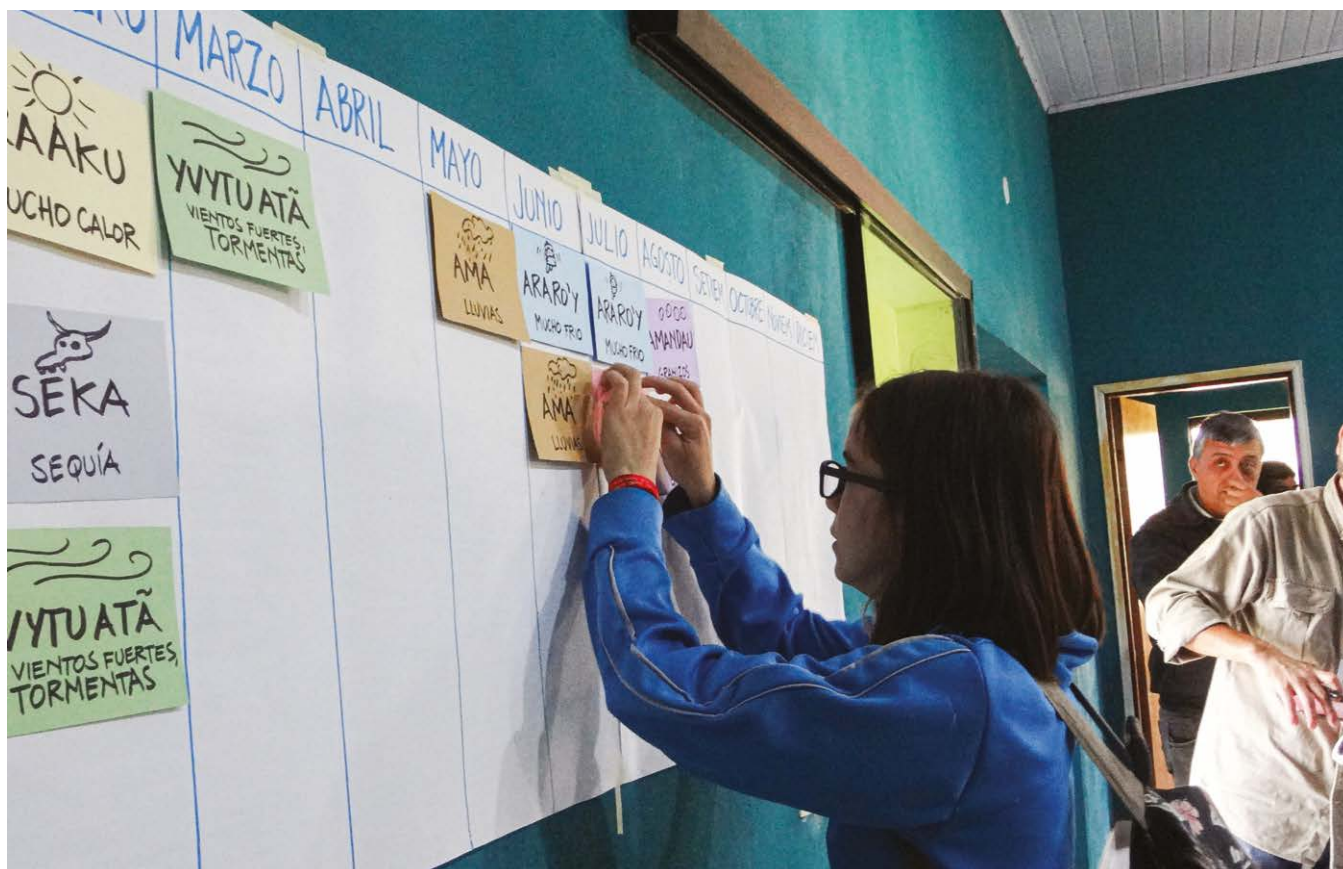


Image: Fundación Avina

Capacity building workshops on climate change were held in 12 local municipalities within the framework of the Green Climate Fund's Readiness Project in Paraguay, with the participation of local stakeholders

climate champions on the formulation process of the Race to Zero, which seeks to rally leadership and support from businesses, cities, regions and investors for a healthy, resilient, zero-carbon recovery, and Race to Resilience, which is designed to catalyse a step-change in global ambition for climate resilience campaigns. We also collaborated in the universal It's Now campaign that aims to promote and accelerate climate action through citizen mobilization. Since its launch in 2019, the campaign has led to a catalytic chain of actions, increased participation and engagement of over 16 thousand citizens around the world in climate matters.

At a regional level, Fundación Avina works with Latin American and Caribbean countries to strengthen their climate governance and increase the ambition of existing climate goals and commitments. For example, together with several partners, we developed NDC-LAC, a digital platform that presents up-to-date information on climate commitments, targets and progress in the implementation of the NDCs of all Latin American countries. In this way, the platform facilitates open access to key climate policy commitments and transparency for tracking progress.

At a national level, we aim to strengthen climate governance by supporting countries to implement their climate policies. To this end, we help generate key technical studies, promote participatory decision-making processes, and support the design and implementation of climate policy instruments. For example, through the Green Climate Fund's readiness programme, we have worked with the

governments of Argentina, Paraguay, Ecuador, and Peru to strengthen institutional climate capacities. We provided similar support to the governments of Bolivia, Peru and the Dominican Republic through the NDC Partnership.

Finally, at a local level, Fundación Avina seeks to increase participation and effective engagement of local governments in the design and implementation of climate policy instruments and actions. To date, we have supported regional governments from Ecuador, Paraguay and Argentina in these efforts.

Climate solutions for tackling climate change

Fundación Avina has been promoting sustainable development in Latin America and the Caribbean for over 25 years. Through our programmes we promote integrated solutions that address development and socio-economic challenges in a sustainable manner. Most of these projects also support climate change goals. On the one hand, we develop access to water solutions for semi-arid areas in Brazil, which can also be considered as a climate solution since they increase the region's adaptation capacities. On the other hand, we heavily invest in the development of disruptive technologies and the introduction of enabling conditions to put them in operation such as PERA Complexity, that could be catalytic for changing energy systems and water desalination processes.

One of the major challenges that global-south countries face in implementing concrete climate solutions is access to climate finance. Whether technological, organizational or



Images: Fundación Avina



A participative process through a series of technical workshops and national events held for the update of the Nationally Determined Contributions in the Dominican Republic, in alliance with NDC Partnership

nature-based, accessing finance is an incredibly complicated process. Local stakeholders, particularly those most vulnerable to climate impacts, have limited capacity to design climate-finance projects. For example, many lack strong project-management skills or the necessary climate-related data to provide convincing arguments for the climate rationale of a project. In response to these challenges, Fundación Avina supports local stakeholders in their efforts to mobilize

resources and partners with different multinational and regional initiatives to develop innovative, high-impact and sustainable solutions to respond to the climate needs and priorities of Latin American countries.

Finally, Fundación Avina is developing adaptation-related project proposals that seek to increase the resilience of vulnerable communities to impacts caused by climate change. In Marajo, Brazil, for example, we will help smallholders tackle climate risks through the implementation of nature-based solutions that have been proven to be effective against climate-change impacts such as sea-level rise, erosion, drought and floods. The project will also strengthen access to markets and financial services for producers of climate resilient agroforestry products. In Mexico, Fundación Avina is working with the Ministry of Environment of Mexico City to develop a proposal to improve access to rainwater harvesting systems and increase flexibility in the city's most vulnerable citizens who lack reliable access to water. This goal will be achieved by facilitating access to information on adaptation to climate hazards, installing rainwater harvesting systems in vulnerable households, and deploying financial and policy instruments to ensure that the target population, particularly women-led households, has access to the technology.

The Global South has the potential to drive a climate-resilient and low-emissions future. Through strong mitigation and adaptation actions, we hope the 2030s will become the decade in which humanity significantly changes their ways for the regeneration of the planet.

International joint research cooperation for building sustainable environmental systems

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The timeframe to reach the 1.5C global temperature limit set in the Paris Agreement has been revised. With the current rate of greenhouse gas (GHG) emissions, global warming may exceed 1.5C and 2C in the 21st century. This requires the urgent implementation of global measures to achieve net zero carbon dioxide emissions.

In October 2020, the Government of Japan (GoJ) declared that Japan will be carbon neutral by 2050. In June 2021, the Cabinet Secretariat and government ministries and agencies formulated the Green Growth Strategy for Carbon Neutrality in 2050 (Green Growth Strategy). This strategy outlines the main cross-sectoral policy tools and action plans in key areas to achieve carbon neutrality. The Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan also formulated the Strategy for Sustainable Food Systems (MeaDRI) against the background of the Green Growth Strategy, and started concrete efforts to achieve carbon neutrality in Japanese agriculture. The GoJ has also expressed its willingness to actively participate in international discussions and rule-making, using the MeaDRI as a model for a new sustainable food system in the Asian monsoon region.

While Japan has been successful in reducing greenhouse gas (GHG) emissions, the agricultural sector of most countries in the developing regions of the world, including the Asian monsoon region, emit more GHGs from their agricultural sectors compared to Japan. Japan's achievements could turn out insignificant if the GHG emissions of these countries are not reduced. A system that enables countries to work together under an international framework is essential. This suggests the importance of international joint research cooperation among countries.

The GOJ has raised the GHG emission reduction target for FY2030 from 26 per cent to 46 per cent, based on FY2013. Even for Japan, which ranks the highest in the Asian monsoon region in terms of Human Development Index and the Human Resource Index, this reduction target is very ambitious. It is important to strengthen policies and accelerate the creation of innovations to achieve this target. In this context, the MeaDRI calls for innovations to improve the productivity and sustainability of the agriculture, forestry, and fisheries sectors. The creation of innovation requires

not only financial resources for research and infrastructure development, but also human resources. However, low- and middle-income countries in the developing regions with low human resource indices do not have sufficient systems and resources to promote emission reductions based on international standards. In addition, since one of the most pressing issues in these countries is how to increase food production for their growing populations, addressing both food production and GHG reduction within a limited timeframe is a technical and economic hurdle. It is essential for the international community to support these countries.

For 51 years since its predecessor, the Tropical Agriculture Research Center, was established, the Japan International Research Center for Agricultural Sciences (JIRCAS) has been working with local research partners to solve problems in agriculture, forestry and fisheries in developing countries in the tropics. In April 2021, the fifth mid- to long-term plan of JIRCAS (5th MLTP) was launched. We will continue to work with countries in developing regions to contribute to solving problems at the national level to address global issues. In particular, the Environment Program will implement six international research projects to promote the development of technologies, in cooperation with research institutes in the partner countries. These projects aim to build sustainable environmental systems in agriculture, forestry and fisheries through appropriate resource management in developing regions in the context of climate change.

Development of comprehensive agricultural technologies for climate change mitigation and adaptation in monsoon Asia

JIRCAS has been working on the development of climate change technologies applicable to small-scale farmers in the Asian monsoon region. For example, we have been conducting research and development on mitigation measures such as GHG emissions reduction from paddy fields and livestock, soil carbon storage, and adaptation measures such as water-saving cultivation and improvement of water management. In the 5th MLTP, aiming for social implementation and dissemination of these technologies, we plan to accumulate evidence as technologies that are easy for local farmers to accept and lead to co-benefits, and make policy recommendations to the governments of partner countries.



Image: JIRCAS

Measurement of GHG emissions from a paddy field in Vietnam

We will develop a method of paddy water management optimized for higher rice yield and supported by an ICT-based tool to reduce soil GHG emission, and we will establish a decision-making tool for efficient water use by water user's associations. Furthermore, we will assess the vulnerability of agricultural areas to climate change using remote sensing technology. Soil fertility in the tropical area will be studied to evaluate the effects of the management on carbon sequestration and crop production through biochar application, organic matter input and conservation tillage, identify the determinants of carbon storage potential as well as evaluate the carbon storage capacity of soils in tropical humid regions. GHG emissions from livestock production will be also studied to develop the GHG mitigation technology from both enteric fermentation and manure management through the utilization of locally available resources. We aim for social implementation and dissemination of the technologies developed in our project through evaluation by GHG Life Cycle Assessment, action research to improve the technologies to make them more applicable to farmers, and utilization of a method to generate carbon credits (emission reductions) used in GHG emission trading.

Development of carbon recycling technologies to address global issues caused by agricultural waste

Agriculture produces a lot of agricultural waste. In developing countries, agricultural waste is used as feed and compost for livestock. Still, it also negatively impacts society and the environment due to abandonment and incineration of land. In tropical plantations, it is desired to build technologies and social systems that promote agricultural waste recycling. Therefore, we will develop a microbial saccharification-gasification bioreactor to generate methane, carbon dioxide

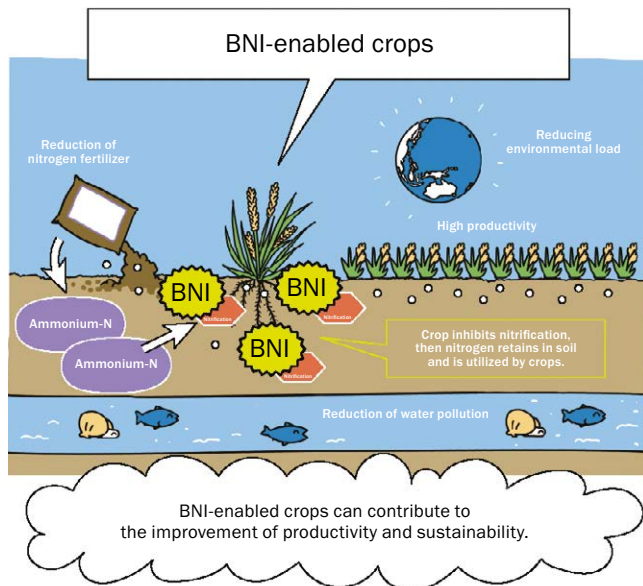
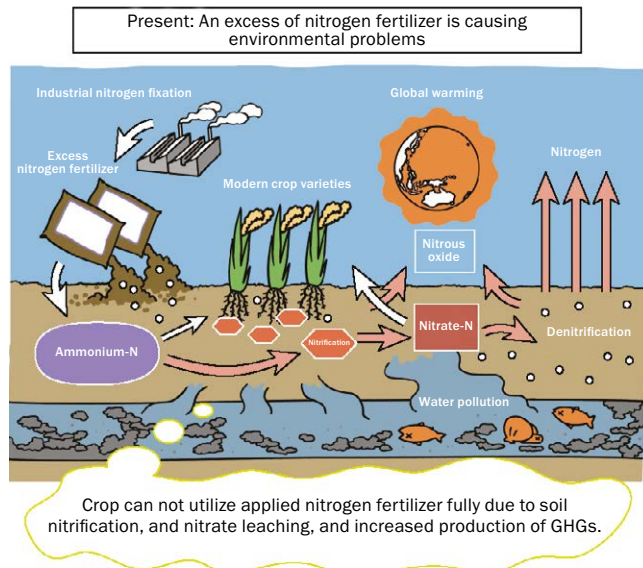
and hydrogen from agricultural waste with high efficiency in the project. In addition, we will work on the development of nutritional pigments and fuel production technology using various generated gases and the development of production technology for producing high value-added substances such as bioplastics.

On the other hand, it is crucial to understand agricultural waste's global environmental impact on recycling it. Therefore, we will propose utilization and management methods for agricultural waste by promotion of GHG data conversion and crop impact assessment generated when agricultural waste is abandoned on agricultural land. Furthermore, we will promote the spread of carbon recycling technology jointly with private companies, government agencies, local



Image: JIRCAS

Agricultural waste (empty fruit bunches) discharged from a palm oil mill in Malaysia



Science Manga Studio (2021)

BNI-enabled crops contribute to the improvement of productivity and sustainability

governments and agricultural cooperatives, aiming for social implementation.

Development of a planet-friendly agricultural production system using biological nitrification inhibition technology

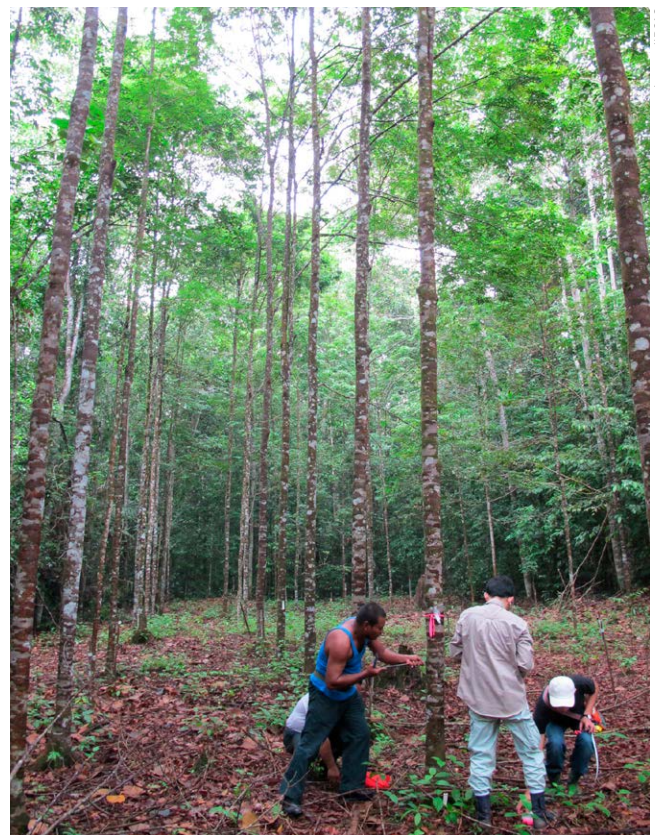
Modern agriculture relies on massive inputs of nitrogen fertilizer derived from industrial nitrogen fixation. However, 50–70 per cent of the nitrogen fertilizer applied to farmland is not utilized by crops. Unutilized fertilizer entails groundwater pollution by nitrate and GHG emissions through nitrous oxide, which is nearly 300 times more potent greenhouse gas than carbon dioxide.

JIRCAS had discovered biological nitrification inhibition (BNI), which can reduce the environmental burden from nitrogen fertilization, and is developing the technologies

to maintain high productivity by genetic exploitation of a naturally occurring plant function as modern agriculture achieved. JIRCAS has then developed BNI-enabled elite-wheat lines, and initiated BNI research for maize through elucidating BNI compounds. JIRCAS is also working on elucidating a behaviour of BNI compounds in soil and crop-soil microflora interactions, marker-assisted selection for BNI-trait components for sorghum, establishing a DeNitrification-DeComposition model as the foundation of a sustainable crop rotation system with *Brachiaria* pasture grass.

Evaluation of genetic resources for strengthening productivity and adaptability of tropical forests

Tropical forests have a particularly large carbon storage and play an important role in the global GHG balance. At the same time, the growing impact of climate change on the health of tropical forests is of concern. Timber is an important export item in Southeast Asia, but due to the decrease in natural forest resources, the timber produced is rapidly being converted to planted trees. JIRCAS is conducting the following research on the native tree species in Southeast Asia to promote effective forest restoration: 1. Evaluation of the growth and properties of wood, as well as their adaptability to environmental changes, such as higher temperature and drought to propose tree species and land suitable for planting; 2. Application of genomic selection technology to the breeding of teak in Thailand and dipterocarps in Malaysia and Indonesia to significantly shorten the breeding cycle; 3. Development of silvicultural technique with growth predic-



Planted dipterocarp trees in Peninsula Malaysia

Image: JIRCAS



Soil erosion in a sugar cane field as a cause of environmental burden, Ishigaki Island



Exhibition of a follow band technology for combating soil erosion in Burkina Faso

tion based on the evaluation of physiological characteristic of tree species to plant tree species and strains in an appropriate combination adapted to the environment of the planting area; 4. Evaluation of the impact of tree planting on ecosystem functions and the proposal of operational guidelines for recovery of the function; and 5. Promotion of international networks to share the obtained information on tropical forest genetic resources.

Development and evaluation of environmental conservation technologies for tropical islands through an approach emphasizing Yama-Sato-Umi (ridge-to-reef agroecosystem) connectivity

The Coral Triangle (CT) is an area in the tropical waters around the Philippines and Indonesia, with a variety of coral species which accounts for 80 per cent of the world. The CT is playing a critically important role in absorption of greenhouse gasses from around the globe. As tropical islands are vulnerable to the impacts of climate change and natural disasters, environmental conservation for mountains and villages as a connecting ecosystem to the coastal area can save the precious marine resources, such as the coral reefs. Based on this idea, we aim for the development of a rural livelihood system that enables to improve the water-soil conservation function and the rural livelihood based on Japanese Satoyama-management method, which leads to mitigation of soil erosion and improvement of material circulation. In the village, we will work on the development of sustainable agricultural management technology through underground irrigation technology to reduce the use of chemical fertilizers, organic matter application technology using unutilized biomass resources, and improved fertilizer application technology, as well as the development of sugar cane cultivation technology and potential breeding lines

to reduce the environmental impact. Furthermore, we will focus on mangroves and macro- and microalgae in the hydrosphere environment, to develop water quality conservation technology based on their biological functions. Since eventually the technologies that JIRCAS develop need to be utilized appropriately and sustainably, we will also comprehensively evaluate the positive environmental impact that our technologies can have and clarify the applicable conditions for the introduction of our technologies.

Development of sustainable land management technologies under extreme weather conditions in drylands

Global warming due to increased GHG threatens the lives of farmers in developing countries. Especially in drylands of Africa and Asia where desertification has progressed due to soil degradation, extreme weather such as drought and heavy rain has risen markedly in recent years and threatens food and nutrition security. To achieve sustainable agriculture and food and nutritional security, we are developing sustainable land management (SLM) that conserves soil resources while maximizing the efficiency of soil and water resource utilization.

In West Africa where soil erosion and drought are major problems, we will improve soil conservation technologies, create soil conservation standards and develop technology to maximize soil resource utilization. Further, we will develop an effective dissemination method for soil conservation technologies.

On the other hand, in northern India where salinization and heavy rain are major problems, we will develop low-cost technologies that mitigate salinization and maximize water resource utilization. Further we will evaluate the local applicability and dissemination potential of the technologies.

Awarding scientific innovation in water research to respond to the uncertainties of climate change

Abdulmalek A Al Shaikh

Prince Sultan Bin Abdulaziz International Prize for Water

The Prince Sultan Bin Abdulaziz International Prize for Water (PSIPW) is a leading scientific award, offered every two years, dedicated to cutting-edge innovation. Since its establishment in 2002 by His Royal Highness Prince Sultan Bin Abdulaziz, PSIPW had given recognition to scientists, researchers and inventors around the world for pioneering work that addresses the problem of water scarcity in creative and effective ways.

To this end, PSIPW offers a suite of five prizes, covering the entire water research landscape. First, there is the Creativity Prize, worth US\$266,000, which is awarded for cutting-edge interdisciplinary work that can rightly be considered a breakthrough in any water-related field. Then there are four specialized prizes, each worth US\$133,000: the Surface Water Prize, the Groundwater Prize, the Alternative Water Resources Prize, and the Water Management & Protection Prize.

Nominations are evaluated by an international panel of distinguished scientists who serve on various committees for each of the five prizes. Nominations undergo a rigorous three-tiered evaluation process, starting with a preliminary evaluation committee, followed by a referee committee, and ending with a final selection committee.

PSIPW has special consultative status with the United Nations Economic and Social Council and is an observing member of the UN Committee for the Peaceful Uses of Outer Space. PSIPW has a close relationship with the United Nations Office for Outer Space Affairs and a substantial number of PSIPW's prizewinners throughout the years have relied heavily on space technologies to achieve their innovative water management solutions.

Since 2016, PSIPW has sent a party-level delegate every year to the Conference of the Parties (COP), the 26th iteration of which took place in Glasgow, Scotland from 31 October to 13 November 2021. PSIPW's delegates to COP over the past six years have advised on a wide variety of topics, including the impact of climate change on groundwater resources, rainwater harvesting and recharge under climate change uncertainty, and physical climate risk analytics to inform adaptation-aligned finance.

Even though PSIPW is a prize dedicated to water, much of the award-winning work is directly relevant to United

Nations Sustainable Development Goal 13, which is to 'take urgent action to combat climate change and its impacts'. Many of our prizewinners have made substantial contributions to our understanding of how climate change affects flood risk, limits water availability, and provides challenges to effective water management.

Climate change and flood hazards

In 2020, Dr Zbigniew Kundzewicz of the Polish Academy of Sciences in Poznan, Poland, won the Surface Water Prize for determining how flood hazard and risk are related to climatic change, globally, in Europe, and at the national level in Poland, Germany, and China. Flood generation is a complex process, integrating the influences of many climatic and non-climatic factors, in which it is very difficult to disentangle the climatic effects on river flow from the effects of human interventions. The knowledge generated by his work impacts on our understanding and interpretation of flood hazard and risk in the past, present, and future. Dr Kundzewicz applies this knowledge to develop a diversified portfolio of flood-risk management approaches — including flood-risk mitigation, preparation, and recovery — that work together for maximum net effect, providing practical solutions for flood risk reduction and flood preparedness.



Dr Jim W Hall serving as PSIPW's Delegate to COP26 in Glasgow

Images: PSIPW

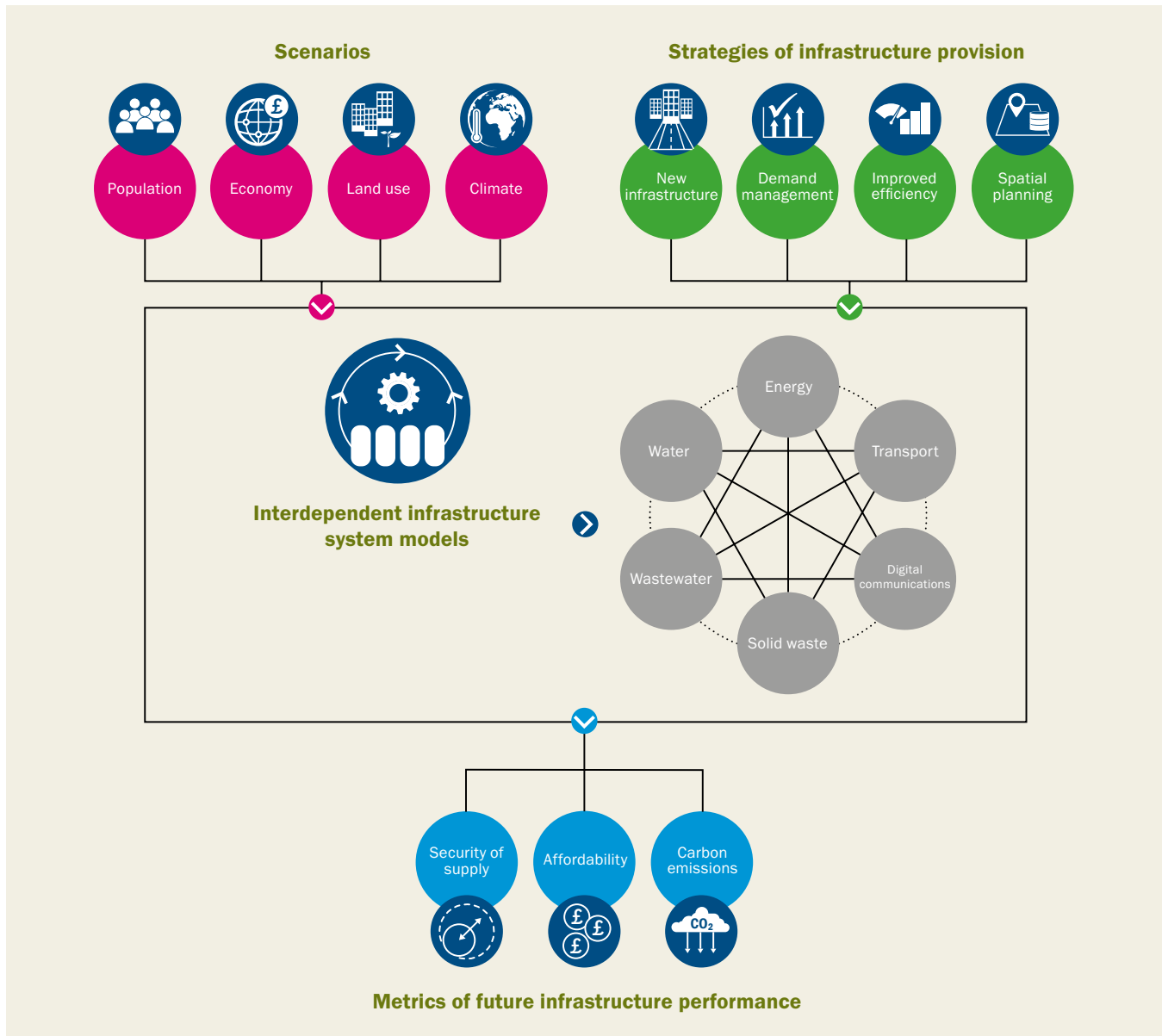


Image: PSIPW

Dr Hall led the development of the National Infrastructure Systems Model (NISM0D), the world's first national infrastructure system-of-systems modelling platform.

A risk-based climate change framework for water managers

Dr Jim W Hall, professor of climate and environmental risks at Oxford University's Environmental Change Institute, and his colleague Dr Edoardo Borgomeo won PSIPW's Water Management & Protection Prize in 2016 for developing and applying a new risk-based framework to assess water security and plan water supply infrastructure in times of climate change. Their innovations include a simulation-based method for analyzing the risk to public water supplies under non-stationary climate conditions, a new non-parametric technique for generating synthetic streamflow sequences for water resources systems assessments, a new method for simulating the impact of unprecedented droughts on public water supplies, and a process for identifying water security investments that meet an acceptable level of water-related risk. Their methods assist water managers in planning investments and policies to cope with the risks confronting their

water systems. This has made them one of the most influential groups providing engineering and scientific advice for water resources planning and adaptation to climate risks in the UK and globally.

Climate change and drought

In 2014, Dr Eric F Wood and Dr Justin Sheffield of Princeton University won the interdisciplinary Creativity Prize for the development of a state-of-the-art system for accurately monitoring, modelling, and forecasting drought on regional, continental and global scales. The team effectively overturned previous expectations of the impact of climate change on drought frequency by demonstrating that they were based on an oversimplified potential evaporation model. Their more comprehensive approach alters our perspective on how global warming impacts hydrological phenomena and extremes. The team's efforts culminated in the development of a drought monitoring and forecasting system with Unesco

for sub-Saharan Africa. Another very important outcome of this capability is the unique Princeton Global Forcing Dataset that is now widely used by scientific and drought forecasting communities worldwide.

Climate change and the global water budget

Dr Kevin Trenberth and Dr Aiguo Dai of the National Centre for Atmospheric Research in the United States won the Surface Water Prize in 2012 for ground-breaking work that provides a powerful estimate of the effects of climate change on the global hydrological cycle, with a clear explanation of the global water budget. In the 21st century, hydrologists face the overwhelming challenge of trying to understand hydrologic variability as it is impacted by climate change. This team has made a unique contribution through the investigation of climate variability and trends in the past, and through the use of models and other creative efforts, to reconstruct river discharge into the oceans across the planet for almost 1,000 river basins. They used climate models to understand likely changes in the future and the uncertainty associated with those predictions and explained their findings using such popular indicators as the Palmer drought index. As a

result, they have given us an exemplary account of the global water budget and a much better understanding of hydrologic responses to climate change, which in turn, provides substantial guidance for future planning.

Other initiatives of PSIPW

Besides awarding its suite of prizes every two years, PSIPW is active in numerous water-related projects, some of which focus on combating desertification, community development and sustainable agriculture through the restoration and rehabilitation of degraded land. The organization also has a memorandum of understanding with the United Nations Office for Outer Space Affairs. Among their joint initiatives is the International Conference on the Use of Space Technology for Water Management, held every three years in various countries around the world, and the UN Space4Water Portal, an online hub for professionals and organizations working with space technology applications for water-related activities. PSIPW supports a research chair at King Saud University dedicated to advanced and specialized research related to the storage and harvesting of rainfall and runoff water, with a particular focus on the effects that climate change has on these activities.

Winners of the Prince Sultan Bin Abdulaziz International Prize for Water, 2020

PSIPW's 9th Awards ceremony took place as a virtual event on 22 March 2021 in conjunction with the 'High-Level Meeting of the Water-Related Goals and Targets of the 2030 Agenda' at the United Nations Headquarters in New York. The ceremony was presided over by His Excellency UN Secretary-General António Guterres and His Excellency Volkan Bozkır, president of the United Nations General Assembly with the participation of His Excellency Ambassador Abdallah Al-Mouallimi, permanent representative of the Kingdom of Saudi Arabia to the United Nations.



Creativity Prize — The team of Dr Sherif El-Safty from the National Institute for Materials Science, Japan, for the development of a unique nano-porous filter medium that enhances selective monitoring and contaminant removal, and provides energy-efficient, high-volume filtration, so that hazards can be removed from water while healthy minerals are retained.



Surface Water Prize — Dr Zbigniew Kundzewicz from the Polish Academy of Sciences in Poznan, Poland, for determining flood hazard and risk and their relationship with climatic change globally, in Europe, and at the national level.



Creativity Prize — The team of Dr Benjamin S Hsiao, which includes Dr Priyanka Sharma, from Stony Brook University, New York, USA, for the development and use of next-generation high-flux nanostructured materials, particularly low-cost nanocellulose, for energy and water purification applications, a sustainable technology that promises to provide clean water to off-grid communities of the developing world.



Water Management & Protection Prize — Dr Jay R. Lund from the University of California Davis in the USA for developing the CALVIN water supply optimization model which shows how the natural and social sciences can inform public policy in a challenging political environment and contribute to regional water conflict resolution. It also demonstrates how game theory, through the creative use of non-cooperative games, can be harnessed to develop more effective water management policies by identifying the externalities and evolutionary pathways of dynamic water resource problems.



Alternative Water Resources Prize — Dr Peng Wang from the King Abdullah University of Science and Technology, Saudi Arabia, for work at the forefront of the solar-water nexus, involving solar distillation, zero liquid discharge desalination, and atmospheric water harvesting.



Groundwater Prize — Dr J Jaime Gómez-Hernández from Universitat Politècnica de València in Spain for work that decisively contributes to solving the inverse problem in hydrogeology.

Building back better with compassionate food systems

*Chien-Cheng Yang, Steve Chiu and Yee Siang Yong
Buddhist Tzu Chi Foundation*

Summer of 2018, in the Bago Region of Myanmar, U Soe Lwin Myint stares in disbelief at the remnants of his eight acres of farmland, now completely submerged by a series of flash floods throughout July and August, destroying his entire crop yield for the year.

Without the harvest, he is now unable to repay the loan he took out from the bank to purchase the seeds, and, with no capital to purchase new seeds, he cannot replenish his crops. Myint's story is not unique; thousands of farmers in

Myanmar are kept in a perpetual cycle of poverty due to the region's frequent floods, cyclones and other climate-related disasters that have increased in frequency and severity in recent years. The rural infrastructure is crude, underdeveloped and provides no protection from such severe weather events. Following the flood, the government's subsidy of 100,000 kyats (roughly £44) for each of the affected households provides some help.

In November of the following year, much needed relief came as the volunteers of the humanitarian aid organization Buddhist Tzu Chi Foundation (Tzu Chi) brought with them a donation of 653 tons of high-quality mung bean seeds from Taiwan, distributed fairly among 10,000 impoverished farmers of Yangon Region and Bago Region. A sigh of relief swept across rural Myanmar, as farmers have another chance at repaying their debts and inch closer out of poverty. But for how long will this relief last?

Current food systems are both a major contributor to climate change as well as a critical infrastructure that is extremely vulnerable to it — a vicious feedback loop that can only be broken through a complete transformation in the way food is produced, distributed and consumed. Modern agriculture is responsible for roughly one third of the world's carbon emissions — a calculation that accounts for several contributing factors. Forests are being cleared at an alarming rate to create grazing land for livestock, leading to a significant loss to the planet's ability to sequester carbon dioxide. Furthermore, methane, with a global warming potential of 28-36 over 100 years, is produced in large quantities by ruminant livestock as a result of a high enteric fermentation in their digestive system. Not to mention the amount of water and resources used to raise these animals for slaughter is highly inefficient and extremely wasteful. Meanwhile, with the ever-increasing global climate resulting in record-breaking heat waves, droughts, flooding and other extreme weather events, a transition to more climate-resilient staple crops and foods is necessary to maintain our ability to feed the growing human population. The IPCC 6th Assessment Report presents a sobering picture of the current status of our climate; average global temperatures are increasing faster than originally predicted and we are on the verge of crossing a dangerous threshold which will expect to yield more intense heat waves, more extreme weather events and unleash a chain of feedback events which would



Image: Hsiao Yiu-hwa

A farmer in Myanmar celebrates his mung bean harvest, courtesy of a donation from Buddhist Tzu Chi Foundation following a series of flash floods that had destroyed his crops the previous year



Image: Buddhist Tzu Chi Foundation

Tzu Chi's monastic community practices a culture of simplistic living in line with the philosophy of Buddhism, growing their own crops and tending to the fields daily

exponentially exacerbate global warming. Crops would be lost to droughts, floods, heatwaves and other severe weather. Further, locusts, which form a swarm during the presence of heavy rains in an arid region, also threaten food security, like in 2019 when a plague of locusts — the largest seen in 25 years — swept across Northern Africa, the Middle East and West Asia, threatening the food supply of millions of people. Finally, millions of farm animals are lost each year from heat stress and extreme weather events such as wildfires and tropical storms.

Clearly, our current food systems cannot survive the coming decades; a radical transformation must come swiftly and fully, not only to mitigate the emissions output in the atmosphere, but also to adapt to the inevitable catastrophic changes to come. This inevitably requires all of us, an entire global population of nearly eight billion, to accept and adopt a new diet — one which is plant-centric, sustainable and nutritious.

Transformation through culture

A global shift in diets, though ultimately inevitable, will prove to be a daunting challenge, despite the urgency and need. Food is an integral part of one's identity; an individual's food choices are influenced by several factors that shape the perception of one's image of the self, such as environment, culture and tradition, economic situation, and health and physiological needs. A sudden, drastic change in food systems would surely result in public backlash. How, then, do we gain the public and political support needed for the necessary transformation in food systems within the limited time we have to avert climate catastrophe?

A shift in the global culture of food — one which promotes sustainability, justice, health, ethics, and environmental awareness — is crucial to addressing a dramatic shift in our global food systems. Diets play a crucial part in many of the world's religions, which provide the basis to an individual's personal moral and ethical framework. Each religion has its own unique tradition on food: Catholic traditions require fasting on Ash Wednesday and Good Friday; those who follow Judaism are required to eat Kosher foods; followers of Islam must eat only foods deemed halal. Those of the dharmic religions are largely restricted to a vegetarian or vegan diet; Hinduism, Jainism, Sikhism and Buddhism all practice the ancient principle of *ahimsa*, nonviolence towards all sentient beings. According to the *Aṅgulināliya Sūtra*, Gautama Buddha taught that all sentient beings are of the same *dhatu*, or essence, and the consumption of meat is akin to self-killing and cannibalism. Additionally, Mahāyāna Buddhism focuses on the bodhisattva path to Buddhahood — one which emphasizes the cultivation of *karuṇā* ('compassion') and *prajña* ('enlightened wisdom'). The consumption of meat, according to the Buddha, would disrupt one's practice of *karuṇā*, leading to an accumulation of negative karma.

Tzu Chi's culture of compassion

Tzu Chi, with its roots in Mahāyāna Buddhist philosophy, focuses on the concept of *karuṇā* in all of its actions. In fact, the 'Tzu' in the name literally means 'Compassion' in Mandarin. The organization's founder, Dharma Master Cheng Yen, preaches to all her followers the importance of kindness to all sentient beings and stresses refraining from the consumption of meat. Thus, a culture of vegetari-



Image: Buddhist Tzu Chi Foundation Indonesia

Movements such as Ethical Eating Day are celebrated worldwide, encouraging mindfulness in the relationship between food choices and the environment

anism was born within the organization, which grew over time, with its 10 million volunteers, donors and supporters vowing to shift their dietary habits to one that is compassionate and ethical. In recent years, it has become clear that the ever-increasing trend of natural disasters has been, at least in part, linked to the unsustainable dietary habits of the ordinary person, inspiring even more followers to make the transition to a more sustainable lifestyle with the increased environmental awareness. This culture of environmentalism and plant-based diets permeates throughout all of the organization's missions and activities, and several initiatives promoting a culture of compassionate diets emerge.

Recognizing that a culture of sustainability, environmentalism and compassion requires a holistic approach to create enabling environments for individuals, Tzu Chi hosts and engages with a multitude of plant-based campaigns that seek to strengthen the social movement for a sustainable future. To amplify the core principles of living in alignment with personal values, while simultaneously advocating for systems transformation, Tzu Chi created a global campaign in 2014, Ethical Eating Day, after being struck by the limited amount of conversation surrounding the role that industrial animal agriculture plays in the perpetuation of climate change. The movement was conceived to empower individuals to disrupt their habitual thinking and take 11 January as a day to experience healthy and sustainable plant-based diets in their personal lives, while educating communities on the impact of food on global climate systems. Ethical Eating Day amassed 1.4 million participants that engage every year in

the ritual of reflection, diet change and dialogue. Four years later, the interfaith group GreenFaith collaborated with Tzu Chi on the Living the Change campaign, which works to reconcile the disconnect between the change we advocate for and the lives we lead on a personal level, drawing forth the power of one's faith and spiritual traditions to remind oneself that change must first come from within. Tzu Chi's engagement with Living the Change not only creates an ideological framework for other Buddhist practitioners to enter the stream of understanding climate change, but also provides tangible actions for those who wish to reduce their environmental footprint.

A new generation leads the way

In Tzu Chi, the leading role of youth in promoting plant-based diets is highlighted in various community-based activities and successful examples of behaviour change. Tzu Chi's youth have led campaigns to educate and promote plant-based diets in the United States, Philippines, Indonesia, New Zealand, Mozambique, Malaysia, Singapore and China, among others, through fun and interactive programmes. In Singapore, for example, Tzu Chi established Veg Forward and Veggie Hero (VERO) social media campaigns to encourage vegetarian diets through the introduction of plant-based meal recipes, photography challenges and webinars. To date, more than 1,695 young people in Singapore have pledged to adopt a plant-based diet. Utilizing similar methodologies, Tzu Chi's youth worldwide share a common vision and mission to encour-



Image: Da Lin Tzu Chi Hospital

The medical staff at Da Lin Tzu Chi Hospital harvest pineapples that they themselves have planted and cared for in a plot of land next to the hospital

age plant-based adoption around their peers as a means to tackle climate change. In Taiwan, Tzu Chi's youth hosted a Meatless Festival, gathering trendy, modern and delicious vegetarian food to encourage the community to rethink their biases against plant-based food, demonstrating the potential of young people in leading and driving sustainable change in personal behaviour towards a carbon-free lifestyle, while advocating for systemic transformation. Through their innovation and creativity in making the adoption of a plant-based diet interesting, fun and meaningful, these youths have influenced and promoted cultural shifts away from the common meat-centric diets not only in their families, but also in the community, attracting participation from nursing homes, schools and restaurants.

Green hospitals

Tzu Chi's culture of environmental awareness is, perhaps, most clearly demonstrated in its hospitals. In the rural province of Da Lin in Taiwan, Tzu Chi's world-class hospital stands out as one of few medical facilities in the world built with sustainability in mind — a 'climate-smart' hospital which emphasizes energy efficiency in all aspects of its construction and operation. It boasts a low-energy architecture which uses natural sunlight for lighting, a water reclamation system that recycles roughly 30 per cent of water used, and a 49.5kW photovoltaic system which reduces as much as 72 tons of carbon emissions per year. The most outstanding feature of Tzu Chi's hospital is the strict adherence to the principle of vegetarianism in the hospital. As a medical facility,

the Tzu Chi Hospital promotes plant-based diets not only for religious or environmental reasons, but also for health reasons as such a change in lifestyle may reduce one's risk of developing cancer, diabetes and heart disease. The nearby plot of land, owned by the hospital, is used for growing pineapples, mangoes, radishes and rice. Enough is grown to feed the staff. For the patients, the hospital provides locally sourced and ethically produced plant-based meals, serving over 900,000 meals within any given year. Through strict adherence to the principle of meat-free meals, the hospital is able to reduce its carbon footprint by more than 4,500 tons each year. The hospital at Da Lin province is only one of six owned and operated by Tzu Chi in Taiwan, each following the same standards of environmentally minded architecture, efficiency and sustainability.

Climate change is the most pressing existential threat of our time. This sentiment has been echoed throughout the global community for decades, and yet, decarbonization continues to be a distant dream. Current commitments made by the 197 signatories of the Paris Agreement have proven to be insufficient thus far, and action has come too late. We continue to fight amongst ourselves while the world is set ablaze, a product of clashing cultures, ideologies and class. From our insatiable pursuit for economic growth and wealth emerges social unrest, widespread division and catastrophe. As our food systems collapse as a result of worsening climate change, only through rebuilding our society with a culture of harmony, compassion and wisdom can we hope to take the first step toward saving our world.

The small farmers large field collective action model — making smallholder farmers profitable and sustainable

*Sampriti Baruah and Samarendu Mohanty
International Potato Center*

Globally, there are 500 million small farmers with landholdings of two hectares or less out of 570 million farmers. Asia is no exception, where a majority of the farmers are small and marginal.

In India alone, 86 per cent of its 146 million farmers are small and marginal. More strikingly, 70 million farmers have less than a half hectare of landholdings and another 30 million have between half and one hectare. In most cases, the less-than-a-hectare landholding of small and marginal farmers is split into multiple patches. These 100 million marginal farmers with one hectare or less are at a huge disadvantage because they cannot afford to mechanize labour-intensive operations such as planting and harvesting and the high transaction costs in accessing both input and output markets. The inability of smallholders to access markets has led to subsistence rather than market-oriented production systems that could have led to diversified farming systems away from cereals to high-value products such as horticultural crops and livestock products. The geographically dispersed nature

of smallholders also makes it difficult to reach them with the knowledge needed to improve efficiency in farming through technology adoption.

The need for collective action to minimize the disadvantages faced by small and marginal farmers has been identified in several recent studies, including those of Gulati and Saini (2016), Chand (2017), and Singh (2018), as key approaches for improving their livelihoods. The small farmers large field (SFLF) model is an adapted version of the large field model (LFM) of collective action that was first introduced in Vietnam. Under the SFLF model, the participating farmers organize themselves into groups to purchase inputs; contract service providers for farm operations, including mechanical planting, harvesting, and other farm operations; and synchronize activities such as planting and harvesting that essentially converts their small landholdings into a large field. This approach enables them to cut costs via bulk purchases, improve efficiency by synchronizing operations, enhance quality by using certified seeds and improved production practices, and receive a premium price for their produce because of quality and volume.

The SFLF collective action model

The SFLF model has been piloted in rice-based cropping systems in the eastern Indian states of Odisha and Assam for rice and potato. Initially, it was piloted for rice in two locations (Taraboisan and Khanizpur) in the state of Odisha. In the 2016/17 dry season, 54 farmers with 90 acres in the Taraboisan village participated in the SFLF pilot by forming an eight-member committee to facilitate discussion and decision making. The group decided to cultivate a new flood-tolerant rice variety, BINA Dhan-11, that was just released in the state. The farmers selected this flood-tolerant variety in the dry season because some of them had witnessed its good stem strength to withstand strong wind, which is a problem toward the end of the dry season.

The committee members negotiated with a certified seed producer to make a joint purchase of seeds and collected money from the members based on their requirement. The first synchronized and collective activity undertaken by the group was nursery management. The participating farmers decided to prepare a nursery bed in three groups



A few committee members, participating in the small farms large field action model, attending a meeting in the Taraboissan village. This village in eastern India pursued the collective action pilot in 2015/16



Image: Sampri Baruah

The SFLF model was adopted by 35 women tenant farmers in Khanijpur and, despite opting for manual transplanting and harvesting, saw a 32 per cent saving in labour

depending on the contiguity of their fields and tube-well locations. The largest nursery bed served approximately 30 acres, which saved water and labour, when compared to each farmer setting up his/her individual nursery in the corner of their own plot. The next collective action was land preparation using a tractor, and transplanting using a mechanical transplanter. The group procured fertilizer in bulk from the Indian Farmers Fertilizer Cooperative Limited by raising money from each farmer based on their requirement. Finally, the SFLF farmers sold their crop to a miller at a higher than market price because of the large quantity of good-quality paddy with no varietal mix.

When practicing individual farming, effective irrigation was hampered because each farmer planted at different times with different varieties needing different quantities of water. The situation became complex when one plot needed irrigation and the adjacent plot belonging to another farmer had mature standing crops. This created problems among the farmers when water flowed into another's field when water was not needed there. The SFLF farming system eliminated those problems since the crops were transplanted at the same time and the irrigation water flow from one field to another was appreciated by farmers in the downstream.

More importantly, the synchronization of planting increased water-use efficiency and sustainability of the farming system. This also led to improved relationships among the farmers. In one instance, a participating farmer injured his leg during transplanting and, since all the farmers are required to do transplanting at the same time, others pitched in to complete the process for the injured farmer.

In the ensuing wet season, and in addition to the Taraboisan farmers, whose group expanded to 77 farmers with 171 acres, a group of 35 women tenant farmers from the nearby village of Khanijpur who had visited Taraboisan, also decided to form a SFLF group to cultivate paddy. The group decided on Swarna-Sub1, a flood-tolerant variety, suggested by some members who had experience in cultivating this variety to effectively fight against early-season flooding.

SFLF with women tenant farmers

The effect of SFLF was even more evident in the case of the 35 women tenant farmers who operated on very small plots of land (less than one acre in most cases) and practiced agriculture with very low investment because of the risk of losing their crop due to flood and drought. Unlike in Taraboisan, the majority of these women farmers opted



Image: CIP Odisha team

More than 20,000 potato farmers in Odisha and Assam have followed the SFLF model and now sell good-quality processing tubers to chip manufacturers and table potatoes to local traders

for manual transplanting and harvesting because of uneven terrain and surplus family labour. This decision was also influenced by landowners who could not be convinced to use machines to cultivate their land nor use straw for their roofs and as fuel and animal feed. Earlier these women farmers cultivated rice varieties that were not flood-tolerant and lost their crop frequently.

Initially, they were not enthusiastic about shifting to a flood-tolerant rice variety, but some of the members of the SFLF committee were able to convince the entire group to switch to flood-tolerant variety Swarna-Sub1, which could tolerate 14 to 17 days of water stagnation without yield being adversely affected. The collective actions of participating farmers in the form of synchronization of key field operations, such as transplanting, significantly improved the efficiency of water use and improved the relationship among the farmers. Previously, the different irrigation schedules resulted in water wastage and misunderstanding among the farmers as the plots that needed irrigation created problems for adjacent plots that had a mature crop. Apart from monetary benefits and good relationships, the SFLF style of farming saved a significant amount of time for farmers in different field operations, which led to greater involvement of these women farmers in family activities. The average number of days of person labour saving was estimated to be 32, nearly 39 per cent increased compared to baseline

labour use. The time saved by these women farmers was used for different purposes (from engaging in other income generating activities, to lending a hand to their husbands in their work, and spending some quality time with their children and other family members).

Overall, both pilots were found to be a highly attractive option for small and marginal farmers who significantly increased their income by harmonizing and synchronizing selected operations to achieve scale and gain bargaining power in input purchases and output sales. The net income of participating farmers more than doubled in both locations. Apart from the monetary benefits, the farmers saved time in many joint activities: input (seed and fertilizer) purchases, paddy sales, and nursery bed management. Other important benefits were social harmony and sustainability of the farming system. The participating farmers developed a feeling of group camaraderie, which resulted in helping each other with exchange labour, and hired labour declined by 90 per cent.

SFLF with potato farmers

The SFLF model was expanded to potato, which is a winter crop and is usually planted after the rice harvest. It was introduced in Odisha and Assam following the same approach, that is, joint seed tuber purchase, mechanization, synchronization of planting and harvesting, and joint

marketing of tubers. This led to a doubling of potato yield and tripling of profit for the participating farmers in these states. Yield doubled because small and marginal farmers no longer used discarded table potatoes as seed and used certified quality seed potatoes. So far, the SFLF model has expanded to involve more than 20,000 farmers in these two states. Unlike rice, whose value chain is well developed and for which government procurement of harvests offers farmers some cushion, potato farmers face more significant market risk. For example, in good harvest years, they incur losses due to a glut of potatoes in the market. The SFLF model not only decreased the per unit cost because of higher yield and mechanization but also attracted traders to their doorstep because of the large quantity of good-quality tubers in one place.

In Gingia, Assam, SFLF potato cultivation started in the 2018/19 dry season with 69 farmers covering 138 acres, but the benefits were few due to virus-infected seed potato that was used. However, the farmers as a group succeeded in negotiating with the seed supplier to agree to provide compensation in the form of free seeds in the next season, which wouldn't have been possible if each farmer had purchased seed individually. Although yield was low because of virus infestation in the seeds, the farmers could still sell good-quality processing tubers to a chip-manufacturing company, and they sold the rest to the traders in the local market.

In the next season, empowered by their bargaining power in the seed and tuber markets, the number of farmers involved in the SFLF increased to 230 covering nearly 500 acres. The group selected three varieties of potato (one processing variety, LR, and two table varieties, Kufri Jyoti and Kufri Pukhraj). At the end of the season, the farmers were able to sell their processing potatoes to chip-processing companies and their table potatoes to local traders at premium prices.

Zero tillage potato cultivation with straw mulching

In the 2020/21 season, some progressive SFLF farmers opted for sustainable production practices including no-tillage potato with straw mulching, which they had viewed in the previous season through demonstrations and exposure visits. It reduces cost by 30 per cent due to land preparation (e.g., digging, planting) is not necessary compared to conventional practices. Low water evaporation and high soil moisture retention because of straw cover reduces water usage by 50 per cent. In addition, straw cover lowers weed infestation and the incidence of pest and disease. Overall, the productivity under no till potato is on par or better in some varieties as compared to conventional practices. No tilling, ridge and furrow for plating and digging tubers have attracted women to take up potato cultivation. This approach could be useful in the many parts of South Asia including northwest India where straw burning is health hazard for millions of people.

Overall, the SFLF collective action model has been found to be highly effective in improving the livelihoods of small and marginal farmers through scale and bargaining power. This collective farming approach creates trust and goodwill



Image: CIF Assam team



Image: Sampriti Baruah

Some farmers in Gingia, Assam, opted for the no-tillage potato practice for the 2020/21 season as it the cost of cultivation is 30 per cent less than traditional methods

among the farmers that leads to faster technology adoption and sustainable production practices within the group. In both states, the SFLF created enthusiasm among farmers to take up potato cultivation because of the strong market linkages established through this approach in which the market came to their doorstep and the support they received from each other. This model has the potential to successfully engage smallholder farmers in sustainable climate action through endogenous solutions adapted to local conditions brought into practice through fellow farmers.

Road to COP27: agricultural innovation and collaboration

*Giulia Di Tommaso, President and CEO
CropLife International*

The importance of the agricultural and food sectors in mitigating and adapting to the effects of climate change and delivering on the United Nations' Sustainable Development Goals (SDGs) will be an important theme at COP27, to be held in Sharm El-Sheikh, Egypt, between 7-18 November 2022.

2022 represents a significant opportunity to accelerate the shift to sustainable agriculture in support of the SDGs of zero hunger, climate action and biodiversity.

Addressing these challenges is beyond the reach of a single actor and organization and will require new approaches, new collaborations and new partnerships to create a true commitment to more sustainable food systems for our planet and its people.

Growing more nutritious food for an expanding population

As the global population continues to grow, the world will need by 2050 to provide safe, nutritious food to nine billion people. This will require producing more from less: improv-

ing yields and simultaneously reducing field losses and waste. The quality of the food we consume is also a growing issue around the world, requiring a greater focus on healthy diets and a steady supply of fresh and nutritious food.

Although global aggregate agricultural production is not projected to decline before 2050, the UN estimates that unless action is taken, developing countries could see a significant decline in agricultural productivity in the coming years due to heat, drought and more changeable weather patterns associated with global warming. Food availability will likely be affected by widespread declining yields in many regions of 10 to 25 per cent, as well as global price volatility.

Climate change is expected to alter growing conditions alongside the occurrence of pests and diseases: production areas will change, affecting cropping and trade patterns, harvests will be more variable and food price volatility will increase.

Pests, diseases and their accelerated transboundary movement — such as the fall armyworm — continue to have a significant impact on farm productivity, food security and balanced nutrition. Reduced farmers' livelihoods will



Creating sustainable food systems will help promote biodiversity and protect natural habitats



Image: CL

By 2050, the world will need to provide safe, nutritious food for nine billion people

severely affect socio-economic stability and trigger migration. Some of the impact will only manifest in the long run, though, through non-communicable diseases that will mark the shift from nutrition security to caloric security for many vulnerable populations.

In the face of this, we at CropLife International are working with our members, farmers and a range of partners and organizations to enhance farm productivity and resilience by highlighting and promoting the responsible use of agricultural and plant-science innovations, which can increase soil health and fertility, improve drought tolerance, reduce water use and irrigation, and positively contribute towards sustainable development.

Delivering on climate change by growing more with less

Like other sectors, agriculture must reduce emissions to be on a trajectory towards net zero. More than any other sectors, agriculture has the ability to sequester carbon by acting as a carbon sink while increasing fertility.

Promoting good soil health through plant and agricultural science will become increasingly crucial for the achievement of the SDGs, as healthy and fertile soil not only acts as an important storehouse for carbon, but also contributes towards climate-change adaptation by increasing organic matter, erosion control and a better water and nutrient management.

CropLife International is proud to support and be a facilitator of the Private Sector Call to Action for Soil Health, and we look forward to working with agricultural input companies, food companies, financial institutions and

other businesses to raise awareness of the central role of soil in achieving the SDGs and accelerate the adoption of best practices for soil health.

Another imperative is to maximize the use of farmland already available in the world to help address critical issues such as deforestation, environmental degradation, water shortages, pollution and biodiversity. Plant science and increased crop nutrition has substantially increased productivity in the last 60 years while reducing the need to bring new land into agricultural production. This will remain critical as countries around the world seek to protect natural ecosystems, increase landscape connectivity and conserve species diversity.

Sustainable food systems will promote biodiversity

Enabling sustainable food systems will help to promote biodiversity and to protect natural habitats. Our strategy is to work with a range of partners and stakeholders to sustainably manage, protect and restore agricultural land so that we can address global challenges more effectively and adaptively, whilst protecting human well-being and biodiversity to the greatest possible extent. This includes enabling farmers around the world to produce more crops and food without further encroaching on natural habitats and also seeking, where possible, to reduce land under agricultural production, to increase connectivity in the landscape. It also means controlling invasive species and pests that threaten native species and habitats, using innovative new technologies and solutions that are cost effective and sustainable.



Image: C.L.I

Promoting good soil health through plant and agricultural science will become increasingly crucial for the achievement of the SDGs

Through our stewardship and regulatory programmes, CropLife International is leading the way in promoting the responsible use of plant-science solutions to help deliver on global sustainability objectives, including safe disposal of obsolete stock, empty container management and rolling out our Sustainable Pesticide Management Framework, which equips farmers with technologies and practices to support their trade alongside climate mitigation and adaptation.

Empowering local communities to drive sustained and inclusive growth

All our work is guided by our purpose and vision to advance innovation in agriculture for a sustainable future. Sustained and inclusive economic growth, as expressly indicated by SDG8, will be critical to drive development and contribute to improved livelihoods, better employment opportunities, and greater economic security.

As we transition to more sustainable food systems, we must ensure that we meet the needs of farming communities around the world, prioritize human rights and remove any barriers to accessing opportunities whilst ensuring that farmers receive decent work incomes and wages. This will include creating opportunities to expand the range of crops grown and increase resilience by partnering with the conservation community to preserve local agrobiodiversity. Addressing social impacts on agricultural development will continue to be critical, including providing women and young entrepreneurs with access to opportunities to attract and retain them in rural areas.

At CropLife International, we are passionate about ensuring that the global agricultural sector is firmly committed to integrating human rights into the global food system, taking into account local traditions, livelihoods and social inclusion.

The important role of finance and policy

New emerging players, such as digital and technology companies, will also have a key role in the transformation of agriculture to deliver socio-economic and environmental benefits. This highlights how, like in other key sectors such as energy and transport, the transition towards sustainable agriculture will require significant investment and commitment from both public and private sectors.

Access to capital for farmers, innovators and agriculture companies will be critical. This in return will require regulatory and trade policies that provide certainty and support and nurture responsible innovation, underpin a predictable global trade environment, and ensure the responsible and effective use of plant-science innovation and technologies.

New partnerships are key to success

At CropLife International, our own engagement continues to be guided by our purpose and vision to advance innovation in agriculture for a sustainable future and play a leading role in enabling sustainable food systems. While not all stakeholders share our views, beliefs or experiences, we truly believe we can find common ground and a shared purpose. This is at the core of our new purpose-led strategy and plan for 2022 and beyond.



Agriculture is a key driver in economic activity, both on and off the farm, especially for women and youth, such as at this banana packaging facility in Costa Rica

In support of the SDGs, we are working with our members to roll out a new strategic framework to drive actionable progress towards the global ambitions of zero hunger, carbon neutrality and nature-positive solutions. Like everything we do, our new strategy is grounded in science and guided by our foundational principles of responsible innovation, respect for human rights, and transparency.

As I mentioned, we recognize that no single actor can solve these challenges alone and our framework provides a blueprint to engage with organizations with shared goals and ambitions. Working with aligned organizations has provided us with great opportunities to collaborate and engage with many key stakeholders, including the UN family of organizations, with whom we are working to boost farmer resilience to climate change, support rural communities, and ultimately address zero hunger.

Setting the agenda for COP27

COP26 held the world's attention in a way that no other previous UN conference has to date and, in my view, demonstrated that the decade-long sustained efforts of business leaders advocating for a more inclusive and collaborative approach to addressing climate change are finally starting to pay off.

Never in our lifetime has the intersection between innovation and sustainable food systems been more evident. In 2022 and beyond we will see renewed emphasis on and elevation of agriculture as an enabler for resilient economies and as a key part of the discussion on how to adapt to and mitigate climate change.



CropLife International is working to enhance farm productivity and resilience by highlighting and promoting the responsible use of agricultural and plant science innovations

As we head down the road to COP27, I am confident world leaders, policy makers, academics and NGOs are increasingly realizing the importance of positive engagement and collaboration with businesses and industry-sector groups to deliver the best possible sustainable solutions for climate action today and in the future.

Looking ahead to COP27, we are eager to form new partnerships and lead the way on the development of new initiatives, best practices, standards and industry commitments to accelerate the transition to sustainable agriculture that values carbon capture, promotes biodiversity enhancement, improves rural community livelihoods, and ultimately realizes our joint ambition of zero hunger.

I believe having the courage to face these challenges together will unlock new and better ideas, exciting innovations, new partnerships, new technologies, and most importantly, new solutions for sustainable and inclusive growth.

CTI-CFF: progress towards SDG 13 and COP26

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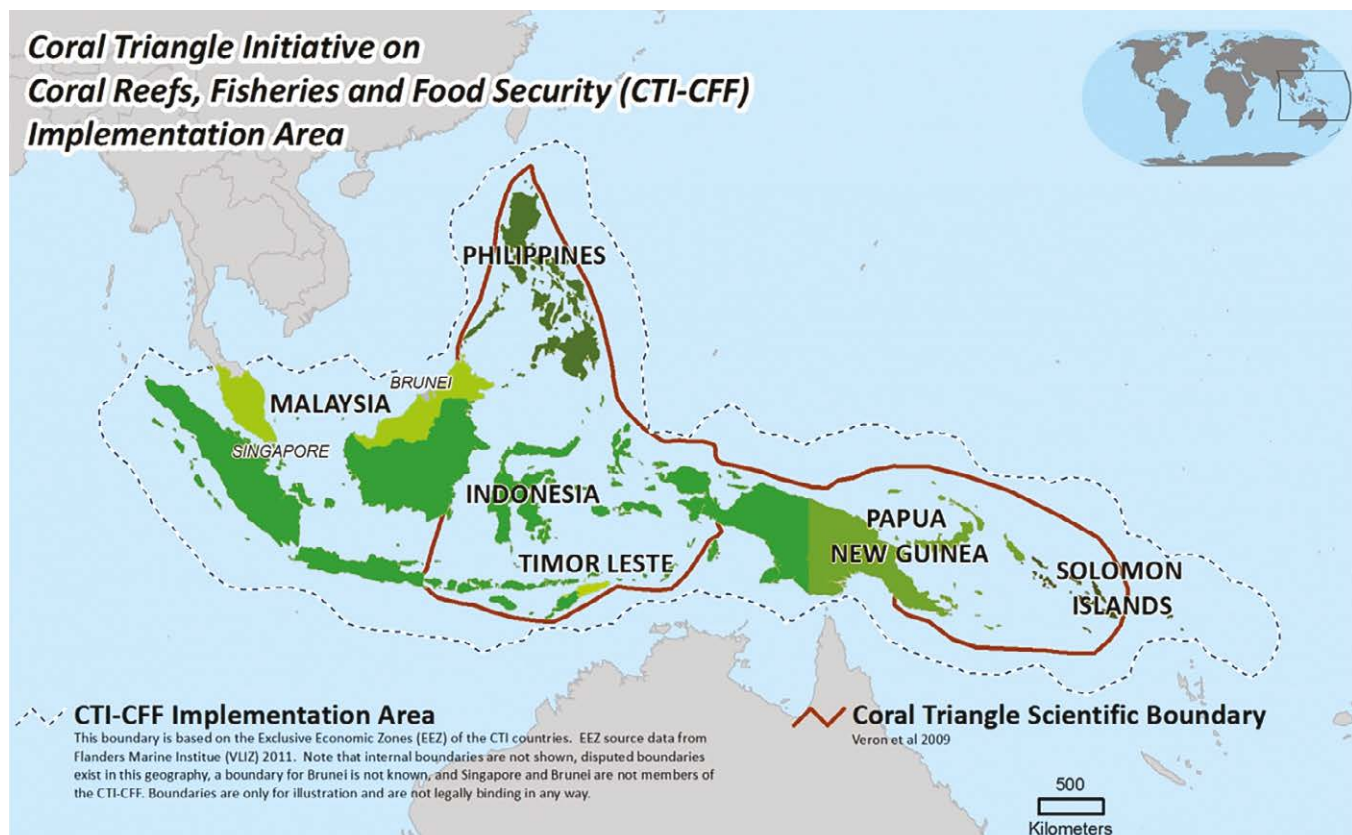
The Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security (CTI-CFF) is a multi-lateral partnership of six countries (the CT6: Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands and Timor-Leste) working together to sustain extraordinary marine and coastal resources by addressing crucial issues such as food security, climate change and marine biodiversity.

Climate change is a real global problem with significant impacts locally, including countries within the Coral Triangle region, especially the Small Island Developing States (SIDS). According to the Special Report on the Ocean and Cryosphere in a Changing Climate issued in September 2019 by the Intergovernmental Panel on Climate Change, impacts such as sea level rise and fisheries projections are worse than expected.

Climate change can result in extreme weather such as storms and cyclones, an increase in sea surface temperature,

sea level rise, coastal erosion, ocean acidification and coral bleaching, as well as a decline in tropical fisheries (including changes in species and population), which are critical nursery grounds for a wide variety of fish and marine species. These changes could severely affect livelihoods, food security, and survival of over 130 million coastal people in the Coral Triangle region.

The CT6 countries are guided by their national action plans as well as the regional and global frameworks, including the United Nations Framework Convention on Climate Change and the Paris Agreement, and have produced Voluntary National Reviews (VNRs) that include tackling climate change issues. COP26 in Glasgow in November 2021 saw Sustainable Development Goal 13 (SDG 13) addressed in depth by parties, a reference point for CTI-CFF to further strengthen its efforts to face the challenges post by climate change in the Coral Triangle region.



Outlook in the CT6: key messages

According to their most recent VNRs for SDG 13, 'Take Urgent Action to Combat Climate Change and Its Impacts', the CT6 countries have taken important steps in tackling the issues of climate change in the region. Indonesia aims to enhance disaster resilience by lowering greenhouse gas emissions and improving disaster risk reduction. Malaysia is increasing the share of renewables in its energy mix, and improving climate change at the policy level, where technical and financial support are still required in the implementation. For the Philippines, the primary catalyst for action is the Philippine Development Plan 2017–2022, where the SDGs were integrated. For climate action, the Climate Risk Management Framework provides risk information to enhance adaptive capacity. A Sustainable Consumption and Production Action Plan is now being formulated to provide a coherent framework for climate action.

The SIDS members of the CTI-CFF are part of the SIDS Accelerated Modalities of Action (SAMOA) Pathway. Papua New Guinea adopted the 2030 Agenda for Sustainable Development and the SAMOA Pathway to achieve its Vision 2050. The National Development Strategy 2016–2035, the blueprint for sustainable development in Solomon Islands, also includes the SAMOA Pathway. Solomon Islands remains vulnerable to climate change and natural disasters. Policy frameworks such as the National Climate Change Policy, Nationally Determined Contributions and the National Disaster Management Plan underpin measures currently in place. The effective implementation of adaptation and mitigation measures is dependent on timely availability of financial and technical resources. In Timor-Leste, an SDG roadmap

outlined how the global goals align with its Strategic Development Plan (2011–2030). Climate-proofing investments and promoting climate change adaptation (CCA) are imperative for community and ecosystem sustainability and resilience. Global action to combat climate change is crucial, especially as a member of SSIDS in the field of renewable energy.

CTI-CFF contributions (regional and national CCA activities)

Apart from the SDG 13 climate-related measures reported by the CT6 countries in their VNRs, CTI-CFF member countries also conducted climate-related activities on the ground nationally, based on their National Plans of Action (NPOAs) as well as regional activities based on the CTI-CFF Regional Plan Of Action (RPOA).

Nationally, the CT6 countries have also accomplished major CCA-related measures and activities. Some examples of important climate-related activities on the ground, also detailed in the CTI-CFF Annual Reports from the year 2018 to 2019, are given below.

Indonesia — the One Map Policy, mainstreaming CCA, climate budget tagging, climate adaptation campaigns, Coastal Youth Camps, Climate Impact on the Ocean and Fisheries research, the Community and Ecosystem-based Climate Adaptation Program, Strategic Planning and Action to strengthen climate resilience of Rural Communities, Indonesia Climate Change Trust Fund, Community Resilience towards Disaster and Climate Change in North Sulawesi, a workshop on Low Carbon Development Plan and Climate Resilience, and the Indonesia Blue Carbon Strategy Framework.



A woman selling fish in Bitung, North Sulawesi

Image: Regional Secretariat, CTI-CFF



Image: Tread

Feeding fish in Kudat, Malaysia



Image: PNG CTI NOC

A woman plants mangrove at Tahira, Bootless Ba, Papua New Guinea

Indonesia's achievements include a programme on local communities implementing climate mitigation and adaptation actions to increase resilience, Mangrove Adaptation to Climate Change, ecosystem-based adaptation (EbA) and climate action on national level, a roadmap on Mitigation and Adaptation of Land Subsidence in Coastal Lowland, the Ocean Health Index, and the Indonesia Mangrove Society's work to accelerate mangrove rehabilitation and coastal communities' sustainable livelihoods.

Malaysia — the 5th CTI-CFF Climate Change Adaptation Working Group Regional Exchange and Grant-Writing Workshop, an exchange programme between Ludwig Maximilian University in Munich, Germany, and the Borneo Marine Research Institute at University Malaysia Sabah, the International Conference on Marine Science and Aquaculture, the Youth Climate Change Training Camp and Marine Biodiversity Awareness Week.

Malaysia's achievements include an environmental data collection and archiving system, the National Coastal Vulnerability Index for Coastal Strategic Assets & Major Urban Centres, the Malaysian Climate Change Coastal Adaptation Plan on sustainable fisheries and livelihood, scientific research, and the Closer Economic Partnership Agreement.

Papua New Guinea — Coastal & Inland Flooding early warning systems in five provinces, community-led mangrove reforestation and conservation, Climatic Risk and Vulnerability maps, risk profiling, institutional capacity to integrate climate change risks into policies and management, published the community-based mangrove handbook, the CCA and Food Security project in Ahus



NGO workers checking a mangrove area in the Philippines



A market survey in Honiara, Solomon Islands

Island, Manus province, planting projects in different parts of the country, programmes that support CTI-CFF goals, Community-based Fisheries Co-management approach and its focus on mangrove protection and rehabilitation in Madang Province, training women on soil improvement methods, the Mangoro Market Meri programme for

empowering women to generate income from sustainable mangrove management, and the Blue Carbon and REDD+ strategy.

Papua New Guinea's accomplishments include the production of a community-based Mangrove Planting Handbook, adaptation to coastal flooding-related risks and hazards for the North Coast and Islands Region communities and awareness raising and knowledge management, building resilience via a sustainable fishery ecosystems and food security projects in nine vulnerable islands and atoll communities (includes Locally Managed Marine Areas, mangroves), climate proofing of Alotau provincial wharf, and vulnerability mapping and planning.

Philippines — the Commission Resolution on Climate Risk Management Framework, Mainstreaming Climate Change Action in Ecosystem Based Adaptation Planning, the 2nd National Convention on Climate Change and Disaster Risk Reduction, the creation of the National Blue Carbon Technical Working Group, mangrove rehabilitation, research, mangrove marine protected areas and nursery establishment, policy and outreach, sustainable financing (livelihood and ecotourism), Carbon Stock Assessment, Building Coastal Resilience for Disaster Risk Reduction and Climate Change, feasibility of green-gray approach, Climate Change Strategic Framework for Disaster Risk Reduction and Management, as well as vulnerability and suitability assessment for capture and aquaculture fisheries.

Philippines' accomplishments include the Communique on Climate Change for review by the Climate Change Action Working Group, mangrove conservation and rehabilitation, the Mindoro Mangrove Green Wall Initiative, Green Gray Infrastructure Initiative, National Blue Carbon Working Group, National Mangrove Summit, Blue Carbon Strategy Workshop, climate change vulnerability and suitability assessment and mapping of aquaculture and capture fisheries, Commission Resolutions on the Creation of Blue Carbon Steering Committee and National Climate Risk Management Framework, National Climate Change Action Plan, Local Government Unit Guidebook, and strengthening of coastal fisheries governance to ensure preferential rights by municipal fisherfolk over the use of coastal and marine resources.

Solomon Islands — national discussion on blue carbon opportunities, policy and legislation through the Climate Change Bill, Integrated Vulnerability Assessment in Malaita Province, climate change education, awareness and training for coastal communities, the USAID Climate Ready Project — Access to Finance, Legislation, Water Sector Adaptation programme, climate change adaptation planning and support for three townships: Taro, Gizo and Tingoa, and three communities: Ferafalu (Malaita), Santa Catalina (Makira) and Tuwo community in Temotu province, the Community Resilience to Climate and Disaster Risk in Solomon Islands Project, the ACP-EU NDRR Program, Global Facility for Disaster Reduction and Recovery, plus 48 community sub-projects rolled out in Guadalcanal, Temotu, Malaita and Central Island.

Solomon Islands' accomplishments include Pacific Ecosystem-based Adaptation to Climate Change (2017-2020), which promotes an ecosystem-based approach as a climate change



Fish-sellers in Dili, Timor-Leste

adaptation strategy, integrated vulnerability and adaptation assessments (21 communities in Malaita Province), CCA activities by NGOs and community-based organisations, and the establishment of an Oceans and Climate Change Desk with the Ministry of Foreign Affairs and External Trade.

Timor-Leste — the establishment of the Center for Climate Change and Biodiversity at the Universidade Nacional Timor Lorosa'e, a national information network on climate change, a coastal community resilience programme in seven municipalities, other activities in relation to CTI-CFF goals, beach clean-up for a healthy environment, and putting a zero plastic decree law in place.

Timor-Leste's accomplishments include the CTI-CFF National Program on Waste for the management of household recycling of fabric, plastic and cloth in Atauro, coastal resilience mangrove replantation, small scale rural infrastructure work, a Zero Plastic environment policy, the Green School, and an integrated regulation assessment climate change working group.

Regionally, CTI-CFF countries, through the Regional Secretariat, have contributed and achieved quite significantly to the SDG 13 and its targets 13.1, 13.2, 13.3, 13b, even before the SDG was officially adopted in 2015. Under the RPOA which has been running since 2009, several important regional CCA activities have been carried out.

Almost a decade ago, the importance of addressing climate change was recognized by the CTI-CFF countries. 'Climate Change Adaptation for Coral Triangle Communities: A Guide for Vulnerability Assessment and Local Early Action Planning' (The LEAP Guide) was published in 2013 to catalyze local early action in coastal communities through education and outreach, vulnerability assessment and local early action planning. The LEAP Guide is a companion resource book to assist local governments and communities in identifying strategic, effective and practical actions to address current and future environmental and socio-economic impacts related to climate change.

This LEAP Guide is organized into four major steps to support the integration of planned adaptation within the context of existing development objectives and plans and ongoing projects and programmes with coastal communities on a wide range of development issues such as food security,

health, biodiversity conservation and economic development. The LEAP Guide is also intended to be incorporated into other plans.

In 2013 the 'Region-wide Early Action Plan for Climate Change Adaptation for the Nearshore Marine and Coastal Environment' (REAP-CCA) was published. The REAP-CCA presents some of the urgent and immediate actions that need to be taken across the Coral Triangle to build coastal community resilience to climate change.

In 2018, the 5th CTI-CFF CCA Working Group Regional Exchange and Grant Workshop was conducted, where the priority actions outlined in the REAP CCA were reviewed. The draft terms of reference for the Regional Center of Excellence (CoE) on CCA was finalized and later transformed to a virtual CoE. The course outline for the Executive Course on CCA was also discussed, with a focus of training local governments, based on The LEAP Guide.

More recently, the CCA Working Group (WG) finalized the draft joint communique and agreed to conduct the Executive Course via two webinars in September and October 2021. Other activities in the CCA WG workplan include Climate and Coastal Vulnerability and Risk Profiling (Tools and Approaches), CEPA and Strategy for CCA (online) and the 7th CCA Working Group Meeting.

The new Regional Plan of Action: RPOA 2.0

The CTI-CFF countries are currently drafting the new RPOA 2.0 (2021–2030) where their goals are focused on communities and ecosystems resilience in the face of climate change:

RPOA 2.0 – 2025 Goal: By 2025, natural communities and coastal and marine ecosystems are enabled to cope with the impacts of climate change, natural and anthropogenic threats, in the CT region, due to measurable increased regional collaboration between the CT6 and are partners, for the implementation of the RPOA 2.0 facilitated through a strong and effective CTI-CFF.

RPOA 2.0 – 2030 Goal: By 2030, coastal communities and coastal and marine ecosystems in the CT region are more resilient/able to adapt to impacts of climate change, natural and anthropogenic threats, by improving food security, sustainable fisheries and coastal livelihoods.

So far, the member countries in principle have agreed on the main outcomes and outputs of which several are specifically on climate change.

CTI-CFF and the need for sustainable and innovative funding

Based on the member countries' latest VNR reports, several major gaps and challenges in facing climate change impacts, mitigation and adaptation have been identified. The gaps and limitations include but are not limited to, capacity building to fully realize the goals, to develop and implement principles, policies, guidelines, frameworks, rules and regulations, agreements, protocols and conventions.

The capacity building in mobilization of resources may require further support and funding in terms of increasing qualified and skilled personnel, inclusive stakeholder participation including gender parity, as well as sufficient sustainable, predictable, additional financial resources at all

levels. These are especially crucial in terms of the future planned mitigation measures which include high tech areas such as renewable energy, solar power, new changing global standards, high tech monitoring and surveillance needs, vulnerability and disaster risks reduction, early warning systems and integrated coastal defense.

It is clear that there is an urgent and dire need for sustainable and innovative funding for the member countries to further accomplish meaningful, reasonable and the necessary CCA measures.

Conservation Trust Fund

Since CTI-CFF is the core of the global marine biodiversity centre and climate change will significantly impact the region, CTI-CFF, together with its strategic partners, has been working to explore sustainable financing opportunities to realize regional and national goals, which include establishing CCA measures.

Following a series of meetings and discussions with the strategic partners, an effort is now in progress to establish a Conservation Trust Fund for CTI-CFF. In November 2020, a technical committee which includes the member countries of CTI-CFF was formed. The Regional Secretariat and WCS, together with the help of CFA, are to lead the design process of the Conservation Trust Fund of CTI-CFF. Since January 2021, monthly meetings have taken place towards setting up the framework of the fund, develop its governance structure including the formation of the Board of Directors. It is envisaged that by 2022, the establishment of the Conservation Trust Fund of CTI-CFF organization will be a reality. It will enhance the effort of the member countries towards facing the challenges of climate change in the Coral Triangle region.

REAP and LEAP for CCA in the CT region

Collaboration among organizations and institutions around the Coral Triangle is essential for full implementation of the REAP-CCA. Nationally, all six countries include CCA as a priority in their CTI NPOAs, and their CTI National Coordination Committees have developed linkages to their National Climate Change Councils or equivalent bodies to harmonize policies and actions between CTI, which focus on marine and coastal issues, and their terrestrial and general national programme.

Addressing regional capacity development needs

Key areas for capacity development include: technical assistance and training on integrating CCA into sectoral plans, such as fisheries management, coastal infrastructure, and rural economic and livelihood development planning; training to assist governments in developing proposals that meet the eligibility requirements of the major international CCA funds; and, building regional, national and local capacity to support data and information management.

Local governments in CT countries are also at the front line in terms of experiencing climate change impacts and will have the critical responsibility of implementation of many of the early actions in the REAP-CCA, including

consideration of climate change vulnerability into local development plans and policies.

CT data sharing

A key requirement for many CCA actions is information. Climate change and adaptation are still new topics for many globally and in the Coral Triangle, especially among slower evolving institutions such as government agencies and for general acceptance into a 'community of practice'. Learning networks are one mechanism or institution that can facilitate a quick development and replication of new knowledge, models and practices.

The CTI-CFF RPOA 2.0 has a target to develop a network of national centres of excellence on CCA for marine and coastal environments. Tracking progress of REAP-CCA implementation and reporting results under the CTI-CFF is essential for catalyzing and sustaining action and funding for CCA. Benchmarking local implementation and monitoring key indicators provide the mechanisms to track progress and report on results. Benchmarks can serve as a useful tool to catalyze and guide local implementation of CCA.

Financing CCA

Financing actions identified in the REAP-CCA can be supported by international, regional, national and sub-national mechanisms. The ability to receive financing from any of the available funding sources for CCA actions typically depends upon a clear articulation of likely climate impacts and on a clear proposal of adaptation measures that will reduce vulnerability. Some financing mechanisms are more applicable to longer-term CCA programmes and projects, therefore national and sub-national budgets and existing donor programmes should be tapped to support implementation of early actions in the REAP-CCA. A number of financing options are available or emerging, including: The Adaptation Fund, established by the Parties to the UN Framework Convention on Climate Change to finance concrete adaptation projects and programmes in developing countries that are parties to the Kyoto Protocol and to allow direct access to the fund by those parties; and, The Asia Climate Change Adaptation Project Preparation Facility, a USAID project to address capacity and information needs of eligible governments in the Asia region in accessing CCA funds and accelerating investments in initiatives that increase resilience to the negative impacts of climate change.

National agencies are integrating CCA into policies and programmes as part of their commitment to their CTI-CFF NPOA as well as NAPA. Many donors are integrating CCA into existing and future programmes and projects. Local governments are beginning to integrate CCA and are allocating a portion of their budget to adaptation projects. These investments would demonstrate the commitment of local government to building coastal community resilience to climate change, potentially improving the ability to access international financing. Public-private partnerships can serve as an important mechanism for funding CCA. Early actions can be integrated with existing public-private partnerships or new partnerships can be formed to support CCA.

Sustained ocean observation for understanding climate change

Ferdy Gustian Utama, BMKG Maritime Meteorological Station of Teluk Bayur Padang, Dava Amrina and Bayu Edo Pratama, Center of Marine Meteorology, Nelly Florida Riama, Center of Research and Development Agency for Meteorology, Climatology and Geophysics of the Republic of Indonesia (BMKG)

Sustained ocean observation is a critical responsibility in relation to ocean resources and has become increasingly important to society. The contributions of many nations cooperating to develop the Global Ocean Observing System (GOOS) have resulted in a strong base of global and regional ocean observing networks.

The oceanographic community has recognized that understanding and adapting to climate change will require additional environmental monitoring through ocean observations. The drivers for sustained ocean observations are in fact much broader, but the support for ocean climate observations is insufficient for the sustained ocean observing system that is required.

One of the challenges faced is damage to observation equipment, such as buoys. Data buoy vandalism, which is an unlawful and willful interference of moored data buoys, has been a troublesome problem for the National Data Buoy Center (NDBC) and other buoy operators around the world. Buoy damage has a significant financial impact on buoy operations, including damaged costs for lost equipment, ship time, and labour costs for repairing, retrieval, deployment and searching drift buoys.



Image: BMKG

Damage disrupts the vital data collected and reported by the buoy system. Data collected from buoys contributes to saving lives, protecting the environment, and aiding commerce and transportation. Impacts of buoy damage are highly significant from financial, scientific, marine prediction and warning, and marine operations standpoints. Loss of buoys in the Indian Ocean for The Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction (RAMA), for example, will substantially impact climate prediction that affects essential business variables and the loss of critical information for weather and marine forecasts, including the Indian Ocean Dipole (IOD) phenomenon and, most importantly, tsunami warnings.

Moreover, global remote-sensing observations through satellites have also developed, and its data is easily accessed. The numerical methodology and computation system have contributed to marine data interpretation and its trend both for global or regional scales.

Extreme events in Indonesia are impacted by the El Niño Southern Oscillation (ENSO) in the Pacific, Mascarene High (MH) in western Australia, and the Madden Julian Oscillation (MJO), which propagates eastward. Global and regional observations showed that: 1. Sea surface temperature (SST) in Indonesian oceans was still warm; 2. The East Asian/Australian monsoon was weaker than the average climate value; 3. SST in the eastern part of African coastal area has negative value related to negative IOD phenomenon, the impact of which is particularly affect excessive rainfall; 4. The Inter-Tropical Convergence Zone (ITCZ) in the Indian Ocean moves into the Indonesian Maritime Continent (MC), pushed by the MJO event; and 5. The MH in western Australia contributed to high waves on the southern coast of Java.

At present, maritime weather observation in Indonesia relies on global cooperation, observations carried out using remote sensing equipment, and in-situ observations made by the National Ministries/Institution. These observations are operationally used to estimate marine weather prediction, including ocean tides, wave height potential and tsunami propagation.

Indonesia-PRIMA activities

RAMA buoys are located in the Indian Ocean, and damage incidents occur to these buoys as it does in any country that

has moored data buoys. So far, this problem has mainly been addressed through education and outreach. Recently, national and international efforts to address data buoy damage have been ramped up to gain regulatory and statutory aid through an international coalition. The Indonesia Agency for Meteorology, Climatology and Geophysics (BMKG) has cooperated with the US National Oceanic and Atmospheric Administration (NOAA) since 2015 to maintain RAMA buoys in the Indian Ocean, located close to Indonesia. Four to five buoys are maintained every year through the Indonesia Program Initiative on Maritime Observation and Analysis (Indonesia-PRIMA) ship activities.

The results of the Indonesia-PRIMA programme, among others, indicate that maintenance of global maritime observation systems can be done more optimally by researching asset utilization among national and international institutions as well as facilitating capacity building programmes. Observation data gives basic interpretation and comprehension of the extreme weather-climate phenomenon and provides an understanding of ocean-atmosphere interaction mechanisms both at the surface and in the ocean. Further activities covering all Indonesian waters will contribute to discovering the role of Indonesian Through Flow (ITF) as the 'missing link' information between the Indian and Pacific Oceans, especially in understanding national and global climate change.

In addition to contributing to global observation activities, Indonesia also seeks to help protect observation equipment from damage caused by accidents and vandalism. BMKG is responsible for the sustainability of RAMA buoy observations.



A damaged buoy found by fishermen in Labuhan Bajau, Siberut Island

Buoy recovery in West Sumatra

BMKG discovered a damaged buoy near the community around Siberut Island, West Sumatra in April 2021. Fishermen from Labuhan Bajau Village on the island found a buoy that was suspected to be a tsunami detector. It was first discovered in the waters of Tanjung Sigep, north of the island, then towed by fishermen to the Siberut Island beacon tower to be reported to local officials. The officer at the beacon tower contacted the BMKG Maritime Meteorological Station of Teluk Bayur Padang, submitting information including a chronology of its discovery, the last location, and documentation in the form of a picture of the condition of the instrument found.

The buoy found by the fisherman belonged to NOAA and was used to observe marine and weather conditions in the Indian Ocean region, part of the research and marine observation consortium RAMA. To ensure the instruments are the responsibility of the BMKG, coordination was carried out between the BMKG Maritime Meteorological Station of Teluk Bayur Padang and BMKG's headquarters in Jakarta, in communication with NOAA.

The preparation process for buoy recovery takes about two months. NOAA directly ships some technical tools from the United States along with guides for tool recovery. As a measure to avoid vandalism that can occur at any time on observation equipment at sea, several observation sensors have been secured at the Indonesia National Army (TNI) headquarters on Siberut Island with permission from BMKG. Unfortunately, some of the equipment was lost, before the local TNI members' rescue.

On 8-10 June 2021, buoy recovery was carried out after technical consultation with a team of experts from NOAA and coordination with TNI officers on duty on Siberut Island. To get the buoy from the storage location in Muara Harbor in Padang to Labuhan Bajau Village takes four hours by sea and continues by speedboat at 19.6 km. The buoy's position is about 150 meters from the shoreline, moored to the bottom of the water, with the data logger still attached to the main buoy framework. Other vital sensors that have been rescued include air temperature sensors, radiation intensity, rain gauge and air pressure. The sensor is packed into a box as directed by the NOAA expert team.

The primary cause of damage to buoys is vessel collision, fishing nets or lines entanglement, fish operation, using the buoys as fish aggregating devices (FADs), or theft of the buoy system or its equipment. BMKG will continue to investigate the disestablishment or movement of data buoys from the proper locations. The drawback to relocation of buoys is the loss of climatological measurements made at the station. The loss of data at a particular site also disrupts climate records that are crucial to understanding climate change.

A programme for ocean literacy

BMKG has also encouraged fishermen to understand maritime weather and climate information and observation to support sustainable marine observation activities through the Fisherman Weather Field School, or Sekolah Lapang Cuaca Nelayan (SLCN), since 2016. This ocean literacy programme emphasizes educating a targeted user (e.g. traditional fishermen, aquaculture fishermen, salt pond farmers



Image: BMKG

Recovery of the data logger from the RAMA buoy

and related stakeholders in fisheries and community sectors) about maritime weather and climate information to support safety at sea and improve welfare.

The outcome of the SLCN programme is an increasing number of users who utilize and benefit from the maritime weather and climate information in their daily marine activities. For fishermen, sustainable fishing will allow for an increased and sustainable catch for generations to come. Second, they are increasing the number of maritime production stocks by utilizing marine weather and climate information. Third, also very important, is improving people's awareness in preventing damage of marine weather observation equipment to maintain the sustainability of maritime weather observation.

Improving understanding and impact

In addition to providing education to the community, BMKG also conducts many research collaborations to utilize observational data and observe climate change occurring on a regional scale, especially in the maritime continent. One of the research activities currently underway is the Years of Maritime Continent (YMC). Its overarching goal is to expedite the progress toward improving understanding and prediction of the local oceanic and atmospheric multiscale variability of the Indo-Pacific MC and its global impacts. YMC is motivated by the unique role of the MC in both the local and global weather climate systems, our lack of understanding of the critical processes governing this role, and



Image: BMKG

Secured sensors from the buoy

persistent systematic biases and errors in numerical model output for the region. The programme builds a comprehensive observational data set of the MC weather climate system, encourages observation-modelling integration, and educates the next generation of scientists who will be the core workforce and leaders to advance the MC study further.

Besides YMC, Indonesia is also involved in the research of Measuring and Modelling the Indonesian Throughflow International Experiment (MINTIE). The international MINTIE observational effort is a novel combination of a three-year deployment of a transport and water mass resolving mooring array within the significant ITF passages and simultaneous observations from profiling and mixing floats in the interior seas. These observations, commencing in 2020, and a series of high-resolution model simulations will be used to investigate the drivers and dynamics of the ITF and the role of tidally-driven water mass mixing in the transformation and storage of the thermocline waters along the pathways from the Pacific through the Indonesian Internal Waters to the Indian Ocean. The research will further explore their effect on the surface ocean temperature and thus climate. This research also investigates the impact of remote, regional and local wind stresses, combined with tidal interactions, on the partitioning of the transport through the significant straits. Some other components like the relative roles of wind, buoyancy forcing, and internal mixing in driving changes in vertical profile and properties of the ITF across different timescales.

Forest conservation is not just about carbon stocks — perspectives from forest ecology and field research

*Tamotsu Sato, Director of the Department of Forest Vegetation
Forestry and Forest Products Research Institute*

Forests remove carbon dioxide from the atmosphere through photosynthesis. For this reason, many people are aware that forest conservation is an important way to protect the environment.

British economist Dr Nicholas Stern, in his book ‘The Stern Review: The Economics of Climate Change’, states that “curbing deforestation is a highly cost-effective way of reducing greenhouse gas emissions”. The ideas he set out are now widely accepted and reducing deforestation is one of the measures taken to mitigate climate change. REDD+ (Reducing emissions from deforestation and forest degradation in developing countries, and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks) has been discussed for more than a decade during the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) and is now being fully implemented as a climate change mitigation measure for the forest sector.

The success of REDD+ hinges on the ability of the implementing countries to accurately account for the carbon emission reductions that result from their actions. However, in many countries where REDD+ has been implemented, it has been difficult to estimate forest carbon stocks due to a lack of information on forest areas from using satellite images and statistical data and ground-based measurements. To ensure the success of REDD+, it is crucial to understand the quantity of forest area and carbon stored.

The Food and Agriculture Organization of the United Nations (FAO) publishes a Global Forest Resources Assessment (FRA) every five years. According to the FRA2020, some parts of Asia and Europe have seen an increase in forest area, but other countries, especially in the tropics, continue to suffer from deforestation. This decrease in forest area, often due to the conversion of land for other uses such as agriculture or residential areas, is easy to assess visually and with satellite imagery. It directly contributes to carbon emissions, so it is important to understand the rate of deforestation that is occurring. There is also a significant need to develop a system that continuously monitors the changes in forest carbon stocks.

The significance of quality in forest carbon

The Forestry and Forest Products Research Institute (FFPRI) is working on the development of monitoring methods to estimate forest carbon stocks and their changes at national and sub-national levels in Southeast Asia and South America. One of these methods uses tree allometry — which establishes quantitative relationships between measurable tree characteristics and other, less easily measured, properties — equations to determine the amount of carbon stored in a single tree. However, in some areas, appropriate equations are not available due to a lack of information. FFPRI has therefore developed and published its allometric equations for Cambodia and Paraguay. The outcomes of this



Ground-based measurements play an important role in estimating forest carbon stocks

Image: Tamotsu Sato, FFPRI



Image: Tamotsu Sato, FFPR

FFPRI disseminates research results at previous COPs of the UNFCCC

have been included in '2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories' by the Intergovernmental Panel on Climate Change as one of the suggested ways to determine regional forest carbon stocks.

However, problems still exist in the implementation of accurate forest carbon monitoring. It is insufficient to assess deforestation alone when considering the actual emission reduction from forests. For example, in some countries, estimates indicate that carbon emissions from forest degradation are higher than deforestation. Forest degradation can be defined as the deterioration of carbon stocks and forest

structure compared with forests in good condition and is often driven by activities such as illegal logging for firewood and charcoal. A clear definition of forest degradation is difficult to achieve though, as the degree of degradation can vary depending on the criteria used to define it. While it is difficult to assess forest degradation through satellite imagery, it is also difficult to control. Even if there is no change in the size of forest areas, the number of carbon stocks will continue to decrease if there is a decline in forest quality through degradation.

Forest functions other than carbon fixation

The conservation of forests is expected to maintain and increase forest area, but is this enough? Even if a forest is maintained in the definition of land classification, if we cannot prevent the degradation of forests, then all forest ecosystem functions will be reduced, including carbon storage. If the rate of carbon fixation in trees — which converts carbon dioxide into organic compounds — is a priority, then planting fast-growing trees is a good option. However, this can seriously undermine the other functions of forests, specifically the ability to provide a habitat to various species. Given that no single forest can perform all functions equally well, it is necessary to plan the landscape so that forest types are defined and allocated appropriately and according to their purposes, such as timber production or biodiversity conservation.



Image: Tamotsu Sato, FFPR

Development of allometric equations, including root part



Image: Tamotsu Sato, FFPRI

Timber production can compromise the fulfilment of other forest ecosystem functions



Image: Tamotsu Sato, FFPRI

Forest degradation causes reduction in carbon stocks and quality of forests

Forest conservation and the realisation of the SDGs

The link between people and forests is ancient and inseparable. Past human activity has had a major influence on the distribution of tree species and the structure of forests, as can be seen in the case of the Brazil nut (*Bertholletia excelsa*), the distribution of which throughout the Amazon reflects its past use by humans. Forests are natural resources for timber production, medicine and traditional crafts. They may also be home to plants and other forms of life, the value of which may be currently unknown but prove to be precious in the future. We have a responsibility to carefully manage our forests in their use as a sustainable resource and to ensure their longevity for future generations.

The Sustainable Development Goals (SDGs) are international goals developed by the United Nations General

Assembly in 2015 to create a sustainable and better world by 2030. SDGs 13 and 15, which demand action on climate change and the protection of the world's green wealth respectively, are particularly strongly linked to forests. The REDD+ initiative is essential to achieving these two goals, as well as others. The multifaceted functions of forests go beyond climate change mitigation — the focus of REDD+ — to include landslide prevention, water supply, cultural values and biodiversity conservation. If we can implement REDD+ to reduce deforestation, we will receive many other benefits from our forests.

Moving towards a brighter future

Covid-19 has impacted several aspects of 'normal' life, including the management of forests due to urban lockdown. With this, it is also possible that workers returning to the countryside from urban areas will become more dependent on forest resources due to economic deprivation. As such, the importance of the sustainable use of forest resources is becoming even more important.

Individual activities cannot achieve the goals of REDD+ and the SDGs, but if each individual understands the significance of these goals and the sustainable use of resources, we will be closer to achieving them. It is vital that local people learn about forest conservation and understand the effects of their actions.

Field research provides us with a wide range of knowledge, but we must use this knowledge as a scientific basis for developing solutions. The situation facing us regarding forests and climate change is complex and challenging, but the FFPRI is working to use its research to provide solutions for those working in forests so that we can move towards a brighter future.

Steering corporate leadership and action by taking a multifaceted approach to protecting forests, building up communities and achieving a net-zero world by 2050

*Letchumi Achanah, Head of Strategic Engagement and Advocacy
Asia Pulp & Paper (APP) Sinar Mas*

COP26 concluded with 200 countries agreeing to the Glasgow Climate Pact and reaffirming the Paris Agreement goal to limit the increase in the global temperature to 1.5C. All signatory nations stressed the urgency for concerted action to cut carbon dioxide emissions by 45 per cent in order to be net zero by 2050.

This global ambition can only be achieved through a collaboration between the private and public sector. Asia Pulp & Paper (APP) Sinar Mas, one of Indonesia's largest pulp and paper producers, realized this early on as it developed one of the sector's most ambitious sustainability policies, aligning itself with both the Indonesian government and global sustainability targets.

The Indonesian government has committed to reduce 29 per cent of its greenhouse gas emissions by 2030 and said it could potentially increase this to 41 per cent by 2030. However, the government added that this is subject to the availability of international support for finance, technological development and capacity building.

The Indonesian archipelago is home to the third-largest rainforest reserve in the world and has pledged to reach carbon neutrality in its forest sector by 2030. To achieve that goal, the Indonesian Government is prioritizing realistic, fair and appropriate treatment of its deforestation issue. Indonesia has also taken significant steps in land use to reduce emissions by instituting a moratorium on the clearing of primary forests, reducing deforestation and forest degradation, restoring ecosystem functions and other strategies to sustainably manage its forests.

In reflection of the Indonesian Government's plan towards sustainable development, APP has pledged to contribute towards the sustainable management of Indonesia's forests through its Sustainability Roadmap Vision (SRV) 2020, which was originally deployed in 2012 and became the framework for the company's sustainability strategy. The SRV sets out 10 key impact areas that are relevant to APP's stakeholders across its business and supply chain, with ambitious targets for each of them.

As a company that is heavily dependent on renewable resources for its pulp and paper production, APP believes it

is also important to conserve and protect forests for future generations. Under its Forest Conservation Policy, established in 2013, more than half a million hectares of forests from Sumatra, Indonesia, to Kalimantan, Borneo, have been set aside for conservation. That represents more than 20 per cent of the total concession areas managed by APP and its suppliers.

While APP has achieved the majority of its targets set out in SRV 2020, it wants to expand the scope of its commitments to sustainability. Hence, SRV 2030 was created. It covers an increased range of issues that are aligned with the United Nations' Sustainable Development Goals and the Paris Agreement on climate change. SRV 2030 focuses on three main areas related to the pulp and paper industry: Production, Forest and People. It includes how APP aims to produce less carbon-emitting products, sources materials from responsibly managed plantations and contributes to the welfare of the local communities.

To achieve this new goal, APP is upgrading and implementing measures at all its production facilities to improve processes, reduce energy and water intensity, and ensure that solid waste does not make its way to landfills. The company is also advancing its product innovations to meet market demands, as well as protect the environment.

APP's endeavour is making significant progress, having already cut carbon intensity by 29 per cent, in comparison to 2012. All of APP's upgraded factories are more efficient, cutting energy intensity by 14 per cent and water intensity by 30 per cent. Overall, waste was reduced by 47 per cent, exceeding APP's target of a 25 per cent waste reduction. However, APP is not just focused on developing roadmaps and setting targets. APP is intent on implementing programmes that will contribute towards sustainable development goals and Indonesia's emission-reduction target of reaching net zero by 2050. Two flagship efforts focus on curtailing deforestation, protecting communities and restoring natural habitats and restore ecosystems.

Leveraging on and investing in cutting-edge technology, and forging community partnerships are two examples of APP's efforts to build defences, warning systems and resilient infrastructure to avoid the loss of homes, livelihoods and the



natural environment. These are best highlighted through its partnership with Canadian space company MDA and APP's 'Desa Makmur Peduli Api' (DMPA) programme, also known as its Integrated Forestry & Farming System.

To ensure that conservation areas remain protected and not illegally encroached upon, ground patrols are regularly dispatched to monitor and verify that these areas remain secure. However, not all areas are accessible by ground patrols. To protect natural forest areas located in the concessions of APP's pulpwood suppliers that are identified as either being of high carbon stock, high conservation value or natural peatland forests, APP needed a near-real time, early-warning system that would allow its pulpwood suppliers to take timely action on detected forest disturbances to minimize and mitigate negative impacts and implement corrective actions.

APP realized that a solution based on remote-sensing technologies was needed and the only practicable technologies were low-earth-orbit imaging satellites. To overcome this challenge, APP partnered with MDA, a satellite surveillance and intelligence provider, to provide monitoring and alerts through its Forest Alert Service. The full monitoring programme covers APP's 38 pulpwood suppliers on the islands of Borneo and Sumatra. Radarsat-2 has the world's highest imaging capacity and footprint at a resolution that is sensitive enough to detect selective logging, sufficient to

image more than 500 million square kilometres every month. With such a capacity and footprint size enabling reliable, frequent and routine detection of subtle forest changes, APP can capture forest disturbances down to a few trees and proactively address the forest cover change in near-real time.

APP concessions are re-imaged every 24 days in a continuous manner. Every two working days of imaging, APP will receive fully quality-controlled, vectorized alerts of forest disturbance anywhere within the monitored areas. By combining the near-real time alerts with other in-house information, the APP team is able to determine and implement the necessary measures to reduce threats to its supplier plantations and address the environmental risks associated with illegal forest clearance.

The APP-MDA partnership has resulted in a significant reduction of forest degradation, dropping from between 5-6 per cent on average between 2013 and 2015 to under 1 per cent across its concession area of over 600,000 hectares.

Aside from using satellites, APP has also adopted a more down-to-earth initiative by engaging with local communities living in and around its operation areas. Importantly, APP recognizes its responsibilities are not only to its own employees but also to these communities. As such, under its Sustainability Roadmap, the company is also investing in human capital management to ensure business continuity,

to empower and to involve communities as part of APP's sustainable operations. The group believes that thriving local communities lead to a thriving business. To that end, APP has started investing in various community empowerment initiatives, whether at forestry, mill or head-office level. The majority of these programmes not only improve local economic condition, but also provide additional benefits to the environment.

It is a well-known fact that local communities play an important role in forest conservation. In many places around the world, people are living either nearby or within the forests. Therefore, it is important for APP to engage with these local communities to work together protect the environment.

To achieve that goal, APP has created a community-forestry programme that improves the welfare of communities living in and around forest areas whilst reducing the risks of illegal logging, forest fires and land disputes. This community programme is the DMPA.

APP's target is to have 500 villages joining DMPA. So far, 386 villages with approximately 31,400 households have joined. The aim is to increase the number of households participating in the programme, especially within villages that are already involved. Close to 200 farmer groups have been engaged and 100 farmers have been nurtured into successful entrepreneurs, serving simultaneously as DMPA champions and agents of change. Amazingly, nine cooperatives and 130 village-owned companies have also emerged from the programme.

DMPA has also encouraged other partnerships including the creation of a guideline to develop a business model for the community, originating from the desire to replicate the programme in other villages that are outside of APP's suppliers' concession areas. These similar programmes are designed to support the government in local economic development as well as environmental protection. For this, APP works with three organisations, including World Agroforestry, Center for International Forestry Research and Yayasan Konservasi Alam Nusantara (the main partner of The Nature Conservancy in Indonesia), to develop the business models, where each organisation will use its own approach for community empowerment.

Another key outcome of DMPA is improving access to market for micro, small and medium enterprises (MSMEs) during the pandemic. This was done through the provision of training on digital marketplace and business incubation. APP collaborates with online marketplaces such as Shopee, Tokopedia and Blibli to provide training to the MSMEs on how to utilize the digital platforms to widen their market reach. While there are still challenges on accessibility, it is encouraging that a lot of the MSMEs have taken on the challenge to be digitally present.

Additionally, APP engages with the Indonesia Womenpreneur Community to provide business incubation programmes to strengthen women's business foundations, including financial management, branding and promotion, and customer management strategies to help Indonesian women to develop their businesses and to do so sustainably. APP is actively working with these villages to demonstrate



Photo: APP

With 386 villages having joined APP's DMPA programme, 100 farmers have been nurtured into successful entrepreneurs

how DMPA can improve villagers' livelihoods by delivering long-term and sustainable livelihood improvements. One such programme focuses on women empowerment, a collaboration between Martha Tilaar Group (MTG) and APP, which is supported by Indonesia Global Compact Network and aims to train 1,000 women from communities living in and around APP's concessions and mill operations. To date, 1,600 women from 80 villages across five provinces have received training under the programme with four participants receiving scholarships for formal training to be spa therapists to work in MTG spas.

DMPA has made an impact to the local economy, creating employment opportunities and raising incomes among communities. The environment has also benefited, with the programme helping to prevent and reduce harmful farming practices, such as using fire for land preparation, thereby reducing forest degradation and carbon emissions. Even as APP is pursuing sustainability efforts across several fronts including forest and peatland management, biodiversity conservation, carbon reduction, resource efficiency and subscribing to international forest certifications, the company realizes that it cannot achieve all this on its own. Partnerships and collaborations like those with the MTG are fundamental to meeting its SRV 2030 goals.

APP is forging new partnerships such as being a member and co-founder of the High Carbon Stock Approach to look at ways to protect high carbon stock areas whilst safeguarding the wellbeing and livelihoods of people.

We have only this precious planet which we call home, therefore we need to ensure that Mother Nature is taken care of and given the opportunity to regenerate to feed and protect us. If we are not able to, then we will definitely be in danger and we would have to hope that one day, we find a new planet nearby to emigrate to — hopefully it does not come to that!

Looking to the world's oldest natural material for positive climate action

*Jane Molony, Executive Director, and Samantha Choles, Communications Manager
Paper Manufacturers Association of South Africa*

For decades, the South African forestry and forest products sector has lobbied government for recognition as a value chain that provides renewable, carbon-storing and climate-friendly solutions through its planted forests and harvested wood products. Now, with both a carbon budget and a carbon tax, South Africa's climate legislation is ambitious, and industry must up the ante to meet it.

The advancement of technology and industry has seen us innovate with materials such as cement, metals and plastics, but over time we have developed an overreliance on these materials. Land, water and air pollution has resulted from unsustainable and unchecked agricultural practices, manufacturing, consumption and waste disposal.

Speaking at a side event of the 2021 United Nations Climate Change Conference (COP26), Angela Graham-Brown of the World Business Council on Sustainable Development said there are three key levers of impact for effective climate action: decarbonization by reducing operational emissions; sequestration/storage by increasing carbon removal; and substitution by growing demand for bio-based materials, such as harvested wood products.

While the uptake of wood-based products in traditional and new markets may seem novel, wood has been with us for time immemorial and the bioeconomy we strive towards is not new.

Trees absorb carbon dioxide from the atmosphere, converting carbon into food stores while giving us back the oxygen.



Image: Mondi South Africa

Trees are planted, grown and harvested in rotation, which ensures there are trees of different ages growing and storing carbon

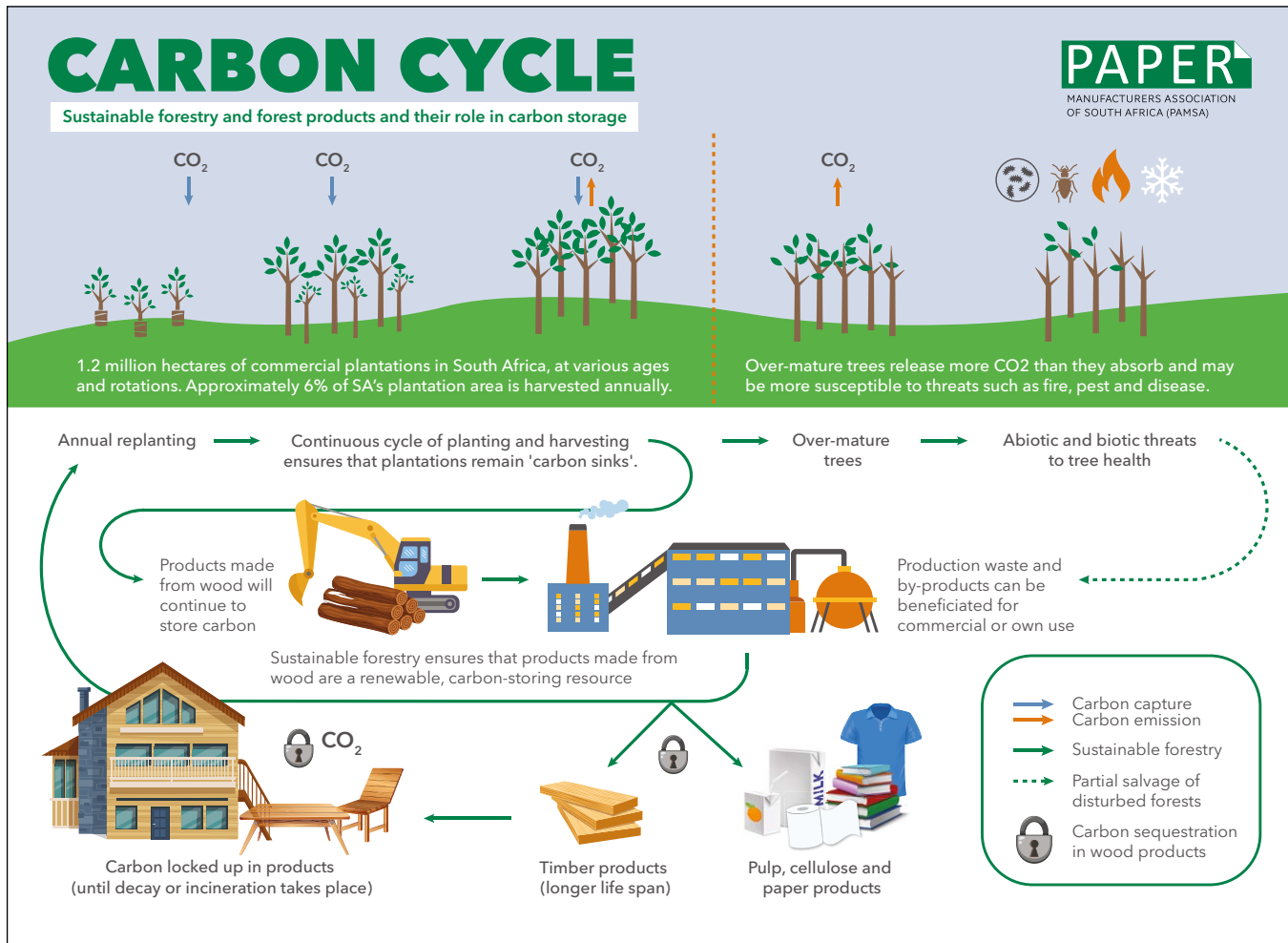


Image: PAMSA



Image: Mondi South Africa

This biodiversity action area managed by Mondi South Africa overlooks Lake Merthley plantation, a prime example of a new generation plantation

For eons, humans have used trees and their by-products of wood, bark, fruit and leaves as fuel, food, fibre, medicine and, more recently, an array of processed and manufactured goods.

The report titled *Forest Products in the Global Bioeconomy: Enabling substitution by wood-based products and contributing to the Sustainable Development Goals* launched at COP26 by the Food and Agricultural Organization of the United

Nations confirms that renewable wood-based products can help combat climate change and achieve the UN Sustainable Development Goals. The publication explores the role of selected forest products in the bioeconomy and considers market factors such as future supply and demand dynamics and implementation gaps in forest product value chains.

Most of us know that paper comes from wood — even the fibres in recycled paper came from a tree at some point in their lives. For decades, the South African timber, pulp and paper manufacturing sectors have made everyday products out of wood, including paper, packaging, furniture, storage, housing and hygiene.

As the digital age and consumer habits have evolved, the demand for printing and writing paper has steadily declined over the last 15 years. However, wood is now finding application in novel products and emerging technologies, augmenting its value, decreasing the carbon and water footprint of products and processes, reducing pollution and waste generation through recycling and waste-to-energy, and improving circularity.

Two exciting forest product categories are engineered wood products such as cross-laminated timber for construction and wood-based textile fibres such as viscose and rayon. Some wood-derived products like cellulose are already in circulation in everyday life — in food, pharmaceuticals and cosmetics. This ever-versatile natural building block is used



Image: Sappi

Dissolving wood pulp (DWP) is a purified cellulose pulp suitable for subsequent chemical conversion into a range of products



Image: Sappi

Wood and its components, along with process waste from pulping and papermaking, offer viable alternatives to fossil-fuel based materials

as a binder, emulsifier and filler. It's in yogurt, cheese, ice cream, lipsticks and vitamins, and it's completely safe.

Through partnerships with universities and the South African Department of Science and Innovation, a number of local projects are exploring renewable alternatives to fossil-based materials in products like plastic, membranes and films made from cellulose, and dust suppressants from lignin. We have students developing biodegradable fruit fly attractant sheets from nanocellulose, and controlled release fertilizer coated with cellulose, starch and diatomite

(silica). There is even opportunity to harness the larvicidal properties of plant-based oils and encapsulate them in a starch-nanocellulose matrix for malaria prevention.

South Africa is a tree-poor country compared to others in Central Africa, Europe and South America. It is home to a mere 500,000 hectares of indigenous forests, roughly 0.4 per cent of the total land area. For this reason, wood for structural timber, pulp and paper comes from cultivated pine and eucalyptus trees grown in commercial timber plantations and planted forests. The commercial planting of trees in the early 1900s helped preserve indigenous forests which otherwise would have been eliminated for fuel, furniture and fibre.

The myth that timber production causes deforestation¹ does not hold water in South Africa. Trees are planted, grown and harvested in line with international certification standards and local legislation. Only six per cent of the country's total plantation area — 1.2 million hectares — is harvested annually. The same area is replanted with new saplings — often at a ratio of two trees for each one harvested. This means there is a constant supply of carbon-capturing trees for productive purposes for years to come.

Thanks to collaboration, research and improved data, plantations are now better designed, and management regimes help reduce their impact on water, soil, ecological networks and biodiversity. Sustainable forest management like this must balance environmental, economic and social needs. The small-scale timber grower industry is a significant player with some 20,000 small growers operating in the country. South African programmes like Sappi Khulisa and Mondi Zimele provide rural communities with seedlings and provide training to their vast network of small growers who sell timber back to the mills.

Depending on the species, planted trees take seven to 10 years to reach commercial maturity. Some believe that planted trees should stay in the ground indefinitely, however forestry experts such as Dr Jacob Crous, who leads a land management programme at Sappi Southern Africa, and Dr Peter Holmgren of the Center for International Forestry Research disagree. Crous is well versed in the history of local industrial forest plantations and their carbon capabilities. He asserts that sustainable intensification protects natural forests and creates a larger carbon pool.

Traditional tree breeding is a relatively slow process, but thanks to sustainable intensification more trees can be planted on less land, thus preserving grasslands, protecting natural forests and creating a larger carbon pool. Storing carbon in harvested wood products is better than storing it in older plantations as the latter are at greater risk of release back to the atmosphere due to pests, disease and other disturbances.

Holmgren, an advocate of active forestry and specialist climate change adviser, believes that there is a structural problem to the way the circularity of the forest bioeconomy is considered. Forests — or land sectors — are viewed in isolation of the rest of the economy and cut off from their value chain. "We can miss a lot of opportunities in climate policy because of this divide, and the policies end up being fragmented and incomplete," he says.



Images: Forestry South Africa



Sustainably managed tree plantations can help to reverse biodiversity loss

To maximize carbon sequestration and storage in both trees and products, we need to go full circle: plant, grow, harvest, make, replant. Repeat. Holmgren notes that it is harvesting wood that makes everything possible and not enough attention is paid to this fact. He maintains that active forestry with an efficient value chain gives us two major climate benefits: stable and increasing storage of carbon in forest and products, and reduced fossil/process emissions as wood-based products displace fossil-based alternatives.

With deforestation and illegal logging continuing to impact biodiversity and contributing around 12 per cent of global greenhouse gas emissions, forestry certification, assurance and chain-of-custody schemes are paramount in halting damaging forestry practices.

More than 80 per cent of South Africa's plantations are certified by the Forest Stewardship Council, and recently, the Programme for the Endorsement of Forestry Certification (PEFC) was opened to South African timber growers through the Sustainable African Assurance Scheme, a non-profit organization that develops and manages the local PEFC standard.

The South African forestry landscape is a synergistic mosaic of planted trees and conservation spaces, as cited in New Generation Plantation's *Life in the 'green deserts'* following a study in collaboration with the International Union of Forest Research Organizations' working group. Even the smallest

of critters benefit from forestry's circular economy when post-harvest residues are left behind as a mulch for the next generation of trees. Bark, limbs, leaves and small parts offer sustenance and refuge for creatures that aid in the decomposition of organic matter, which in turn attracts birds and other predators.

Another myth is that fast-growing exotic species of eucalyptus and pine are water hungry. Just like other plants, these trees take up water from the ground. Much of this goes back into the water cycle through transpiration. The forestry industry's water use is legislated through the water licensing process. With forestry recognized as a streamflow reduction activity, companies pay for the rain that plantations use.

Compared to irrigated agricultural crops which use over 60 per cent of available water, the forestry industry is one of the most efficient water users at approximately three per cent and has established a number of key partnerships to protect the water it shares with other land uses and communities.

Nearly three decades ago, Mondi pioneered a landscape approach to freshwater ecosystem stewardship with the South African arm of the World Wildlife Fund. The WWF-Mondi Water Stewardship Partnership is a wetland conservation programme which extends beyond the boundaries of Mondi's plantations to include the agricultural sector and small forest growers.

Further along the chain, pulp and paper mills demonstrate responsible water stewardship with various closed-loop processes using resources such as water, energy and chemicals more efficiently — often more than once. Process water is reused and recycled, lost fibre is recovered and reused, and spent chemicals are recovered for energy production. Even bark is used to power boilers, producing steam that generates electricity. Recycling water can also help reduce energy consumption by recovering the heat content of water to improve energy efficiency.

These step-changes in silviculture and manufacturing have seen us use more of the tree, ensuring little goes to waste. The circular nature extends to our products through the recycling of office paper, magazines, books, cardboard boxes, newspapers and more. These products are repulped and made into corrugated boxes, tissue, cereal boxes and moulded protective packaging that comes back into our homes, and which we use and recycle, further extending the time that carbon stays locked up.

According to a study conducted by Graz University of Technology in Austria, fibre-based packaging material can be recycled at least 25 times without losing its mechanical or structural integrity. With a four-year average recovery rate of 70 per cent and the second-most recycled material in South Africa, this is good news for a sector that understood seven cycles to be the limit.

The forest products sector is the epitome of a circular bioeconomy and it is abundantly clear that it is well-placed for driving greener economic recovery and demonstrable climate action. This centres on sustainably managed tree plantations and responsibly harvested wood products which not only address growing demand for renewable materials, but absorb and store carbon, reverse biodiversity loss and conserve shared resources.

Climate change adaptation in the Pacific: can COP26 deliver solutions?

*Espen Ronneberg, Director
Climate Change and Environmental Sustainability Administration*

The Pacific Islands region is comprised of 14 small island developing states (SIDS)¹. The features and size of Pacific SIDS (PICs) are diverse and vary considerably, although most are very small. They have a combined land area of only 550,073 sq km but are spread out in the world's largest ocean. Nauru and Tuvalu, for example, comprise a land area of less than 27 sq km. Large expanses of water and small areas of land create numerous challenges, including difficulties of transport and communications both within and between countries, and to the international community.

The rapid growth in population that many PICs have experienced in past decades, along with increasing commercialisation of traditional, subsistence-based economies, has been associated with rapid increases in rates of natural resource exploitation, especially land, forests and living marine resources. On the other hand, many PICs are characterized by extremely small land area and limited land resources, such as soil and forest, making many terrestrial and near shore resources quite vulnerable to overexploitation and pollution from poorly planned waste disposal.

All PICs have a traditional dependence on marine resources for subsistence, and as the region's ocean resources contain the highest marine biodiversity in the world, it represents almost the sole opportunity for substantial economic development for many of the small island nations.



Extreme weather events such as high category cyclones impact life in the Pacific Islands region

Many Pacific islands, especially atolls, have very low topography, some reaching only a few metres above sea level at their highest point. In recent times PICs have experienced enormously damaging extreme weather events, suffered severely from global economic pressures and fluctuations, and have a heavy reliance on the productivity of one or two economic sectors. The 2008 and 2014 king tides, and 2015 tropical typhoons Maysak and Chan Hom caused major damage to people's homes and properties; government wharves and ships in the Marshall Islands and the Federated States of Micronesia. The Solomon Islands registered a first tropical cyclone to occur within the month of July 2015, the middle of the dry season. These extreme events are exaggerated with the accelerated rise in sea level now experienced by communities who make these islands their home.

The small size of islands results in the interactions between components of natural systems and the sectors of economic activity being rapid and strong, which demands that sustainable development be holistic and balanced. This feature of small, highly integrated environmental and economic systems is also key to the overall environmental and economic vulnerability of the region.

Countries in the region have been reporting serious socioeconomic, environmental, physical, and cultural consequences of climate change. Numerous studies suggest that climate variability and change is likely to accentuate the spatial and temporal variations, including variability, which result from the El Niño-Southern Oscillation events. According to the Intergovernmental Panel on Climate Change (IPCC), the risks and impacts of climate change and variability for SIDS including the Pacific are:

- Sea level rise — with more than 70 per cent of the population living in the coastal zone, at less than a few metres above sea level, PICs are very vulnerable to IPCC-predicted levels of sea level rise.
- Extreme weather events — higher category cyclones appear to becoming more frequent, while the number of cyclones remains stable. The economic impact for small islands in the region can be of a magnitude equivalent to their GDP or more.
- Changes in rainfall patterns — projections indicate more droughts and more intense rainfalls in parts of the region, with implications on agriculture and human health.



Image: SFC

The Pacific islands, which are spread over a vast ocean territory, are implementing various initiatives to adapt to the adverse effects of climate change

- Coral reefs — increased sea temperatures and ocean acidification will have severe impacts on the health and viability of coral reefs, a key resource for tourism as well as for near shore fisheries.
- Fisheries — it has been documented that El Niño conditions cause a shift in tuna migratory patterns, and this is seen as a proxy for future climate change with impacts on individual countries returns from fisheries, food security as well as the longer term viability of Pacific fisheries.
- The threats to human settlements and infrastructure amass within the coastal zone where 80 per cent of all properties concentrate. Given the limited ability to relocate, the costs to protect or rebuild will be immense for the Pacific. Insurance is often lacking — while a parametric insurance scheme is being trialled in the region by the Secretariat of the Pacific Community, it remains clear that insurance premiums will require subsidies, most likely from donors.
- Consequences to human health — changes in rainfall patterns and higher temperatures will affect the prevalence of vector borne diseases and their range, and also affect human populations through heat stress.

Most of the time, an occidental perspective climate change is fully related to environmental and weather modifications. But the view of local communities on the field is more holistic. They often consider climate change as a more global and societal change, in addition to environmental issues. As an example, a study in Vanuatu showed that for the communities interviewed, climate change is deeply related to the way-of-life modifications, including teenage pregnancy, increasing consumption of alcohol, less engagement in community life,

and increased usage of new technology like mobile phones or the internet.

When communicating on climate change thematics, as defined in occidental science, in the Pacific, it is important to consider that there are no existing words in indigenous languages to talk about climate change, and often the same word is used for weather and climate.

Regional adaptation objectives

The PICs established initial adaptation needs in their national communications and have expanded on their ability to build and improve their adaptation programmes over the last two decades. From the mid- to late-1990s, PICs had focused their objectives to adapt to climate change largely on enabling and capacity-building activities, carrying out baseline vulnerability and adaptation assessments, simple climate modelling and establishing ad hoc institutions. This changed quickly to implementing immediate and urgent adaptation activities from as early as 2002, when national communication reports to the United Nations Framework Convention on Climate Change (UNFCCC) recommended immediate actions for adaptation, especially for least developed countries (LDCs) in the Pacific. A key policy document was developed for the region in the 2006–2015 Pacific Islands Framework for Action on Climate Change (PIFACC), the regional climate change policy endorsed by the Pacific Leaders in 2005. The Framework's vision is “Pacific island people, their livelihoods and the environment are resilient to the risks and impacts of climate change”.

All PICs adhere to the following adaptation objectives as agreed under PIFACC:

- Adaptation measures to the adverse effects of climate change developed and implemented at all levels.



Image: SPC

The United Nations Development Programme commissioned a project to build a 500-metre-long seawall in Tuvalu to protect islanders from rising sea levels

- Identification of vulnerable priority areas/sectors and appropriate adaptation measures using available and appropriate information recognizing that such information may be incomplete.
- Adaptation measures in vulnerable priority areas supported by existing data sets and traditional knowledge, or new data developed in some instances as necessary.
- Appropriate adaptation measures integrated into national/sectoral sustainable development strategies or their equivalent and linked to the budgeting process.

This could involve: clearly identifying national adaptation priorities; engaging with stakeholders in priority sectors to discuss impacts and appropriate adaptation responses; developing national adaptation plans based on the priorities identified, with appropriate support from regional organisations and donors; designing national adaptation programmes, with appropriate support from regional organisations and donors, to implement these plans that address underlying vulnerabilities and support resilience building; and committing national budgets for adaptation programmes as appropriate.

The early experiences from individual countries implementing adaptation projects were financial and resource problems affecting sustainability and impacting adaptation efforts. With ample capacity-building activities from the late 1990s to early 2000, the region pushed for immediate implementation of objectives on the ground and with isolated island communities.

PICs have put in place the necessary policies, strategies, legal provisions and governance arrangements, in accordance with their national circumstances and practices. Nevertheless, the severe capacity constraints of these countries limit their ability to implement needed projects and programmes, their access to climate change finance, and their capabilities in managing international financing. The rules and conditions of most international funding are also limiting their abilities through caps on management costs, transportation (crucial for outer island projects) and disincentives to apply due to the onerous process.

PICs have looked to the UNFCCC and its Conferences of the Parties (COPs) as the pathway to seek to rectify the problems and challenges they face with the implementation of adaptation. Prior to COP26 in Glasgow, PICs actively engaged in virtual preparatory and technical sessions, supported by the regional agencies² through the One CROP Plus mechanism (for coordination of the Council of Regional Organisations of the Pacific).

Outcomes from COP26 in Glasgow

Going into Glasgow, PICs had an agreed position relating to financing for adaptation, but there were also other agenda items that impinge on the overall issue of adaptation, and the priority areas can be grouped into three broad themes: access to finance, raising ambition, and securing the environmental integrity of the Paris Agreement.

Targeted support for adaptation planning and implementation is seen as very necessary and has been supported by the

Alliance of Small Island States, including knowledge or database of adaptation technologies and techniques of special interest for SIDS. SIDS continue to face the realities of climate change's negative impacts and given their particular vulnerability, preparing for the inevitable future impacts based on past local experiences and cutting-edge science has become more and more relevant. Adaptation planning, finance and implementation are pivotal for our membership and their individual climate resilient development pathways. There are also concerns that with current mitigation ambition falling well short of meeting the 1.5C warming target, there will be limits to the extent of adaptation feasibility. This issue is linked to finance and raising ambition, as well as environmental integrity and seeking to avoid maladaptation.

As tough as the negotiations turned out to be, PICs could at least take comfort in the ambitious, but not legally binding overarching decisions of COP26. In these, according to the COP26 Presidency, Glasgow mobilized billions and trillions for climate change action. Developed countries have made progress towards delivering the US\$100 billion climate finance goal and will reach it by 2023 at the latest. Thirty-four countries and five public financial institutions will stop international support for the unabated fossil fuel energy sector next year. Private financial institutions and central banks are moving to realign trillions towards global net zero. In Glasgow, countries agreed on the way forward for the new post-2025 climate finance goal. Developed countries committed significantly increased funding to vital funds such as the Least Developed Countries Fund, and to double their funding for adaptation. However, these will remain aspirational until financing agreements are actually signed by those who made pledges, and disbursement procedures are made more clear.

Raising ambition is the other side of the coin of adaptation, in that greater mitigation efforts are inherently going to reduce the adaptation burden. Again, according to the COP26 Presidency, Glasgow secured near-global net zero, Nationally Determined Contributions (NDCs) from 153 countries and future strengthening of mitigation measures. This can be juxtaposed against where we were at the start of 2021 when around 30 per cent of world GDP was covered

by net zero commitments; it is now over 90 per cent. New 2030 emissions targets were put forward by the 153 countries that updated NDCs. The Glasgow Climate Pact “accelerates the drumbeat” and puts in place the underpinning rules and systems. In Glasgow, countries agreed to come back next year with new strengthened commitments, a new UN climate programme on mitigation ambition, and they finalized the Paris Rulebook. To deliver on these stretching targets, the Presidency has driven commitments to move away from coal power, halt and reverse forest loss, reduce methane emissions and speed up the switch to electric vehicles. The details of these commitments and programmes will determine their overall effectiveness in driving down global emissions, as well as whether PICs will be beneficiaries.

Environmental integrity underpins the Paris Agreement, in that any loopholes created through reporting, market mechanisms or the transparency framework could create perverse incentives to mitigate less in real terms, while reporting increased progress. The market mechanisms were adopted in Glasgow, but will only contribute a two per cent mandated credit cancellation and a five per cent share of proceeds to adaptation through the international trading mechanism (art. 6.4). For bilateral arrangements, there will only be a voluntary system in place. In addition, credits generated under the Kyoto Protocol will be allowed to be traded but with some limitations. Overall PICs welcomed the rules and regulations adopted, but were disappointed that a larger proportion of carbon credits would not be cancelled, and that a share of proceeds would not be mandatory for bilateral arrangements.

In terms of the overarching effect on the adaptation priorities of PICs, the need to scale up adaptation finance was not reflected in the decision under the main agenda items, only in 1/CP.26 and 1/CMA.3. It should be noted that at COP26 developed countries pledged US\$356 million to the Adaptation Fund, including first-time contributions from the US and Canada. While a record, it is far cry from meeting countries' needs, which are estimated in the trillions. The agreement “notes with concern that the current provision of climate finance for adaptation remains insufficient”. About three quarters of the fund was pledged by the EU and its member states. The European Commission alone committed more than double the US pledge. In terms of guidance to the Green Climate Fund (GCF), developed countries were more concerned about the need to avoid micro-managing the GCF Board, and wanted the guidance to be more high level and strategic, rather than the targeted support sought by PICs. The decision does reiterate “the request to the GCF Board to continue efforts to maintain the balance in the allocation of resources between adaptation and mitigation”.

The Marshall Islands was the first country to submit second NDCs with binding objectives and more ambition in terms of greenhouse gas reduction, followed by Fiji, Papua New Guinea and Tonga, which have also submitted their enhanced NDCs.

Islanders' local knowledge is increasingly recognized as an important resource for bridging the information gap on climate change in the Pacific, providing insight into past and ongoing environmental developments.



Pacific islands such as Kiribati are still dotted with reminders of the devastation caused by World War II

CLIMATE ACTION

PICs worked hard to get their points across in the negotiations, and were listened to — that became clear from 1/CP.26 — but this decision remains aspirational in that parties will individually have to action the pledges contained therein. The groundwork has certainly been laid for meaningful climate change action, and there were positive outcomes

from Glasgow. The challenge for PICs will be to ensure that these outcomes are turned into real meaningful action to assist them with their adaptation needs, and to effectively reduce the global emissions that are making the future of the region so fraught with catastrophic consequences if insufficient action is taken by major emitters.

PICs' stated climate change adaptation objectives

Country	Objective	Timeline
Pacific Islands region	Vision: Pacific islands people, their livelihoods and the environment resilient to the risks and impacts of climate change. Goal: To ensure Pacific island people build their capacity to be resilient to the risks and impacts of climate change with the key objective to deliver on the expected outcomes.	2006–2015
Cook Islands	To consider implications of increasing risks associated with extreme weather and climate events, through taking an integrated approach to adaptation and disaster risk reduction, at institutional, policy and practical levels. Development sectors prioritized: coastal zones and infrastructure, agriculture, marine resources and fisheries, biodiversity, water resources, human health and wellbeing.	2011–2015
Fiji	To reduce the vulnerability and enhance the resilience of Fiji's communities to the impacts of climate change and disasters.	Not stated (policy endorsed in 2012)
Kiribati	To communicate in a simplified way the identified immediate and urgent adaptation needs of Kiribati, which is also relevant to the national communication obligation required by the UNFCCC. These adaptation needs are identified through a participatory, consultative and multidisciplinary planning process.	Not stated (NAPA endorsed in 2007).
Marshall Islands	To develop and have in place a contingency/adaptation plan to counter emerging threats resulting from the adverse effects of climate change, including a National Disaster Plan.	2015–2018
Federated States of Micronesia	To develop and have in place a contingency/adaptation plan to counter emerging threats resulting from the adverse effects of climate change, including a National Disaster Plan.	Not stated (policy endorsed in 2009)
Nauru	To identify effective solutions that support adaptation and reduce risks in the areas of water security, energy security, food security, the natural environment, health, and land resources.	Not stated (policy framework endorsed in 2014)
Niue	To develop effective adaptation responses and enhance adaptive capacity in order to protect livelihoods, natural resources and assets, and vulnerable areas to the impacts of climate change to all sectors.	Not stated (policy endorsed in 2009)
Palau	To achieve a resilient, sustainable and food-secure Palau.	Not stated (strategy endorsed in 2015)
Samoa	To develop and implement immediate and urgent project-based activities to adapt to climate change and climate variability. To protect life and livelihoods of the people, infrastructure and environment. To incorporate adaptation measures and goals into national and sectoral policies, and development goals. To increase awareness of climate change impacts and adaptation activities in communities, civil society and government.	Not stated (NAPA endorsed in 2005)
Solomon Islands	To provide a guiding framework to (i) integrate climate considerations and support the implementation and achievement of Solomon Islands National Development Strategy and other regional and international policies and frameworks, (ii) guide the government and its partners efforts in ensuring that the people, natural environment and economy of the country are resilient and able to adapt to the predicted impacts of climate change.	2012–2017 (policy endorsed in 2012)
Tokelau	To build Tokelau's resilience to a changing climate.	2010–2015
Tuvalu	To protect Tuvalu's status as a nation and its cultural identity and to build its capacity to ensure a safe, resilient and prosperous future.	2012–2021
Vanuatu	To develop a country-wide programme of immediate and urgent project-based adaptation activities in priority sectors, in order to address the current and anticipated adverse effects of climate change, including extreme events.	Not stated (policy endorsed in 2005)

Source: Uga. Et et unt velicid essinci molent, culluptiur sus

Notes

Page 12: Tackling causes and consequences of climate change through partnerships in Vietnam

- 1 For an overview of interventions, and summary of overall impact, see: https://luxdev.lu/files/documents/VIE_033_Compndium_ENG_final1.pdf, and for more on the Randomized Control Trial, see: https://luxdev.lu/files/documents/Note_2_VIE033_vF2.pdf. For more information on LuxDev's work in TT Hue province, see the LuxDev project website at: <https://luxdev.lu/en/activities/project/VIE/433> (Climate Adaptation and Resilience in Thua Thien Hue Province) and <https://luxdev.lu/en/activities/project/VIE/401> (Energy Efficient Lighting NAMA Pilot in Hue City).

Page 19: International joint research cooperation for building sustainable environmental systems

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Page 53: Looking to the world's oldest natural material for positive climate action

- 1 Deforestation is the removal of trees or clearing of forests for commercial development, housing, firewood or agriculture *without* replanting.

Page 57: Climate change adaption in the Pacific: can COP26 deliver solutions?

- 1 Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu. Of these, Kiribati, Solomon Islands, Tuvalu and Vanuatu are listed as amongst the least developed countries (LDCs) in the world. In 2014, Samoa graduated from this LDC status to a Middle-Income Country. American Samoa, Guam, Commonwealth of the Northern Mariana Islands are territories of the United States of America. French Polynesia, New Caledonia, Wallis and Futuna are territories of France. Tokelau is an associated territory of New Zealand.
- 2 FFA, PIFS, SPC, SPREP, USP, PIDF, UNDP and UNEP.



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