

# NAM

## S&T Newsletter



A Quarterly of the  
Centre for Science and Technology of the Non-Aligned  
and Other Developing Countries (NAM S&T Centre)

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### FROM THE DG'S DESK

Warmest Greetings to all our Esteemed Readers!!



I would like to thank the Focal Points, scientific community and S&T organisations in Member Countries of the NAM S&T Centre and Members of the NAM S&T – Industry Network for extending support in taking forward the Centre's pursuit of promoting Science, Technology and Innovation (STI) for the benefit of NAM and other developing countries.

During the last quarter of the year, the Centre has successfully organized an International Workshop on **“Leveraging Innovations for Infrastructure Development and Sustainable Industrialisation”** in partnership with the Government of Zimbabwe through the Ministry of Higher and Tertiary Education, Innovation, Science and Technology Development; and the National University of Science & Technology, Zimbabwe during 17-18 November, 2022 in Hybrid-Mode. The Workshop was attended by 78 scientists, researchers, academicians, policymakers and other professionals from 10 countries namely: Burkina Faso, Egypt, India, Mauritius, Myanmar, Nigeria, Pakistan, South Africa, Sri Lanka and Zimbabwe.

I am happy to announce that our Monograph on **“Blue Economy - An Ocean Science Perspective”** edited by Dr. Edward R. Urban Jr. (USA) and Dr. Venugopalan Ittekkot (Germany) and published by Springer Nature, Singapore has been released in October 2022. The printed book as well as the e-book are now available for purchase from the publisher.

Considering the importance of increased agricultural production in developing countries in achieving Sustainable Development Goal (SDG-2) to end hunger, achieve food security and improved nutrition, the Centre has published a Fact File on **“Sustainable Agriculture”** for wider dissemination of information on the subject. This is a new initiative of the NAM S&T Centre and we hope to bring out other such “Fact Files” on various scientific topics that are important and relevant to the developing world from time to time.

The Centre invites applications from interested scientists and experts for the International Workshop on **‘Combating Plastic Pollution in Terrestrial Environment’** being organised by the Centre, in partnership with the JSS Academy of Higher Education and Research, Mysuru, India and the Scientific Committee on Problems of the Environment (SCOPE), Amstelveen, the Netherlands during **March 14-15, 2023**. Detailed guidelines for participation are available at Centre's official website: [www.namstct.org](http://www.namstct.org).

The Centre has sponsored three scientists under the **Joint NAM S&T Centre – ZMT, Bremen (Germany) Fellowship Scheme** on 'Blue Economy in Tropical Coastal Marine Research' for the year 2023 to carry out research work at the Leibniz Centre for Tropical Marine Research (ZMT) in Bremen, Germany for a period of up to 3 months.

With great conviction, the NAM S&T Centre will continue to pursue its objectives of promoting South-South Cooperation in STI for collective self reliance of NAM and other developing countries and to facilitate the implementation of various SDGs.

Happy Reading!

*Amitava Bandopadhyay*  
**(Amitava Bandopadhyay)**  
Director General

### Centre Organised

#### International Workshop on **LEVERAGING INNOVATIONS FOR INFRASTRUCTURE DEVELOPMENT AND SUSTAINABLE INDUSTRIALISATION**

17-18 November 2022  
[Hybrid Mode]

There is an urgent need for developing countries to transform their economies and create jobs, enhance income and achieve sustainable development. Sustainable industrialization is integral for leaders from the developing world to achieve these objectives, with infrastructure development as a necessary enabler. The United Nations Sustainable Development Goal-9 (SDG-9) as well as Africa's Agenda 2063 assert the role of infrastructure and industrialization in economic transformation, job creation, increased productivity and achieving sustainable development. However, realizing SDG 9 by 2030 will require overcoming resource constraints, building and strengthening capabilities of developing countries and exploring innovative ways of facilitating infrastructure development and harnessing sustainable industrialization.

In order to deliberate on the above issues, the Centre for Science and Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre), New Delhi, India in partnership with the Government of Zimbabwe through the Ministry of Higher and Tertiary Education, Innovation, Science and Technology Development (MHTEISTD); and the National University of Science & Technology (NUST), Zimbabwe organized an International Workshop on **“Leveraging Innovations for Infrastructure Development and Sustainable Industrialization”** during **17-18 November 2022**. The Workshop was hosted by MHTEISTD at NUST Innovation Hub, Zimbabwe in **Hybrid-Mode**.

The two-day Workshop aimed to bring together scientists, researchers and policy makers from the developing countries in the areas of sustainable industrialization management in agricultural, economic and human development and other representatives from government, academia and industry. The Workshop was attended by **78 scientists, researchers, academicians, policy makers and other professionals from 10 countries namely: Burkina Faso, Egypt, India, Mauritius, Myanmar, Nigeria, Pakistan, South Africa, Sri Lanka and the host country Zimbabwe.**

The Inaugural Session was facilitated by **Prof. M. E. Dlodlo**, Professor and Vice-Chancellor, National University of

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Science and Technology (NUST), Zimbabwe. In his address, he welcomed the participants and experts from various NAM S&T Centre Member Countries and other developing countries. **Dr. Amitava Bandopadhyay**, Director General, NAM S&T Centre, New Delhi welcomed the participants and briefly discussed the idea behind conducting the Workshop. In his address, he provided an overview about the NAM S&T Centre, describing the organizational structure, objectives and major scientific activities of the Centre.

Following this, a **Keynote Address** was delivered by the Guest of Honour **Dr. Raymore Machingura**, Hon'ble Deputy Minister, Ministry of Higher & Tertiary Education, Innovation, Science and Technology Development (MHTEISTD), Zimbabwe. In his address, Hon'ble Machingura mentioned that the Zimbabwe Ministry is developing a system of education that will help in making Zimbabwe more sustainable by innovations focusing mainly on the heritage and well being of Zimbabweans. Afterwards, **Prof. F. Tagwira**, Permanent Secretary, Ministry of Higher & Tertiary Education, Innovation, Science and Technology Development (MHTEISTD), Zimbabwe, in his closing remarks emphasized on the importance of implementing an education system that would support innovation and industrialization in any developing nation.

The Workshop was conducted with **4 Technical Sessions** comprising **1 Keynote Lecture** and **17 paper presentations**. Four technical sessions were: **Industry, Innovation and Infrastructure; Resource and Energy Efficiency; Economic Development and Human Well Being** and **Sustainable Industrialization in Agriculture** which were respectively chaired by **Dr. William Goriwondo**, Pro-Vice Chancellor, Innovation and Business Development (IBD), National University of Science and Technology (NUST), Zimbabwe, **Dr. Diroubinee Mauree-Narrainen**, Senior Lecturer, University of Technology, Mauritius, **Dr. Pradeep Rajan**, Senior Principal Scientist, CSIR-Central Mechanical Engineering Research Institute, West Bengal & Punjab, India and **Dr. Xavier Poshiwa**, Dean, Gary Magadzire School of Agriculture, Great Zimbabwe University, Zimbabwe.

At the beginning of Technical Session I, a **Keynote Lecture** was delivered by **Dr. Xavier Poshiwa**, Dean, Gary Magadzire School of Agriculture, Great Zimbabwe University, Zimbabwe on: **'Sustainable Industrialization in Agro-processing'**. Dr. Poshiwa in his lecture discussed the immediate need of sustainable development in agriculture and highlighted the issues of the local peasants of Africa. He discussed in detail about ICEDA (Innovation Centre for Dryland Agriculture), an innovation centre which promotes sustainable industrialization, proposed by the Great Zimbabwe University- with its objectives, expectations and outcomes. He concluded that the rudimentary methods of agriculture should be replaced with the new and modern innovative methods of agriculture.

This was then followed by a presentation titled **'State of Nanotechnology in Sub-Saharan Countries: Opportunities and Challenges'** by **Dr. Sidiki Zongo**, Researcher/Lecturer, Laboratoire de Physique et Chimie de l'Environnement, Université Joseph KI-ZERBO, Burkina Faso. In his presentation, Dr. Zongo explained how nanotechnology promotes sustainable industrialization to a greater extent.

There were three presentations from India titled **'Creation of Hemoglobin Map for ASEAN Countries using GPS enabled Camera-based HB Measurement Instrument'**; **'Leveraging Innovations in Remote Sensing Technology for Sustainable Industrialisation in Agriculture for Medicinal, Aromatic and Commercially important crops'** and **'Precision Agriculture as a Sustainable Farming Enabler in Developing Countries'** respectively presented by **Dr. Htet Ne Oo**, Associate Professor, Department of Computer Science and Engineering, Chitkara University (Punjab Campus), Punjab; **Dr. Amit Kumar**, Senior Principal Scientist, CSIR-Institute of Himalayan Bioresource Technology, Himachal Pradesh and **Dr. Pradeep Rajan**, Senior Principal Scientist, CSIR-Central Mechanical Engineering Research Institute, West Bengal & Punjab.

Two presentations from Mauritius were on **'Reinforcement of Information Technology Skills for Business Students towards an Entrepreneurial Mindset'** and **'New Technologies in Agricultural Production—Agricultural Mechanization of Small Scale Onion Production in Mauritius'** respectively presented by **Dr. Diroubinee Mauree-Narrainen**, Senior Lecturer, University of Technology and **Mr. Balakrishnen Tandarayen**, Senior Agricultural Engineer, Ministry of Agro-Industry and Food Security. From Nigeria, three presentations were **'Reindustrialization of De-industrialized Textile Sectors in Zimbabwe and Nigeria: Towards Achieving Sustainable Development Goal 9'**; **'The Impact of Infrastructural Development in the Adoption of Internet- Based Technological Innovations in the Nigerian Industrial Clusters'** and **'The Role of Space Technology on Innovation for Infrastructural Development and Sustainable Industrialization in Nigeria'** respectively presented by **Dr. Diyaolu Idowu**, Senior Lecturer, Obafemi Awolowo University, **Mr. Olomu Oluwaseun Michael**, Asst. Chief Research Officer, National Centre for Technology Management and **Dr. Muhammad Musa Gaji**, Asst. Chief Scientific Officer, Energy Commission of Nigeria.

**Dr. Syed Tufail Hussain Shah**, Professor and Director, National Centre of Excellence in Analytical Chemistry, University of Sindh from Pakistan presented a paper titled **'Impact of Covid-19 and Recent Flood on Industry, Innovation and Infrastructure of Pakistan'**.

One paper entitled **'A Case Study on "Resource Efficiency Implementation at Valve Manufacturing Factories"** from South Africa was presented by **Ms. Thembi Sibanda**, Senior Project Manager, National Cleaner Production Centre.

From Sri Lanka, two presentations were **'Applicability (drivers and barriers) of Cleaner Production Principles to**

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**Construction Industry of Sri Lanka'** and **'A Framework to Increase the manual performance of People without or with Physical Disabilities to Work in Industry'** respectively presented by **Mr. Tharinda Denagama**, Lecturer, University of Vocational Technology and **Dr. Kokila Madhuri Wijewickrama Abeykoon**, Engineer/Sr. Lecturer, University of Moratuwa.

There were four presentations from Zimbabwe with the titles **'A Review of Mechanical Flywheel Energy Storage Systems and their Applications'**; **'Developing Sustainable Strategies for Reducing Post-Harvest Losses for Improved Food, Nutrition and Income'**; **'Effect of Temperature on Biogas Production in the Treatment of Yeast Processing Effluent Using an Up Flow Anaerobic Sludge Blanket (UASB) Reactor'** and **'Leveraging Climate Smart Crops in Resilience Building and Industrialisation of Rural Communities'** respectively presented by **Dr. Nkosilathi Zinti Nkomo**, Fibre and Polymer Materials Engineering, National University of Science and Technology (NUST); **Ms. Prettimore Mafirakureva**, Biotechnology Research Institute, Scientific and Industrial Research and Development Centre (SIRDC); **Dr. Shepherd Manhokwe**, Science & Technology, Midlands State University (MSU) and **Dr. Tavagwisa Muziri**, Agriculture, Midlands State University (MSU).

**The Concluding Session** was co-chaired by **Mr. Charles Musari**, Chief Science and Technology Officer, Ministry of Higher & Tertiary Education, Innovation, Science and Technology Development, Zimbabwe and **Dr. Amitava Bandopadhyay**, Director General, NAM S&T Centre, New Delhi. It was concluded that promoting techno-preneurship and establishing institution-industry links are important issues for leveraging innovations. For infrastructure development, government should support establishment of Growth Centres and establishment of Science & Technology Parks and Technology Business Incubators. Investing in new and resilient infrastructure or retrofitting the existing infrastructure, can make R&D in developing countries more sustainable. Overall, it is necessary to draw a holistic roadmap to achieve SDG-9 and other relevant SDGs.

## JOINT NAM S&T CENTRE- ZMT BREMEN (GERMANY) FELLOWSHIP 2023

The Joint NAM S&T Centre – ZMT Bremen Fellowship Scheme was initiated in the year 2008 for providing opportunities to the scientists from the developing countries to affiliate themselves with the Leibniz Centre for Tropical Marine Research (Leibniz-Zentrum für Marine Tropenforschung-ZMT), Bremen, Germany [www.leibniz-zmt.de] in order to upgrade their research skills, conduct joint research in Ecology, Biogeochemistry, Modelling and Tropical Coastal Marine Systems and undertake short-term Joint Research Projects with senior researchers and faculty members at ZMT, Bremen for a period of up to 3 months. Research proposals in the area of Blue Economy were highly encouraged to strengthen research on solutions.

The response to the Fellowship Scheme for the year 2023 was fairly good in terms of number of applications received by the Centre. Out of these, following three candidates are being sponsored by the NAM S&T Centre under the Joint NAM S&T Centre – ZMT, Bremen Fellowship Scheme on **'Blue Economy in Tropical Coastal Marine Research'** for the year 2023 to carry out their research work at Leibniz Centre for Tropical Marine Research (ZMT), Bremen, for a period of up to 3 months.

**Mr. Edwin Jefri**, Lecturer at the University of Mataram, **Indonesia**, will carry out his research work in relation to two separate ZMT projects, COMPASS and TransTourism, analysing pollution exposure in both aquaculture and tourism using interdisciplinary methods, under the supervision and guidance of Prof. Dr. Marie Fujitani, Working Group Leader, Deliberation, Valuation & Sustainability, Leibniz Centre for Tropical Marine Research (ZMT), Bremen.



**Dr. Amy Then Yee Hui**, Senior Lecturer at Universiti Malaya, **Malaysia**, will carry out her research work on the proposal titled “Clarifying the population structure of the endangered bottlenose wedge fish in Malaysia” under the supervision and guidance of Prof. Dr. Oscar Puebla, Group Leader, Fish Ecology and Evolution, Leibniz Centre for Tropical Marine Research (ZMT), Bremen.



**Prof. Amila Sandaruwan Ratnayake**, Professor, Department of Applied Earth Sciences at Uva Wellassa University, **Sri Lanka**, will carry out his research studies on the topic “Reconstruction of blue carbon storage capacity along with paleo environmental changes in southwest Sri Lanka” under the supervision and guidance of PD Dr. Tim Jennerjahn, Working Group Leader, Ecological Biogeochemistry, Editor-in-Chief, Estuarine, Coastal and Shelf Science, Leibniz Centre for Tropical Marine Research (ZMT), Bremen.



## Special Features

### MEASURING THE ENVIRONMENTAL IMPACTS OF ARTIFICIAL INTELLIGENCE COMPUTE AND APPLICATIONS : THE AI FOOTPRINT

Artificial intelligence (AI) systems can use massive computational resources, raising sustainability concerns. The report aims to improve understanding of the environmental impacts of AI, and help measure and decrease AI's negative effects while enabling it to accelerate action for the good of the planet. It distinguishes between the direct environmental impacts of developing, using and disposing of AI systems and related equipment, and the indirect costs and benefits of using AI applications. It recommends the establishment of measurement standards, expanding data collection, identifying AI-specific impacts, looking beyond operational energy use and emissions, and improving transparency and equity to help policy makers make AI part of the solution to sustainability challenges.

**The green and digital “twin transitions” offer the promise of leveraging digital technologies for a sustainable future.** As a general-purpose technology, artificial intelligence (AI) has the potential not just to promote economic growth and social well-being, but also to help achieve global sustainability goals. AI enabled products and services are creating significant efficiency gains, helping to manage energy systems and achieve the deep cuts in greenhouse gas (GHG) emissions needed to meet net-zero targets. However, training and deploying AI systems can require massive amounts of computational resources with their own environmental impacts.

**The computational needs of AI systems are growing, raising sustainability concerns.** While AI can be perceived as an abstract, non-tangible technical system, it is enabled by physical infrastructure and hardware, together with software, collectively known as “AI compute”. In the last decade, the computing needs of AI systems have grown dramatically, entering what some call the “Large-Scale Era” of compute.

At the same time, according to the International Energy Agency (IEA), data centre energy use has remained flat at around 1% of global electricity demand, despite large growth in workloads and data traffic, of which AI is estimated to represent a small fraction. While this may point to hardware efficiency gains, some researchers note that AI compute demands have grown faster than hardware performance, bringing into question whether such efficiency gains can continue.

**The environmental impacts of AI compute and applications should be further measured and understood.** Policy makers need accurate and reliable measures of AI's environmental impacts to inform sustainable policy decisions. The 2010 Organisation for Economic Co-operation and Development (OECD) Recommendation on ICTs and the Environment encourages the development of comparable measures of environmental Information ICT impacts. Further, the 2019 OECD Recommendation on Artificial Intelligence underlines that AI should support beneficial outcomes for people and the planet. The 2021 OECD Recommendation on Broadband Connectivity also stresses the need to minimise the negative environmental impacts of communication networks. Yet further efforts are needed to develop measurement approaches specifically focused on AI and its environmental impacts.

**The report defines AI compute as including one or more “stacks” (i.e. layers) of hardware and software used to support specialised AI workloads and applications in an efficient manner.** This definition was developed by the OECD AI Expert Group on AI Compute and Climate (the “Expert Group”) to meet the needs of both technical and policy communities. Informed by the Expert Group and experts involved in the Global Partnership on AI (GPAI), this report synthesises findings from a literature review, a public survey and expert interviews to assess how the environmental impacts of AI are currently measured.

**A number of indicators and measurement tools can help quantify the *direct* environmental impacts from AI compute, as well as the *indirect* environmental impacts from AI applications.** The report distinguishes between *direct* and *indirect* positive and negative environmental impacts. Direct impacts stem from the AI compute resources lifecycle (i.e. the production, transport, operations and end-of-life stages). Analysis indicates that direct impacts are most often negative and stem from *resource consumption*, such as the use of water, energy and its associated GHG emissions, and other raw materials. Indirect impacts result from *AI applications* and can be either positive, such as smart grid technology or digital twin simulations, or negative, such as unsustainable changes in consumption patterns.

**Sustainability and measurement good practices enable efficiency gains in AI compute.** Several good practices for sustainable AI exist, such as using pre-trained models, where relevant, and powering data centres with renewable resources. Researchers at the Massachusetts Institute of Technology (MIT) and start-up MosaicML are training neural networks up to seven times faster by configuring AI algorithms to learn more efficiently. Some compute providers are starting to report AI-specific estimates. For example, Google says that its machine learning workloads represented about 15% of its total energy use over the last three years. A large cloud compute provider<sup>3</sup> estimates that between 7-10% of enterprise customers' total spend on compute infrastructure supports AI applications, with 3-4.5% used for training machine learning models and 4-4.5% spent using these models (known as “inference”). Such estimates help quantify AI-specific energy use and associated GHG emissions, while shedding light on how impacts differ according to whether compute is used to train AI models or to use them (inference).

**Policy makers must ensure that AI is part of the solution to meet global sustainability targets.** A starting point is to address five measurement gaps with policy implications:

1. **Measurement standards for sustainable AI are needed.** Measuring the environmental impacts of AI compute and applications to inform policy decisions would be facilitated by consensus on terminology, standards, consistent

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indicators and reporting requirements. A comprehensive framework developed by international or inter-governmental standard-setting institutions and, international initiatives, as part of a multi-stakeholder process, could enable benchmarking, comparability and compatibility of national AI compute initiatives and their environmental impacts. Organisations such as the OECD could contribute to developing such a framework.

2. **Data collection on the environmental impacts of AI compute and applications should be expanded.** Efforts to collect national, firm and AI model level environmental data should be expanded. National agencies and institutions, and private-sector actors should collect more data using sustainability metrics such as GHG emissions, energy, water and natural resources used for AI compute, and AI applications where possible.
3. **AI-specific measurements are difficult to separate from general-purpose compute.** It is challenging to distinguish compute used for AI from that for other scientific, mathematical and general-purpose ICT needs. Further efforts should be made by governments, national statistical offices, intergovernmental organisations, the private sector, academia and others to disaggregate ICT infrastructure datasets, estimate the share used by AI and explore relevant proxy measures.
4. **Environmental impacts beyond operational energy use and GHG emissions should be considered.** The environmental impacts of AI compute beyond the energy use and carbon footprint of the operations stage (i.e. the production, transport, and end-of-life stages) warrant further research. This includes biodiversity assessments and the impacts of AI compute on other planetary boundaries (e.g. land system change and freshwater use), direct natural resource impacts from manufacturing, transport and end-of-life impacts, and indirect impacts from AI applications.
5. **Efforts are needed to improve environmental transparency and equity everywhere.** Most frameworks and analysis of AI compute are undertaken by experts from advanced economies. With negative environmental impacts anticipated to disproportionately affect emerging economies, further research should focus on ensuring that AI compute and applications support sustainability objectives across a broader range of national contexts, and sharing information and best practices.

**OECD DIGITAL ECONOMY PAPERS**  
 November 15, 2022 No. 341  
[www.oecd-ilibrary.org](http://www.oecd-ilibrary.org)

## COP27 REACHES BREAKTHROUGH AGREEMENT ON NEW “LOSS AND DAMAGE” FUND FOR VULNERABLE COUNTRIES

The United Nations Climate Change Conference COP27 ended with a breakthrough agreement to provide “**loss and damage**” funding for vulnerable countries hit hard by climate disasters.

“This outcome moves us forward,” said Simon Stiell, UN Climate Change Executive Secretary. “We have determined a way forward on a decades-long conversation on funding for loss and damage – deliberating over how we address the impacts on communities whose lives and livelihoods have been ruined by the very worst impacts of climate change.”

The World Leaders Summit, held over two days during the first week of the conference, convened six high-level roundtable discussions. The discussions highlighted solutions – on themes including food security, vulnerable communities and just transition – to chart a path to overcome climate challenges and how to provide the finance, resources and tools to effectively deliver climate action at scale.

COP27 took place from 6-20 November 2022 in Sharm el-Sheikh, Egypt. The conference brought together more than 45,000 participants to share ideas, solutions, and build partnerships and coalitions. Indigenous peoples, local communities, cities and civil society, including youth and children, showcased how they are addressing climate change and shared how it impacts their lives.

COP27 resulted in countries delivering a package of decisions that reaffirmed their commitment to limit global temperature rise to 1.5 degrees Celsius above pre-industrial levels. The package also strengthened action by countries to cut greenhouse gas emissions and adapt to the inevitable impacts of climate change, as well as boosting the support of finance, technology and capacity building needed by developing countries.

Creating a specific fund for loss and damage marked an important point of progress, with the issue added to the official agenda and adopted for the first time at COP27. Governments took the ground-breaking decision to establish new funding arrangements, as well as a dedicated fund, to assist developing countries in responding to loss and damage. Parties also agreed on the institutional arrangements to operationalize the Santiago Network for Loss and Damage, to catalyze technical assistance to developing countries that are particularly vulnerable to the adverse effects of climate change.

COP27 saw significant progress on adaptation, with governments agreeing on the way to move forward on the Global Goal on Adaptation, which will conclude at COP28 and inform the first Global Stocktake, improving resilience amongst the most vulnerable. New pledges, totaling more than USD 230 million, were made to the Adaptation Fund at COP27. These pledges will help many more vulnerable communities adapt to climate change through concrete adaptation solutions. COP27

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President Sameh Shoukry announced the Sharm el-Sheikh Adaptation Agenda, enhancing resilience for people living in the most climate-vulnerable communities by 2030. UN Climate Change's Standing Committee on Finance was requested to prepare a report on doubling adaptation finance for consideration at COP28 next year.

The cover decision, known as the Sharm el-Sheikh Implementation Plan, highlights that a global transformation to a low-carbon economy is expected to require investments of at least USD 4-6 trillion a year. Delivering such funding will require a swift and comprehensive transformation of the financial system and its structures and processes, engaging governments, central banks, commercial banks, institutional investors and other financial actors.

Young people in particular were given greater prominence at COP27, with UN Climate Change's Executive Secretary promising to urge governments to not just listen to the solutions put forward by young people, but to incorporate those solutions in decision and policy making.

“We have a series of milestones ahead. We must pull together, with resolve, through all processes, may they be national, regional, or others such as the G20. Every single milestone matters and builds momentum,” said Stiell. “The next step for change is just around the corner, with the United Arab Emirates' stewardship of the First Global Stock take. For the very first time we will take stock of the implementation of the Paris Agreement. It will independently evaluate the progress we have made and if our goals are adequate. It will inform what everybody, every single day, everywhere in the world, needs to do, to avert the climate crisis.”

COP27 President Sameh Shoukry said: “The work that we've managed to do here in the past two weeks, and the results we have together achieved, are a testament to our collective will, as a community of nations, to voice a clear message that rings loudly today, here in this room and around the world: that multilateral diplomacy still works.... despite the difficulties and challenges of our times, the divergence of views, level of ambition or apprehension, we remain committed to the fight against climate change.... we rose to the occasion, upheld our responsibilities and undertook the important decisive political decisions that millions around the world expect from us.”

#### **Summary of some of the other key outcomes of COP27 follows below:**

##### **1. Technology**

COP27 saw the launch of a new five-year work program at COP27 to promote climate technology solutions in developing countries.

##### **2. Mitigation**

COP27 significantly advanced the work on mitigation. A mitigation work programme was launched in Sharm el-Sheikh, aimed at urgently scaling up mitigation ambition and implementation. The work programme will start immediately following COP27 and continue until 2030, with at least two global dialogues held each year. Governments were also requested to revisit and strengthen the 2030 targets in their national climate plans by the end of 2023, as well as accelerate efforts to phasedown unabated coal power and phase-out inefficient fossil fuel subsidies.

##### **3. Global Stocktake**

Delegates at the UN Climate Change Conference COP27 wrapped up the second technical dialogue of the first global stocktake, a mechanism to raise ambition under the Paris Agreement. The UN Secretary-General will convene a 'climate ambition summit' in 2023, ahead of the conclusion of the stocktake at COP28 next year.

##### **4. Snapshot of other announcements:**

- Countries launched a package of 25 new collaborative actions in five key areas: power, road transport, steel, hydrogen and agriculture.
- UN Secretary-General António Guterres announced a USD 3.1 billion plan to ensure everyone on the planet is protected by early warning systems within the next five years.
- The UN Secretary-General's High-Level Expert Group on Net-Zero Commitments published a report at COP27, serving as a how-to guide to ensure credible, accountable net-zero pledges by industry, financial institutions, cities and regions.
- The G7 and the V20 ('the Vulnerable Twenty') launched the Global Shield against Climate Risks, with new commitments of over USD 200 million as initial funding. Implementation is to start immediately in a range of pathfinder countries.
- Announcing a total of USD 105.6 million in new funding, Denmark, Finland, Germany, Ireland, Slovenia, Sweden, Switzerland, and the Walloon Region of Belgium, stressed the need for even more support for the Global Environment Facility funds targeting the immediate climate adaptation needs of low-lying and low-income states.
- The new Indonesia Just Energy Transition Partnership, announced at the G20 Summit held in parallel with COP27, will mobilize USD 20 billion over the next three to five years to accelerate a just energy transition.

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- Important progress was made on forest protection with the launch of the Forest and Climate Leaders' Partnership, which aims to unite action by governments, businesses and community leaders to halt forest loss and land degradation by 2030.

<https://unfccc.int/news/cop27>, November 20, 2022

## COP15: NATIONS ADOPT FOUR GOALS, 23 TARGETS FOR 2030 IN LANDMARK UN BIODIVERSITY AGREEMENT

***By 2030: Protect 30% of Earth's lands, oceans, coastal areas, inland waters; Reduce by \$500 billion annual harmful government subsidies; Cut food waste in half***

The United Nations Biodiversity Conference (COP15) ended in Montreal, Canada, on 19 December 2022 with a landmark agreement to guide global action on nature by 2030. Representatives from 188 governments have been gathered in Montreal for two weeks for the important summit. **Nations of the world agreed on a historic package of measures deemed critical to addressing the dangerous loss of biodiversity and restoring natural ecosystems.**

Convened under UN auspices, chaired by China, and hosted by Canada, the 15th Conference of Parties to the UN Convention on Biological Diversity adopted the “**Kunming-Montreal Global Biodiversity Framework**” (GBF), including four goals and 23 targets for achievement by 2030. The GBF aims to address biodiversity loss, restore ecosystems and protect indigenous rights. The plan includes concrete measures to halt and reverse nature loss, including putting 30 per cent of the planet and 30 per cent of degraded ecosystems under protection by 2030. It also contains proposals to increase finance to developing countries – a major sticking point during talks.

**Kunming-Montreal Global Biodiversity Framework framework's four overarching global goals to protect nature, including:**

- halting human-induced extinction of threatened species and reducing the rate of extinction of all species tenfold by 2050;
- sustainable use and management of biodiversity to ensure that nature's contributions to people are valued, maintained and enhanced;
- fair sharing of the benefits from the utilization of genetic resources, and digital sequence information on genetic resources; and
- that adequate means of implementing the GBF be accessible to all Parties, particularly Least Developed Countries and Small Island

**Global Biodiversity Framework features 23 targets to achieve by 2030, including the following:**

- Effective conservation and management of at least 30 per cent of the world's land, coastal areas and oceans. Currently, 17 percent of land and \*8 per cent of marine areas are under protection
- Restoration of 30 per cent of terrestrial and marine ecosystems
- Reduce to near zero the loss of areas of high biodiversity importance and high ecological integrity
- Halving global food waste
- Phasing out or reforming subsidies that harm biodiversity by at least \$500 billion per year, while scaling up positive incentives for biodiversity conservation and sustainable use
- Mobilizing at least \$200 billion per year from public and private sources for biodiversity-related funding
- Raising international financial flows from developed to developing countries to at least US\$ 30 billion per year
- Requiring transnational companies and financial institutions to monitor, assess, and transparently disclose risks and impacts on biodiversity through their operations, portfolios, supply and value chains

### **Finance at the core**

Finance played a key role at COP15, with discussions centring on how much money developed countries will send to developing countries to address biodiversity loss. It was requested that the Global Environment Facility set up a Special Trust Fund, the GBF Fund to support the implementation of the GBF, in order to ensure an adequate, predictable and timely flow of funds.

Countries also approved a series of related agreements to implement the GBF, including on planning, monitoring, reporting and review, which are all vital to ensure progress is made – in the words of the GBF, to ensure that there is not “a further acceleration in the global rate of species extinction, which is already at least tens to hundreds of times higher than it has averaged over the past 10 million years.”

[www.nature.com/articles/d41586-022](http://www.nature.com/articles/d41586-022), December 19, 2022

[www.unep.org/news](http://www.unep.org/news), December 20, 2022

*New Publications of NAM S&T Centre*



# BLUE ECONOMY

## AN OCEAN SCIENCE PERSPECTIVE

The ocean is a major source of income for many coastal nations, particularly in the developing world. Economic benefits from the ocean in the long-term depend on its wise science and technology-based management. The intersection of science, technology, and economy are most obvious in nations' coastal zones.

The NAM S&T Centre has successfully published its third scientific Monograph titled “**Blue Economy – An Ocean Science Perspective**” edited by Edward R. Urban Jr. (USA) and Venugopalan Ittekkot (Germany). The book highlights the importance of oceans as a source of economy in coastal countries/nations. It also presents the use of science and technology to improve the management of coastal resources for best economic outcomes and discusses the importance of this approach to create sustainable economic growth.

The book would be a valuable reference material for ocean scientists, researchers, government officials, policymakers, and other concerned working in the area of “Ocean Science and Technology” and relevant fields.

**Foreword:** *Sinjae Yoo (Korea)*

**Preface:** *Edward R. Urban Jr. (USA) and Venugopalan Ittekkot (Germany)*

**Introduction:** *Amitava Bandopadhyay (India)*

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# EXTREME NATURAL EVENTS

## SUSTAINABLE SOLUTIONS FOR DEVELOPING COUNTRIES

A. S. Unnikrishnan  
Fredolin Tangang  
Raymond Durrheim *Editors*

# Extreme Natural Events

Sustainable Solutions for Developing  
Countries

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Extreme Natural Events occur frequently across the world and many of these phenomena are affected by the climate change. Developing countries are far more vulnerable to these extremes of normal climatic change due to their inadequate financial, technical and logistic capabilities. It is thus, imperative for the developing countries to improve their ability to forecast, mitigate and manage these extreme events in order to reduce the economic, social (human) and environmental impacts.

The NAM S&T Centre has successfully published its second scientific Monograph titled “**Extreme Natural Events - Sustainable Solutions for Developing Countries**” edited by A.S. Unnikrishnan (India), Fredolin Tangang (Malaysia) and Raymond J. Durrheim (South Africa). The book presents the challenges of developing countries to understand and manage the risks of extreme natural events. In the seventeen chapters, the book brings together scientific communities from Ghana, India, Indonesia, Malaysia, Philippines, Sri Lanka, South Africa, and Venezuela to share their expertise in different aspects of managing extreme natural events, particularly those related to climate. It also discusses how adaptation to these extreme natural events must be an integral part of national policy of the developing countries dealing with disaster mitigation and management.

The book would be a valuable reference material for social and natural scientists, meteorological community, disaster mitigation agencies, and policymakers in developing countries and others concerned working in the area of “Extreme Natural Events” and relevant fields.

**Foreword:** *Philip L. Woodworth (United Kingdom)*

**Preface:** *A.S. Unnikrishnan (India), Fredolin Tangang (Malaysia) and Raymond J. Durrheim (South Africa)*

**Introduction:** *Amitava Bandopadhyay (India)*

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*Science, Technology & Innovation News***HEALTH****Electrical Stimulation helps Paralysed people Walk Again**

*Detailed gene-activity map could pave way for more precise treatments for many more people with spinal-cord injuries.*

Neuroscientists have identified the nerve cells responsible for helping paralysed people to walk again, opening up the possibility of targeted therapies that could benefit a wider range of people with spinal-cord injuries.

Severe spinal-cord injuries can disrupt the connection between the brain and the networks of nerve cells in the lower spine that control walking. In 2018, neuroscientist Grégoire Courtine at the Swiss Federal Institute of Technology in Lausanne and his colleagues showed that delivering electrical pulses to those lower-spine nerves, a technique known as Epidural Electrical Stimulation (EES), when combined with intensive training, get people with this kind of spinal-cord injury walking again. All three participants in a trial went from having severe or complete motor paralysis and minimal sensation in their legs to being able to take steps on their own, or with a walker or crutches. Two other teams showed similar results that year.

Courtine's team has now extended the work, showing that the system works in people who have lost all sensation in their legs. The group reports in *Nature* that nine participants in the same trial, three of whom had complete paralysis and no sensation in their legs regained the ability to walk after training paired with EES delivered by devices implanted in their spines. Five months into the trial, all participants could bear their own weight and take steps, using a walker for stability. Four no longer need the EES to be switched on to walk. This sustained recovery suggests that the stimulation triggers remodelling of the spinal neurons to bring the locomotion network back on line.

“The amount of hope that it gives to people with spinal-cord injury is incredible,” says Marc Ruitenberg, a neurologist at the University of Queensland in Brisbane, Australia, who studies spinal-cord injury.

First, the researchers emulated each aspect of the treatment in mice from injury and electrical stimulation to training with a purpose-built robotic support for stability. The results mimicked those in people. Next, the researchers measured gene activity in thousands of individual neurons in samples of mouse spinal tissue. This produced an exquisitely detailed map of nerve cell types in the lower spinal cord. They then used a machine-learning algorithm to search for mouse neurons that showed changes in gene activity at set stages of EES-assisted rehabilitation that paralleled the changes observed in the human participants' walking ability.

The algorithm identified a subpopulation of excitatory interneurons nerve cells that connect motor and sensory neurons that seemed to fit. When Courtine and his team silenced those cells in injured mice, they found that EES no longer enabled the injured animals to walk. The overall decrease in neural activity at the site during rehabilitation reflects a learning process, says Courtine.

Eiman Azim, a neuroscientist at the Salk Institute for Biological Studies in La Jolla, California, says detailed understanding of the spinal circuitry could allow neuroscientists to manipulate the activity of specific neurons directly with other treatments, such as gene therapy. Stem-cell therapies could one day replace crucial populations of neurons damaged in spinal-cord injuries, says Ruitenberg.

Courtine and his colleagues have also used EES to restore arm movement and hand grip in monkeys.

*www.nature.com, November 9, 2022*

(Contd. from Page 10 - STI News)

## IoT TECHNOLOGY

### IoT Street Lighting Project helps Aberdeen Reduce Carbon Production

An intelligent street lighting project has been rolled out by Aberdeen City Council, unlocking sustainability and decarbonisation improvements across the city. The Lighting-Up Aberdeen project is part of a partnership with the UK's leading IoT service and solutions provider, North, and is helping the local authority create a greener future through the use of energy-efficient lighting across the city.

The project has seen a state-of-the-art IoT solution installed to manage and monitor more than 37,000 streets lighting units remotely, enhancing the city's lighting provision, whilst simultaneously helping to create a greener and safer city for the people of Aberdeen in Scotland. Through the new solution, there is now no need for the manual process of checking lights, significantly reducing carbon emissions from travelling, while custom dimming profiles can be used to manage the level of energy required at any given time and automated fault reporting has allowed for more efficient maintenance.

Lighting-Up Aberdeen has delivered considerable carbon reductions through a reduction in energy use and, in turn, the council has seen significant savings across street lighting electricity bills. Now, the project has been recognised across the UK, winning the Sustainable Customer Project of the Year category at the recent CRN Tech Impact Awards. North was awarded for its work with Aberdeen City Council, providing the local authority with a city-wide LoRaWAN IoT Network and Central Management System (CMS) based Intelligent Lighting solution. North's intelligent technology solutions are supporting Aberdeen City Council with its Net Zero Aberdeen Route Map, a city-wide approach to reducing carbon emissions, and helping Aberdeen become a smart city.

Scott McEwan, acting CEO at North, said, "We are incredibly proud to receive recognition from CRN for the work we are helping to deploy across the region and look forward to continuing this relationship as we collaborate with Aberdeen City Council to further utilise the IoT network".

<https://www.iotechnews.com>, November 11, 2022

## CLIMATE CHANGE

### Cropping Frequency Decline due to Climate Change may impact Food Security

The global demand for food is expected to increase in the coming decades, but global food production may not be able to keep pace with it. A study published in *Nature* journal in October showed a prevalent decline in cropping frequency (CF), crop caloric yield and caloric production.

CF refers to the number of crops cultivated per year on a given area of land. Crop caloric yield is the crop yield in calories produced per area. There was a decline in the above three for warm areas in the study period of 1979-2018, resulting in an overall decline in the global average.

Warm regions, which already have a long growing season, might record lower CF due to the higher risk of crop failure caused by more frequent heat or drought stresses, the paper said.

These dynamics have been confirmed for the Brazilian corn-soyabean cropping system. Satellite observation in these regions suggested that CF was impacted by warming. The study was done by 10 researchers from the United States, China, France and Hong Kong.

India's staple rice and wheat crops have been significantly impacted in the last two years due to climate change. This year, many farmers witnessed their usual cropping cycles getting disturbed. They could not take up timely sowing of the kharif crop due to the failure of monsoon rains.

Rains were delayed significantly in some areas. In such cases, farmers avoided the cropping season altogether and timely sow the next rabi crop. Meanwhile, the researchers also estimated lower declines or even smaller gains for cold areas per one degree Celsius of warming. "Warmer temperature might be beneficial for increasing CF in cold areas, as the frost-free period expands and shortens single-crop growth duration," it said.

For example, there are increases in CF in Canada, Scandinavian countries, Mongolia and Russia with above 1°C warming. However, the authors suggested that these increases are insufficient to fully offset the decline in warm and dry regions.

Irrigation effectively offsets the projected production loss, but irrigated areas have to be expanded by over five per cent in warm regions to fully offset climate-induced production losses by the 2050s.

These divergent conclusions support the need for holistic quantification of how climate warming influences global-scale CF to manage its impact on regional and global food security.

[www.downtoearth.org.in](http://www.downtoearth.org.in), November 22, 2022

## ENVIRONMENT

### New UN Report urges Europe to Step-Up Action over Triple Environmental Crisis

A new UN report presented to the Organization's highest pan-European environmental policy body, covering 54 countries, is calling for greater action to tackle the triple environmental crisis roiling the planet. Action is needed over emissions, waste, pollution and biodiversity loss, it says, adding that solutions can be found, through a focus on a "circular economy" and sustainable infrastructure.

The call came during the ninth Environment for Europe Ministerial Conference, which runs until Friday, in the report authored by the UN Economic Commission for Europe (UNECE) and UN Environment Programme (UNEP).

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“The findings of this assessment almost halfway through Agenda 2030, must be a wake-up call for the region,” said UNECE chief Olga Algayerova. “The historic drought the region faced this summer, announced what we should expect in years to come and shows that there is no more time to lose”.

**Combating air pollution:** Despite some progress, the report notes that air pollution remains the greatest health risk in the region. The assessment calls for additional measures, including the best available strategies for cutting emissions and reducing those coming from traffic.

**Slash greenhouse gas:** The report encourages governments to eliminate or reform harmful subsidies and develop incentives to promote decarbonisation by shifting investments towards renewables.

**Time for a plan:** According to the report, the region's river basins, lakes and aquifers are under multiple stresses with climate change delivering additional challenges such as floods, droughts and water-borne diseases. Pollution as well as urban and industrial wastewater discharges remains public health concerns, the report advocates for greater water conservation and nature-based solutions for water retention basins.

Ms. Andersen said “As citizens feel the pinch and are facing higher energy bills than ever before, as they see record temperatures and their water reservoirs shrink... countries must show that there is a plan”.

**Circular economy:** A circular and more efficient economy, where production and consumption are mutually sustaining and focused on resource efficiency will help address growing waste and resource use.

The report urges governments to step up waste prevention in production, consumption, and re-manufacturing, including through financial incentives such as tax relief, and upholds that a Pan-European e-waste management partnership would enable the recovery of valuable resources.

**Developing infrastructure:** During post-COVID recovery, sustainable infrastructure investment has been shown to have a major impact. However, most countries have yet to develop mechanisms incorporating sustainability, such as the cost of pollution, ecosystem services, or biodiversity protection – into the cost-benefit analysis of large infrastructure projects. The UN report offers tools to help remedy this.

“This assessment can be a guide for lowering emissions, a healthier environment for people and for nature, and better waste management and cleaner air,” maintained Ms. Andersen.

*www.news.un.org/en, October 6, 2022*

### **Lasting Impact: Microplastics Settling into Soil**

Whether we like it or not, plastic is a major part of our lives. The production and use of plastics has been found to create a problem because “microplastics” are accumulating in our soil. Microplastics are tiny particles of plastic debris that are often found in the environment. Less than 5000 micro millimetres in size, they are the result from the disposal and breakdown of consumer products and industrial waste. With limited studies of the impacts on the environment, researchers in Europe wanted to dig deep to learn how microplastics may impact the flow of water through soil.

Andreas Cramer, a researcher from ETH Zurich in Switzerland, and his team believe that high amounts of microplastics in soil cause the soil to repel water. This is because plastics do not wet easily. Overall, their experiments tested soils with various amounts of microplastics to see how water hit the soil surface and flowed through the soil.

The study was published in the *Vadose Zone Journal*, a publication of the Soil Science Society of America. The research team found that, in large quantities, microplastics begin to impact how water flows through soil. Fortunately, it is not likely that an entire area, such as a crop field, will contain this high amount of microplastics.

However, their data also showed how microplastics can concentrate or pool in certain areas, rather than being evenly distributed. This can cause issues in the soil in particular spots that have higher concentrations of the particles.

“If we take the example of an agricultural field, the uneven distribution of microplastics might cause an uneven distribution of water through the depths,” Cramer says. “Consequently, this could impact the root architecture of plants. Spots with higher levels of microplastics in the top layer of soils could impact water availability for shallow rooting plants and, down the line, also nutrient availability.” The scientists' imaging techniques showed how water infiltration can be locally impeded because water doesn't flow into regions with high levels of microplastics.

“Average levels of microplastics are unlikely to occur in large volumes of soils at the higher levels we studied,” Cramer explains. “However, we expect uneven distribution of microplastics in soils. Consider agricultural mulch film pieces incorporated into the soil. These pieces become brittle over time and fall apart, turning into particles within the pore space creating hotspots of microplastic content. Or if you think about deposition of airborne microplastics, they will be collected in rough areas of the soil surface.”

Cramer also wants to explore how long microplastics may repel water if they break down over time, as well as if what a microplastic is made of makes a difference. “This work is contributing to the awareness of society about impacts on the environment,” he says. “It is helping us realize the urgency to improve waste management systems and human behaviours that contribute to contaminating the environment.”

*www.crops.org, October 31, 2022*

## **ASTRONOMY**

### **Astronomers Discover Closest Black Hole to Earth**

Astronomers have discovered the closest-known black hole to Earth. This is the first unambiguous detection of a dormant stellar-mass black hole in the Milky Way. Its close proximity to Earth, a mere 1600 light-years away, offers an intriguing target of study to advance our understanding of the evolution of binary systems.

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Black holes are the most extreme objects in the Universe. Super massive versions of these unimaginably dense objects likely reside at the centres of all large galaxies. Stellar-mass black holes, which weigh approximately five to 100 times the mass of the Sun are much more common, with an estimated 100 million in the Milky Way alone. Only a handful has been confirmed to date, however, and nearly all of these are 'active'.

Astronomers using the Gemini North telescope on Hawai'i, one of the twin telescopes of the International Gemini Observatory, operated by NSF's NOIR Lab, have discovered the closest black hole to Earth, which the researchers have dubbed Gaia BH1. This dormant black hole is about 10 times more massive than the Sun and is located about 1600 light-years away in the constellation Ophiuchus, making it three times closer to Earth than the previous record holder, an X-ray binary in the constellation of Monoceros. The new discovery was made possible by making exquisite observations of the motion of the black hole's companion, a Sun-like star that orbits the black hole at about the same distance as the Earth orbits the Sun.

"Take the Solar System, put a black hole where the Sun is, and the Sun where the Earth is, and you get this system," explained Kareem El-Badry, an astrophysicist at the Center for Astrophysics | Harvard & Smithsonian and the Max Planck Institute for Astronomy, and the lead author of the paper describing this discovery. "While there have been many claimed detections of systems like this, almost all these discoveries have subsequently been refuted. This is the first unambiguous detection of a Sun-like star in a wide orbit around a stellar-mass black hole in our Galaxy."

Though there are likely millions of stellar-mass black holes roaming the Milky Way Galaxy, those few that have been detected were uncovered by their energetic interactions with a companion star. As material from a nearby star spiral towards the black hole, it becomes superheated and generates powerful X-rays and jets of material. If a black hole is not actively feeding (i.e., it is dormant) it simply blends in with its surroundings.

The team relied not only on Gemini North's superb observational capabilities but also on Gemini's ability to provide data on a tight deadline, as the team had only a short window in which to perform their follow-up observations.

"As part of a network of space- and ground-based observatories, Gemini North has not only provided strong evidence for the nearest black hole to date but also the first pristine black hole system, uncluttered by the usual hot gas interacting with the black hole," said NSF Gemini Program Officer Martin Still. "While this potentially augurs future discoveries of the predicted dormant black hole population in our Galaxy, the observations also leave a mystery to be solved despite a shared history with its exotic neighbour, why is the companion star in this binary system so normal?"

The International Gemini Observatory is operated by a partnership of six countries, including the United States through the National Science Foundation, Canada through the National Research Council of Canada, Chile through the Agencia Nacional de Investigación y Desarrollo, Brazil through the Ministério da Ciência, Tecnologia e Inovações, Argentina through the Ministerio de Ciencia, Tecnología e Innovación, and Korea through the Korea Astronomy and Space Science Institute. These Participants and the University of Hawaii, which has regular access to Gemini, each maintain a "National Gemini Office" to support their local users.

[www.sciencedaily.com](http://www.sciencedaily.com), November 4, 2022

## ROBOTICS

### A Low-Cost Robot Ready for any Obstacle

Researchers at Carnegie Mellon University's School of Computer Science and the University of California, Berkeley, have designed a robotic system that enables a low-cost and relatively small legged robot to climb and descend stairs nearly its height; traverse rocky, slippery, uneven, steep and varied terrain; walk across gaps; scale rocks and curbs; and even operate in the dark. This little robot can go almost anywhere.

"Empowering small robots to climb stairs and handle a variety of environments is crucial to developing robots that will be useful in people's homes as well as search-and-rescue operations," said Deepak Pathak, an assistant professor in the Robotics Institute. "This system creates a robust and adaptable robot that could perform many everyday tasks."

The researchers trained the robot with 4,000 clones of it in a simulator, where they practiced walking and climbing on challenging terrain. The simulator's speed allowed the robot to gain six years of experience in a single day. The simulator also stored the motor skills it learned during training in a neural network that the researchers copied to the real robot. This approach did not require any hand-engineering of the robot's movements a departure from traditional methods.

Most robotic systems use cameras to create a map of the surrounding environment and use that map to plan movements before executing them. The process is slow and can often falter due to inherent fuzziness, inaccuracies, or misperceptions in the mapping stage that affect the subsequent planning and movements. Mapping and planning are useful in systems focused on high-level control but are not always suited for the dynamic requirements of low-level skills like walking or running over challenging terrains.

The new system bypasses the mapping and planning phases and directly routes the vision inputs to the control of the robot. What the robot sees determines how it moves. Not even the researchers specify how the legs should move. This technique allows the robot to react to oncoming terrain quickly and move through it effectively. Because there is no mapping or planning involved and movements are trained using machine learning, the robot itself can be of low-cost. The robot used by the team was at least 25 times cheaper than available alternatives. The team's algorithm has the potential to make low-cost robots much more widely available.

"This system uses vision and feedback from the body directly as input to output commands to the robot's motors," said Anany Agarwal, an SCS Ph.D. student in machine learning. "This technique allows the system to be very robust in the real world. If it slips on stairs, it can recover. It can go into unknown environments and adapt." This direct vision-to-control aspect is biologically inspired. Humans and animals use vision to move.

(Contd. from Page 13 - STI News)

The team looked to nature for other elements of the system, as well. For a small robot, less than a foot tall, in this case to scale stairs or obstacles nearly its height, it learned to adopt the movement that humans use to step over high obstacles. When a human has to lift its leg up high to scale a ledge or hurdle, it uses its hips to move its leg out to the side, called abduction and adduction, giving it more clearance. The robot system Pathak's team designed does the same, using hip abduction to tackle obstacles that trip up some of the most advanced legged robotic systems on the market.

"Since there's no map, no planning, our system remembers the terrain and how it moved the front leg and translates this to the rear leg, doing so quickly and flawlessly," said Ashish Kumar a Ph.D. student at Berkeley.

This research could be a large step towards solving the existing challenges faced by legged robots and bringing them into people's homes.

[www.sciencedaily.com](http://www.sciencedaily.com), November 16, 2022

## AGRICULTURE

### A Win, Win, Win for Dairy Production in East Africa

Newswise - Adopting high yield dairy cattle breeds and improving feed would allow Tanzania to increase milk production, while reducing planet warming greenhouse gas (GHG) emissions and alleviating poverty, a new study reveals.

Tanzania has the second largest dairy herd in East Africa with 28 million cows. However, its dairy sector is poorly developed with mainly small-scale farms stocked with low-yielding breeds, using poor quality feeds. This, along with other supply chain problems around handling and refrigeration, results in poor productivity and the need to import processed dairy products leading to a \$23 million trade deficit.

A new research paper from an international team of researchers led by Lancaster University scientists and published in *Nature Food* is the first to find evidence that breeding higher yielding dairy cattle offers significant potential to help Tanzania to reduce its dependency on foreign food imports and at the same time help meet its climate commitments. The findings shows the two key targets of Tanzanian government policy - becoming self-sufficient in milk and cutting GHG emissions by a third can be achieved simultaneously while increasing income in farming communities.

Researchers carried out a household survey of 1,200 dairy farmers in Tanzania which was used as a baseline for a sectoral modelling analysis. The survey, which extended across four districts and two agro-ecological zones, was used to estimate milk production yields from different cattle breeds and how the cattle are managed - for instance what they are fed and how disease is managed.

Tanzania's local cattle cope well with high temperatures but produce little milk. New breeds, which cross local cattle with high yielding European cows, produce as much as three times milk, while still coping well with heat.

The study takes as its starting point the Tanzanian Dairy Development Roadmap (DDR), a Government plan which, with support from stakeholders, aims to achieve dairy self-sufficiency by 2030. The researchers model how the Roadmap could be delivered through farmers changing from local to improved breeds of cattle, and feeding their cattle more nutritious, locally produced feed. Crucially, it assumes land that is already used in agriculture, mainly local pasture, is converted to grow feed crops, so farmers do not rely on imported feed and no forest needs to be cut down to grow it.

"The idea was to model the Tanzanian Government's planned interventions to increase milk production and also their targets for improved dairy breeds and feeding practices," said Dr James Hawkins, an environmental economist from the Lancaster Environment Centre, and lead author of the study. "What is very important is understanding the interactions between cattle management and productivity because the carbon footprint is strongly related to the productivity of dairy cows."

The combination of more nutritious feed and more productive cattle means that production can be increased while reducing herd size, and cutting the amount of land needed to support the cattle, the study found. Better feed can increase the milk yield for local cows by up to 179% and for the higher yielding breeds by up to 130%. The study modelled a series of scenarios, with different levels of milk production and adoption of new breeds and feeds. All the scenarios showed increase in production and a decrease in GHG emissions. The analysis showed that fulfilling the DDR targets for adopting improved breeds would enable Tanzania to meet 70% of the target milk production level while also fulfilling the country's ambition to reduce GHG emissions from dairy by a third. The main driver of emissions reductions was from avoided land use change. While the model showed improving feed requires more cropland, a much larger decline in grasslands would reduce carbon dioxide emissions from forest clearance.

"This is a win, win, win for Tanzania," said Professor Mariana Rufino, from the Lancaster Environment Centre, principal investigator in the study, who has been researching dairy production in Africa for almost twenty years.

"There have been a lot of studies showing how to mitigate emissions from the livestock sector that tell low-income countries what they should do, that they shouldn't have livestock etc. This study is special because we take Tanzania's own ambitions, a country level target, and work out how they can achieve it, and more.

Dr Amos Omoro, Tanzania country representative for the International Livestock Research Institute, said: "The findings of this paper have huge implications. The same quantity of milk being produced in smallholder dairy farms that dominate in eastern Africa can easily be produced with less than a quarter the number of animals currently, given the large yield gaps. What is required is more investment in sustainable animal productivity in smallholder farms - a clear win-win for better lives and greener planet."

[www.newswise.com](http://www.newswise.com), November 16, 2022

## MEETINGS AND VISITS OF DIRECTOR GENERAL, NAM S&T CENTRE



### MEETING WITH MINISTRY OF SCIENCE & TECHNOLOGY, GOVERNMENT OF SOCIALIST REPUBLIC OF VIETNAM, HANOI

Dr. Amitava Bandopadhyay, Director General, NAM S&T Centre met Ms. Le Thi Viet Lam, Deputy Director General, International Cooperation Division, Ministry of Science and Technology (MoST), Hanoi, Vietnam in the Office of the Ministry on 13<sup>th</sup> October 2022 to discuss the future proposals for S&T collaboration between MoST and the NAM S&T Centre during 2023-24. The meeting was also attended by Mr. Nguyen Van Thuong and Ms. Nguyen Thi Lan Huong, Officials from MoST, Hanoi and Mr. Bui Xuan Quynh, Expert in Science & International Cooperation Department, Agricultural Genetics Institute, Hanoi and Former Science Counsellor, Vietnam Embassy in New Delhi, India.

Dr. Bandopadhyay thanked Ms. Lam for her kind support towards various scientific activities of the Centre and facilitating participation of many scientists and other experts from Vietnam in these S&T events. During the meeting, Dr. Bandopadhyay proposed that an International Workshop/Training Workshop may be organised by MoST in partnership with the NAM S&T Centre in Vietnam in collaboration with any academic/research institution of the country. Ms. Lam happily accepted the proposal and agreed to host one such scientific event sometime during 2024 (in physical mode).

Ms. Lam also accepted Dr. Bandopadhyay's proposal to jointly undertake a Monograph Publication Project in the near future. A suitable topic and participating S&T institutions for technical support to bring out the publication will be identified through mutual discussion.

Dr. Bandopadhyay shared the information with Ms. Lam about the Monograph and a book recently brought out by the NAM S&T Centre respectively on Lightning and Dryland Agriculture which have been published by Springer Nature, Singapore.

### MEETING WITH HAIPHONG UNIVERSITY OF MEDICINE AND PHARMACY, HAIPHONG CITY, VIETNAM

Dr. Amitava Bandopadhyay, Director General, NAM S&T Centre met Professor P. V. Linh, Vice-Rector for Graduate Education, Research and International Relations, Haiphong University of Medicine and Pharmacy (HPMU), Haiphong City, Vietnam in his Office on 19<sup>th</sup> October 2022 to discuss the future proposals for S&T collaboration between HPMU and the NAM S&T Centre during 2023-24. The meeting was also attended by Dr. C. D. Tuan, Professor, HPMU.

Dr. Bandopadhyay thanked Prof. Linh and Dr. Tuan for the kind support extended by HPMU to the NAM S&T Centre towards organising the joint International Workshop on "Drug Development from Herbs and Marine Medicinal Materials" held in Haiphong City during December 10-12, 2018. Dr. Bandopadhyay requested Prof. Linh for organising another joint International Workshop on a suitable topic sometime during the first/second quarter of 2024. Prof. Linh readily agreed to the proposal and suggested that an International Workshop may be organised jointly by HPMU and NAM S&T Centre on a theme related to "Emerging Issues in Medical Science in the Developing World" sometime during early 2024 (in physical mode) in Haiphong. The exact dates and topic will be finalised through mutual discussion.

Prof. Linh also accepted a proposal from Dr. Bandopadhyay regarding undertaking a Monograph Publication Project in the near future on a topic of mutual interest.



## Distinguished Visitors to the NAM S&T Centre



Prof. Kiran Bhujun, Director, Tertiary Education & Scientific Research, Ministry of Education, Tertiary Education, Science and Technology, Mauritius



Prof. (Dr.) Someshwar Das, South Asian Meteorological Association (SAMA), New Delhi

## Centre Announces

# International Workshop on COMBATING PLASTIC POLLUTION IN TERRESTRIAL ENVIRONMENT

Mysuru, Karnataka (India)  
14-15 March, 2023

With mounting evidences that plastic waste is rising and the accumulation of plastics in our natural environment is getting worse, the plastic pollution dilemma has recently taken centre stage in the discussions of global policy. As a result, presently more attempts are being made to identify the international frameworks and initiatives that could aid not just in containing this crisis but also in repairing some of the damages caused.

It is now abundantly clear that the problem of single-use plastics has caused a worldwide crisis, the scale of which is becoming clear now. In light of this, the President of the UN General Assembly has classified the problem of plastic pollution as a top priority during the 73<sup>rd</sup> Session. It has been realized that a deeper knowledge of the processes causing the environmental release of plastic in the terrestrial environment is necessary to address the problem of global plastic contamination.

In this context, the Centre for Science & Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre), New Delhi, India, in partnership with the JSS Academy of Higher Education and Research (JSS AHER), Mysuru, Karnataka, India and the Scientific Committee on Problems of the Environment (SCOPE), Amstelveen, the Netherlands is organizing an International Workshop on “**Combating Plastic Pollution in Terrestrial Environment**” to be held during **March 14-15, 2023** at Mysuru, Karnataka, India.

The Workshop will be organized and hosted by JSS AHER at Mysuru, India.

Experts and scientists desirous of participating in the Workshop, except those from India, are required to submit their applications directly to the NAM S&T Centre at email: [namstcentre@gmail.com](mailto:namstcentre@gmail.com) as early as possible, but latest by **1 February, 2023**.

Applicants from India should, however, submit their applications to the Dean (Academics), JSS AHER, Mysuru at [vishalkumargupta@jssuni.edu.in](mailto:vishalkumargupta@jssuni.edu.in)/ [shivvarajuhp@jssuni.edu.in](mailto:shivvarajuhp@jssuni.edu.in).

**More details about the Workshop are available at Centre's Official Website: [www.namstct.org](http://www.namstct.org).**

## FACT FILE – SUSTAINABLE AGRICULTURE



Sustainable Agriculture (SA) integrates environmental health, economic profitability, and social equity, and constitutes a part of UN's Sustainable Development Goals (SDGs). This type of agricultural operation can increase crop production, preserve and restore critical habitats, help protect watersheds and improve soil health, water quality and biodiversity.

SA, through justifiable resource management, must meet society's present food needs without compromising the ability for future generations to meet their requirements. This new approach would bring improvements in agricultural policies, manage livestock, and identify new and diversified income opportunities for producers, while optimizing the manual workforce.

Considering the need for increased agricultural production in developing countries and achieving **SDG-2 to end hunger, achieve food security and improved nutrition**, the NAM S&T Centre has successfully published its first Fact File on “**Sustainable Agriculture**”. The Fact File provides a comprehensive overview of sustainable agriculture and its principles; a differential comparison to traditional farming; methods and practices; benefits and advantages; sustainable agriculture in NAM Countries; developing a business model and building a common ethical vision through intervention of science and technology to ensure food security and manage hunger.

The contents of this Fact File have been reviewed by Dr. G. Ravindra Chary, Project Coordinator (Dryland Research), Former Acting Director, ICAR - Central Research Institute for Dryland Agriculture, Hyderabad, India. The Centre also received valuable comments from Prof. Xavier Poshiwa, Dean, Gary Magadzire School of Agriculture, Great Zimbabwe University, Masvingo, Zimbabwe. The Fact File has been conceptualized and edited by Dr. Ranadhir Mukhopadhyay, Former Chief Scientist, CSIR-National Institute of Oceanography (CSIR-NIO), Goa, India.

The Centre has received appreciation and valuable feedback from countries namely Mauritius, Myanmar, Iran and India.

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