



INITIATIVE ON
NEXUS Gains

INITIATIVE OVERVIEW

The Challenge

Water, energy, food, forests and biodiversity – critical to rural livelihoods and our food and nutrition security – are strongly interconnected. Complex challenges emerge at the intersection of these systems, but governments, stakeholders and investors struggle to recognize and manage these interdependencies and trade-offs. These interlinked systems are further stressed by climate change, civil conflict and pandemics. With systems deeply connected, investments in water, energy and food – intended to enhance socio-economic development – have often had unforeseen, harmful impacts for the poorest and most marginalized in society.

Addressing these challenges and risks requires coordinated action across political and institutional boundaries and scales, from the global to the local, and across the public and private sectors and civil society. Systems thinking helps avoid unintended consequences that jeopardize sustainability and worsen conflict over resources. Good governance across boundaries and sectors requires strong institutions and actors willing to overcome siloed approaches and adopt new tools and innovations to support systems approaches.

NEXUS Gains aims to improve integrated management across the water, energy, food and environment (WEFE) nexus for inclusive, sustainable development against the backdrop of the climate crisis. This requires working closely with governments, investors and local communities to identify where and how to maintain, restore and improve ecosystems and biodiversity, revitalize agriculture, and support sustainable irrigation, clean energy and agro-processing needs.

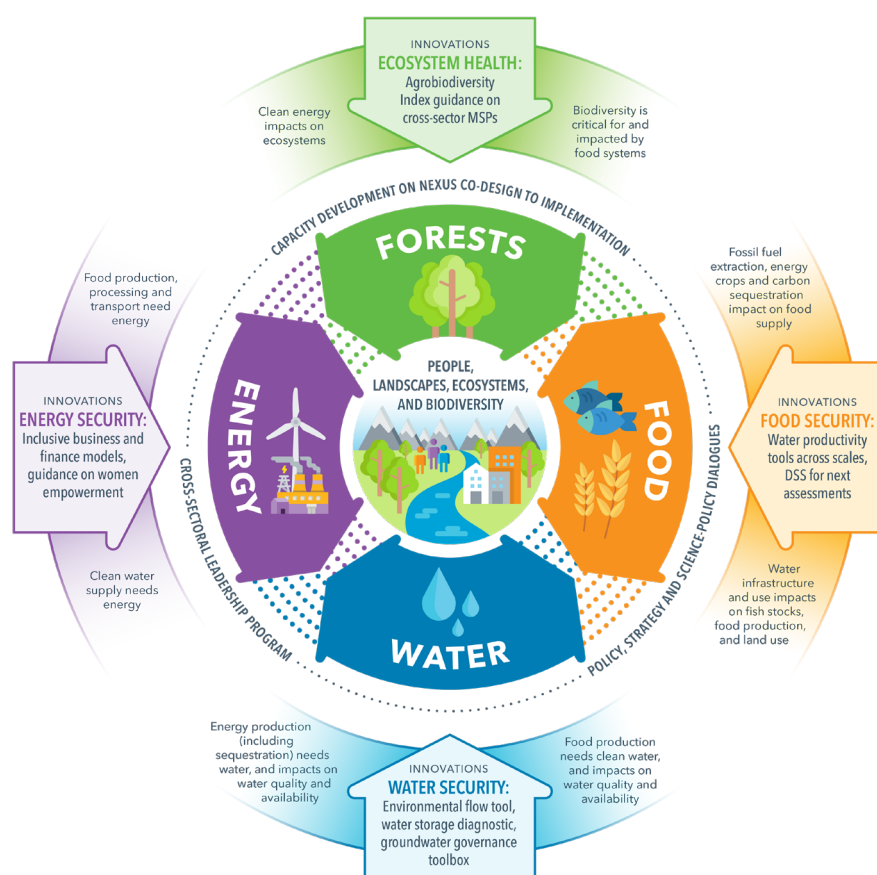
The Initiative analyzes alternative, practical interventions at different scales – from farms to watersheds to river basins – to support economic efficiency and environmental sustainability. It seeks to improve understanding of WEFE synergies and trade-offs, engaging vulnerable groups such as women, youth and other marginalized communities that bear the brunt of poorly managed WEFE systems and have little say in decisions that affect them. NEXUS Gains is also using integrated biophysical and socio-economic tools to support policy design, investment planning and improved governance.

Water, energy and food systems and the health of ecosystems are increasingly stressed, with the most negative impacts for poor people. These systems are inextricably linked, yet most efforts to improve water, energy and food security and ecosystem health continue to focus on single-sector approaches that neglect the complexity of their interactions, often worsening rather than solving underlying problems. The NEXUS Gains Initiative uses a systems approach to better understand interlinkages and to promote interventions to boost sustainable water resource management, protect biodiversity, and provide clean and inclusive access to energy for our agri-food systems.

Systems transformation

The first phase of the NEXUS Gains Initiative runs for three years, to the end of 2024. If additional funds are made available it will continue, in two additional three-year phases, to 2030. NEXUS Gains aims to identify transformative and inclusive strategies, innovations and policies to achieve gains across WEFE systems – with environmental systems focusing on forests and biodiversity – in selected transboundary river basins. The Initiative will contribute to CGIAR's Systems Transformation by:

- Developing and applying trade-off analyses and foresight methodologies that can help local and national governments use evidence and data in policy and decision-making processes.
- Developing tools with partners, for use by institutions from local to transboundary scales, to boost water productivity and develop integrated water storage management.
- Co-developing business and finance models for accelerated, inclusive and sustainable access to clean energy and water systems.
- Strengthening WEFE nexus governance by engaging stakeholders across sectors, making sure that marginalized voices are heard.
- Empowering WEFE stakeholders, including emerging women leaders, through technical and leadership skills development.



Interconnectedness of water, energy, food and ecosystems and NEXUS Gains' approach, including examples of core innovations and activities

Where are we working?

NEXUS Gains focuses on six transboundary river basins that are critical for food and nutrition security in Central Asia (Aral Sea Basin), South Asia (Ganges and Indus basins), East Africa (Blue Nile Basin) and Southern Africa (Limpopo and Incomati basins).

The basins were chosen because they represent important global breadbaskets. The basin resources directly support more than one billion people, many of whom suffer from food and nutrition insecurity, and are extremely vulnerable to climate change. Each of the selected basins is characterized by dwindling ecological integrity and high biodiversity loss, and many areas within the basins are hotspots of degradation and resource overuse. Gender inequality is acute in all basins. Systems transformation is therefore urgently required to improve access to WEFE resources and management and governance of WEFE systems.

1 Aral Sea Basin

The shrinking of the Aral Sea due to water diversion for irrigation projects in the former Soviet Union has been classed as among the planet's worst environmental and socio-economic disasters. It stands as a tragic example of the ill-considered trade-offs that result when systems thinking is not applied. The destruction of the lake's ecosystem and the fishing industry that depended on it, combined with severe pollution and salinization, have destroyed livelihoods and affected the health of many people, calling into question the future of a region with a population of 60 million. To address this requires the co-development of a regional strategy underpinned by coherent national strategies. NEXUS Gains will work with governments and other stakeholders in **Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan**.

2 Ganges Basin

Around 4% of the world's food production depends on South Asia's breadbasket basin. The Ganges Basin is increasingly challenged by the reduced availability of groundwater and surface

water, climate extreme events, deforestation, pollution and severe ecosystem degradation. The lack of inter-sectoral coordination stresses WEFE resources across basins characterized by growing populations and agricultural water demand. Sustainable, integrated approaches to water storage and productivity are needed to improve food security and achieve more inclusive socio-economic development. NEXUS Gains will work with stakeholders at multiple scales and across multiple sectors in **India and Nepal** to build on existing knowledge and institutions for improved system-level productivity.

3 Indus Basin

As the catastrophic floods of 2022 have demonstrated, there is a critical need for a new approach to managing water flows and storage in the Indus Basin, which provides water for almost 90% of food production in **Pakistan**. Climate change will increase the variability in the monsoons and lead to changes in the timing and amount of snow and glacier melt, increasing the frequency and severity of floods and droughts. NEXUS Gains will help better understand underlying drivers of change and how surface water and groundwater can be better managed to safeguard against floods and droughts, boost agricultural productivity, grow energy security and protect the environment.

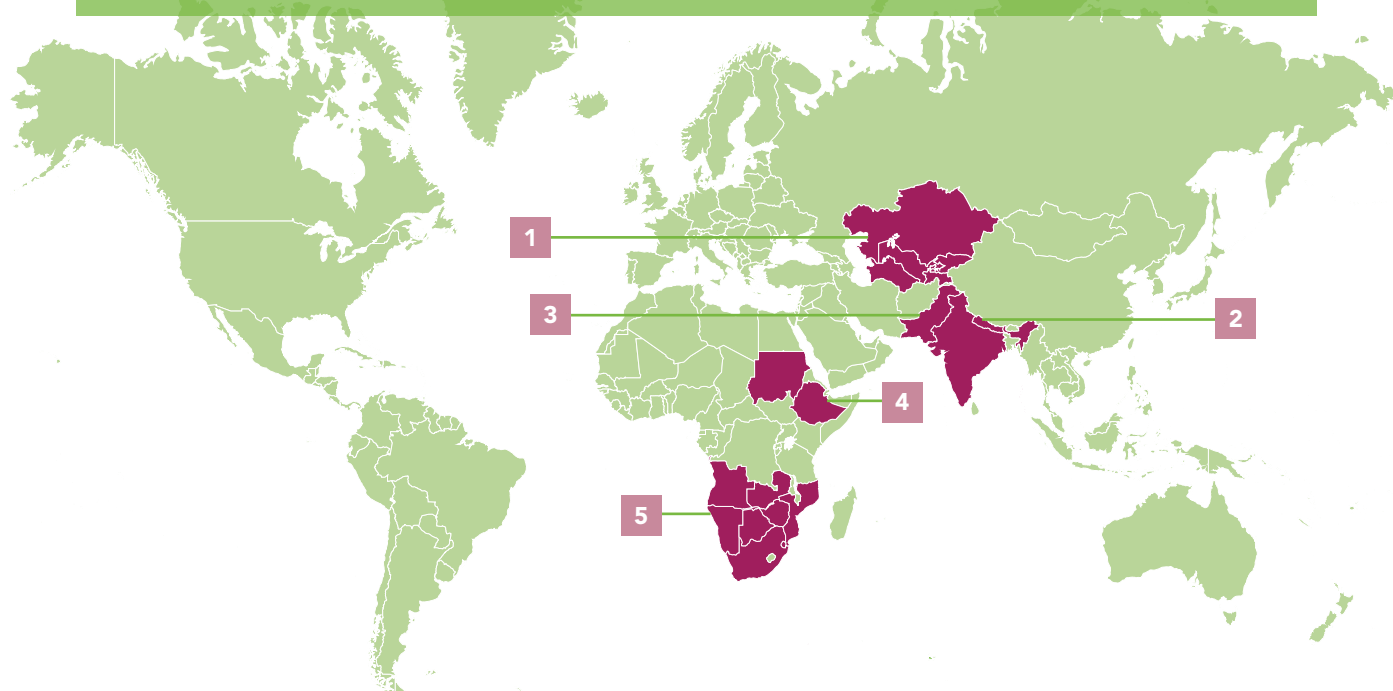
4 Blue Nile Basin

In East Africa, a rapidly growing population faces increasing food and nutrition insecurity due to climate and demographic change, severe ecosystem degradation and low productivity, and lack of irrigation and access to clean energy. Transboundary conflicts over resources are growing with development and climate change. In Ethiopia, for instance, inadequate coordination of water resources management for the irrigation, hydropower and tourism sectors in the Lake Tana and Beles sub-basins is adversely affecting the limited natural resources and the viability of interdependent economic activities. NEXUS Gains will work in **Ethiopia and Sudan** to introduce innovations on coordinated and

The NEXUS Gains systems approach

NEXUS Gains examines WEFE systems in internationally significant transboundary basins. The approach involves fully embracing the complexity of interconnected systems, including the additional challenges of working across national borders. The Initiative works with a broad range of stakeholders to overcome disciplinary and administrative silos and co-develops solutions that can be applied from local to transnational scales. The goal is not solely economic efficiency, but inclusive socio-economic development and environmental sustainability in the context of the climate crisis.

NEXUS Gains focuses on river basins: mosaics of ecosystems and landscape elements connected by water flows. Digital tools will help understand and quantify both upstream and downstream system interdependencies and predict future conditions. Practical innovations can then be implemented to better manage WEFE systems while strengthening capacity and governance in collaboration with partners at all levels.



sustainable water resources management for improved irrigation as well as linkages to clean energy, hydropower development and ecosystem services. The initiative will promote enhanced awareness and capacities to manage trade-offs and maximize synergies in water resources management in the Blue Nile Basin.

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Limpopo and Incomati basins

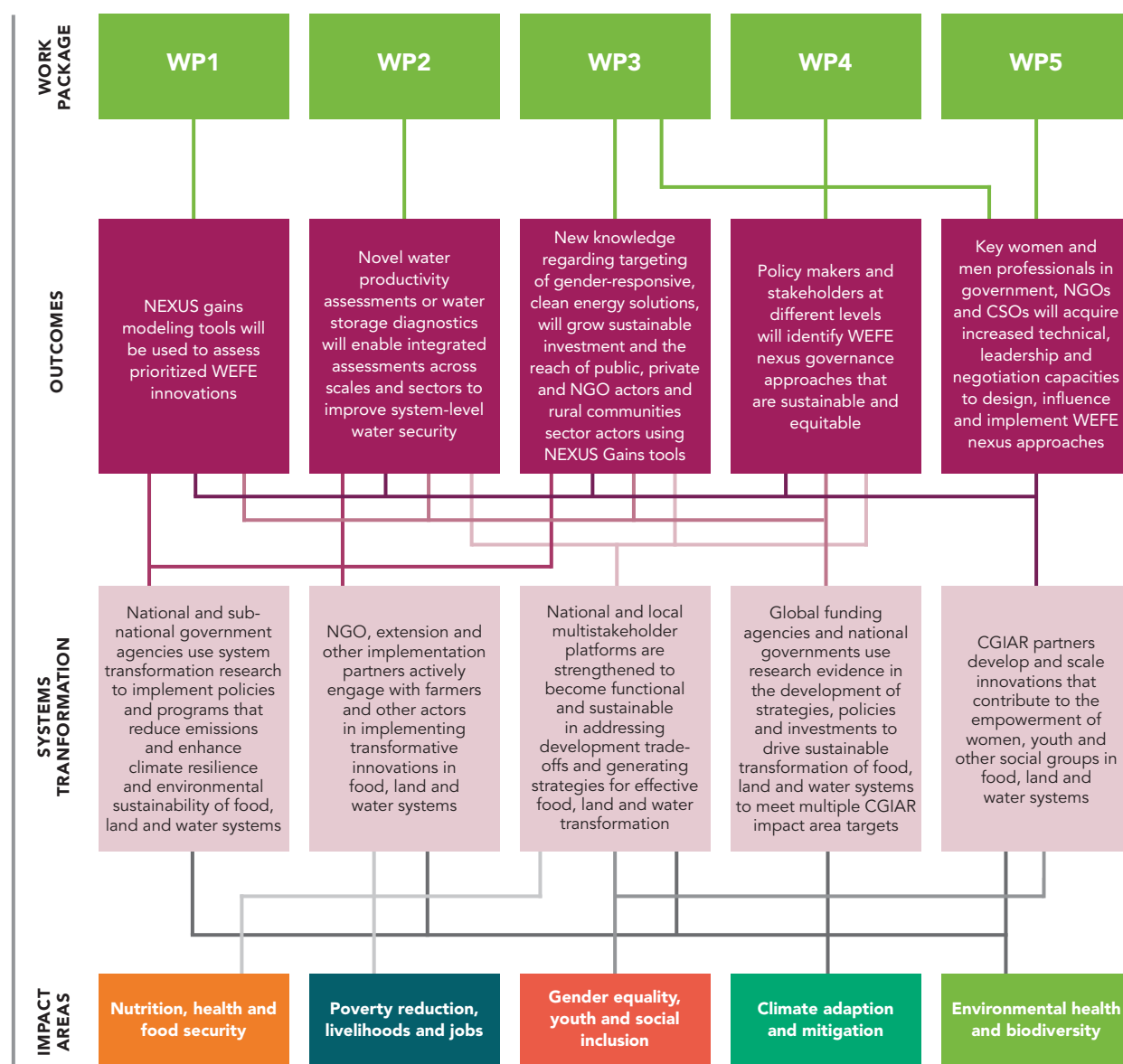
Southern Africa's shared basins are integral to the region's landscape. Basins like the Limpopo and Incomati (shared by four and three countries, respectively) face extreme water stress due to high levels of water resources development, mainly for agriculture. Increasingly frequent

manifestations of climate variability and change (usually droughts) challenge resource managers' ability to satisfy and balance the water requirements of WEFE sectors. Frameworks for coordinating the use of water and other resources across borders exist but have not been fully harnessed. NEXUS Gains will work in **Botswana, Mozambique, South Africa, Eswatini and Zimbabwe** to foster inclusive and equitable approaches to water resource use. Specific work is centered on enhancing the use of integrated water storage approaches in the Shashe catchment (Botswana, Zimbabwe) and developing a decision support system (DSS) for the newly-established Incomati Maputo Watercourse Commission (INMACOM). Capacity enhancement activities will support countries to participate in the co-development of nexus solutions.

Understanding the nexus to act on it

NEXUS Gains is an ambitious initiative based on the recognition that for synergies across WEFE sectors to emerge, interlinkages have to be identified and analyzed and positive linkages strengthened through institutional, technological and policy coordination. To this end, NEXUS Gains

has developed five interlinked work packages to better assess the challenges and priorities for nexus interventions and improve the governance and capacity needed to achieve these goals. The work packages complement each other in order to achieve WEFE systems transformation.



NEXUS Gains' summarized Theory of Change

Analyzing WEFE nexus innovations using foresight and trade-off methodologies

The complexity of the WEFE nexus and the challenge of understanding both the benefits and potential adverse consequences of interventions demands new tools to inform and guide solutions and policies. Successful design and implementation of such solutions requires comprehensive assessment encompassing biophysical and socio-economic dimensions.

Systems thinking is required to identify linkages, feedback loops and trade-offs across WEFE sectors at different levels. If decision makers have practical and easy-to-use tools and the capacity to use them, they will be much more likely to draw on scientific evidence to inform decisions that minimize adverse, often unintended, consequences that jeopardize sustainability and food security and may exacerbate conflict.

- **Work Package 1** is co-developing, with partners, foresight methodologies and trade-off analyses to identify, assess, prioritize and scale nexus interventions. These tools will enable losses and gains under business-as-usual and alternative development pathways (scenario analyses) to be identified across sectors, including the environment.
- The results will support the development of guidelines and toolboxes for basin planners, managers and investors, who will assess trade-offs and synergies and develop prioritized WEFE nexus innovations and policies.
- As a result, water use will become more productive and contribute to national priorities and regional and transboundary equity. National and sub-national stakeholders, including women, youth and other marginalized groups, will lead food, land and water system transformations because they have been empowered to participate in and define objectives for their livelihoods, nutrition and the environment.

- The resulting research evidence base will inform next-level policymaker, investor and donor decisions about the potential impacts of scaling WEFE interventions, the costs and benefits of solutions, alternative scenarios, and relationships across the WEFE systems.

Outcome

By 2024, NEXUS gains modeling tools will be used to assess prioritized WEFE innovations.

Targets: Ganges and Indus river basins.

Innovations

- An interactive tool that supports analysis of trade-offs between WEFE sectors.
- An environmental flows calculator to evaluate flow requirements to safeguard valuable ecosystem services.
- An agrobiodiversity solution hotspot tool based on the Agrobiodiversity Index that integrates data on nutrition, agriculture and genetic resources.

Boosting water productivity and integrated storage management at basin scale

Water is the connector across the WEFE nexus: enhancing water productivity, ensuring equitable allocation and securing water storage across sectors and scales are prerequisites for unlocking nexus gains.

Increasing water productivity means finite water resources are used more effectively. Water storage is essential for managing variability in rainfall and river flows but in many places is declining as a consequence of environmental degradation. Within basins, a lack of capacity for nexus thinking and coordination, a lack of data (particularly concerning trade-offs) and a gap between research and policy are exacerbated by gender and social inequity. Practical and easy-to-use tools and processes that address the day-to-day challenges they face will help boost water productivity and improve water storage at basin level.

- **Work Package 2** is mapping existing water stores with links to current and future needs by sector, developing a water storage diagnostic tool, and carrying out political economy analyses and socio-economic assessments, keeping in mind partner priorities in the different basins.
- An integrated water storage tool is being developed and will be applied in at least four basins to map water storage types and assess their potential (volumetric) contribution to human development and resilience activities.
- Storage diagnostic work will inform planning, so that a broader range of storage options are drawn on to produce a wider range of benefits.
- Work Package 2 also includes a comprehensive stocktaking of tools, approaches and experiences in basin water productivity improvement. This will ensure that the tools developed build on what works and respond to need.
- Of equal focus is how nexus interventions can boost water productivity and manage

water storage at different scales across multiple sectors, including agriculture, to equitably benefit rural women and men.

- Early engagement of planners, policymakers and investors through science–policy dialogues and innovation platforms is promoting understanding that these tools can reliably inform investment decisions. Capacity development will also strengthen the long-term involvement of WEFE stakeholders, including women, youth and marginalized groups.
- At least two solutions for improved storage management and/or DSS for water productivity improvement will be co-developed in each target basin. This will generate evidence to enhance uptake of these tools for planning, management and investment decisions in other basins in Africa and Asia.

Outcome

By 2024, novel water productivity assessments or water storage diagnostics will enable integrated assessments across scales and sectors to improve system-level water security. **Targets:** Ganges and Indus river basins; Blue Nile basins.

Innovations

- A strategic diagnostic tool to design, evaluate and implement integrated water storage solutions.
- Decision support system to boost water productivity at basin scale.

Energizing food and water systems sustainably and inclusively

Lack of energy access is a key obstacle to agricultural productivity and growth, and hampers the development of agri-businesses. It also limits the production of nutritious, high-value foods, disempowers women, leads to deforestation and greenhouse gas emissions, and threatens overall ecosystem health and biodiversity. Clean energy technologies such as solar irrigation can improve access and incomes of smallholder farmers, although women and marginalized groups may be excluded and compelled to continue to use fossil fuels or firewood.

Clean energy solutions such as solar, micro-hydropower, wind and bioenergy are also critical to transforming agri-food systems. However, lack of knowledge about appropriate locations and the siloed development of water and energy interventions, as well as a lack of appropriate business and finance models that can reach poorer, marginalized farmers limit their roll-out. Accelerating rural clean energy access sustainably, inclusively and at scale requires business and finance models for energy solutions that work for the poor.

- **Work Package 3** uses action research to engage with water and energy ministries, the private sector and rural communities within target basins to find out which technologies work best in different settings and how rural women and men can participate in the rural energy economy, with a particular focus on agri-food systems. The potential of solar-powered groundwater irrigation systems is being explored.
- Case studies and inclusive business models are being developed that consider women's needs and constraints to help them benefit from energy technologies. Government, private sector and researchers will co-design energy portfolios for productive agricultural uses.

- Research is being coordinated with other CGIAR initiatives to support the transformation of food systems while improving environmental sustainability and significantly increasing the use of clean energy in food systems by 2030.

Outcome

By 2024, new knowledge regarding targeting of gender-responsive, clean energy solutions, will grow sustainable investment and the reach of public, private and NGO actors and rural communities sector actors using NEXUS Gains tools. **Targets:** Blue Nile basin (Ethiopia), Ganges (India and Nepal) and Indus (Pakistan).

Innovations

- Inclusive business and finance models for sustainable clean energy access in agri-food systems.



Strengthening WEFEnexus governance

The lack of good governance at all levels (community to international) leads to continuous degradation of water, food, land and ecosystems, and means that innovative solutions that could generate tangible benefits across the WEFEnexus go unrealized. A major barrier to the adoption of nexus solutions is the political economy at the transnational level, where inequities in access to resources and economic development can challenge something as simple and essential as sharing data. At the national level, the political economy of farm subsidies and concerns for farmer livelihoods prevents water and energy prices from reflecting the true value of these resources, despite the fact that pricing could potentially correct resource overuse and degradation. Moreover, sectoral divisions and contested mandates prevent agricultural, environmental and energy ministries from working together.

There is a critical need for evidence on how multistakeholder platforms and other institutions can improve governance of WEFEnexus systems and break down sectoral silos that prevent the formulation of coherent policies and effective management. Working in transboundary basins, NEXUS Gains supports collective action for more inclusive, sustainable and effective governance of WEFEnexus systems.

- **Work Package 4** supports multistakeholder platforms and other learning opportunities to co-develop narratives of change and guidelines for cross-sectoral, local to transboundary nexus management. Multistakeholder processes and science–policy dialogues will help adoption and adaptation of toolboxes and guidelines for collective action, such as a groundwater governance toolbox, and will be linked with tools and processes from other work packages.
- By contributing to the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) Nexus Assessment on the links between biodiversity, water, food and health, and engaging member states

and stakeholders in dialogues on the IPBES Transformative Change Assessment, NEXUS Gains results feed into global science–policy processes. Co-hosting the Technical Support Unit for the latter assessment, the initiative is working with national focal points from the United Nations Food Systems Summit (UNFSS) and IPBES to develop “change narratives” that will feed into foresight models and trade-off analyses. Co-convening science–policy dialogues provide an opportunity to advance nexus approaches globally.

- The resulting tools and evidence base will inform Work Packages 1, 2 and 3 and contribute to cross-sectoral groundwater management, a governance environment promoting adoption of nexus innovations, and increased involvement and influence of women, youth and marginalized groups in nexus governance.

Outcome

By 2024, policy makers and stakeholders at different levels will identify WEFEnexus governance approaches that are sustainable and equitable. **Targets:** India and Nepal.

Innovations

- A groundwater governance toolbox to address growing competition for, and degradation of, water resources.
- Multistakeholder platforms to influence integrated, inclusive WEFEnexus management.
- South-to-South learning opportunities between Africa and Asia.

Developing capacity for WEFE actors, including emerging women leaders

Lack of capacity is a major obstacle to achieving transformative systems change. To develop, implement and scale nexus solutions, researchers, practitioners and decision makers need in-depth subject matter expertise as well as soft skills, such as leadership and negotiation capacities, to create an enabling environment for investment in nexus approaches. Solidifying skills to plan, implement and manage nexus interventions is particularly important in complex situations characterized by resource limitations and challenging political economies.

Women professionals face many obstacles in exerting influence and progressing in their careers due to cultural norms that persist in the workplace. For instance, women professionals in civil society and the private and public sector (including elected representatives) continue to be marginalized in processes of knowledge production and policy and decision making – and where any attention is paid to gender equality, it is usually focused on the number of women included rather than the roles they play. NEXUS Gains will work with researchers, practitioners and decision makers to build capacity to co-develop and implement sustainable and equitable WEFE nexus innovations, with a particular focus on providing a platform for development for emerging women leaders.

- **Work Package 5** supports capacity-strengthening efforts that target professionals working in ministries and government organizations, the private sector, agricultural extension services, civil society, non-governmental organizations (NGOs) and academia. Multiple channels and learning products, developed using user-centered design principles, will be used to advance knowledge on sustainable and equitable nexus approaches, including through online learning courses and curriculum development. The main partners will include academic institutions in the focal basins.

- A nexus leadership and mentoring program is being co-designed with partners. The program will include a minimum of 40 professionals, at least 60% of whom will be women, to enhance their influence and leadership – not simply by strengthening women's technical knowledge and skills, but by developing a cadre of "champions" in each basin, connecting them to networks from local to transboundary scales, and supporting them as mentors to other practitioners. These emerging leaders will develop skills that can, inter alia, directly address the challenges of centering gender and social inclusion into nexus approaches. Participant professionals will champion at least two nexus innovations on resource use efficiency and WEFE security, and play a key role in achieving next-level outcomes.

Outcome

By 2024, key women and men professionals in government, NGOs and civil society organizations (CSOs) will acquire increased technical, leadership and negotiation capacities to design, influence and implement WEFE nexus approaches. **Targets:** 40 professionals (at least 60% of whom are women) have increased capacities, across 1 or more focal basins.

Innovations

- A cross-sectoral leadership program, with a majority of women participants, to design, lead and accelerate WEFE nexus thinking.
- An ecosystem of learning resources, training events and communities of practice to support a cadre of emerging WEFE nexus champions.



INITIATIVE ON NEXUS Gains



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CGIAR is a global research partnership for a food-secure future. CGIAR science is dedicated to transforming food, land and water systems in a climate crisis. Its research is carried out by 13 CGIAR Centers/Alliances in close collaboration with hundreds of partners, including national and regional research institutes, civil society organizations, academia, development organizations and the private sector.

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