



NEXUS Gains: Realizing Multiple Benefits Across Water-Energy-Food-Forest-Biodiversity Systems

Initiative Lead and Co-Lead	Primary CGIAR Action Area	Estimated 2022 - 2024 Budget
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Challenge

Water, land, energy, forests and biodiversity are critical to rural livelihoods and food and nutrition security, and are strongly interconnected. Water availability [<https://bit.ly/3gdohl5>] and ecosystem health [<https://bit.ly/3dknooF>] directly affect food security and nutrition through multiple pathways. Similarly, lack of clean energy access leads to degradation of upper watersheds, forests and biodiversity, and soil erosion and water siltation downstream impacting important infrastructure [<https://bit.ly/2R2x8eK>], lowering agricultural productivity and limiting rural agro-processing [<https://bit.ly/32jKmpW>]. All these systems are under extreme stress from climate change and other mutually reinforcing human-induced pressures. Planetary boundaries are exceeded [<https://bit.ly/3mTS57E>] and social foundations eroded [<https://bit.ly/3mUDMPZ>] in many low- and-middle-income countries and related impacts are accelerating. These challenges are particularly pronounced in South Asia's breadbasket basins, where unsustainable (ground)water abstraction, climate change, deforestation and biodiversity loss, and poor policies put 8% of the world's food production at risk, with potentially devastating impacts on wellbeing, health and peace for more than 2 billion people. Similarly, glacial retreat, changing hydrological and ecological regimes, unsustainable water withdrawals and fossil fuel reliance, aggravated by transboundary water conflicts, profoundly impact Central Asia's future. East Africa's rapidly growing population faces increasing food insecurity from climate change and low productivity, lack of irrigation and energy access. However, investors do not know where or how best to retain forests and biodiversity, and support sustainable irrigation, clean energy and agro-processing needs [<https://bit.ly/32fVkfR>]. Similarly, investments in water remain disconnected from policy goals of healthy diets [<https://bit.ly/3aeKhYT>]. National/regional institutions fail to account for the integrated nature of these systems or the cross-sectoral feedbacks, including tradeoffs and synergies. And women, girls, and other vulnerable groups face the greatest adverse consequences from poorly developed water, energy and food systems and ecosystem degradation.

Objective

NEXUS Gains will realize gains across water-energy-food-forests-biodiversity (WEFFB) systems in three selected regions by co-generating a series of outputs via four work packages and a cross-cutting capacity development program. All work packages build on previous work by CGIAR and partners and all will focus on strengthening the benefits of marginalized groups, including youth and women. Specifically, NEXUS Gains will:

- 1) Co-develop and scale at least six WEFFB nexus innovations focused on increased resource use efficiency and strengthened ecosystem functions with regional and local partners using foresight tools and tradeoff analyses in focal basins.
- 2) Develop the evidence and approaches for improved water productivity across scales (farm to watershed to basin) using a systems approach that considers all water users, i.e., agriculture, industry, energy, domestic sector (incl. WASH), forests and biodiversity in two focal basins.
- 3) Energize food systems equitably and sustainably (water, ecosystems) with at least four innovations, such as solar systems for women farmers and entrepreneurs, small hydropower generation, bioenergy, and solar-supported agro-processing and storage, in close collaboration with private energy and other WEFFB actors.
- 4) Strengthen governance across WEFFB systems, including groundwater and basin/landscape management at regional and national government levels across key ministries/departments, including at least five social learning, citizen-science, or multi-stakeholder platform mechanisms.

To ensure that these objectives and outputs lead to desired outcomes at scale, NEXUS Gains will support a capacity development program and build on deep partnerships that will unlock inclusive cross-sectoral gains in these interconnected systems and directly support investments.

Theory of Change

NEXUS Gains will foster integrated management of water, energy, food, land, biodiversity and forests, for inclusive, sustainable development in transboundary river basins in a climate crisis. To achieve this, NEXUS Gains will 1) co-develop prioritized, scalable water-energy-food-forest-biodiversity (WEFFB) nexus innovations using foresight tools and tradeoff analyses; 2) co-generate the evidence and approaches to significantly improve water productivity across scales (farm to watershed to basin) and sectors using a systems lens; and 3) energize food systems sustainably (water, ecosystems) and inclusively with private sector actors. These work packages will be anchored by 4) research on strengthening cross-sectoral, multi-stakeholder governance at community, national and regional levels. Capacity-building on WEFFB nexus approaches, deep partnerships, interdisciplinary biophysical and social science methods, and strengthening inclusion will help to improve food security and nutrition, climate action, water security, environmental health, and inclusion, and increase rural growth. NEXUS Gains will thus reduce costs of tradeoffs and strengthen cross-sectoral synergies, with benefits for food (SDG2), water (SDG6), energy (SDG7), climate action (SDG13) and ecosystems (SDG14), as well as other interdependent SDG targets. River basins will be the main frame of analysis, intersected with political boundaries that introduce geopolitical challenges. The initiative will work with the initiatives Harnessing Digital Technologies and Foresight Analyses; and key outcomes will be achieved at national levels considering - regional interlinkages - by engaging with the Regional integrated initiatives, National strategies and policies, Agroecology, and the One Health initiatives. Focal areas in phase 1 are the Eastern Nile, where accelerated water and clean energy access and watershed rehabilitation will support agricultural productivity, food security, job creation and economic growth and reduce conflict; and the Indus, Ganges and Aral Sea basins, where NEXUS Gains will increase resource use efficiency, strengthen ecosystem functions and support governance and sustainable development. Phase 2 will add the entire Nile, Brahmaputra and the Zambezi basins.

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Highlights

NEXUS Gains aims to meet the demand for more integrated solutions-ranging across South Asian governments' request to reduce land and water resource depletion while improving food security and nutrition; Central Asia's need to reduce conflict over shared resources; and East Africa's urgent need to expand WEFFB securities more sustainably and equitably.

NEXUS Gains works at scale considering food systems as part of a larger set of interdependent systems, allowing us to develop innovations outside the traditional focus on agriculture alone to alleviate growing systemic stresses for human and planetary health; building on two decades of learnings from CGIAR water [<https://bit.ly/2PY89t3>], land and ecosystem [<https://bit.ly/3e3kiEV>] programs.

NEXUS Gains will develop the evidence, tools, capacity and support partnerships for boosting water productivity and tangible, more inclusive access to clean energy for sustainable food systems for human wellbeing and planetary health, with a particular focus on benefits for rural women. This includes innovations in solar systems, small hydropower, bioenergy, postharvest loss reduction and agro-processing.

NEXUS Gains will strengthen local ownership, strive to overcome disciplinary and administrative silos, and support inclusive, polycentric governance systems by strengthening existing platforms and other institutions and introducing WEFFB nexus thinking and approaches - fundamental steps for sustainable rural livelihoods and green growth.

NEXUS Gains will build deep partnerships and develop capacity through 1) a cross-sectoral leadership program for professionals to design, implement and scale integrated innovations, 2) curriculum development and mentoring of junior researchers, and 3) online training modules to support design and implementation of WEFFB nexus innovations.

Work Packages

	Scope of Work	3-year Outcomes
Co-developing and scaling WEFFB nexus innovations using foresight tools and tradeoff analyses	Identifying and scaling of WEFFB nexus innovations through evidence-based assessment, foresight analyses and prioritization processes that consider cross-sectoral tradeoffs. Potential innovations include new mechanisms to scale integrated forestry/landscape management, land restoration, wastewater reuse, and integrated water storage solutions. Innovation grants and novel ideas for green recovery from COVID-19 will broaden partnership and grow impact.	Co-developing and scaling WEFFB nexus innovations using foresight tools and tradeoff analyses: WEFFB actors increase water, energy, and food and nutrition security and environmental sustainability (i.e., forest, biodiversity) through scaling prioritized innovations in focal regions based on NEXUS Gains data, tools, institutions, and innovations.
Boosting water productivity across scale	Reducing food insecurity and strengthening food systems in water scarce regions through more productive uses of available water at system level. Opportunities will be identified across scales (farm, watershed, basin) and sectors; and foresight analyses of alternative WEFFB Nexus Futures will be co-developed, integrating the latest Earth system data.	Boosting water productivity across scales: WEFFB actors (e.g., public sector, private sector, farmers, NGOs, investors, IOs, academia) in focal basins are enabled to significantly improve water productivity across scales.
Energizing food systems sustainably (water, ecosystems) and inclusively	Developing scalable business and finance models for accelerated, inclusive, sustainable access to energy for food systems, and generating evidence to strengthen environmental (water and ecosystem sustainability) and economic benefits for vulnerable groups. Innovations include solar systems for women farmers and entrepreneurs, micro-hydropower, and incentives for inclusive bioenergy and sustainable agro-forestry systems.	Energizing food systems and building water and ecosystem security sustainably and inclusively: WEFFB actors use scalable business models to accelerate rural energy access for more sustainable and equitable food systems in at least three target basins. Business models consider environmental, economic, and social impacts and support marginalized groups, including rural women and youth.
Strengthening multi-stakeholder WEFFB nexus governance	Supporting collective action for more inclusive and sustainable WEFFB nexus systems. Innovations considered include practical guidelines for cross-sectoral multi-stakeholder platforms at various scales, social learning interventions for improved (ground)water governance, science-policy dialogues and guidelines for transboundary WEFFB nexus management.	Strengthening multi-stakeholder WEFFB nexus governance: Policymakers and communities are enabled to develop more inclusive WEFFB nexus institutions through knowledge products, practical learning tools and guidelines, and science-policy dialogues.
Developing capacity to support WEFFB nexus co-design and implementation	Developing capacity (cross-cutting work package) through 1) a cross-sectoral leadership program for professionals to lead on-the-ground WEFFB nexus policy innovations and implementation and/or to become scaling accelerators, 2) curriculum development and research support for junior researchers (graduate students, post-docs), and 3) online training modules to support design and implementation of WEFFB nexus innovations.	Capacity development for NEXUS analysis, co-design and implementation (cross-cutting activity): A wide range of WEFFB actors from public and private sectors, NGOs, investors, IOs and academia have increased capacity to identify, assess and act on WEFFB nexus tradeoffs and synergies and to lead implementation.

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Impact Area Contributions

Nutrition, health & food security	30 million (~2% of focal basin populations) will access sustainable healthy diets via 1) lower prices/higher incomes from irrigated (horticultural) crops, and 2) renewable energy supporting perishables and reducing postharvest losses; currently 85% in sub-Saharan Africa and 76% in South Asia [https://bit.ly/3aeM67Y] cannot afford healthy diets. Infectious diseases [https://bit.ly/3uOeMMY] will be reduced through improved water supply.
Poverty reduction, livelihoods & jobs	Rural poverty of ~5 million farm households reduced and labor absorbed in agro-processing and irrigated farms through 1) expanded horticultural crop irrigation, higher dry-season incomes and employment, and 2) increased rural energy access generating rural incomes and jobs (est. 500,000 new jobs estimated in horticulture and irrigation in Ethiopia [https://bit.ly/3gcqPjI] alone).
Gender equality, youth & social inclusion	Approximately 2 million youth and 2 million rural women access irrigation and energy benefit streams. Reduction in women's time-burden to collect water [https://bit.ly/3do1bX7] through 1) improved water access, 2) reduced water competition, and 3) improved energy access, supporting wellbeing; and new jobs for youth in renewable energy and agro-processing.
Climate adaptation & greenhouse gas reduction	Reduced fossil energy intensity in South and Central Asian agriculture and increased access to renewable energy [https://bit.ly/3e9yOL8] in East Africa will reduce GHG emissions of agricultural output by 5% over baseline. Climate-smart WEFFB nexus innovations will reach 5 million farm households, increasing adaptive capacity. WEFFB nexus planning will stimulate investments of at least US\$5 billion.
Environmental health & biodiversity	Strengthened ecosystem functions and greater resource use efficiency through scaling WEFFB nexus innovations will support resource conservation (water, biodiversity, forests) and land restoration and reduce water pollution. We project a 10% improvement over business-as-usual trajectories in biodiversity, consumptive water use and deforestation in the focal basins.

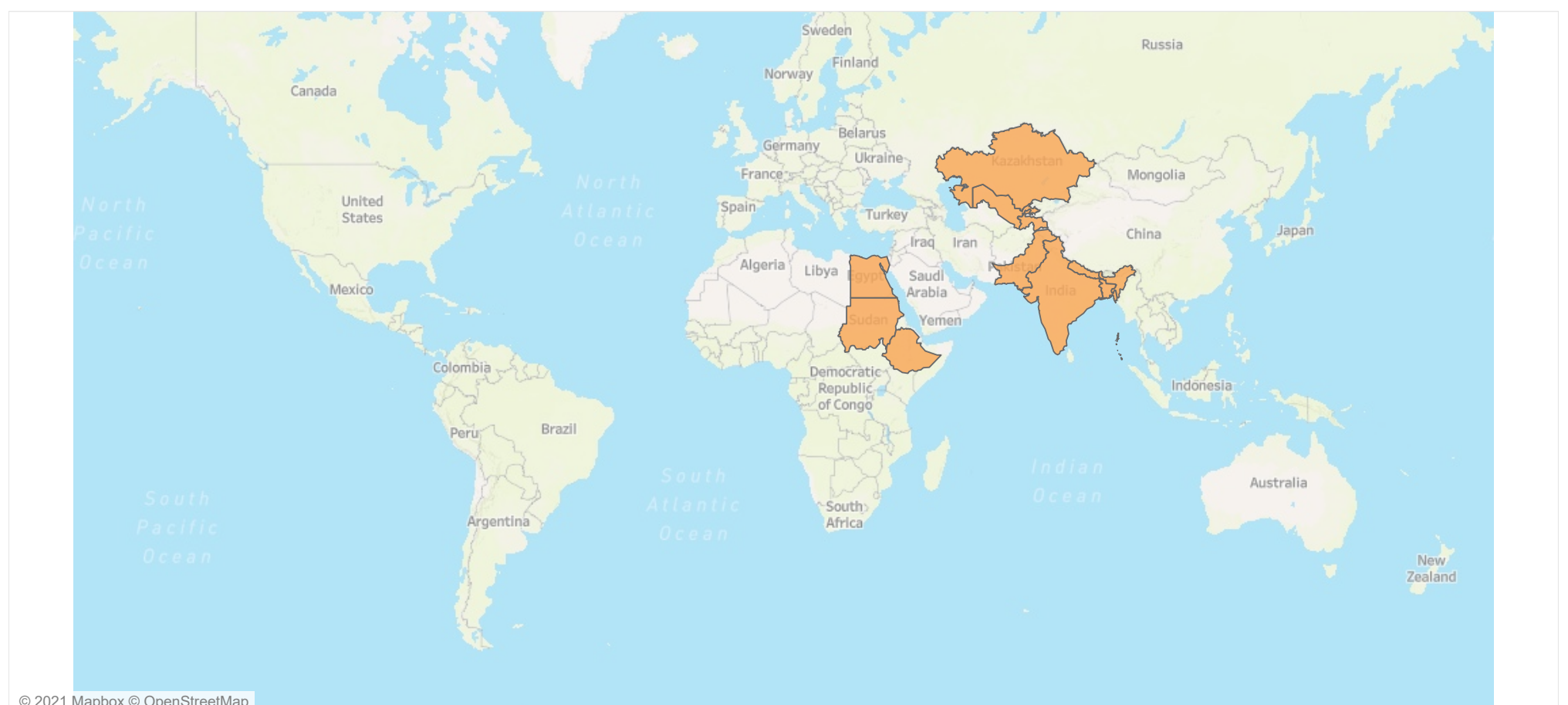
Impact on SDGs



Regions

Central and West Asia and North Africa (CWANA), East and Southern Africa (ESA), South Asia (SA)

Countries



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Innovations

Inclusive business models [<https://bit.ly/3e5cfHI>] for sustainable, inclusive rural energy use in agrifood systems can unlock billions of dollars in value [<https://bit.ly/3wZbWa8>] from enhanced agriculture and rural growth and strengthen outcomes for women and youth. They include solar systems for women farmers and entrepreneurs, small hydropower and bioenergy systems and will support irrigation, households, storage and agro-processing [<https://bit.ly/3awwddb>].

Policy- and decisionmaking to significantly enhance water productivity will be supported through comprehensive tradeoff/synergy analyses of several (bundeled) interventions, inter alia, land use, scaling of irrigation (technology, behaviour), agronomic practices, wastewater reuse, economic instruments, etc.

Establish effective cross-sectoral multi-stakeholder platforms by building on existing dialogue initiatives [<https://bit.ly/3agcGO9>] to support participatory planning, implementation and monitoring of cross-sectoral strategies that include women, youth and other marginalized or vulnerable groups in the focal regions to leverage integrated WEFFB systems, conserve resources and support inclusive socio-economic development.

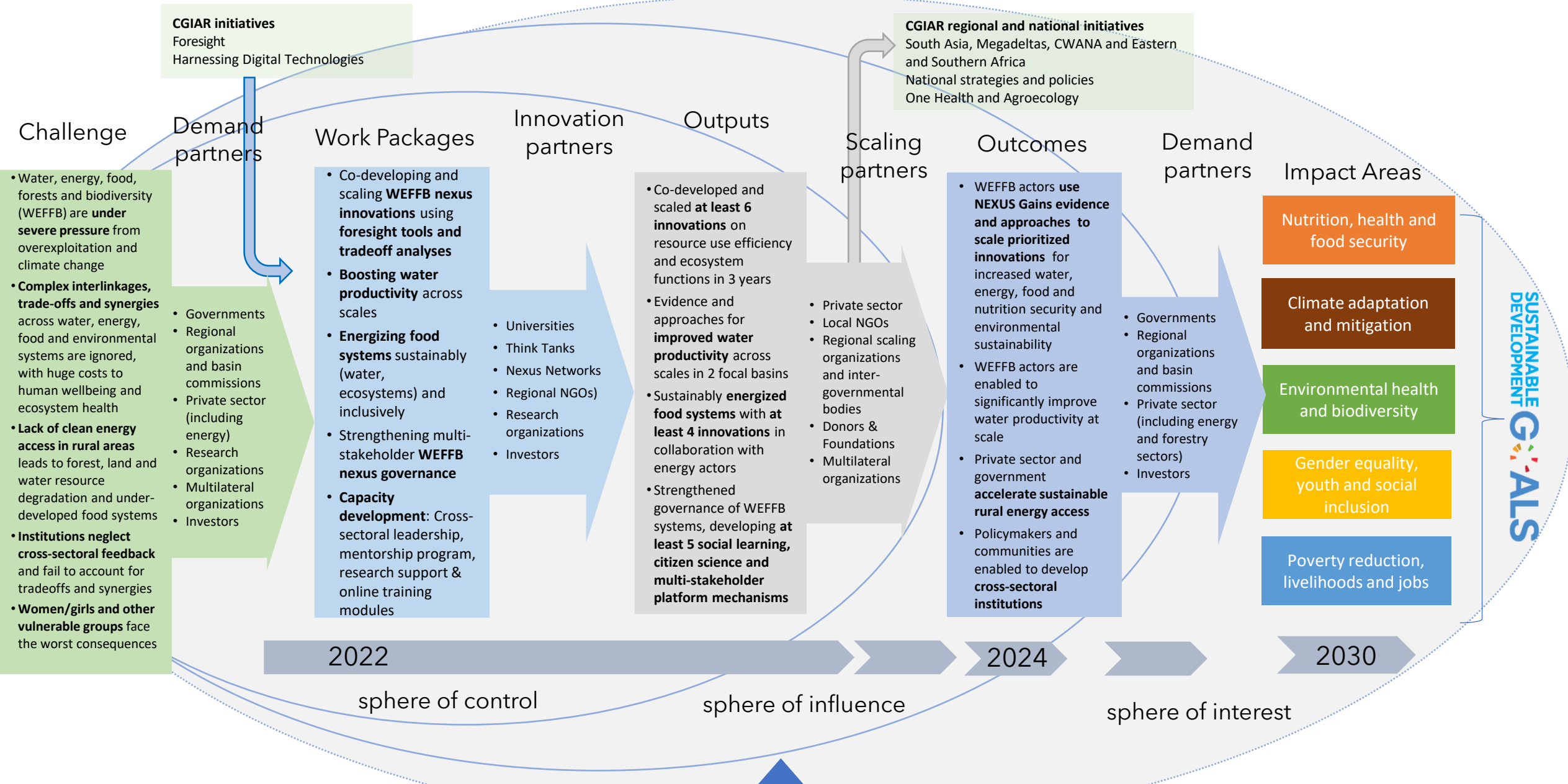
Integrated water storage solutions build resilience and support WEFFB security while promoting ecosystem health and considering climate change and growing water storage gaps [<https://bit.ly/3e4lJmp>]. Planners and basin managers will recognize storage as a service and tools will enable them to smartly combine nature-based (e.g., groundwater, wetlands, soil water, forests) and engineering solutions.

A groundwater governance toolbox scaled by policymakers and communities will help address growing competition, degradation, and depletion of resources in hotspot basins. Tools will include behavioral change interventions [<https://bit.ly/3dnKU48>] through experiential games, citizen science for monitoring [<https://bit.ly/3tmZD4V>], and learning exchanges via ICT at community levels focusing on strengthening women's agency.

Key Partners

Demand	Academic, Training and Research	Bangladesh Center for Advanced Studies (BCAS), Indian Council of Agricultural Research (ICAR), Pakistan Council of Research in Water Resources (PCRWR), Scientific-Research Institutes of Water Problems and Water Economy of Central Asian States
	Government	Governments (national and state level) of Bangladesh, India, Pakistan, Central Asian states, Egypt, Ethiopia, and Sudan (water, agriculture, energy, and environment ministries)
	Multilateral	World Bank, FAO, AfDB, ADB, Africa Union
	Other	Nile Basin Initiative (NBI) and Eastern Nile Technical Regional Office (ENTRO)
	Private Sector	Water and Energy for Food Hubs [https://bit.ly/3dmnQTG], Power for All Agriculture Campaign [https://bit.ly/3tofhxc], energy investors, etc.
Innovation	Academic, Training and Research	Universities of Bahir Dar, Addis Ababa and Khartoum, University of Central Asia, Council on Energy, Environment, and Water (CEEW) India, IHE Delft (Netherlands), SLU (Sweden), Australian National University (ANU)
	Government	Indian Council of Agricultural Research (ICAR), Indian Council of Forestry Research & Education (ICFRE), Institute of Hydrology, IIT, (all India)
	International NGO	ICIMOD, World Vegetable Center, Regional Environmental Centre for Central Asia (CAREC), Global Resilience Alliance
	Other	International Innovation Center for the Aral Sea Basin, Sustainable Development Policy Institute (SDPI), Pakistan, WEF Africa Nexus Network, FE2W Network, Sustainable Water Futures, Future Dams
	Private Sector	Futurepump, Hydrosolutions
Scaling	Local Government	State Governments in the Indus, Ganges and Nile basins
	Other	FES, FH, World Vision, GIZ, SDC, Tata Trust, Agha Khan Foundation, Global Green Growth Institute, Global Resilience Alliance, Donors & Funders, etc.
	Other Public Sector	AMCOW, AGRA, AUC
		International Fund to Save the Aral Sea
Private Sector	Power for All, Power Africa, Powering Agriculture, CLARO Energy Pvt. Limited	

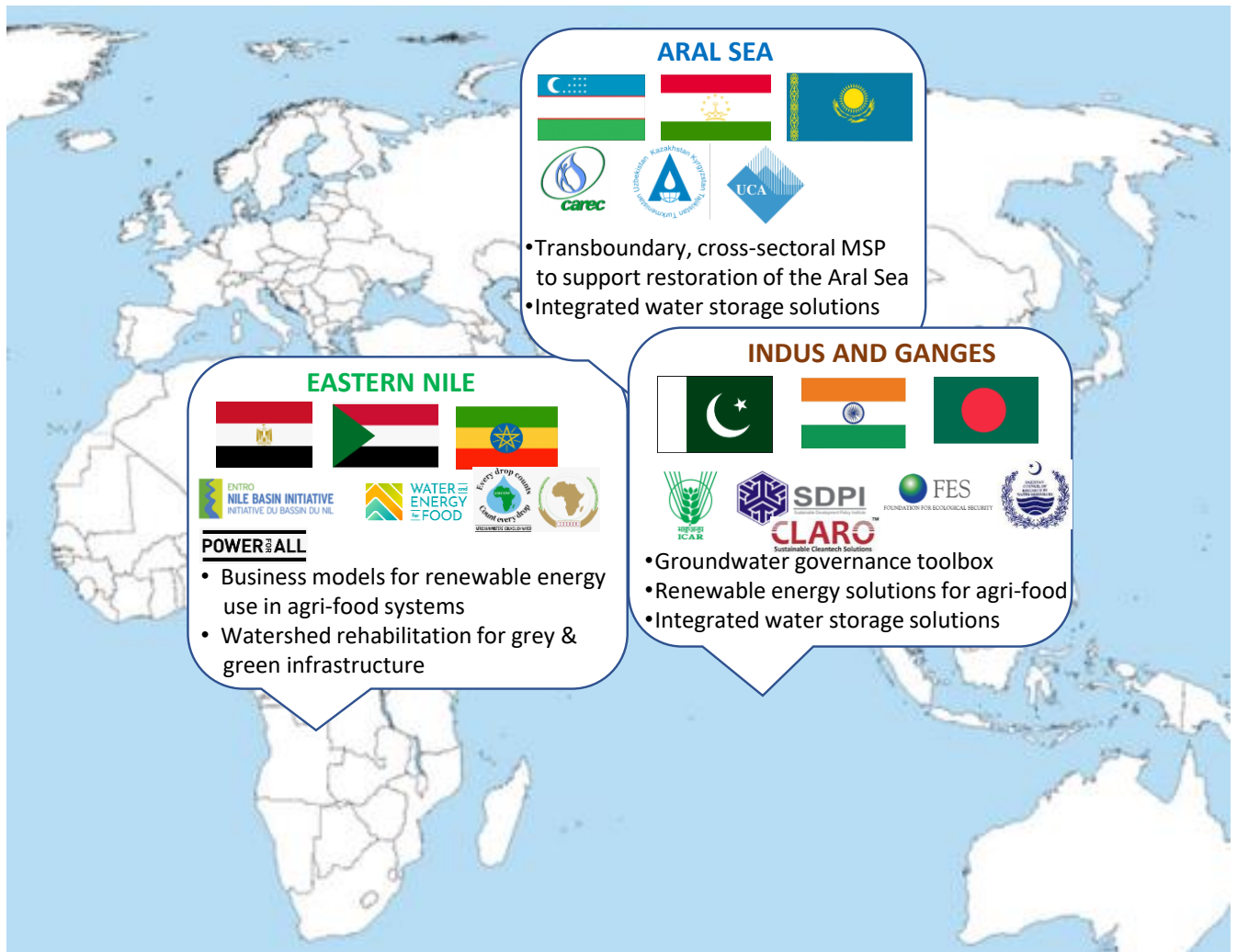
Theory of change: NEXUS Gains



SUSTAINABLE DEVELOPMENT GOALS

Objective: NEXUS Gains will foster integrated management of water, energy, food, land, biodiversity and forests for inclusive, sustainable development in transboundary river basins in a climate crisis.

Exhibit 1: NEXUS Gains Regions, Selected Partners and Innovations



Note: The list of partners and innovations is indicative only.