Focus and impact on environmental health and biodiversity

CGIAR | INITIATIVE ON NEXUS Gains

Objective: Increasing productivity in food systems while improving environmental systems, including biodiversity

Today, we face multiple interlinked global challenges, including climate change, biodiversity loss, and large inequities in access to resources, which contribute, in turn, to growing food and nutrition insecurity, water stress, and energy poverty. The CGIAR Initiative on NEXUS Gains works at the critical intersection of water, energy, food, and environmental systems in selected transboundary river basins to realize multiple development benefits and reduce trade-offs.

NEXUS Gains works to achieve positive, measurable benefits across all five CGIAR Impact Areas, as outlined in the CGIAR Strategy to 2030: nutrition, health, and food security; poverty reduction, livelihoods, and jobs; gender equality, youth, and social inclusion; climate adaptation and mitigation; and environmental health and biodiversity. A key element of the nexus approach is understanding that impacts in one Impact Area can affect outcomes – positively or negatively – in all others.

Globally, 33 percent of greenhouse gas emissions derive from food systems. Photo taken in Nepal by Nabin Baral/IWMI.

Food and energy systems are major drivers of environmental degradation and the climate crisis. Globally, 33 percent of greenhouse gas emissions derive from food systems and 25 percent from electricity production. The hidden social, economic, and environmental costs of food systems are estimated at USD 10–12 trillion a year. Producing, transporting, and consuming energy all have environmental impacts, few of which are factored into the economics of energy use. Global biodiversity loss is a major concern and rates of loss in aquatic ecosystems are staggering – far outstripping those in terrestrial systems. As the human population approaches 10 billion and climate change impacts intensify, the need for more food and more energy is increasing the pressure on the environment and biodiversity, resulting in an urgent need for positive transformation across the world's water, food, and energy systems. Because of the interdependence of these systems, this can only be achieved with holistic solutions that enhance science and innovation, maintain and restore natural capital, stay within ecological limits, and deliver equitable social and economic outcomes.

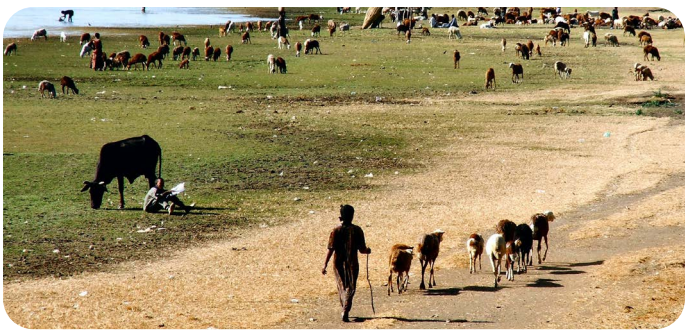
Work Package 1:
Trade-off and foresight methodologies

Supporting planners, policymakers, and investors with customized foresight and trade-off analysis tools to plan, assess, prioritize, and scale up climate-resilient interventions across the water–energy–food–ecosystems (WEFE) nexus.

Environmental health and biodiversity are tightly interlinked with climate change, water availability, food security, energy production, poverty, and inequality. Nexus approaches can help to identify and understand these interlinkages and assess the impacts of interventions in large river basins. NEXUS Gains has developed new tools which use a systems approach to analyze interconnected ecological, social, and economic processes, and help identify synergies and trade-offs at various scales. These, in turn, can guide and inform solutions and policies, helping to minimize unintended consequences that can jeopardize sustainability and food security, and threaten the environmental health of terrestrial and aquatic ecosystems in river basins.

ENVIRONMENTAL FLOW ESTIMATION TOOLS

Based on the premise that a river's environmental health is strongly determined by its flow, NEXUS Gains has developed a family of software tools or calculators that enable quick, first-cut estimates of environmental flow requirements. The tools are designed to be used by water managers and decision-makers to support rapid, cost-effective environmental flow estimation during the project planning stage. Three offline tools calculate environmental flows in major rivers of Sri Lanka, the Ganges Basin, and Western Nepal; a fourth offline tool uses a global data set to estimate environmental flows in all of the world's major river basins. The online tool, the Global Environmental Flow Information System, can be used anywhere in the world. The calculators estimate optimum environmental flow requirements and provide planners and decision-makers with information that can contribute to the preservation of river health and biodiversity, while protecting millions of river-dependent livelihoods.



Globally, more than two billion people live in water-stressed countries and this number is set to increase. Photo taken in Ethiopia by Matthew McCartney/IWMI.

AGROBIODIVERSITY SOLUTION HOTSPOT TOOL

NEXUS Gains is contributing to the development of the agrobiodiversity solution hotspot tool, which is being piloted in the Ganges Basin. The tool, based on the award-winning Agrobiodiversity Index, overlays agrobiodiversity maps onto maps of food production 'threats' to identify "hotspots" for agrobiodiversity-based interventions. At such locations, approaches that safeguard and increase agrobiodiversity can reduce or reverse the threats and increase the resilience of agriculture and food production systems. Combining data from the tool with local stakeholder knowledge and concerns helps to validate the hotspots and co-design effective interventions for achieving biodiversity-friendly agricultural land, in line with Target 10 of the Global Biodiversity Framework.

Work Package 2:
Water productivity and integrated storage management

Mapping existing water stores; developing a water storage diagnostic tool; formulating fit-for-purpose water productivity decision support systems; and conducting policy and institutional analyses. Integrated storage solutions, as well as activities in other areas, can reduce the negative impacts of climate change-induced water variability and improve water productivity.

Siloed approaches to agriculture, infrastructure development, and energy generation in large river basins can result in the inefficient use of water, leading to the deterioration of environmental health, and posing threats to water, food, and energy security. This situation is worsened by poor management of water storage. Globally, more than two billion people live in water-stressed countries and this number is set to increase, due to growing populations and the impacts of climate change. Increasing water productivity is crucial to ensure water security, as well as to safeguard environmental health and biodiversity. A nexus approach is key to boosting water productivity and to support the sustainable management of water storage. Addressing the science–policy gap that exists around these issues is critical if empirical scientific evidence is to be used in decision-making.

INTEGRATED WATER STORAGE ASSESSMENT

In the Shashe sub-basin, on the arid border of Botswana and Zimbabwe, efficient, well-designed water storage is crucial to ensure healthy ecosystems, food and water security, and climate resilience. NEXUS Gains carried out a storage assessment to calculate the potential volume of water storage available in dams, groundwater, and soils. The Initiative aims to encourage a shift to more integrated water storage planning that combines gray and green infrastructure, such as sand dams, which are particularly effective at capturing and storing water, even during periods of low rainfall. Integrating environmental conservation into storage design and management is critical for long-term ecological health and resilience.

Work Package 3:
Energizing food and water systems sustainably and inclusively

Co-developing scalable business and finance models for accelerated, inclusive access to clean energy in rural areas, focusing on women and other marginalized groups.

The global dependence on fossil fuels leads to greenhouse gas emissions and threatens environmental health and biodiversity. Moreover, in many low-income countries, air and water pollution from fossil fuels negatively impacts agricultural productivity, food security, and human health. Access to renewable energy technologies, such as solar irrigation pumps, wind, and micro-hydropower, can transform agrifood systems, support progress towards the Sustainable Development Goals, and contribute to cleaner, more productive ecosystems. NEXUS Gains is carrying out research to explore which technologies work best in different settings, and to identify business and finance models that can be scaled by the private sector, non-governmental organizations (NGOs) and governments.

Rates of loss in aquatic ecosystems far outstrip those in terrestrial systems. Photo taken at Lukanga wetland, Zambia by Matthew McCartney/IWMI.

SOLAR IRRIGATION PUMP SIZING TOOL

Solar-powered irrigation pumps can bring significant environmental benefits, while supporting food security and livelihoods. However, ensuring pumps are the right size is critical. With no running costs, a pump that is too large will likely result in the over-pumping of groundwater, while an undersized pump will not meet farmers' needs, meaning that it will supplement rather than replace a diesel pump. To address this, NEXUS Gains is working with partners, including GIZ and the Government of Nepal, to develop a version of IWMI's solar irrigation pump (SIP) sizing tool for use in Nepal. The tool enables extension services and farmers to calculate the size of solar systems best suited to local conditions, backed by science. The tool helps reduce the potential for groundwater depletion while also lowering agriculture's dependence on fossil fuels.

Work Package 4:
Strengthening WEFE nexus governance

Enhancing the governance of natural resources through more effective multistakeholder platforms and social learning interventions.

Poor governance is a major contributor to the degradation of land, water, and ecosystems. Effective policies, regulations, and incentives can promote sustainable resource management, reduce pollution, and safeguard environments and biodiversity. Transparent decision-making processes, stakeholder engagement and effective regulatory frameworks across WEFE sectors are essential for promoting environmental health and conserving biodiversity. There are, however, many obstacles to collaboration between governments, ministries, the public sector, and civil society, including a lack of data sharing, mutual distrust, and sectoral divisions. Too often, decisions that affect the environment and biodiversity are made in siloes and by weak agencies. Multistakeholder platforms (MSPs), bringing together actors from across government departments, sectors and, in some cases, countries, are a nexus approach to governing WEFE systems. Evidence shows that by incorporating multiple perspectives and expertise, MSPs can enhance the implementation of sustainable development initiatives. NEXUS Gains has established a community of practice which aims to learn from experiences of how MSPs can promote collective action and successfully address complex challenges while safeguarding environmental health and biodiversity.

FABLE CALCULATOR

Recent research by the Food, Agriculture, Biodiversity, Land-Use and Energy (FABLE) Consortium has demonstrated that changing the way we manage our food and land-use systems can contribute towards global biodiversity and net zero targets. NEXUS Gains is supporting the development of long-term pathways for sustainable food and land-use systems in Ethiopia through the use of the FABLE Calculator, and supporting the team's participation in FABLE's scenario development marathons – or 'scenathons' – where results from countries and regions are aggregated to assess global outcomes. This supports stakeholders at national level to adapt their country's targets to meet global biodiversity and climate mitigation commitments, as well as supporting action on national and global food security, water, and pollution targets. The Ethiopia FABLE team has organized a series of multisectoral stakeholder workshops to iteratively improve the pathway design and spark evidence-based dialogues on how to ensure national policies help pivot Ethiopia's food and land-use system to a sustainable trajectory.

Capacity-strengthening efforts enhance understanding of WEFE linkages. Photo taken in Central Asia by Neil Palmer/IWMI.

Work Package 5:
Developing capacity for WEFE actors, including emerging women leaders

Supporting capacity-strengthening efforts for improved WEFE nexus practices that target professionals working in ministries and local government organizations, the private sector, agricultural extension services, civil society, NGOs, and academia.

Capacity development enhances understanding of WEFE linkages, including the impacts of investments in energy and food systems on the environment, and raises awareness of the critical importance of protecting habitat and biodiversity to ensure sustainability. NEXUS Gains is investing in multiple capacity development activities to strengthen the ability of governments, professionals, and communities to strengthen their ability to implement evidence-based policies, monitor environmental health, and mitigate threats to the environment and biodiversity using WEFE nexus thinking and principles.

NEXUS GAINS SUMMER AND WINTER SCHOOLS

NEXUS Gains schools and masterclasses, conducted in collaboration with a constellation of partners across focal geographies, play a pivotal role in enhancing environmental health and biodiversity through WEFE nexus approaches and principles. By providing interdisciplinary training and fostering collaboration, the programs equip early- and mid-career professionals with the knowledge and skills to address complex sustainability challenges. Through practical workshops and field experiences, participants learn to integrate environmental considerations into decision-making processes. By nurturing a deeper understanding of the interconnectedness of water, energy, food, and environmental (forest, biodiversity) systems, the summer and winter schools empower individuals to develop innovative solutions that prioritize environmental health and biodiversity conservation, building resilience and contributing to a more sustainable future.

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