



HELP Principles on Gray and Green Infrastructure for Water and Disasters

HELP Principles on Gray and Green Infrastructure for Water and Disasters are a complete set of recommended actions for all stakeholders to advance gray, green and integrated infrastructure for disaster risk reduction (DRR) and water resources management. They will assist decision-makers, administrators, academia, practitioners and stakeholders to address water-related disasters and water resources management in wholistic and concrete ways. They will help, inter alia, exponential acceleration of water-related SDGs towards the full achievement of all SDGs. These principles are intended to not only guide the design of new infrastructure, but also to guide the review and climate adaptability of existing infrastructure to make it more resilient.

The Principles advocate expanded transparent benefit-costs analyses that include commensurate and non-commensurate measures. They facilitate integration of gray and green infrastructure, thereby enhancing effectiveness of basin-wide water management systems, which leads to a healthier water cycle. They can be tailored to natural, social and economic conditions based on scientific methods and proven effective experiences.

The Principles recommend integration of gray and green infrastructure in DRR and WRM as it creates co-benefits for climate change mitigation and adaptation, for enhancing biodiversity, and for progress on disaster risk reduction (DRR) and water resources management. This approach expands options for transboundary water agreements to jointly cope with difficult and recurring disasters and to ensure harmonious water sharing, which will lead to peace and prosperity in the region.

HELP is convinced that (a) governance and policies that enable integration of gray and green Infrastructure on water and disasters rather than their separation, (b) administrative mechanisms that bridge the gap between science and politics for critical decision making on gray-green-and-integrated infrastructure, and (c) end-to-end, practical approaches relaying scientific, engineering, socio-economic, and political actions for their implementation in a systematic manner will bring revolutionary change to our society from a quantity-oriented to a quality-oriented one based on quality infrastructure. The change will enable drastic acceleration of progress of the SDGs towards their full achievement.

With this conviction, HELP wishes that the Principles be proactively used by decision-makers, governments, academia, civil society, and stakeholders at all levels so that gray and green Infrastructure and their integration as a whole will lay solid foundations for the creation of the future we want without anyone left behind, via the creation of disaster resilient and sustainable basins with healthy water cycles for all.

1. HELP's definition on green and gray infrastructure

Beware that there are still various "definitions" on gray and green infrastructure. Practitioners must clarify, with source documentation, what definitions of gray and green infrastructure are used in specific discussions and decision-making with regards to gray and green infrastructure. Keep in mind that definition may change depending on time and stages.

- Definition of infrastructure

Fundamental structural and non-structural facilities and systems that support functions and the operations for society. The function of water-related infrastructure consists of three components: storing the water, controlling water flow, and purifying the water.

- Definition of "green infrastructure"

A strategically planned network of natural and semi-natural areas with other environmental features, designed and managed to mitigate the three components of water-related disaster risks, i.e., hazard, exposure, and/or vulnerability and to improve water resources management by delivering ecosystem services.

- Definition of "gray infrastructure"

Artificial structures or facilities, and their networks, designed and managed to mitigate the three components of water-related disaster risks, i.e., hazard, exposure, and/or vulnerability as well as water resources management by delivering non-ecosystem services.

Reference:

Definition of "Green Infrastructure" by the EU: "A strategically planned network of natural and semi-natural areas with other environmental features, designed and managed to deliver a wide range of ecosystem services, while also enhancing biodiversity." Such services include, for example, water purification, improving air quality, providing space for recreation, as well as helping with climate mitigation and adaptation. This network of green (land) and blue (water) spaces improves the quality of the environment, the condition and connectivity of natural areas, as well as improving citizens' health and quality of life. Developing green infrastructure can also support a green economy and create job opportunities.

Definition of Nature-Based Solutions: The European Commission defines nature-based solutions as "Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions."¹ Consequently, solutions rooted in nature should be advantageous for biodiversity and assist in providing various ecosystem services.

¹ Source: https://rea.ec.europa.eu/funding-and-grants/horizon-europe-cluster-6-food-bioeconomy-natural-resources-agriculture-and-environment/nature-based-solutions_en

2. Decision-making in policies and plans of gray and green infrastructure

- Mainstream integration of gray and green infrastructure at regional, national, district, and local levels.
- Consider wide options of green and gray infrastructure that will serve the purpose of the facilities at the outset of policy formulation, planning, building and operating infrastructure for water-related DRR and water resources management. Compare, without prejudice, benefit and cost of options, which use both gray and green infrastructure by maximizing their benefits and minimizing the costs.
- Consider integration of gray and green infrastructure in a basin-wide water resources management system, which enables creation of a healthier water cycle.
- Decide, in transparent and accountable procedures, the best set of options. Use appropriate examples and practices when explaining the decisions. Rigorously make sure that the selected gray, green, and integrated gray-green infrastructure will achieve numerical targets/functions for DRR and water resources management through certified assessment methodologies.

3. Valuing gray-green infrastructure on water and disasters

- Value gray, green, and integrated infrastructure by economic, social, financial, and environmental yardsticks.
- Conduct comprehensive cost-benefit analysis on gray and green and integrated infrastructure, which will reveal how water is valued. Options will contain various economic, social, political, and environmental benefits and costs. These benefits and costs will also vary depending on local, regional, national, and global scales.
- Use rigorous economic, social, and environmental methods in analyzing and comparing gray and green and integrated infrastructure. Methodologies of assessing cost/benefits of green infrastructure are still in development stages compared with those of gray infrastructure. It will not, however diminish the value of green infrastructure. While the measure of gray and green include non-commensurate measures of value, great progress on the methods regarding non-commensurate Benefit-Cost Analysis (BCA) is evolving. For example, keeping green areas intact may not increase their functions for DRR and water resources management. However, there are cases in which functions of green infrastructure are drastically enhanced by combining them with gray facilities.
- Evaluate the life cycle costs of infrastructure solutions, considering not only financial aspects but also local environmental and social conditions. Decisions should be context-driven and informed by a comprehensive assessment that accounts for the local factors and conditions, to ensure the most sustainable, disaster-proof, and cost-effective solutions are chosen.
- Consider also the ecological benefits, such as providing habitats for migratory birds for instance, that connects green and gray infrastructure and ecosystems.
- Consider cultural and historical factors in the assessment of infrastructure choices to ensure that they align with the unique local context and heritage.

4. Financing gray and green infrastructure

- Conduct dialogues with finance ministers and officials on gray, green, and integrated infrastructure so that they understand the merit of financing these. Understanding the value of a healthy water cycle in economic, social, and environmental terms, will create a policy foundation for national prosperity.
- Apply rigorous economic, social, and environmental analysis on gray and green infrastructure when deciding piecemeal large-scale green or integrated infrastructure. Use available closest examples and/or guidance/ manuals when deciding small-scale infrastructure.
- Prioritize and promote integration of gray and green infrastructure in policies, plans, and projects, particularly in those by ODA. Include assessment and evaluation on levels of integration of gray and green infrastructure in bilateral and multilateral cooperation plans and projects. Make an investment master plan for gray-green infrastructure, and include them in Nationally Determined Contributions (NDC) and Climate Adaptation Plans.

5. Capacity building for gray and green infrastructure

- Support planners, and practitioners to enhance their knowledge and capability to plan, design, and implement both green and gray infrastructure projects through education and training including on the job training.

6. Proactive integration of gray and green infrastructure to address Climate Change

- Proactively integrate gray and green Infrastructure in policies, plans, and projects on water, DRR, and climate change in a basin to enhance resilience of the basin against impacts of climate change.
- Be aware that existing gray infrastructure may not ensure the level of water security originally planned/ designed and that a “gray-only” approach may not be feasible in economic, social, and/or environmental terms. Integration of gray and green Infrastructure will bring effective solutions to progressive challenges of hydrological extreme events under uncertain scenarios of climate change.
- Be aware that intricate, cascading, and structural risks that are latent in social, economic, and environmental systems may suddenly emerge and intensify to the extent that a single-handed solution by grey infrastructure cannot cope with increased variabilities of water events.
- Strategize integration of gray and green infrastructure as a core part of “quality infrastructure policy” towards building quality-oriented societies that are more sustainable, resilient, and inclusive.

7. Promoting advancement of science and technology on gray and green infrastructure

- Convene scientists and experts, not only those on water and DRR but also on food and agriculture, ecosystem, biodiversity, energy, climate, IT, etc., to bring their expertise and intellect to deepen the understanding of gray and green infrastructure.

- Promote scientific discussion and action on observation, modelling, analysis, and assessments of gray and green infrastructure, including those on social science and particularly in terms of quantification, which will lead to overall consilience, or fusion of sectoral intelligence, on this subject.
- Promote financing and investment in science and technology on gray, green, and integrated infrastructure to enhance scientific knowledge and broaden application on both. Financing in research on green infrastructure is of particular importance as its functions can be fully tapped by elucidating ecological services on, e.g., water resilience of green areas.
- Cultivate “facilitators” who fill gaps between science and technology and decision making, planning, and field practices. They will become catalysts to create science-based, practical solutions to water challenges.

8. Promoting science-based decisions on gray and green infrastructure

- Keep developing scientific knowledge on gray and green infrastructure that are applicable to regions, countries, districts, and communities. Create databases for geographic, geological, vegetation, and other natural conditions of basins so that they are effectively used when making plans and decisions on gray and green infrastructure.
- Create and use scientific advisors/facilitators or their panels when making critical decisions, such as:
 - Decision-making mechanisms for development, maintenance, and conservation of gray and green infrastructure
 - Decision-making for use and conservation of gray and green infrastructure during emergency and crisis
- Ask scientists to explain the current status of science and technology and innovation on gray and green infrastructure and indicate prospects for their further development.

9. Stakeholder involvement for integrating gray and green infrastructure

- Be aware that Integration of gray and green infrastructures will increase the number of stakeholders and raise their interests. While their participation/involvement process tends to be more complicated and time-consuming, it also can increase the possible areas for agreement and solidarity. Creating a well-crafted and legitimate stakeholder involvement process is key. Using an IWRM approach facilitates the process.
- Involve all stakeholders in planning, building, and operating gray, green, and integrated infrastructure in preparing, planning, implementing, operating and monitoring gray and green infrastructure. The full involvement and participation by, and collaboration with, local stakeholders will particularly augment functions of green infrastructure.

10. Using IWRM and a Basin Approach to promote the Integration of gray and green infrastructure

- Apply an IWRM approach in assessing and planning gray, green, and integrated gray-green infrastructure. Use the basin as a basic unit when making overall plans of gray and green infrastructure as it is often most productive. Implementing gray and green infrastructure in a basin should be based on IWRM concepts. Thus, create master plans of gray and green infrastructure within or in coordination with IWRM Plans.

11. Promoting gray and green infrastructure in transboundary water

- Include gray-green infrastructure in dialogue among riparian countries, which can increase the possibilities for agreements and solidarity in transboundary situations. Discuss historical examples and options of gray and green infrastructure, particularly their integration, for conflict resolution and peace building.

12. Promoting common understanding on gray and green infrastructure and their integration at global, regional, and basin levels

- Strengthen international solidarity on gray and green infrastructure and their integration by agreeing on international principles on gray and green infrastructure and their integration at global, regional and basin levels.
- Create sets of practical guidelines that are applicable for policy, plans and practices in accordance with diverse hydrological, geophysical, economic, social, environmental, cultural and other conditions. Share globally and regionally, good practices and lessons on the application of gray and green infrastructure and their integration.