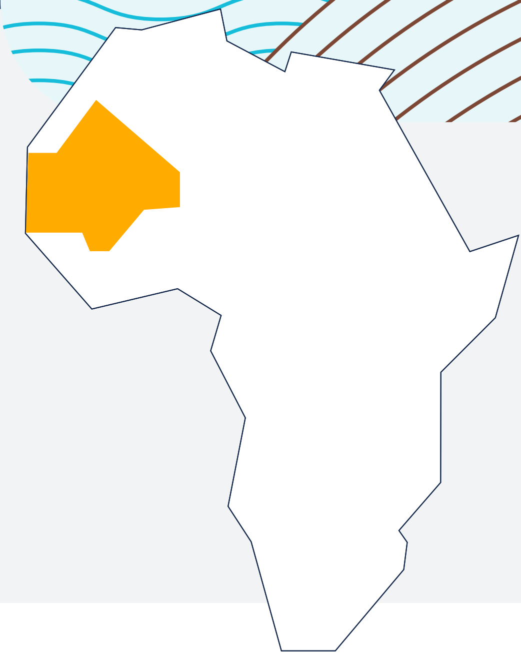
GoNEXUS

FACTSHEET

Senegal River Basin
WEST AFRICA



BRIEF OVERVIEW

The Senegal River Basin **covers 300,000 km²** across Guinea, Mali, Mauritania, and Senegal. The river's headwaters **originate in Guinea,** flowing northwest through Mali and subsequently forming the border between Mauritania and Senegal before **discharging into the Atlantic Ocean.** Its main tributaries include the Bafing, Bakoye, and Faleme rivers.

Flow regime is bimodal, characterised by a high-flow season (July to November) and a low-flow season. Additionally, there is considerable variability in river discharges from year to year.

Water has been used for **artisanal inland fishing, flood recession agriculture**, and more recently, for **hydropower generation and irrigation**.

Hydropower is produced at **the Manantali multipurpose reservoir** (200 MW) and at **two run-of-river power plants:** Gouina (140 MW) and Félou (62 MW).

Future planned infrastructures include **hydropower plants** (Koukoutamba (294 MW), Gourbassi (18 MW), Boureya (161 MW)) and **new irrigation schemes**.

The floodplain is critical for **farming, pastoralism and fisheries.** Managed flood releases from the Manantali reservoir can be implemented to **support flood-recession agriculture** in the downstream areas.

IDENTIFIED WEFE CHALLENGES & PROSPECTED SOLUTIONS

The WEFE (Water - Food - Energy - Ecosystems) challenges arise from the conflict between traditional food production methods, such as flood-recession farming and fishing, and modern uses which include hydropower generation, river transportation, and irrigated agriculture. Traditional practices depend on a natural flow regime, while modern applications **require more consistent river discharges throughout the year.** With the damming of the Bafing River, traditional food production can only be maintained through **managed flood releases from the Manantali reservoir.** However, this approach inevitably decreases energy output due to increased spillage losses and a reduction in the water level of the reservoir.

Artificial floods

- These are controlled flood releases **designed to imitate natural flooding patterns,** supporting traditional activities such as flood-recession agriculture and artisanal fishing. By mimicking natural floods, these releases **help sustain ecosystems,** replenish fish stocks, and enable communities that rely on floodplain farming and fishing to **maintain their livelihoods.**

Coordinated reservoir operation

- This approach promotes **long-term cooperation among water users** within a river basin to improve water management and reduce conflicts. By balancing competing demands, it ensures that **water is distributed fairly and efficiently,** supporting agriculture, electricity generation, and essential ecosystem services.

Agricultural diversification

- This approach aims to **transform the production system** by adjusting crop patterns and incorporating other activities, such as aquaculture. These changes **enhance food security**, provide multiple income sources, and strengthen resilience to climate change. By using water resources more efficiently, communities reduce the risks associated with relying on a single livelihood while also **supporting ecosystem balance.**

MODELLING TOOLS

The core of the modelling framework is **the Hydro-Economic Model (HEM) of the Senegal River Basin**, which guides water allocation policies across the basin. This model integrates key components, such as the river network, hydropower plants, reservoirs, and water demand points.

Using historical streamflow data from 1904 to 2020, the framework **simulates water allocation policies** and **evaluates performance indicators** relevant to the WEFE nexus. It can also incorporate future streamflow projections to assess the potential **impacts of climate change on water-dependent activities.**

SCENARIOS

The GoNexus team has **outlined three scenarios**, each balancing different aspects of development to address the needs of both modern and traditional water uses:

Full development scenario

This scenario emphasises **the full-scale development of hydropower and irrigated agriculture,** prioritising maximum expansion in these areas. It focuses on building modern infrastructure to **drive agricultural and energy production** at the expense of traditional water-dependent activities like flood-recession agriculture and artisanal fisheries.

Sustainable development

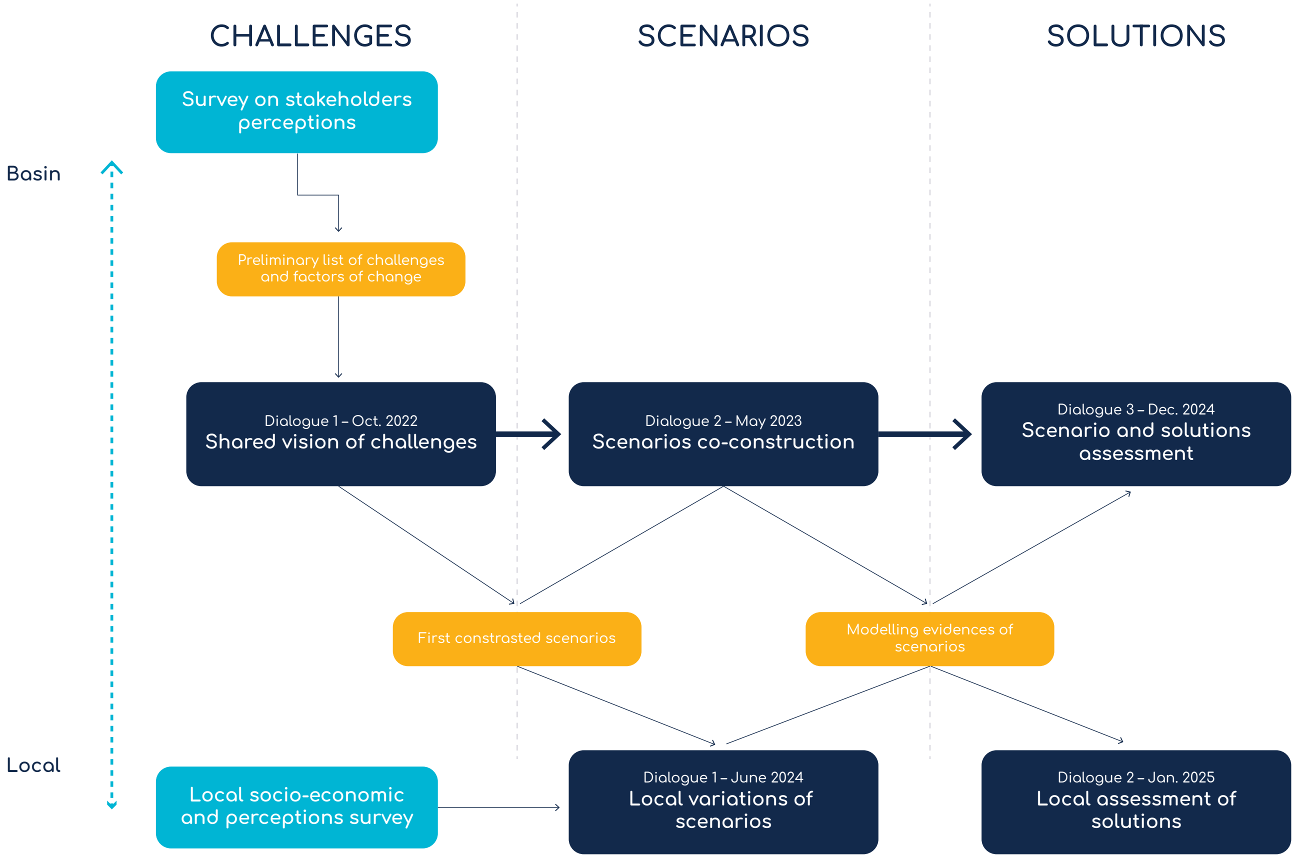
Here, modern development coexists with the preservation of traditional activities and ecological services. Unlike the full development scenario, this approach **limits the construction** of some irrigation systems and hydropower plants while still supporting managed flood releases **to sustain traditional activities.**

Solar revolution

This scenario fully develops irrigated agriculture but limits the expansion of hydropower plants, using **solar farms as a substitute for some hydropower facilities.** Solar-powered pumping systems are widely adopted to divert substantial river water volumes to irrigation schemes, supporting agricultural growth **with minimal hydropower expansion.**

DIALOGUES

The GoNexus Dialogues are based on surveys conducted at the start of the project to identify **challenges in water resource management at both basin-wide and local levels.** This approach ensures we engage a variety of stakeholders affected by the WEFE nexus, particularly local communities in the floodplain. By combining workshop insights with modelling results, we can **better define scenarios** and **develop solutions for managing the nexus.**



GoNexus methodology to conduct Dialogues.

EVIDENCE
MODERN *VERSUS* TRADITIONAL

Evidence of the interdependence between water, energy generation, food production and ecosystem are best illustrated by the presence of **two coalitions of water-related activities: 'modern' versus 'traditional' uses.** Modern uses include irrigated agriculture, hydropower generation and navigation, while traditional uses involve flood recession farming, floodplain fisheries and floodplain ecology represented by the biomass production (net primary production). Making one coalition better off can only be achieved at the detriment of the other.

The figure below shows that **this trade-off exists essentially between 'modern' and 'traditional'.** When the relative performance in one group increases, then the performance in the other tends to decrease.

Trade-offs between competing uses (average values)

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