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Adaptation Without Borders

Transboundary Climate Risks in Senegal: Opportunities for Regional and International Cooperation on Adaptation

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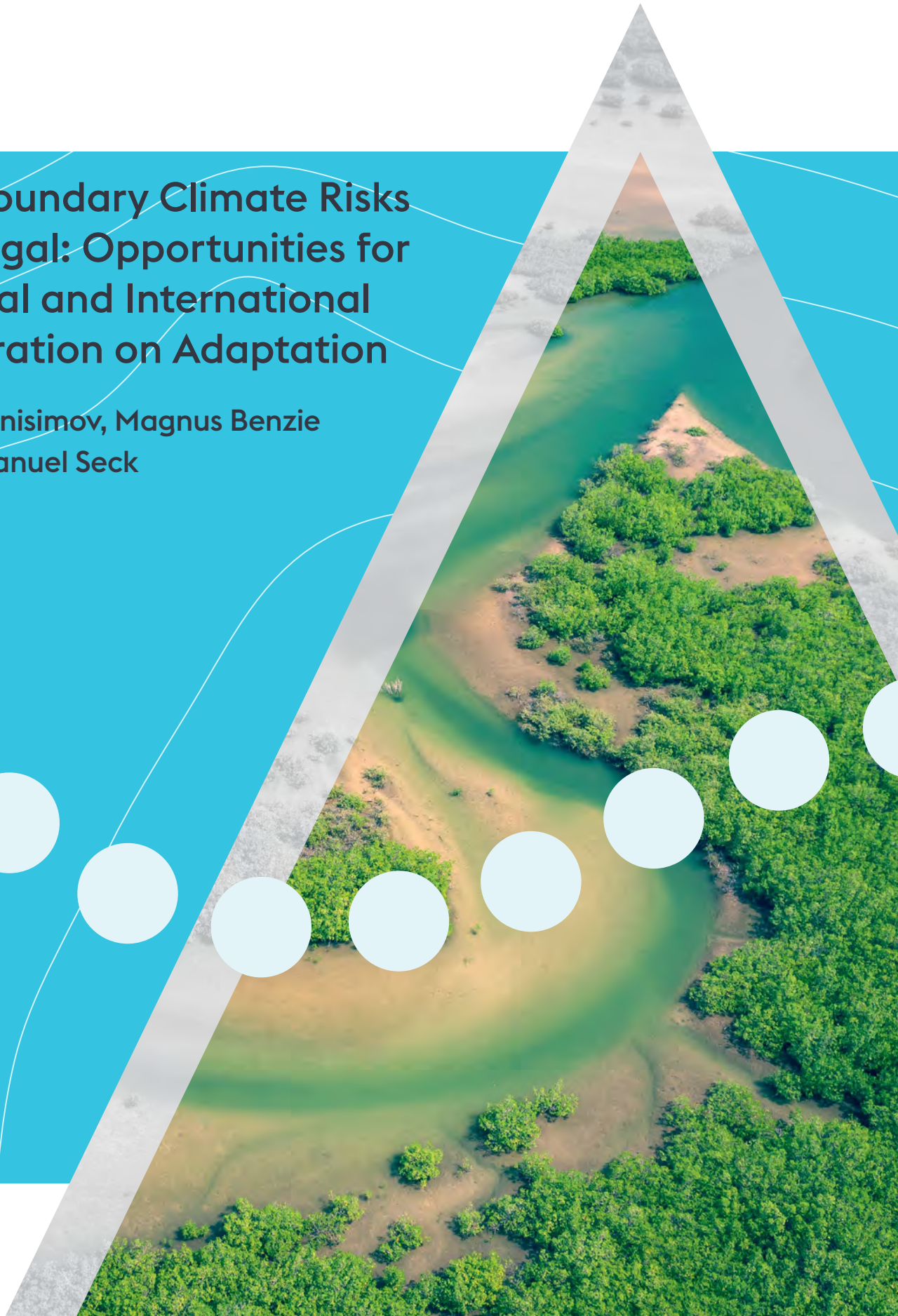

Credits

Adaptation Without Borders is a global partnership working to strengthen systemic resilience to the cross-border impacts of climate change. We identify and assess transboundary climate risks, appraise the options to better manage those risks and support policymakers, planners and the private sector to develop climate-resilient and inclusive solutions. We catalyse new alliances and forms of cooperation on adaptation that pave the way towards a more sustainable and resilient world.

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Front cover image: mangrove forest in the Saloum Delta National Park, Senegal. Photo by Curioso Photography on Unsplash

Inside front cover image: Saint-Louis, Senegal. Photo by E. Diop on Unsplash

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Executive summary

Climate change adaptation poses an increasingly strategic challenge for countries like Senegal. Extreme and variable weather, sea-level rise, coastal erosion and ecosystem degradation directly impact the country, heightening the need for effective adaptation. These climate-driven challenges have been compounded by broader drivers of vulnerability. These other drivers include insufficient climate and development financing from the international community, and the lingering effects of debt accumulation, the 2008 global financial crisis, and the 2020-2021 pandemic. Planners and communities in Senegal are busy dealing with the myriad and complex challenges of adapting to the direct impacts of climate change at local scales. Meanwhile, new and emerging risks are surfacing. These new risks include the threat of international conflicts, trade wars, fragmenting global governance, and insecurity in the Sahel. All these forces add to the scale of the adaptation challenges in Senegal.

In this light, expanding adaptation to incorporate international dimensions and transboundary climate risks might seem like an unwelcome distraction. To those already dealing with many direct adaptation challenges, this addition might appear to add further complexity to already overwhelmed development planning processes.

Nevertheless, ignoring these risks will not make them go away. Senegal will not achieve climate resilience – the goal of adaptation – if it does not acknowledge and act on the cross-border dimensions of the problem. Indeed, overlooking these dimensions could limit Senegal's potential to benefit from regional and international cooperation measures that offer solutions.

When it comes to exploring transboundary climate risks, the very term borders can mean multiple things. Borders include, but are not limited to, formal administrative or jurisdictional boundaries across different governance levels, from national to local. Other borders refer to conceptual boundaries, such as those determined by natural ecosystems, socio-cultural distinctions, or policy domains. These many notions of border surface, for example, through shared water resources and trade. It is important to acknowledge and integrate the climate risks that connect Senegal and other countries. These borders shape how to understand, manage and govern climate change impacts.

This is why the Adaptation Without Borders partnership and ENDA Energie have produced this report. It seeks to take a first step to support adaptation planners in Senegal by helping them identify key transboundary climate risks and to build on existing arrangements to devise potential adaptation priorities and solutions.

Building on existing, national plans and regional relationships

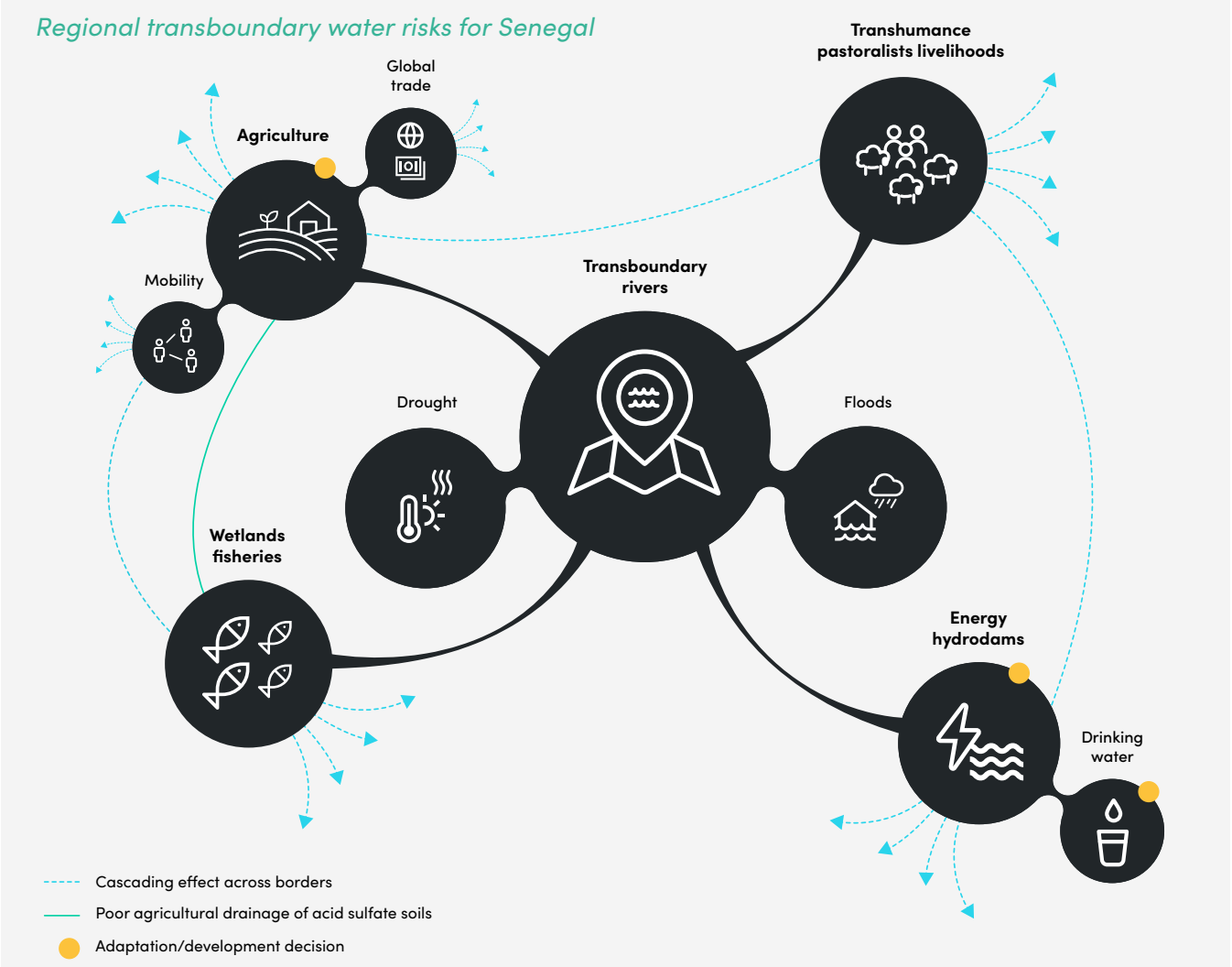
In the coming years, concerted and dedicated efforts to address transboundary climate risks are needed. Senegal can begin by:

- **Signalling clear intentions and assigning responsibilities.** The government of Senegal can indicate its clear intention to act on this agenda by assigning responsibility for transboundary climate risks to specific individuals within its adaptation team in the Ministry of Environment, and with adaptation focal points across government.
- **Building on its nationally determined contribution (NDC).** Senegal's revised nationally determined contribution (NDC) offers a first opportunity to signal its intentions, priorities, and a willingness to do what is needed.
- **Leveraging regional governance to enhance adaptation cooperation in the region.** Several interlinked and cascading climate risks facing Senegal originate across the border in upstream and neighbouring countries; in the short term, Senegal is well positioned to initiate adaptation policy and planning cooperation with its West African neighbours. It has established many existing forms of collaboration with them. Examples include participation with the Economic Community of West African States (ECOWAS)

and in regional water management bodies. Such entities create institutional capacity to lead regional resilience-building efforts. Senegal can build on existing regional cooperation agreements and governance arrangements for managing shared water resources to facilitate adaptation in the context of a broader set of interconnected sectors. Senegal can begin by:

- **Undertaking needed planning for critical infrastructure.** Financial planning should seek to enhance the climate resilience of shared energy systems, and to ensure a just transition that integrates solar and other renewable sources.
- **Integrating water management and dryland adaptation strategies to address the transboundary nature of livelihoods.** This approach must account for the impact of climate risks and hydro-energy infrastructure on a variety of other issues: water accessibility, land use for grazing, biodiversity conservation in protected areas, and transhumance. Sustainable resource management across borders implies a need for policy coherence on mobility and land rights by recognizing formal and informal land ownership, governance and pastoralist movement.
- **Strengthening synergies between regional water governance and food security.** For example, the goal of achieving food security could be pursued by integrating adaptive agricultural-ecological practices as part of broader irrigation planning; such efforts can support the cultivation of traditional crops like millet and sorghum, and the development of family gardens. To enhance synergies between local production and regional trade, Senegal should prioritize community-level management of shared water resources and integrate local food systems into broader water governance.

Figure 1. Regional transboundary water and interconnected sectors



This figure depicts how cross-border water risks intersect with multiple sectors, such as energy, drinking water, agriculture, and livelihoods, generating ripple effects across the region.

- **Aligning regional water adaptation strategies with the needs of downstream communities.** This can help identify the effects of new adaptation policies on shared coastal zones, and help bring attention to issues impacting coastal communities, ecosystems and fishing rights.

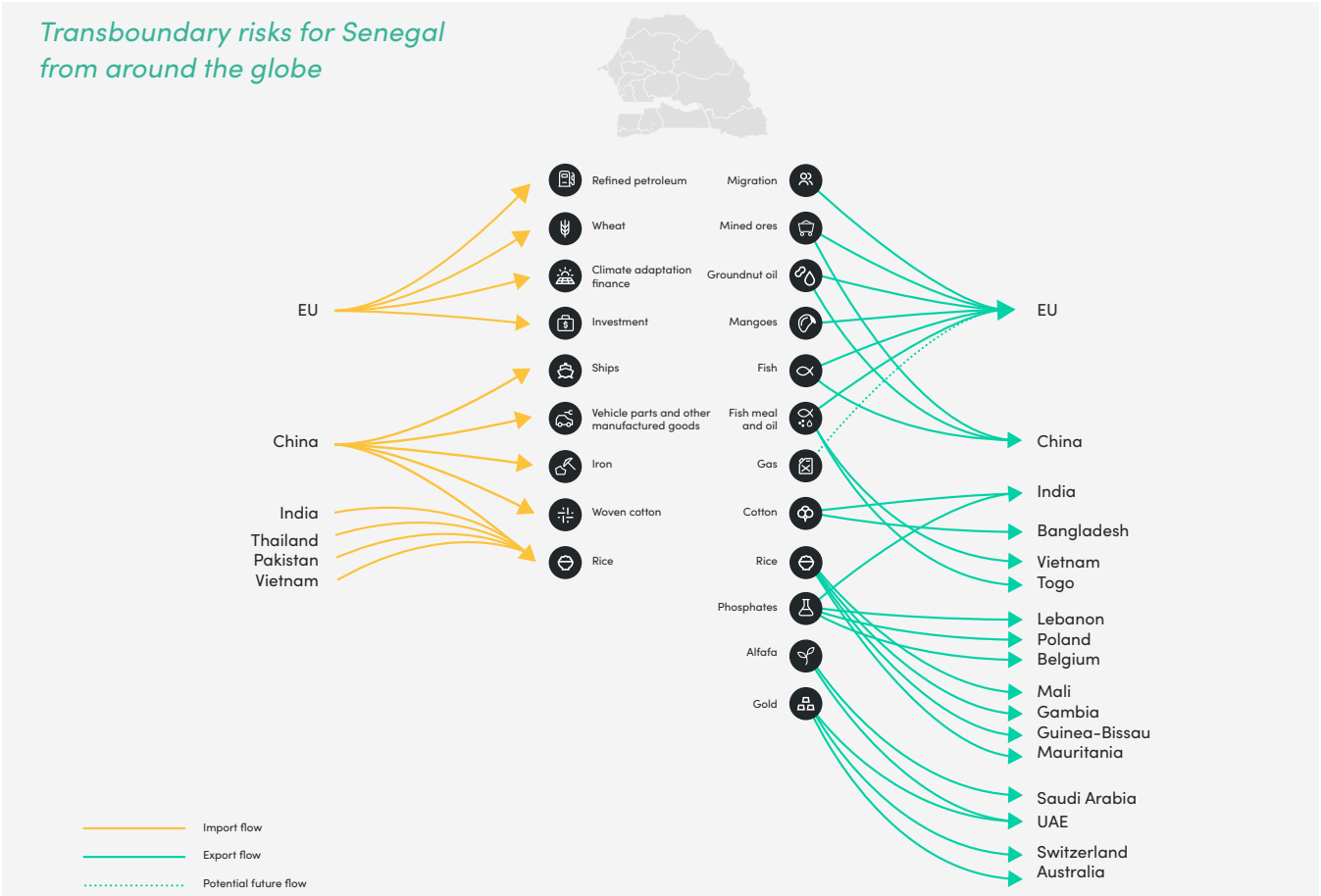
Addressing risks from geographically remote regions

It is also necessary to strategically address teleconnected climate risks – that is, those risks that result from Senegal's interdependence with countries beyond West Africa. Systemic global risks interact with climate and nature, presenting big policy and governance challenges, especially in low- and lower-middle-income countries. Senegal's pathway to align resilience with national priorities should seek to address structural trade imbalances and bring the topic of resilience into strategic dialogues with dominant trade partners. For example, discussions with the EU and China can highlight resilience in relation to the provision of critical commodities. Major trade partners are becoming more aware of their dependence on successful adaptation in countries like Senegal, for their own climate resilience. Senegalese leadership on this issue should be met enthusiastically by international partners inside and beyond the UN Framework Convention on Climate Change (UNFCCC). Given uncertainty in global politics and the complexity of the challenge, Senegal should seek to implement actions now rather than later.

Senegal can begin by:

- **Initiating a strategic dialogue with the EU on shared climate resilience and strategic policy coherence.** This dialogue can build on the EU's policy work since 2016 on its own vulnerability to climate change impacts occurring outside of Europe.
- **Exploring the creation of a groundnut climate resilience initiative.** Explore options with actors from China to invest in and strengthen resilience throughout the groundnut value chain in Senegal.
- **Co-leading an international coalition on rice resilience with other import-dependent and producing countries.** Such a coalition can seek to advance political discussions on trade policy, trade reform, generate

Figure 2. Teleconnections between Senegal and other countries



This figure depicts the main sources of inflows into Senegal (orange arrows) and the main destination of outflows (green arrows) across a range of traded goods, commodities and material flows (Source: authors, based on OEC trade data).

international support, and spur systemic investments from multilateral actors – for example by using climate adaptation finance. A goal should be to reduce volatility in international rice markets and thereby support food security and social stability in Senegal and coalition partner countries.

- **Engaging partners to co-design cooperative responses to transboundary maladaptation – that is, actions that can lead to adverse outcomes.** Senegal can begin to lead on this issue by engaging regional neighbours in shared learning processes and joint risk reduction plans, and by clearly identifying where transboundary maladaptation occurs.

To move forward on these or any other measures to adapt to transboundary climate risks, Senegal will need help: financial assistance, scientific expertise and governance support. Given the high demands already being placed on adaptation planners in Senegal, the international community must rise to meet this challenge. It can and should provide new and additional financial and technical support, and capacity building for the government and for Senegalese stakeholders who must be part of this process.

In these efforts, Senegal's development partners have a key role to play. Senegal should urge development partners to support explicit initiatives, programs and projects that address transboundary climate risk at the national, regional and international scale. Moreover, development partners should also make the case internally within their own governments to better align national policies to contribute to coherent, systemic resilience, most obviously via trade and security policies, and via their broader contributions to global governance. In order to achieve systemic resilience globally, powerful donor countries need to act with more strategic coherence; development agencies can help to provide the insight and business case within government for this kind of coherent policy approach.

Acting now

Senegal can take concrete actions now to help address the risks that it faces from regional and global forces. Box 1 contains three, initial steps that Senegal can take at the national level to begin to address the transboundary risks it faces in the region.

Box 1. National actions

Three steps Senegal can take at the national level to address transboundary climate risks

Step 1: Formally acknowledge transboundary climate risks

Explicitly recognize transboundary climate risks in Senegal's updated nationally determined contribution (NDC), national adaptation plan (NAP), and other adaptation-related assessments and communications.

Step 2: Designate clear risk ownership of transboundary climate risks in Senegal

Today, there is no clear designation of responsibility for managing transboundary climate risks in Senegal. A central actor should coordinate cross-government responses to transboundary climate risks. This central actor should animate a wider, multistakeholder-shared vision of national resilience, including consideration of trade-offs between sectors and priorities. This position could be in the Ministry of Environment, the Prime Minister's Office (The Primature), or the Presidency's General Secretariat (Secrétariat Général de la Présidence de la République).

In addition, clear responsibility should be assigned to sectoral leads in Senegal's government and civil society. For example, risk ownership can be designated by leveraging existing multi-government river basin organizations to establish a cross-border committee to address water and food matters. The committee can liaise with local communities on water access and coordinate policy across national ministries on food production and trade to promote regional resilience via integration.

Step 3: Integrate transboundary climate risks into negotiations

Transboundary climate risks should be considered when setting national negotiating positions in regional and international forums. In these forums, new or modified positions should be adopted to articulate and pursue Senegal's interests in light of the transboundary nature of climate risks. New or modified positions should be adopted to articulate and pursue shared regional and even international (systemic) interests, via the inclusion of transboundary climate risks. This is particularly relevant in forums such as the UN Framework Convention on Climate Change (UNFCCC), the World Trade Organization (WTO), and multilateral and bilateral treaties and agreements in West Africa and internationally. Currently, Senegal's negotiating positions in these forums do not reflect or leverage the impacts of transboundary climate risks.

Senegal can also engage now in international processes, and it can lead in advocating for measures that can help it – and other countries – build greater resilience to transboundary climate risks. Box 2 contains three pathways forward.

Box 2. International actions

Three pathways Senegal can pursue through international cooperation to strengthen its resilience to transboundary climate risks

Pathway 1: Mobilize financial support for science and research on transboundary adaptation

New investments are needed to support research for transboundary adaptation.

Donor-led programs and international climate finance should be mobilized, and private investments enhanced to fund collaboration and data-sharing platforms. This will improve research and assessment of transboundary climate risks and risk-resilience relationships involving Senegal and international partners. Such efforts should focus on teleconnected risks – that is, those climate risks that propagate between geographically remote regions through means such as trade and value chains.

At the regional scale, existing knowledge-sharing platforms, such as early warning systems, should be leveraged to monitor transboundary risks and the effects of adaptation across borders. Examples include regional efforts such as the common food security early warning mechanisms, operated by the Economic Community of West African States (ECOWAS) and facilitated by the AGRHYMET Regional Centre's drought-monitoring work, and satellite-based data tools to monitor soil moisture and vegetation access.

Pathway 2: Raise awareness and build capacity related to transboundary climate risks within West Africa's foreign policy community and with development partners

It is important to equip national policymakers interacting with international organizations and development partners with a greater awareness of transboundary climate risks and their relevance to bilateral relationships and international cooperation across a variety of fields beyond a narrow interpretation of climate change.

A variety of approaches could be effective, including regional training and capacity-building programs and exchanges, bespoke training programs for Senegalese policymakers, and international exchanges. All countries are going through a similar learning process on transboundary climate risks at the same time, suggesting that international exchanges between African and non-African countries could be especially effective. Priority topics include the role of transboundary climate risks and adaptation in transboundary water, agriculture and trade networks. Specific briefings could be conducted for trade negotiators and government ministries of economy on the importance of transboundary climate risks for national interests, and coalition building with international partners.

Pathway 3: Build partnerships to shape new forms of international cooperation to address transboundary climate risks

Senegal could play a key role in facilitating regional partners to cooperate on new adaptation governance initiatives and in co-leading new coalitions in international processes to address cross border cascading risks. Development cooperation partners and international organizations could do much more to support such processes. For example, Senegal could seek funding and support to convene workshops and collaboration between regional partners on adaptation. Further, development cooperation could help with the pre-submission phase of a multi-country application to one of the major adaptation funds (i.e., Green Climate Fund or the Adaptation Fund) to address adaptation to transboundary climate risks.

Introduction

Senegal's adaptation policy priorities are intrinsically linked to foundational socio-economic development decisions. They aim to create pathways to build more resilient societies, ecosystems, and economies. Climate risks intersect with multifaceted vulnerabilities, affecting water resources, coastal zones, urban areas, agriculture and drylands. These effects cascade with ramifications on livelihoods, economic activities and community health and well-being. Risks cascade in other ways, through connections, such as those of natural resources, trade and other networks. These connections allow climate risks to travel across regional and global boundaries. These cross-border, cascading risks are defined as transboundary climate risks. If not adequately addressed, these risks can obstruct broader socio-economic development goals. For these reasons, transboundary climate risks pose critical challenges for those seeking to assess and address vulnerabilities and create strategies to adapt to the impacts of climate change.

Transboundary climate risks in Senegal arise from both domestic and international sources (AWB, 2024). Climate events occurring within Senegal have domestic impacts, of course, but these events can also have repercussions on neighbouring countries, leading to regional risks, even disasters. This is particularly evident in areas of shared resources and biodiversity hotspots, such as rivers, wetlands, forests and pastoral grazing areas (ECOWAS, 2022). The effects of climate change on these transboundary resources can significantly impact a range of livelihoods from local farming, fishing, and pastoralism – and the well-being, human health and community stability of Senegal and its neighbours (Opitz-Stapleton et al., 2021).

Climate impacts can also cross to and from distant regions through global supply chains and trade routes. For example, Senegal has complex trade relationships with Asian markets because of its reliance on rice imports and its export of groundnuts and mangoes. Or, consider Senegal's artisanal fishing, which has been threatened by declining fish stocks from climate impacts on coastal areas, combined with over-fishing from foreign fleets. As these examples illustrate, such interconnected factors play a key role in shaping Senegal's risk and resilience because they influence the exposure and vulnerability of resources vital to the country's economic and social security.

Background

What are transboundary climate risks?

Our interconnected global societies and economies have established complex networks through which climate risks can travel, making the impacts of climate change systemic and dynamic. Transboundary climate risks refer to the effects of climate change that cascade across borders (Adaptation Without Borders, 2024). These risks emerge when a climate-related hazard in one location generates repercussions for livelihoods, environments, and economies in another. Additionally, they occur when adaptation actions implemented in one area or country produce impacts that extend beyond their initial context, potentially redistributing or creating new vulnerabilities and risks. Transboundary climate risks occur at various scales: between neighbouring countries that share ecological resources or cross-border flows; at the regional scale, where countries are highly integrated along political and socio-economic lines; and internationally and globally as a result of markets and systems that link many countries together.

Risk pathways

Transboundary climate risks propagate through several pathways, such as biophysical routes, trade flows, financial systems, and networks among people (Anisimov & Magnan, 2023).

- **Biophysical pathways:** These risks manifest within large-scale ecosystems or natural resources that span multiple countries. Shared water resources and river corridors serve as primary examples. Multi-country, cooperative governance arrangements and agreements for water and river resources have been established in several regions of the world.
- **Trade pathways:** Climate risks also travel through trade flows along supply chains. For example, climate events can impact agricultural yields that are economically and socially important for import-dependent countries. Often, these types of risks are underrecognized in domestic adaptation planning. These pathways highlight the interconnectedness of global trade networks and the vulnerabilities they may introduce.
- **Financial pathways:** Financial networks are another critical route for climate risks. For example, foreign direct investment channels can affect investments and resource allocations across borders.
- **People pathways:** Human mobility is another source of transboundary climate risks. For example, migrants, refugees and pastoralists may cross borders in search of economic opportunity, safety, or resources.

Risk-resilience relationships

Connections between countries do not only transmit risk; they can also provide resilience to shocks. For example, when a domestic harvest is decimated by extreme weather or pests, recourse to international markets offers hungry consumers an alternative source of food. In this way, pathways of transboundary climate risk can also be pathways of resilience and adaptation.

It is therefore helpful to think of the relationship between countries that are impacted by climate change as "risk-resilience relationships". Both risk and resilience flow between them. Therefore, the most important question to answer is this: How can the inter-dependence between countries be used to maximize mutual resilience and minimize shared risks?

Global science and policy advancements

The extreme events and slow-onset processes caused by climate change have the potential to trigger ripple effects across national borders. Scientific advancements have significantly increased understanding of these risks (Anisimov & Magnan, 2023). The UN Intergovernmental Panel on Climate Change (IPCC) has begun to highlight these concerns; the latest assessment report (sixth) published in 2022 specifically addresses the economic and

social impacts of climate change across national boundaries through supply chains, markets, and natural resource flows (Intergovernmental Panel on Climate Change, 2022). Nevertheless, climate vulnerability assessments and the national plans that emerge from them are often tightly framed within national boundaries (UNEP, 2023).

Climate policy has started to draw on scientific findings that emphasize the systemic nature of climate-related impacts. International climate policy has begun to recognize that transboundary climate risks are critical for enhancing cooperative adaptation actions. For example, the UN Framework Convention on Climate Change (UNFCCC) has incorporated cross-border and cascading climate risks under the Global Goal on Adaptation (GGA), as outlined in the Paris Agreement (Article 7.2). This integration is also reflected in the Global Stocktake, the assessment of collective progress towards meeting the goals of the Paris Agreement.

At the 28th UN Climate Change Conference, parties reaffirmed the importance of recognizing the transboundary nature of climate change impacts. The final agreement text outlined that,

> ". . . climate change impacts are often transboundary in nature and may involve complex, cascading risks that can benefit from collective consideration and knowledge-sharing, climate-informed transboundary management, and cooperation on global adaptation solutions" (Decision 2/CMA.5, paragraph 18;UNFCCC, 2023).

Transboundary cooperation has been emphasized as a governance approach to more effectively assess, plan for, finance, and respond to cross-border and cascading climate risks. The emphasis is on cooperation for adaptation, which seeks to foster cross-sectoral and cross-border dialogues and knowledge sharing to better assess, evaluate and manage risks.

Efforts are just beginning to navigate the complexities and assign risk ownership – steps that must be taken to move towards and devise cooperative adaptation solutions. More case studies and analyses are needed to understand the impacts on different geographies and institutions, and to provide lessons and guidance for adaptation planners.

Addressing transboundary climate risks in Africa

African policymakers have recognized transboundary climate risks in continental and regional policy and planning tools (Opitz-Stapleton et al., 2023). The African Union (AU) Climate Change and Resilient Development Strategy and Action Plan (2022–2032) emphasizes the need to "enhance coordination between the Regional

"Transboundary cooperation has been emphasized as a governance approach to more effectively assess, plan for, finance, and respond to cross-border and cascading climate risks."

Economic Communities (RECs) and Member States in addressing and managing transboundary and cascading climate risks" (African Union, 2022). This strategy recognizes existing opportunities for integration, by leveraging regional policies and governance mechanisms.

In 2022, during the 18th Session of the African Ministerial Conference on the Environment (AMCEN), ministers acknowledged the importance of enabling African member states to identify, manage, and adapt to transboundary and cascading climate risks, in alignment with Africa's Climate Change and Resilient Development Strategy and Action Plan.

In accordance with these policy orientations, the Adaptation Without Borders Partnership conducted research and policy dialogues throughout 2023 to co-design "A Roadmap for African Resilience" (Harris et al., 2023). The roadmap identifies 25 actions for stakeholders across various governance levels to build on existing mandates and policies to effectively address transboundary climate risks, supporting the policy goals established in the African Union plan.

Additionally, a regional report has explored the policy mechanisms employed by the regional economic communities to manage transboundary climate risks in alignment with the roadmap's action areas (Opitz-Stapleton et al., 2023). This work has contributed to a deeper understanding of the socio-economic and political contexts surrounding transboundary climate risks. It also has identified key regional policies and programs that can serve as entry points for integrating these risks into policy.

Adding to this research and policy engagement at continental and regional levels are country-level case studies, which provide valuable insights into the dynamics of transboundary climate risks. Such case studies reveal barriers and opportunities for integrating these risks into other climate and institutional policies and practices.

Opportunities to act through regional and international cooperation

This report draws insights from stakeholder consultations and a workshop with national adaptation planners within the National Climate Change Committee (Comité

National Changement Climatique) and Ministry of Environment and Ecological Transition held in Dakar in September 2024 with the support of ENDA Energie. The report explores regional and teleconnected transboundary climate risks – that is, those risks that can spread across geographically distant regions. It identifies entry points to consider for effective policymaking to address these risks. Key policies and governance arrangements offer a solid foundation for integrating cross-border and cascading risks. These measures include the adaptation component of the NDC, and sectoral adaptation plans, which have been led by the National Climate Change Committee. Indeed, as it enters a new cycle of revising its NDC, Senegal is updating its vulnerability assessments and its adaptation policy and planning tools. This serves as a moment of opportunity to address transboundary climate risks.

Senegal has opportunities to lead regional cooperation to address and formulate long-term adaptation strategies to these risks. Senegal has extensive experience in regional bodies such as the regional economic community Economic Community of West African States (ECOWAS), the Senegal River Basin Development Organization (OMVS), and the Gambia River Basin Development Organization (OMVG); through these bodies, Senegal has been able to participate in the direction of socio-economic development projects, infrastructure and integrated water management schemes. This experience can be leveraged to inform adaptation cooperation in other sectors. Similarly, experience with the Food Crisis Prevention Network (RPCA) can be brought to bear on regional agricultural issues to leverage cross-border cooperation on food- and agriculture-related risks. Senegal is also well placed to lead new forms of governance required to build regional resilience. For example, Senegal could facilitate regional dialogues on technical issues, such as best practices for joint-investment models, data sharing, early warning schemes, and contingency plans.

How can Senegal help create more robust pathways to shared resilience? One way would be to align adaptation strategies in West Africa by coordinating efforts to build the resilience of common-pool resources such as cross-border coastal zones, fisheries, drylands, and pastoralism. There are also opportunities to facilitate cross-sectoral collaboration by involving ministries such as trade and finance into adaptation policy formulation. Such efforts could consider supply and value chains and Senegal's position within the broader regional and global economy. This would enable Senegal's adaptation approach to better reflect the realities that guide strategic and commercial negotiations and cooperation with private actors and overseas governments conducted by and with the trade and finance ministries, for example.

This report highlights opportunities to better recognize and integrate transboundary climate risks into comprehensive adaptation policy frameworks. It shows how Senegal can capitalize on these opportunities by building on and leveraging three tools: existing policy foundations, institutional capacities, and regional governance arrangements.

Senegal case study

This case study explores transboundary climate risks in Senegal by examining two key dimensions: biophysical risks, those that flow through ecosystems and natural resources; and teleconnected risks, those that travel to and from distant locations. These two types of transboundary risks were chosen to demonstrate critical pathways of cross-border risks that are key focus areas for development in Senegal. Each risk involves governance and cooperation at regional and international levels (GIZ et al., 2022;).

The case study analyses transboundary water resources and cross-border risks, including shared energy, irrigation, agriculture, and water accessibility. All these issues are intricately linked to livelihoods, particularly farming and pastoralism. This pathway demonstrates that there are opportunities for regional cooperation and shared resilience. Senegal can pursue these pathways by building on regional integration activities to strengthen the intersections of water with three key issues: food, health, and traditional livelihoods.

The case study also examines teleconnected transboundary climate risks that arise through trade relations. It explores Senegal's import-export balance sheet, focusing on commodities such as rice, fish, groundnuts and alfalfa. The work highlights how climate risks can permeate these networks, which connect Senegal with the EU, Asia and other regions. This pathway highlights opportunities for new forms of international cooperation and underscores the shared benefits that can surface from better adaptation in Senegal.

Regional climate risks: shared water resources

Up to 88% of Senegal's renewable water resources are transboundary. They are shared with neighbouring countries: the Gambia, Guinea, Guinea-Bissau, Mali, and Mauritania (World Bank, 2022). The primary rivers – the Senegal, Gambia, and Casamance – originate from the Fouta Djalon mountains in Guinea and flow through a network of tributaries and municipalities. This intricate system presents challenges for river use, accessibility, and the diverse needs of riparian communities, which face varying exposure and vulnerabilities to climate change risks (USAID, 2021).

Variations in water flow between rainy and dry seasons are extreme and becoming more so. The neighbouring Sahel region is facing intensifying drought, and the northern part of Senegal is confronting desertification. Coastal areas are at risk of erosion, salinization and flooding. Further, climate change has made rain patterns more unpredictable. With up to 90% of farming rainfed, agriculture is affected (Noblet et al., 2018). In response to these challenges, water management policies have prioritized flood risk reduction and water use to serve broader socio-economic goals: to produce energy, preserve the supply of drinking water, and provide for agricultural irrigation, particularly transforming floodplains for cultivation(Bruckmann, 2023; Republic of Senegal, 2020; Ministère de l'Environnement, de la Protection de la Nature, 2006; Niasse, 2004).

The extent of shared rivers and different priorities led the region to establish multi-country governance arrangements beginning in the 1970s. These arrangements monitor the hydrology systems and foster cooperation for shared water resources, which cover 41.8% of Senegal's national territory. Indeed, Senegal boasts one of the highest numbers of basin management agreements: 11 in total. These arrangements and conventions oversee the development of shared infrastructure projects, their legal status, and financing arrangements (Bolognesi et al, 2015; Poncin et al, 2024). For example, L'Organisation pour la mise en valeur du fleuve Sénégal (OMVS) oversees the Senegal river and relevant projects shared with Mali and Mauritania. L'Organisation pour la Mise en Valeur du Fleuve Gambie (OMVG) manages three water basins: the Gambia, Kayanga-Geba and Koliba-Corubal basins.

Major joint initiatives include the construction of dams and hydro-energy infrastructure, such as the Diama, Manantali, and Félou dams. For instance, the Diama Dam Management and Operation Company (SOGED) generates revenue through water withdrawal fees, with annual contributions from member states. Similarly, the Energy Management Company of Manantali (SOGEM) operates with representatives from shareholder states, including Mali, Mauritania and Senegal. The Félou dam was updated in 2006, and the Félou Hydroelectric Plant produces power for these three countries.

Additional, smaller projects include building dams and the strengthening of embankments. These shared projects are managed by OMVS and OMVG in collaboration with public energy companies and local stakeholders, including farmers and mining operations. This management design reflects a multi-sectoral and multi-territorial approach to water use, aligning with national adaptation planning. Other stakeholders involved in managing water uses include the Senegal River Delta Land Development and Exploitation Company (SAED), the Senegalese Agricultural and Industrial Development Company (SODAGRI), and local authorities. The design of projects involves ecosystem and socio-economic analyses that map villages and communities affected by water development projects, and examine cultural practices, mobility issues, local governance, and local food production systems (farming and livestock).

The interdependence of water resources with energy production, agriculture, and fisheries highlights the importance of water policies in supporting socio-economic development and climate adaptation. Since 2007, integrated management policies have focused on regional cooperation and cross-sector engagement. With support from the World Bank and from various projects funded by AFD, basin organizations have financed projects that expanded irrigation and improved access to potable water.

Most recently, the OMVG has designed a master plan to enhance regional knowledge and water allocation with acute attention to building resilience to climate change (Poncin et al., 2023). The plan was supported by the Blue Peace Financing Initiative, which was developed in partnership between the Swiss Agency for Development and Cooperation and the UN Capital Development Fund. The initiative aims to create new financing instruments and enabling environments for cross-border cooperation on water management (UNCDF, 2023)

The regional approach to water governance incorporates transboundary climate risks; by contrast, climate adaptation remains largely confined to national borders, with transboundary climate risks unaddressed. Thus, the lessons from the governance of water resources offer insights that can help in understanding potential pathways for transboundary climate risks that arise from other shared, natural systems across sectors in the region.

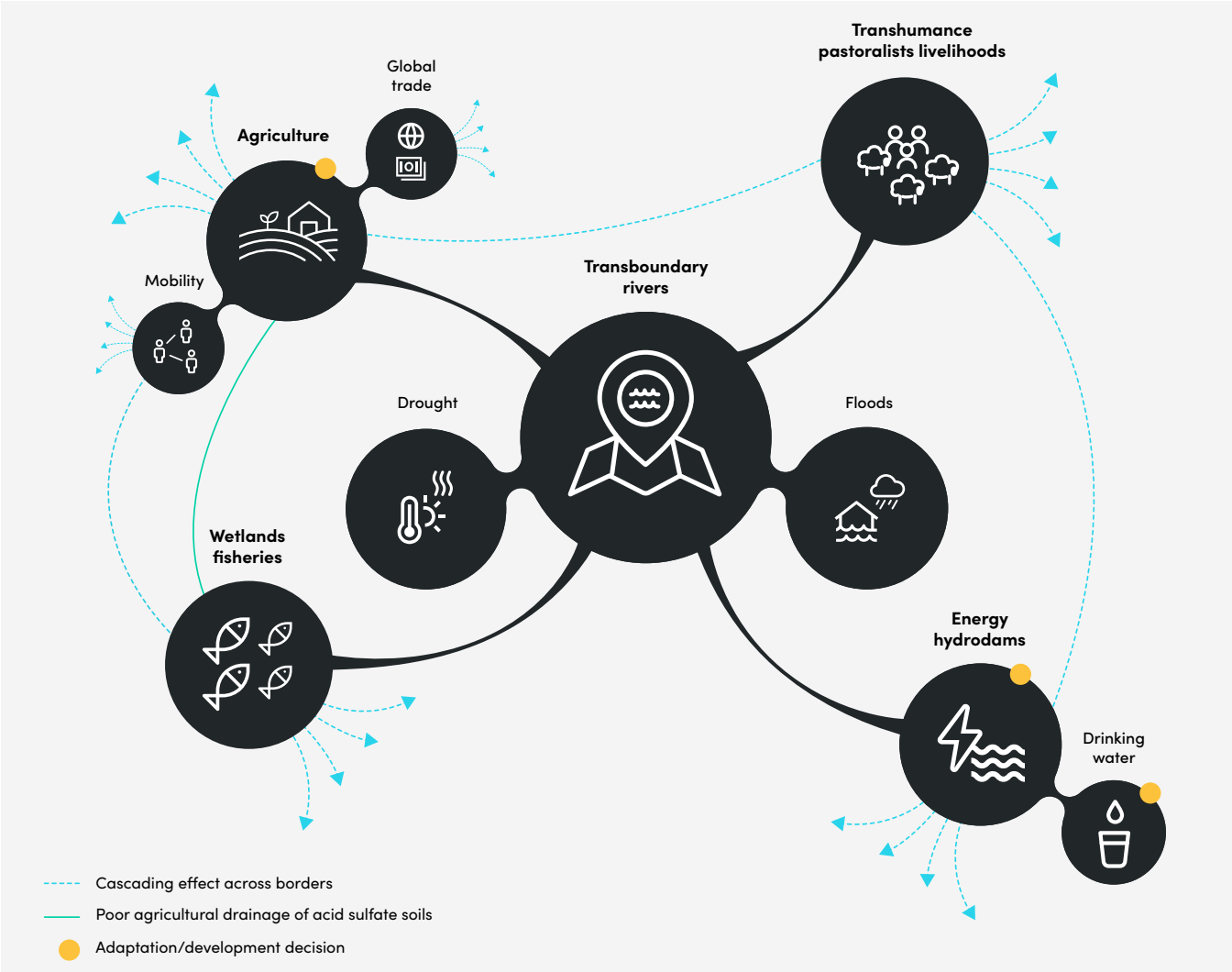
Figure 1 illustrates the cross-border and cascading risk pathways for Senegal stemming from shared rivers. It maps direct climate, adaptation, and socio-economic development policies along transboundary waters.

Shared energy systems

There are promising opportunities for a collective energy future in the region.

- **Hydropower:** Hydropower generated from transboundary rivers not only contributes to climate change mitigation but also plays a crucial role in adaptation by ensuring reliable energy access for urban centres and expanding electricity supply to rural areas. Shared water resources and jointly financed infrastructure projects have already been undertaken, led by the OMVG and the OMVS in partnership with public energy companies. Going forward, efforts to enhance the resilience of critical infrastructure to climate risks will require significant financial resources and strong, continued collaboration between river basin organizations and energy

Figure 1. Cross-border, cascading risk pathways from shared rivers for Senegal from shared rivers



companies, especially concerning financial flows and potential debt incurred from international donors.

- **Solar power:** As a just energy transition becomes more prominent in the climate future of Senegal, solar power is emerging as a complementary renewable energy source. Developing these solar initiatives through a regional effort (such as in northern Senegal with Mauritania) could feed into shared energy grids and back-up sources. In this case, planning efforts will need to include the cross-border flow of sandstorms because desertification is a greater concern in Senegal, where it affects air quality and health. Another issue that must be addressed in planning is the risk of sand storms interfering with solar panels.

Interconnections with drylands and mobility pathways

Transboundary waterways intersect with vital mobility pathways, facilitating the cross-border movement of livestock and supporting the traditional livelihoods of pastoralists. Unpredictable rainfall patterns, rising temperatures, and intensified evaporation are affecting soil conditions. When combined with water infrastructure (such as dams, water towers, generators and treatment plants), this can alter land distribution and water accessibility.

The nomadic movements of pastoralists in search of grazing areas and water resources are integral to the socio-ecological assessments conducted by OMVS and OMVG. For example, OMVS integrates mobility corridors in the planning of major development projects. Adaptation planning that bridges water management and drylands must consider these transboundary nature of these livelihoods, especially as mobility is a key dimension of the climate resilience of pastoralism in allowing grazing areas to regenerate. At the same time, climate risks can influence mobility pathways, which may also be affected by other, potentially competing decisions that affect activities in indirect ways. This can occur, for example, when lands are designated as protected areas for biodiversity.

Legal and administrative instruments overseeing borders and the status of various forms of mobility are also critical to consider for adaptation planning in transboundary water governance. This is because of the cascading effects on mobility. Climate change risks are expected to interact increasingly with vulnerability drivers, altering routes used by pastoralists, for example. At the same time, regional and African Union policies on pastoral mobility, and mobility more broadly, can influence patterns and accessibility (Opitz-Stapleton et al., 2023). Extreme climate events add to the complexity of other mobility issues. Planners must consider involuntary displacement and immobility that may arise in the case

"Transboundary waterways intersect with vital mobility pathways, facilitating the cross-border movement of livestock and supporting the traditional livelihoods of pastoralists."

of events such as prolonged drought, major regional flooding, sandstorms, salinization of agricultural lands, and intensive deforestation).

Agricultural and farming spaces

Transboundary climate risks along shared water resources are closely linked to shifting agrarian landscapes and local food production systems. Rural smallholder farmers face significant adaptation challenges amid pressures from climate change compounded by larger agro-industrial projects in Senegal and regionally.

National priorities to enhance food sovereignty, such as reinforcing domestic rice production, must account for these climate hazards and agricultural-economic policy dynamics at both domestic and regional levels. Effective planning of transboundary river basins for irrigated agricultural areas – especially in regions where deltas have been transformed into rice production zones – should carefully consider potential cascading effects on water use and accessibility, and, more broadly, on local livelihoods of farmers, pastoralists and gatherers.

Some initiatives aimed at expanding rice cultivation have had unintended consequences on other livelihoods, particularly for livestock farmers already vulnerable to climate risks. In areas such as the Fanaye, Ndiael, and Nayré Reserves, farmers have been forced to move their cattle farther from their villages due to changing water resources. This has disrupted local food supplies, leading the availability of local meat and milk to fall and prices to rise (Gmur et al., 2021).

Moreover, large-scale water and agricultural projects face challenges related to complex land use and ownership, both formal and informal. While regional water authorities have implemented relocation policies in some cases, it is crucial to adopt a just approach that ensures land tenure rights – even informally. Such projects must provide adequate compensation and address non-economic factors, such as cultural ties to the land, traditions, and community networks. Without this, there is a risk of dispossession and forced cross-border migration, as seen with women crossing into Mauritania from Senegal in pursuing traditional food gathering. Developing shared water resources to expand irrigated areas

> "Effective cross-border coordination, driven by community-level management of shared water resources and the integration of local food systems, is central towards promoting regional food security."

presents opportunities for adaptive practices in agriculture that consider ecological impacts. Efforts to adapt to local biophysical and soil conditions can particularly benefit traditional crops, such as millet and sorghum, and family gardens that cultivate fruits and vegetables. So far, cross-border water governance strives to incorporate these practices into broader irrigation and rice cultivation frameworks as part of building shared sustainability. Indeed, effective cross-border coordination, driven by community-level management of shared water resources and the integration of local food systems, is central towards promoting regional food security and synergies between local production and regional trade.

Coastal zones and fisheries

Climate-related coastal risks, including sea-level rise, flooding, and salinization of estuaries, compound with impacts of upstream activities that can cross borders, such as adaptation and mitigation projects. For example, increased agricultural runoff and dam infrastructure, have significantly altered the ecology of downstream coastal areas.

The National Adaptation Plan for the Fisheries and Aquaculture Sector to Climate Change, Horizon 2030 emphasizes the downstream effects of river management on coastal habitats (Ministère des Pêches, des Infrastructures Maritimes et Portuaires, 2024). The plan highlights adaptation initiatives aimed at mitigating acidification, by addressing inadequate agricultural drainage in acid sulfate soils along transboundary rivers, including the Senegal River delta and lower Casamance valley, which have been leading to vegetation issues and cascading effects on aquaculture and fisheries. These downstream dynamics are critical to address in coastal adaptation planning, along with the coordination of risk reduction measures along shared coastal areas.

Along coastal zones, communities face multiple climate related risks and challenges around shared resources. Fishing communities between Senegal and Mauritania have faced conflicts over flooding, erosion and access to fishing waters. In 2020 an agreement was signed to foster better cooperation on rights to fishing. (International fishing is also a subject considered in the following section on teleconnected climate risks.)

Teleconnected climate risks from across the globe

Senegal's economy heavily depends on international trade. A wide variety of imports from across the world supplies much of the energy, food, machinery and materials needed to support development. A narrower set of exports, mostly to West African neighbours and larger economies further afield, provides vital income and jobs. These trade links will be subject to the impacts of climate change, both at home and abroad, creating a dimension of climate risk that is often ignored in adaptation planning.

Imported climate risks

Senegal imports more than $16 billion worth of products annually from across the world. The highest value imports include energy (refined and crude petroleum), a range of chemicals, metals, machinery, vehicles, clothing and food (Observatory of Economic Complexity, 2022). The sources of these products are equally diverse, with over a third coming from emerging economies such as China, India, Indonesia, Turkey, the United Arab Emirates, Russia and others, mostly in Asia. The European Union is a key trade partner, particularly France, but also Belgium, Spain, the Netherlands and others. Major African economies such as Nigeria, South Africa and Morocco supply a smaller proportion of Senegal's imports. Economies in the Americas, including the US, Brazil and Argentina, also contribute to total imports.

Climate change impacts on the production of these imported goods will affect their availability and price, creating risks for Senegalese importers and consumers. Climate change impacts throughout supply chains, including on inland and port infrastructure hubs that funnel global trade, will disrupt international trade.

Exported climate risks

Senegal's own exports are concentrated on fewer products, with less diverse links. And yet, these trade links create important interdependencies for Senegal.

As a coastal country with busy ports, Senegal re-exports some of what it imports. These re-exported goods go to neighbouring countries, some of whom are landlocked. Countries that heavily depend on re-exports via Senegal include Mali, Guinea, Gambia and Côte d'Ivoire.

The value of trade is highest with a small number of economies and tends to be focused on key products. For example, 66% of gold exports go to Switzerland. Almost all of Senegal's phosphorous goes to India. Some 92% of its groundnuts go to China. And 86% of refined petroleum and most rice exports go to Mali.[1] Overall, most of Senegal's exports are raw or only partially processed materials or commodities, such as fish, agricultural commodities and mined minerals.

If climate change disrupts the availability or production of these exports, it will also disrupt the income that Senegal can generate from their sale. Such disruptions can stem from gradual changes to agricultural production or mining operations, or from extreme weather events that upend or destroy stock and supply chains.

Risk-resilience relationships

In some cases, Senegal imports from and exports to the same country. This creates a dynamic interdependence. To a greater or lesser degree, both countries rely on each other to adapt well to the impacts of climate change to maintain stable and predictable trade flows. In this way, trade ties can transmit both risk and resilience. For example, risks can be transmitted when exports are disrupted by climate impacts, and resilience can be transmitted when adaptation by the exporter maintains the trade flow, providing the importer with a reliable source of a product that it needs or wants, possibly even to help with its own adaptation.

Trade relationships are rarely balanced, however. One partner usually dominates. A clear case would be

1 Rice exports to Mali are largely re-exports of rice that has entered Senegal from Asia.

Senegal's relationship with China. China's exports to Senegal are worth 10 times China's imports from Senegal. Its exports are valued at $376 million, representing a range of goods, from iron products to vehicles, machinery, cotton, footwear and furniture; by contrast, imports are valued at $36.7 million, exclusively from mined minerals, groundnut products and fish (Centre of Prospective Studies and International Information, 2024). Thus, the risk-resilience relationship between Senegal and China is real, but lopsided.

When looking at teleconnected climate risks, it is useful to consider the risk-resilience relationships that are created by trade interdependence, and not merely at one-way trade flows.

Rice: southeast Asia

Background

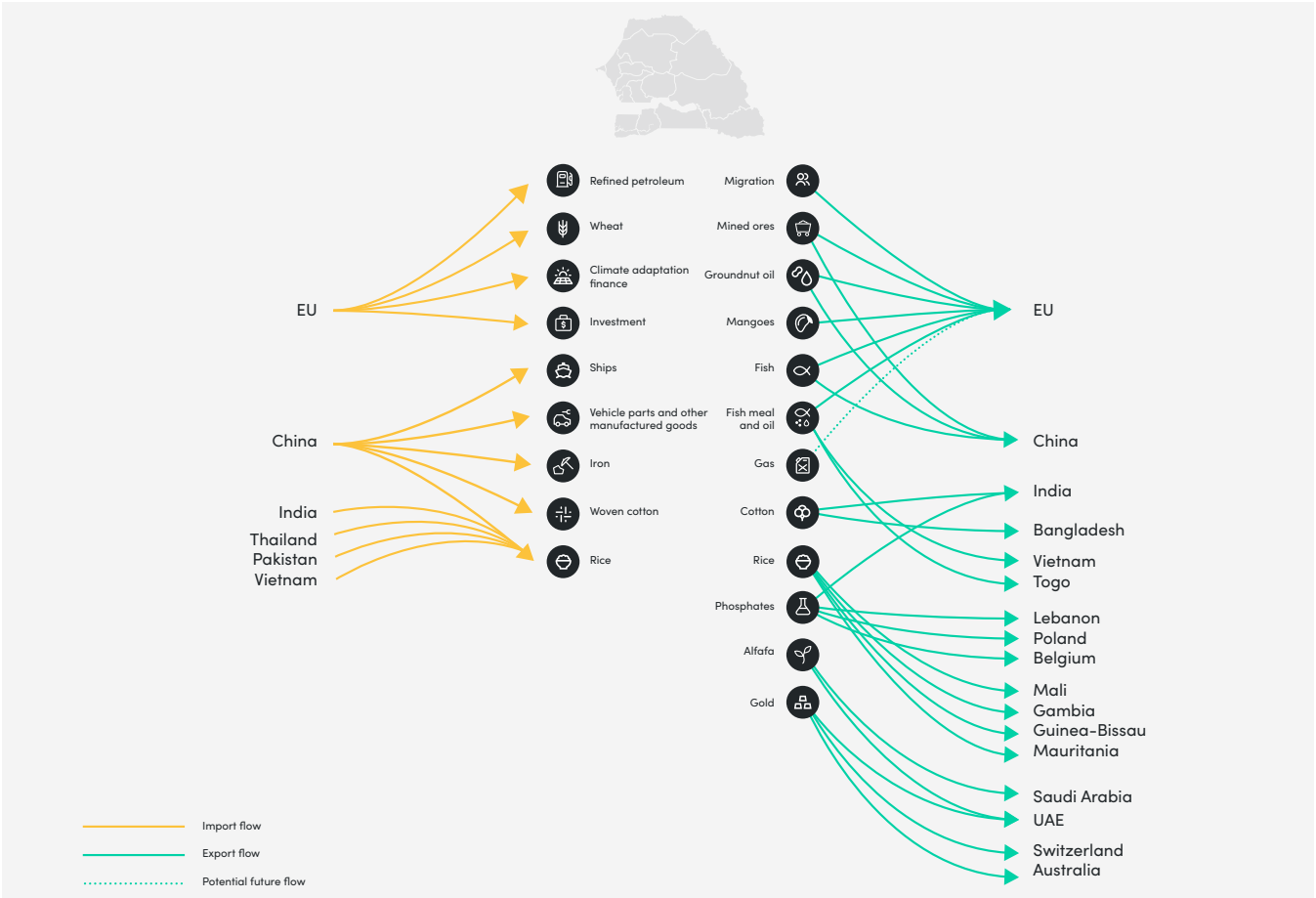
Perhaps Senegal's most critical import is rice. Food security in Senegal depends on affordable, imported rice. This dependence is the outcome of colonization and post-colonial policies that incentivized specialization in export crops, such as groundnuts, over staples like rice. This leaves Senegal exposed to volatile international rice markets, which periodically face crises. such crises arise when poor harvests in key producing countries trigger government restrictions on exports and panic buying; in turn, politicians from Asia to Africa face the wrath of the population when staple food prices rocket (Benzie & John, 2015).

Senegal currently imports rice from India and Thailand. In some years, Viet Nam, Brazil, Pakistan and China also export to Senegal. In response to the government's desire to rely less on risky global markets, domestic production has increased. However, population growth and urbanization mean that imports are still crucial.

Climate change threatens to trigger increasing and more intense, global rice shocks. Such threats include droughts, extreme weather and saline intrusion into rice paddies in key producing regions of southeast Asia. Price crises are likely as governments "adapt" by protecting domestic markets at the expense of global stability (Sekhar, 2018). Senegal is therefore becoming more exposed to teleconnected climate risks via the global rice market.

The adaptation challenge for Senegal has many components. Increasing domestic rice production up to a

Figure 2. Key import and export flows connecting Senegal and other countries worldwide



Source: authors, based on OEC trade data.

maximum resilient and sustainable level makes sense. But extending beyond this level would expose domestic production to ever higher levels of direct climate risk, particularly if rain-fed rice production displaces other food crops, diverting scarce rainwater resources towards thirsty rice. A resilient domestic food system would also include diverse crops like sorghum, millet and fresh vegetables, which are not only essential for nutrition security, but also good hedges against rice price fluctuations (Benzie & John, 2015). Calculating the optimum mix and balance of domestic crops and imports for Senegal's climate resilience requires further study and analysis.

Actions

Continued, focused support is needed to develop and market the domestic rice value chain in Senegal. Such support should be considered an open and shut case of "climate change adaptation", eligible for adaptation financing (given its direct role in reducing vulnerability to transboundary climate risk).

Senegal could more aggressively call for cooperation in the governance of international commodity markets to protect against future global market crises. For example, Senegal could call for adherence to existing World Trade Organization rules on export restrictions. Senegal could also seek to convene new coalitions of similarly exposed import-dependent countries in such efforts. Such coalitions could include small, higher-income, import-dependent countries that face similar risks in Europe and the Middle East and thus merge North-South (or Annex I and non-Annex I Parties under the UNFCCC) interests.

Senegal's development partners could do much more to remove the current incoherence in their negotiation positions vis-à-vis climate change adaptation and agricultural trade, where it is hard to escape the conclusion that many rich countries are giving with one hand – for example, by providing adaptation finance for projects – while taking with the other – for example, by maintaining international agricultural trade rules that disadvantage import-dependent countries; such rules can preventing countries like Senegal from taking steps to protect their nascent, domestic agriculture sectors in an effort to overcome dangerous levels of import-dependence.

Senegal should consider co-creating and co-leading an international coalition on rice resilience with other import-dependent countries and producing countries. This would differ from existing knowledge-based international partnerships (such as the International Rice Research Institute, or the Consortium of International Agricultural Research Centers (CGIAR)) and other rice initiatives (such as the Sustainable Rice Platform). Instead, such a coalition would focus explicitly on building political moment to reduce rice price volatility. Such an initiative might benefit from joint leadership. For example, Senegal, a low-income rice import-dependent country, could lead with a higher-income rice, import-dependent country,

"Senegal's development partners could do much more to remove the current incoherence in their negotiation positions vis-à-vis climate change adaptation and agricultural trade, where it is hard to escape the conclusion that many rich countries are giving with one hand while taking with the other."

such as Singapore or the United Arab Emirates, or with a middle-income country, such as the Philippines. Co-leadership like this would help to position the coalition beyond the "us versus them" dynamic that characterizes negotiations on adaptation under the UNFCCC; it would help reveal the shared interests that import-dependent countries have in maintaining stable, predictable flows of climate-resilient rice on global markets. The coalition could seek international agreements that stabilize prices during small supply shocks, thus preventing price crises. At the World Trade Organization, discussions on these matters appear to be stuck; under the UNFCCC, such discussions have not been held. Thus, a coalition of this type would be novel and could be influential. Eventually such a coalition could appeal for international adaptation finance to be invested in measures that support stability in global rice markets, in cooperation with both producing countries and other importing countries.

Fish, migration and fruit: the European Union

Background

Senegal and the European Union (EU) are intertwined in ways that are already impacted by climate change. Fish stocks in European waters have declined, driven by climate change and over-fishing. As a result, EU fleets travel from Spain, Portugal and France to Senegalese waters to extract 10,000 tonnes of tuna, hake and other species each year, under the Sustainable Fisheries Partnership Agreement. The direct catch by European boats is not the only way in which Senegalese fish end up on Europeans' plates. Smaller species that used to be caught and consumed locally are now processed and exported as fish meal and fish oil (Coalition for Fair Fisheries Agreement, 2024). Fish meal is increasingly used as a protein feed for farmed chicken, pork and salmon produced and consumed in Europe (as well as other countries).

> "Much criticism has been levied towards the unsustainable, foreign extraction of Senegal's fish stocks by European and other fleets."

Much criticism has been levied towards the unsustainable, foreign extraction of Senegal's fish stocks by European and other fleets (including those from Turkey and China) (Fatshimetrie, 2024). Artisanal fishing is a key industry in Senegal, employing around 16% of the population. Fish contributes more than 40% of animal protein to the average diet in Senegal, making it key to nutrition security across the whole country. But, in recent years, artisanal catches have been dropping, putting pressure on nutrition security nationwide, and on employment and income in fishing communities. Foreign exploitation is blamed for collapsing stocks, though local over-fishing may also play a role; data are sparse and contested (Belhabib et al., 2014). Climate change is driving fish stocks to gradually migrate north along the West African coast, adding to the pressures on local artisanal fishing communities (NOA Africa, 2022).

Foreign over-fishing drives international migration (Chen-Zion, 2022; Uwazuruike, 2023). Pushed by the lack of income from fishing, many young men embark on dangerous land and sea crossings, sometimes on boats previously used for fishing; they head to Europe in search of jobs and incomes to feed their families (Sarr, 2024). In this way, many see a direct link between the EU's exploitation of Senegal's offshore fish stocks and Senegal-EU migration (Gauriat, 2022).

According to this view, there is a hypocrisy, or at least a stark incoherence, between two EU policy stances: one to receive flows of fish and fish meal from Senegal, and the other to oppose or reject migrants into Europe whose journeys may have been partly brought about by the exploitation of fish stocks in sender countries. One expert put it this way: "Want to stop forced migration from West Africa? Start by banning bottom trawling" (Chen-Zion, 2023). In November 2024, the European Commission decided not to extend the controversial partnership agreement, but the future of the EU's fishing interests in Senegal remains uncertain.

Actions

One way to prevent the multidimensional challenges associated with forced, poorly governed migration is to create resilient job opportunities for young people in Senegal. Employment in fruit and vegetable production in rural areas represent one such example. Fruits such as mangoes and melons are relatively high-value export crops, and their production has increased in recent years to satisfy growing demand from European consumers. Senegal's national strategy (Plan Sénégal Émergent[2]) and the newer Vision 2050[3] emphasize the role of horticulture – particularly fruit production – as a core element for achieving transformational change, including jobs and economic restructuring.

Mangoes are currently grown in several areas: the Casamance region, Niayes, Sine-Saloum and Mbour (Elhadji et al., 2019) with seasonality that complements the European market and relatively close proximity (compared to other producers in Latin America, for example). This puts mango production in a good position to expand in Senegal. Because the mango supply chain involves fresh, perishable produce, it needs to operate reliably, rapidly and efficiently so that Senegalese producers and traders can convert more of the 100,000 to 150,000 tonnes of mangoes produced annually into profitable sales (GIZ, 2021).

As the climate changes, investment is needed throughout the value chain to build resilience. Efforts are needed on a wide array of fronts: to provide production advise, collect production data, solve equipment issues, address transport and storage concerns, improve marketing efforts, and expand processing into a wider range of products, such as juice and dried fruit, to diversify and decrease sensitivity of farmers and traders to seasonal prices.

In a similar way, the melons produced in Senegal perfectly fills a supply gap for the European market between the Latin American and Spanish seasons, creating a growth opportunity for producers in Casamance and irrigated areas in the north.

All horticultural and agricultural production is sensitive to climate change, meaning that mango and melon producers will need to proactively adapt. Adaptation in the mango and melon value chains can support job creation and the resilience of livelihoods; it can also reduce pressures on international and rural-to-urban migration. Opportunities exist for donors and private finance to support more and better adaptation in these value chains in ways that will benefit people in Senegal, as well as traders and consumers in Europe.

The interconnected flows of fruit, fish and people are complex. They create a risk-resilience relationship between Senegal and the EU that is lopsided; the EU benefits from extraction of Senegal's resources, largely without taking into account the potential ramifications for migration from Senegal. However, these interconnected flows presents an opportunity to explore the benefits of more strategic coherence in EU policies with Senegal. Senegal can and should raise these issues in bilateral forums and discussions. Senegal should initiate a strategic dialogue with the EU on shared resilience and strategic policy coherence. Such a dialogue should address the

2 https://www.senegal-emergent.com/

3 https://vision2050.sn/

relationships between key policy agendas: EU fishing policy; EU migration policy; EU-Senegal trade policy, including oil and gas exports from Senegal; and the EU's adaptation support to Senegal.

Groundnuts: China

Background

Originally introduced to West Africa from Brazil by Portuguese colonialists, groundnuts have been at the centre of Senegalese agriculture for around 200 years. Groundnuts grow well on the warm, arid plains across the centre of the country in Kaffrine, Kaolack, Fatick, and in the south in Kolda. The history of Senegal and groundnuts is intertwined with colonialism and exploitation (Lewis, 2022). Groundnuts were once exported as a lubricant for British trains and as an ingredient for the French soap industry; now more than 90% of Senegal's groundnut crop is exported to China for food use each year. Production has increased steadily, with annual production of more than 1.5 million tonnes per year (USDA, 2024), valued at an estimated $285 million, making Senegal the second largest groundnut exporter in Africa (Cissé, 2023).

Chinese traders prefer to buy raw whole nuts en masse, and are willing to outbid locals; this has led to the collapse of the Senegalese domestic groundnut oil and meal processing industry, costing associated jobs. Low-income households in Senegal depend to a great degree on the groundnut sector; half of all households in extreme poverty grow groundnuts (World Bank, 2017). As such, Senegal depends to an outsized extent on one trade partner, and it is unable to leverage the economic potential of industries that process and add value to products produced from its lands.

Climate change threatens groundnut production by increasing drought and rainfall variability. The groundnut basin in Senegal relies on rain-fed agriculture. Export revenues and livelihoods are therefore at risk without effective adaptation support.

Although Senegal is major groundnut supplier for China, it holds little leverage or direct influence over Chinese policy. Groundnuts dominate the trading relationship, with mined minerals and fish making up the rest of Senegal's exports to China. China is a major investor in Senegalese infrastructure, Senegal being the first African country to sign agreements on China's Belt and Road Initiative. This raises the question of whether such a low level of trade interdependence can be used to leverage support for adaptation among groundnut farmers.

Actions

The resilience of Senegal's groundnut supply to China could be used as a focus area for future Sino-Senegalese dialogue. Senegal could establish a groundnut climate resilience initiative, involving actors from both countries. Such an initiative could advocate for efforts to build water supply infrastructure for irrigation, boost processing facilities, organize related scientific exchanges, and provide financial support for adaptation at the farm level.

Alfalfa: maladaptation

Background

Alfalfa is a water-intensive crop used as a high-protein feed for livestock (dairy and beef cattle). It is usually irrigated. Alfalfa is grown extensively in the US, for example in the Colorado River valley, which is the source of water for more than 40 million people. During the recent mega-drought in that area, the use of scarce water resources for alfalfa production generated controversy (Fu, 2022).

Long-term climate projections highlight the unsustainability of such water-intensive farming practices, particularly in regions in which water resources are under stress. For example, in 2018, faced with dwindling groundwater reserves, Saudi Arabia banned the production of green fodder – deciding to rely instead on important crops to feed dairy herds.

In 2021, African Agriculture Holdings Inc., was established as a US-based company that aims to develop commercial farming in Africa and to produce and sell alfalfa for animal feed in Africa. Its business plan set out to secure access to cheap water resources in West African to produce animal feed on 2.9 million hectares of land, and to then export it to countries like Saudi Arabia (Securities and Exchange Commission, 2023).

With a project on 25,000 hectares of the Ndiaël nature reserve that had been granted by Presidential Decree in 2012, the company began using irrigation water to produce alfalfa (Waldman et al., 2023; Collective for the defence of Ndiael lands et al., 2024). The irrigation is drawn from Lake Guiers, the only freshwater reserve in Senegal and the source of drinking water for the capital city, Dakar. The alfalfa farm is surrounded by barbed wire despite being located inside the Ndiaël nature reserve, which is traditional pastureland. Until 2012 it was shared by local herders, who have been fighting to regain access, their movements restricted by the farm's perimeter.

The foreign investment by African Agriculture Holdings to use irrigation water and pastureland to produce water-intensive crops for export to rich countries represents at least three dimensions of maladaptation. These are evidenced by the following: 1) Impacts on pastoralists. Such practices affect pastoralists whose land has been controversially seized, driving a cascade of impacts on livelihoods and social stability in affected communities and across the borders where pastoralists migrate. 2) Inefficient use of irrigation. Irrigation could be more effective applied to a diverse range of horticulture crops

for the domestic market in Senegal. For example, irrigation could be used to help hedge against price shocks on international rice markets, or to provide more extensive employment opportunities and create additional value by expanding export markets for alternative, less thirsty agricultural products, such as melons. 3) Implications for water security. Extensive extraction of water could negatively impact the water security of the rapidly expanding urban population in Dakar. The city is already struggling to adapt to the worsening effect of drought on an intermittent, expensive and unsafe drinking water system (Waldman et al., 2023; Grain, 2024).

As this example illustrates, climate risks can be redistributed across borders, or exacerbated by actions taken to adapt somewhere else; links between countries can be exploited, creating negative dependencies, that leave one country worse off than it would have been without the link. This is one form of transboundary maladaptation.

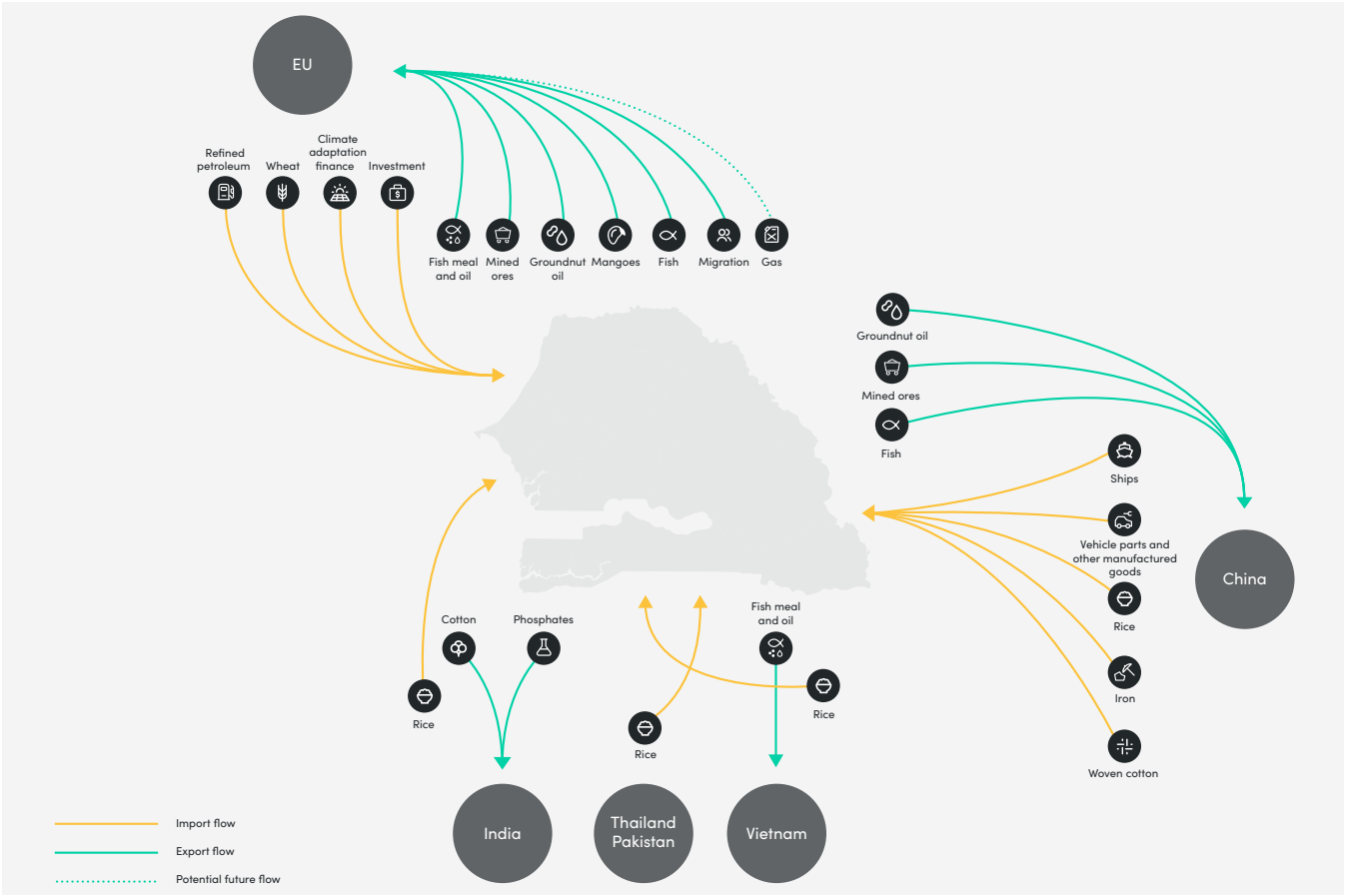
Actions

Senegalese stakeholders could highlight the effects of transboundary maladaptation by other actors. Furthermore, government officials should feel justified in raising such concerns within the context of international forums on adaptation. For various bureaucratic, procedural and political reasons, the UNFCCC negotiations rarely if ever touch on specific, contentious issues around maladaptation. Exploitative maladaptation, as exemplified by foreign investments in alfalfa production for export, or even overfishing by foreign fleets, largely remains an elephant in the negotiating rooms of UN conferences on climate change. Yet the reality of the adaptation challenge cannot be grasped without acknowledging how cross-border exploitation undermines the implementation of national adaptation plans and exacerbates climate risks.

The issue is not isolated to a foreign firm's experiment with growing alfalfa; similar dynamics occur in other sectors. For example, Senegal generates significant income from the export of various mined minerals, which in some cases also require significant water inputs for processing. Senegal also produces cotton, another water-intensive crop. Even efforts to adapt to Senegal's over-dependence on imported rice by boosting domestic production in effect prioritizes the use of irrigated water for rice farming.

Strategic decisions to prioritize the use of scarce resources, such as water, should become central elements in Senegal's National Adaptation Plan and related assessments and documents.

Figure 3. Key flows of teleconnected risks between Senegal and the EU, China and southeast Asia



Source: authors, based on OEC trade data

Summary

This report introduces the topic of transboundary climate risks and highlights recent related developments at the global level and in Africa. The report offers background information and suggestions for actions on key issues. These are intended to help Senegal and the wider region better understand and adapt to such risks. The report analyses the implications of two key issues for Senegal:

1. **Regional risks from shared water resources.** The report examines the impacts of climate change on the shared water resources of the region, and outlines the resulting adaptation challenges facing energy, wetlands, agriculture, and pastoralists mobility.
2. **Teleconnected risks – that is, those risks that flow across long geographical distances.** The report examines climate change impacts on key imports and exports between Senegal and the rest of the world. The focus is on inflows of rice and outflows of fish and groundnuts. It identifies a complex of adaptation challenges linked to trade policy and to a broader picture of international agreements, investments, and the governance of migration.

These two types of risk are distinct but not separate. For example, consider local farming. Effective adaptation to the climate impacts on transboundary water resources for domestic fruit and vegetable production may directly help to reduce teleconnected risks. That is, such actions may help ease the risks that stem from Senegal's over-reliance on imported rice. A similar relationship exists between responses to regional dynamics on coastal zones and fisheries. Making beneficial changes at the regional level may help reduce the risks that stem from the teleconnections between Senegal's fishing industry and exports of fish to the EU, China and other markets.

Thus, it is not necessary or helpful to view transboundary climate risks as a new or distinct area of a type of adaptation – or, worse, as a new piece of jargon. The contribution of this this branch of adaptation research into transboundary climate risks is twofold: to extend the scales that are considered when planning local, national and international measures to address climate risks, and to underline the importance of cooperation for adaptation efforts to be effective. If the implications of transboundary climate risks are properly understood, then the value attached to adaptation is likely to increase – along with a willingness to invest in it.

Shared challenges, shared solutions

Three steps Senegal can take at the national level to address transboundary climate risks

Step 1: Formally acknowledge transboundary climate risks

Explicitly recognize transboundary climate risks in Senegal's updated nationally determined contribution (NDC), national adaptation plan (NAP), and other adaptation-related assessments and communications.

Step 2: Designate clear risk ownership of transboundary climate risks in Senegal

Today, there is no clear designation of responsibility for managing transboundary climate risks in Senegal. A central actor should coordinate cross-government responses to transboundary climate risks. This central actor should animate a wider, multistakeholder-shared vision of national resilience, including consideration of trade-offs between sectors and priorities. This position could be in the Ministry of Environment, the Prime Minister's Office (The Primature), or the Presidency's General Secretariat (Secrétariat Général de la Présidence de la République).

In addition, clear responsibility should be assigned to sectoral leads in Senegal's government and civil society. For example, risk ownership can be designated by leveraging existing multi-government river basin organizations to establish a cross-border committee to address water and food matters. The committee can liaise with local communities on water access and coordinate policy across national ministries on food production and trade to promote regional resilience via integration.

Step 3: Integrate transboundary climate risks into negotiations

Transboundary climate risks should be considered when setting national negotiating positions in regional and international forums. In these forums, new or modified positions should be adopted to articulate and pursue Senegal's interests in light of the transboundary nature of climate risks. New or modified positions should be adopted to articulate and pursue shared regional and even international (systemic) interests, via the inclusion of transboundary climate risks. This is particularly relevant in forums such as the UN Framework Convention on Climate Change (UNFCCC), the World Trade Organization (WTO), and multilateral and bilateral treaties and agreements in West Africa and internationally. Currently, Senegal's negotiating positions in these forums do not reflect or leverage the impacts of transboundary climate risks.

Three pathways Senegal can pursue through international cooperation to strengthen its resilience to transboundary climate risks

Pathway 1: Mobilize financial support for science and research on transboundary adaptation

New investments are needed to support research for transboundary adaptation.

Donor-led programs and international climate finance should be mobilized, and private investments enhanced to fund collaboration and data-sharing platforms. This will improve research and assessment of transboundary climate risks and risk-resilience relationships involving Senegal and international partners. Such efforts should focus on teleconnected risks – that is, those climate risks that propagate between geographically remote regions through means such as trade and value chains.

At the regional scale, existing knowledge-sharing platforms, such as early warning systems, should be leveraged to monitor transboundary risks and the effects of adaptation across borders. Examples include regional efforts such as the common food security early warning

mechanisms, operated by the Economic Community of West African States (ECOWAS) and facilitated by the AGRHYMET Regional Centre's drought-monitoring work; , and satellite-based data tools to monitor soil moisture and vegetation access.

Pathway 2: Raise awareness and build capacity related to transboundary climate risks within West Africa's foreign policy community and with development partners

It is important to equip national policymakers interacting with international organizations and development partners with a greater awareness of transboundary climate risks and their relevance to bilateral relationships and international cooperation across a variety of fields beyond a narrow interpretation of climate change.

A variety of approaches could be effective, including regional training and capacity-building programs and exchanges, bespoke training programs for Senegalese policymakers, and international exchanges. All countries are going through a similar learning process on transboundary climate risks at the same time, suggesting that international exchanges between African and non-African countries could be especially effective. Priority topics include the role of transboundary climate risks and adaptation in transboundary water, agriculture and trade networks. Specific briefings could be conducted for trade negotiators and government ministries of economy on the importance of transboundary climate risks for national interests, and coalition building with international partners.

Pathway 3: Build partnerships to shape new forms of international cooperation to address transboundary climate risks

Senegal could play a key role in facilitating regional partners to cooperate on new adaptation governance initiatives and in co-leading new coalitions in international processes to address cross border cascading risks. Development cooperation partners and international organizations could do much more to support such processes. For example, Senegal could seek funding and support to convene workshops and collaboration between regional partners on adaptation. Further, development cooperation could help with the pre-submission phase of a multi-country application to one of the major adaptation funds (i.e., Green Climate Fund or the Adaptation Fund) to address adaptation to transboundary climate risks.

References

Adaptation Without Borders (AWB). (2024). *Transboundary climate risks – An Overview.* AWB Brief. https://adaptationwithoutborders.org/wp-content/uploads/2024/02/transboundary_climate_risks_web-2-1-3.pdf

African Union. (2022). *African Union climate change and resilient development strategy and action plan (2022–2032).* https://au.int/en/documents/20220628/african-union-climate-change-and-resilient-development-strategy-and-action-planAfrican Union+1African Union+1

Agence France-Presse. (2023, November 22). *Overfishing, climate change prompt Senegalese fishermen to migrate*. VOA Africa. https://www.voaafrica.com/a/overfishing-climate-change-prompt-senegalese-fishermen-to-migrate/7363179.html

Anisimov, A., & Magnan, A.K. (eds.) (2023). *The global transboundary climate risk report.* Institute for Sustainable Development and International Relations & Adaptation Without Borders.

Belhabib, D., V. Koutob, A. Sall, V.W.Y. Lam, D. Pauly (2014) Fisheries catch misreporting and its implications: The case of Senegal, Fisheries Research, Vol. 151, pp. 1-11, https://doi.org/10.1016/j.fishres.2013.12.006.

Benzie, M., &John, A. (2015). *Reducing vulnerability to food price shocks in a changing climate.* SEI Discussion Brief. https://www.sei.org/publications/reducing-vulnerability-to-food-price-shocks-in-a-changing-climate/

Bolognesi, T., Bréthaut, C., Sangbana, K., & Tignino, M. (2015). *Note on water governance in the Senegal River Basin (OMVS) and the Niger River Basin (NBA): Historical Analysis and Overview of the Status of Common Facilities and Benefit Sharing Arrangements.* University of Geneva, Geneva Water Hub. https://www.genevawaterhub.org/sites/default/files/atoms/files/gwh_note_on_water_governance_in_omvs_and_abn_final.pdf

Bruckmann, L., Delbart, N., Descroix, L., & Bodian, A. (2021). Recent hydrological evolutions of the Senegal River flood (West Africa). Hydrological Sciences Journal, *67*(3), 385-400. https://doi.org/10.1080/02626667.2021.1998511

Centre of Prospective Studies and International Information (2024) Data on bilateral trade between Senegal and China, BACI HS6 REV. 1992 (1995 - 2022), available at: https://www.cepii.fr/CEPII/en/bdd_modele/bdd_modele_item.asp?id=37

Chen-Zion, N. (2022). Caught in Europe's net: ecological destruction and Senegalese migration to Spain. *Review of African Political Economy, 49*(174), 584–600. https://doi.org/10.1080/03056244.2022.2186599

Chen-Zion, N. (2023, May 31). Want to stop forced migration from West Africa? Start by banning bottom trawling. *EUobserver.* https://euobserver.com/opinion/157090

Cissé, D. (2023). *Senegal: Booming groundnuts export to China poses long-term risks*. German Institute for International and Security Affairs (SWP). Megatrends Spotlight, 27, 25.07.2023. SWP Berlin. https://www.swp-berlin.org/publikation/mta-spotlight-27-senegal-boomender-export-von-erdnuessen-nach-china-1#:~:text=Senegal%20is%20among%20the%20top,was%20only%20topped%20by%20Sudan

Coalition for Fair Fisheries Arrangements (CFFA). (2024). *Senegal's exports of fishmeal and fish oil "explode".* https://www.cffacape.org/news-blog/senegals-exports-of-fishmeal-and-fish-oil-explode

Collective for the defence of Ndiael lands, Global convergence of struggles for land and water - West Africa, GRAIN, & Oakland Institute. (2024). US agribusiness – African Agriculture Holdings – threatens land and water rights in West Africa. *GRAIN.* https://grain.org/en/article/7097-us-agribusiness-african-agriculture-holdings-threatens-land-and-water-rights-in-west-africa

Economic Community of West African States (ECOWAS). (2022). Regional Climate Strategy (RCS) And Action plan (2022-2030). https://disasterdisplacement.org/wp-content/uploads/2022/10/ECOWAS-Regional-Climate-Strategy_FINAL_compressed.pdf

Elhadji, O. D., Saliou, N., Faye, P.D., Balayara, A., Badji, K., & Sembéne, P.M. (2019). New inventory of the diversity and seasonal abundance of Tephritid fruit fly species on mango orchards in Senegal. *Journal of Entomology and Zoology Studies, 7*(6), 975-986.

fatshimetrie. (2024, February 13). The tragedy of European fishing treaties in Senegal: how they affect fishing communities and fuel the migration crisis. *the citizen's blog.* https://eng.fatshimetrie.org/2024/02/13/the-tragedy-of-european-fishing-treaties-in-senegal-how-they-affect-fishing-communities-and-fuel-the-migration-crisis/

Fu, J. (2022, September 12). It's the thirstiest crop in the US south-west. Will the drought put alfalfa farmers out of business? *The Guardian.* https://www.theguardian.com/environment/2022/sep/12/colorado-drought-water-alfalfa-farmers-conservation#:~:text=According%20to%20an%20analysis%20by,of%20almonds%2C%20pistachios%20and%20rice

Gauriat, V. (2022, February 11). "Nothing, there's nothing": Senegal's plummeting fish stocks drive migrant surge to Europe. *Euronews Witness.* https://www.euronews.com/2022/02/11/nothing-there-s-nothing-senegal-s-plummeting-fish-stocks-drive-migrant-surge-to-europe

GIZ. (2021). *Sector brief - Senegal: Mangoes*. https://www.giz.de/en/downloads/SectorBrief_Senegal_Mango.pdf

GIZ, PIK, & BMZ. (2022). *Climate risk profile: Senegal*. AGRICA project. https://www.pik-potsdam.de/en/institute/departments/climate-resilience/projects/project-pages/agrica/crp_senegal_en_20220602

Gmür, D., Felber, S., Owolodun, B., Ollier, C., Camara, L., Beye, A., & Haller, T. (2022). Climate change, vulnerability of food systems and institutional transformations in Senegal. In Bruce, D., & Bruce, A. (Eds.), *Transforming Food Systems: Ethics, Innovation and Responsibility* (pp 40–45). Brill. https://doi.org/10.3920/978-90-8686-939-8_4

Harris, K., Benzie, M., Lager, F., Lindblom, A., McAuley, S., Ababio, K., Mshelia, H. I., Lukorito, C., & Opitz-Stapleton, S. (2023). *A roadmap for African resilience: Addressing transboundary and cascading climate risks*. Adaptation Without Borders. https://adaptationwithoutborders.org/knowledge-base/adaptation-without-borders/a-roadmap-for-african-resilience/weA-DAPT+4SEI+4ODI: Think change+4

Intergovernmental Panel on Climate Change. (2022). *Climate change 2022: Impacts, adaptation, and vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (H.-O. Pörtner, D. C. Roberts, M. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama, Eds.). Cambridge University Press. https://doi.org/10.1017/9781009325844

Lewis, J. (2022). *Slaves for peanuts: A story of conquest, liberation, and a crop that changed history*. The New Press.

Ministère de l'Environnement, de la Protection de la Nature. (2006). *Plan d'action national pour l'adaptation aux changements climatiques*. https://faolex.fao.org/docs/pdf/Sen169374.pdf

Ministère des Pêches, des Infrastructures Maritimes et Portuaires. (2024). *Plan national d'adaptation actualisé du secteur de la pêche et de l'aquaculture face au changement climatique – Horizon 2035*. Projet de Gestion des Ressources Naturelles au Sénégal (SENRM). https://www.senrm.org/index.php/plan-national-dadaptation-actualise-du-secteur-de-la-peche-et-de-laquaculture-face-au-changement-climatique?utm_source=chatgpt.com

Niasse, M. (2004). *Climate-induced water conflict risks in West Africa: Recognizing and coping with increasing climate impacts on shared watercourses*. Paper presented at the Human Security and Climate Change International Workshop, Asker, Norway, 21–23 June 2005. https://www.researchgate.net/publication/237699436_Climate-Induced_Water_Conflict_Risks_in_West_Africa_Recognizing_and_Coping_with_Increasing_Climate_Impacts_on_Shared_Watercourses

Noblet, M., Seck, A., Sadio, A. F. M., Camara, I., & Bah, A. (2018). *État des lieux des connaissances scientifiques sur les changements climatiques pour les secteurs des ressources en eau, de l'agriculture et de la zone côtière*. Projet d'Appui Scientifique aux processus de Plans Nationaux d'Adaptation, Climate Analytics.

Opitz-Stapleton, S., Lindsey, C., & Anisimov, A. (2023). *Policy mechanisms of the African Union and the Regional Economic Communities to manage transboundary climate risks*. Overseas Development Institute. https://adaptationwithoutborders.org/wp-content/uploads/2023/12/awb_wp3_africapolicymechanisms40.pdf

Opitz-Stapleton, S., Cramer, L., Kaba, F., Gichuki, L., Borodyna, O., Crane, T., Diabang, S., Bahadur, S., Diouf, A., & Seck, E. (2021). *Risques transfrontaliers liés au climat et à l'adaptation en Afrique : perceptions en 2021* (SPARC Report). October 2021. https://www.sparc-knowledge.org/sites/default/files/documents/resources/Risques%20transfrontaliers%20li%C3%A9s%20au%20climat%20et%20%C3%A0%20l%E2%80%99adaptation%20en%20Afrique.pdf

Observatory of Economic Complexity (OEC) (2022) Data on Senegalese bilateral trade relationships with other countries, accessed throughout 2022 via https://oec.world/en

Poncin, M., Ogilvie, A., Descroix, L., Chariag, I., & Balique, C. (2024). *How does a master plan contribute to strengthening transboundary water management? A case study in West Africa.* Water International, 1-14. *https://doi.org/10.1080/02508060.2024.2321785*

Republic of Senegal (2020). *Contribution déterminée au niveau national du Sénégal*. https://faolex.fao.org/docs/pdf/sen211288.pdf

Sarr, L. (2024). When fishing boats rush to the Spanish coasts in Senegal. *La Croix International*. https://international.la-croix.com/bakhitastories/when-fishing-boats-rush-to-the-spanish-coasts-in-senegal

Securities and Exchange Commission (SEC). (2023). *African Agriculture Holdings - Prospectus*. https://www.sec.gov/ix?doc=/Archives/edgar/data/0001848898/000101376223007374/fs42023a5_10xcapital.htm

Sekhar, C. S. C. (2018). *Climate change and rice economy in Asia: Implications for trade policy* (62 pp.). FAO. https://openknowledge.fao.org/server/api/core/bitstreams/228de799-d90c-43e1-8b38-a9c9dbf000d9/content

UNCDF. (2023). *Blue Peace Financing Initiative*. https://www.uncdf.org/blue-peace-financing-initiative

UNEP. (2023). Underfinanced. Underprepared. Inadequate investment and planning on climate adaptation leaves world exposed. Adaptation Gap Report. https://www.unep.org/resources/adaptation-gap-report-2023

UNFCCC. (2023). *Decision 2/CMA.5: Global goal on adaptation*. In *Report of the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement on its fifth session, held in Dubai from 30 November to 13 December 2023. Addendum. Part two: Action taken by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement at its fifth session* (FCCC/PA/CMA/2023/16/Add.1). United Nations. https://unfccc.int/documents/637073

USAID. (2021). *Senegal water resources profile*. USAID and Sustainable Water Partnership, Water Resources Profile Series. https://winrock.org/wp-content/uploads/2021/08/Senegal_Country_Profile-Final.pdf

USDA. (2024). *Country summary - Senegal peanut area, yield and production*. https://ipad.fas.usda.gov/countrysummary/Default.aspx?id=SG&crop=Peanut

Uwazuruike, I. (2023). Migration and the right to survival: An empirical study of three fishing communities in Senegal. *Journal of Rural Studies, 99*, 71–78. https://doi.org/10.1016/j.jrurstud.2023.02.007

Waldman, P., Niang, M., & Hoije, K. (2023). A global hunt for water profit risks draining cities dry. *Bloomberg*. https://www.bloomberg.com/features/2023-senegal-wall-street-water/

World Bank. (2017). *Groundnut value chain competitiveness and prospects for development* (Agriculture Global Practice - West Africa (GFA01) Final report). https://documents1.worldbank.org/curated/en/523961498623774515/pdf/Final-report.pdf

World Bank. (2022). *Challenges and recommendations for water security in Senegal at national level and in the Dakar-Mbour-Thiès triangle*. https://documents1.worldbank.org/curated/en/099625003082251396/pdf/P1722330bb79db04d0993305b34176c0341.pdf

World Bank. (2024). *Senegal - Country climate and development report*. World Bank Group. http://documents.worldbank.org/curated/en/099110524131023348

Adaptation Without Borders

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Adaptation Without Borders is a global partnership working to strengthen systemic resilience to the cross-border impacts of climate change. We identify and assess transboundary climate risks, appraise the options to better manage those risks and support policymakers, planners and the private sector to develop climate-resilient and inclusive solutions. We catalyse new alliances and forms of cooperation on adaptation that pave the way towards a more sustainable and resilient world.

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