



AGENCE PANAFRICAINNE DE LA GRANDE MURAILLE VERTE  
PAN-AFRICAN AGENCY OF THE GREAT GREEN WALL  
الوكالة الإفريقية لـلسور الأخضر الكبير



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# ECHOES *of the* GREAT GREEN WALL

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Science, Technology and Innovations in  
support of the implementation of the  
**Great Green Wall**

**Photo cover:** Dr Barkissa Fofana during field data collections on her doctoral plot in Djibo, June 2018, Burkina Faso.

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# Message to Readers

**Contributions of scientific, technological and innovative research to the implementation of the Great Green Wall**

**Dear colleagues, partners and readers at large,** awarm welcome to our revamped Special Edition of Les Echos de la Grande Muraille Verte – Echoes of the Great Green Wall! I hope you will enjoy the new design and format, tailored to offer relevant and engaging content on research that is accelerating the implementation and supporting the objectives of the Great Green Wall (GGW).

I would like to recall that the Great Green Wall for the Sahara and Sahel initiative was launched by the African Union in 2007 as Africa's response to increasing negative effects of droughts on rural development and communities' livelihoods. The Panafrican Agency of GGW was established by the 11 Sahelian countries on 17 June 2010 to coordinate, mobilise resources and monitor progress on its implementation. I took office on xx2021, as the second Executive Secretary, succeeding Prof Abdoulaye DIA.

The PA-GGW is replicated/mirrored at each country level through both the National coordination agencies and the recently established National Coalitions of the GGW to reinforce its institutionalization and leadership/instalment as national priorities. This ambitious, complex, but well-thought programme has come far and has taken long to materialize on the ground. After agreeing on both the harmonized regional and the national strategies for its implementation, which clearly define restoration of degraded lands as the major priority of the initiative, today we have all the necessary elements for scaling up and scaling out. Its main objectives of restoring

100 millions ha of degraded agro-sylvo-pastoral lands, creating 10 million green jobs, improving the livelihoods of communities, and sequestering 250 million tons of carbon by 2030 are within reach. While there is still much work to be done to achieve these targets, it is inspiring and comforting to observe the great contributions of the scientific community towards supporting and accelerating the understanding and consolidation of the catalytic solutions, applied methodologies and technologies required to achieve results at scale.

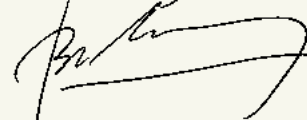
This Special Edition reflects the state of important selected key areas and concrete scientific, technological and innovative contributions to the implementation of the Great Green Wall. I take this opportunity to thank donors and contributors, in particular I acknowledge the tremendous inputs and support of FAO-Action Against Desertification (AAD) and IRD- through the RESET-GGW programmes and the financial contribution of EU-K4GGWA project. I re-affirm that we all stand ready for more collaboration and a successful GGW!

Wishing you a good read and learning, I look forward to your constructive feedback.



Cordially,

**Dr Ibrahim SAID**  
PA-GGW Executive Secretary



## The scientific community, a key accelerator in the Great Green Wall initiative

**T**he Great Green Wall is Africa's response to the climate change adaptation and mitigation and goes hand in hand with all the 17 Goals of the UN Sustainable Development. This collective outcry to meet livelihoods and development demands comes from the rural communities, ministries and institutions in charge of the environment, and sectors benefiting from natural resources. Mankind and rural communities in particular have been using and managing plants and animals, and other natural resources for millennia with care, accumulating knowledge and experience, and giving the necessary time and space to biodiversity to regenerate and flourish. Africa has been an inspiring source of nature-based solutions.

In this Special Edition, ***Les Echos de la Grande Muraille Verte*** gives voice to the science, technology and innovations that are investigated and developed as solutions and understandings to support the effective and efficient implementation of the GGW and the options of scaling up and out successes and achievements. It showcases how the science of complex systems in land restoration can help us understand (and eventually correct) failures in the interventions, which we all have observed and experienced in various parts of projects and programmes, and how we can build on successes.

The FAO's landmark report on Africa Open DEAL sets the panoramic scene and provides a baseline of land use and land use change in Africa and specifically in the GGW areas of interest, vital for understanding where we are and keeping track of where we want to go. Rolling out large scale land restoration in *Action Against Desertification* showcases the principles and major restoration techniques employed to date, with communities at the heart of the entire process, from seeds and restoration to products, market and land productivity. The process includes for example:

- **efficient rainwater harvesting techniques** related to how we prepare the ground for better capturing water and improved soil permeability, which give better chance to plants and seedlings to grow in very limited water conditions of these arid and semi-arid zones.
- **the use of resilient native (woody and grass) species that are selected and preferred by stakeholder communities** through close consultations, which require planting the right species at the right place and time for restoring at large scale for small scale farming.



- **innovative monitoring systems** which combine field data and observations with digital remote sensing from the onset of land preparation to successful growth of biomass.
- **restoring the GGW landscape with plants and people**, with proven benefits for feed and food security, health and good life in rural areas, in addition to the various ecosystem services, all the while keeping track of the early socio-economic benefits reaped by the communities. This includes harvesting a suite of non-timber forest products (NTFPs) such as planted fodder grass for livestock from year one, whilst awaiting long after for gums producing Acacia and/or fruit tree to mature for future subsistence or income generation.


The broader contributions to climate mitigation aspects are critical in the programme, as successful restoration benefits the environment and increases carbon sequestration. Maintaining and improving biodiversity in the GGW areas are of interest and also considered by research findings. The scientific contributions have also helped assess the economic efficiency and return on investment in the Great Green Wall. A specific costs and benefits analysis concludes that for each USD invests in the GGW restoration, the return-on-investment ranges between 1.1 and up to 4 USD. Such statistics should and would encourage the private sector and investors to come to business with the GGW.

Successful interventions and sustainable management practices do exist, but we need to learn from them, and scale them up, roll them out and address the challenges still laying ahead of us. Science and the scientific community are a key player and accelerators in GGW. The promising catalytic solutions now need to be mainstreamed in policy, practice, sectors at local, national, regional and global levels for a greater implementation success.

Lastly, I would like to emphasise that FAO provides support to countries on science-driven innovative practices, approaches, methodologies and tools. Due to its unique position as a specialized agency of the UN and facilitator of inter-governmental processes, FAO is well-positioned to connect technical, development and financial partners, policymakers, producers, scientists and innovators, in all sectors of agrifood systems through a shared global agenda.

**Welcome to the Special Edition on Science, Tehcnology and Innovations in the Great Green Wall.**

Yours sincerely,

 **Dr Moctar SACANDE**  
*FAO's GGW Focal person*



# The scientific community, an essential accelerator of the **Great Green Wall** initiative




The Great Green Wall initiative was designed as an African response to the harmful effects of climate change and for the climate adaptation of Sahelian and Saharan populations. It is a vast development project with the objective of implementing a mosaic of restoration and rehabilitation interventions to combat land degradation in agro-silvo-pastoral systems, and desertification. While initially perceived as narrow in scope and focus on tree plantings, the approach has given way to a paradigm shift in the implementation of land restoration activities. Both the assessment of the 2011-2020 decade and the ten-year priority investment plan 2021-2030 of the Panafrican Agency of the GGW now has as specific objectives to restore 100 million hectares, create 10 million green jobs and sequester 250 million CO<sub>2</sub> by 2030. Building on the recommendations of this plan and these objectives, the 11 environment ministers of the GGW countries have pledged to international partners to strengthen coordination of efforts and financial commitments. The launch of the GGW Accelerator in 2021, during the One Planet Summit, is one of the important responses to this call. In addition to playing a catalytic role for resource mobilization at an unprecedented scale in the history of the GGW, these changes in strategic direction have also enabled to make significant progress in terms of multi-stakeholders mobilization.

**Promoting community-led ecosystem restoration actions on a large scale requires mobilizing existing knowledge in various fields** such as soil biology, political sciences, ecology, agronomy, botany, food security and nutrition, and sociology. The contribution of the scientific community to the successful implementation of GGW actions is needed to generate knowledge guiding the design of interventions and the appropriate monitoring and evaluation tools to monitor practices and their impacts on the well-being of communities and the sustainability of production ecosystems.

In recent decades, scientific interest in different aspects related to combatting land degradation in the Sahel has been growing, yet research results are not always made available to those who need them the most. Moreover, many important issues remain unexplored, yet vital to informing decision making on viable approaches towards land restoration. This new impetus towards a science-inspired approach provides an opportunity to re-mobilize scientific actors and to strengthen the multidisciplinary knowledge base in support of the GGW and its specific objectives. The scientific community should invest in the GGW as a new scientific field but also to provide answers to the multifaceted challenges hampering the achievement of the objectives of the transformative and innovative projects carried out by the GGW national agencies and coalitions.





# Contributions of scientific, technological and innovative research to the implementation of the Great Green Wall

To boost the achievement of GGW objectives, research activities must provide a response to challenges and identify the conditions for success, causes of failure, aspects for consolidation, adoption and transfer of good practices, and propose innovative and catalytic solutions. The 3rd **Residential Seminar of the Panafrican Agency of the Great Green Wall** held in Ouagadougou from 4-8, 2024, aligning with this vision, registered the participation of several national, regional and international technical and research institutions (FAO-AAD, the National Center for Forest Seeds -CNSF of Burkina Faso, the National Center for Scientific and Technical Research -CNRST of Burkina Faso, the Institute of Research for Development - IRD of France, the Institute of Rural Economics - IER of Mali, specialized and technical bodies of the United Nations, and the Permanent Inter-State Committee for Drought Control in the Sahel - CILSS).

The seminar was a landmark opportunity to present a sample of scientific, technical and innovative/catalytic results from different thematic areas in the context of arid and semi-arid zones of the Sahel. These include approaches to large-scale land restoration, ecosystem services, biodiversity and territorial governance.

Here we highlight key research findings directly associated with the GGW implementation activities, developed by research institutions and universities in collaboration with the GGW Panafrican and National Agencies and FAO.

- ➡ **Dr Moctar SACANDE**  
Focal point for GGW, Rome, Italy
- ➡ **Dr Oumarou MALAM ISSA,**  
IRD Reset\_GMV, Paris, France

# Planning large-scale land restoration

## EXPLORE BEFORE YOU RESTORE INTEGRATING COMPLEX SYSTEM THINKING INTO ECOSYSTEM RESTORATION

Ecosystem restoration offers hope for a thriving planet and people. It promises to reverse damage, restore habitats and bring back biodiversity through efforts such as reforestation of degraded lands, improvement of grasslands and landscapes, restoration of mangroves and wetlands and restoration of coral reefs. But why do some restoration projects succeed while others fail? The adoption of concepts from complex systems science (CSS), such as regime shifts and ecological resilience, could provide valuable insights.

Although several science-based guidelines exist to help achieve successful restoration outcomes, significant variations remain in restoration project results. Part of this disparity may be attributed to unexpected responses of ecosystem components to planned interventions. Given the complex nature of ecosystems, we propose that complex systems science concepts related to non-linearity, such as regime shifts, ecological

resilience, and ecological feedbacks, be used to explain this variation in restoration outcomes from an ecological perspective. Given their impact on restoration outcomes by influencing degradation and recovery trajectories, these concepts must be integrated into the typical restoration project cycle through an assessment phase in order to improve results. Indicators and practical methods are available to guide restoration teams to answer the key questions that should be part of such an assessment, including the main scientific and policy tasks that are needed to make the restoration framework operational and before beginning their substantive work.

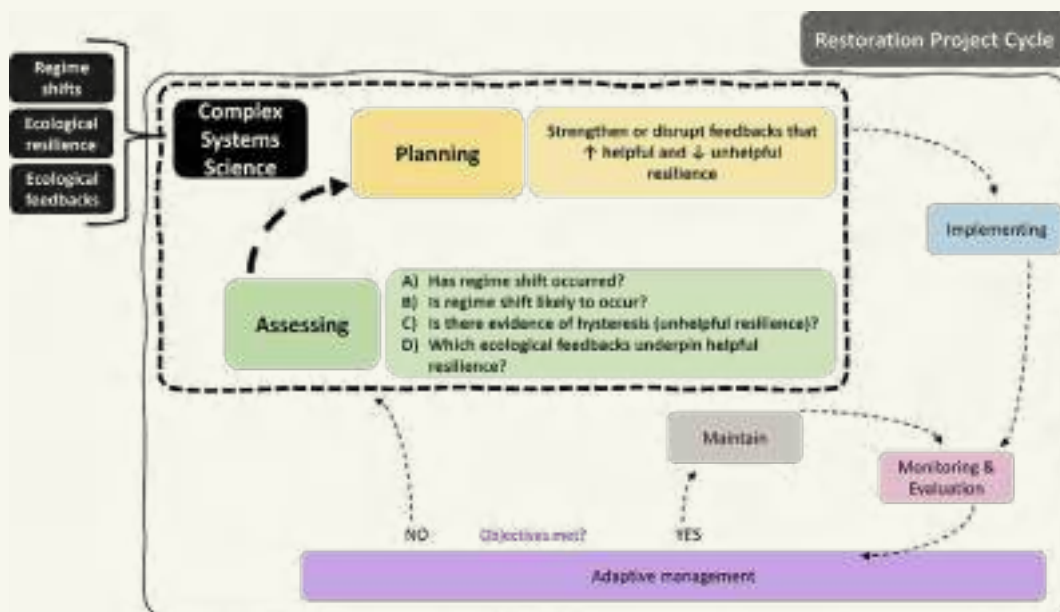
Our “Exploring Before Restoring” framework demonstrates the need to incorporate complex systems thinking into ecosystem restoration, which can significantly improve results, paving the way for better practices and higher success rates! \*

REFERENCE: Journal of Applied Ecology, 2024

CONTACT: Dr Sybryn MAES, University of Louvain and Dr Moctar SACANDE, FAO, Rome, Italy

### RESTORATION PROJECT CYCLE

Different phases identified by scanning 9 ecosystem restoration guidelines from international organizations published in the last decade (2012–2022). Three key elements of Complex Systems Science (top left) should be incorporated into the project cycle to improve restoration outcomes.



## ■ BIOPHYSICAL ASSESSMENTS AND IDENTIFICATION OF THE RESTORATION POTENTIAL

Using digital technology for data collection and analysis, a comprehensive technical report on land use and land use change in Africa and the GGW was produced (Africa Open DEAL & GGW) in collaboration with the PA-GGW, the AU, SADC, and several other partner organizations. It assesses the state of land in Africa, including in the GGW and in each country, highlighting restoration potentials and numbers of trees outside forests. The data shows, for example, that with 50 million hectares, Nigeria is the country with the most cultivated land on the continent and has 402 million trees in non-forest land, with an average of 5,6 trees per hectare. However, with 12 million hectares, Nigeria has the highest proportion (2%) of degraded land in the Sahel region. At national level, the balance between degraded and improved (rehabilitated) land in Nigeria shows a degradation prevalence of 5 million hectares of net loss, which can be compensated through large-scale land restoration in the years to come.

These data provide a baseline and a comprehensive picture of land use and restoration potential in each of the three dryland regions of the continental GGW: the Sahel, North Africa and Southern Africa. They are accessible and usable by member countries, can help in decision-making, support sustainable management and land restoration, result in better allocation of resources, and represent progress in monitoring and communication on the impacts of the GGW and other land restoration initiatives in Africa (e.g. AFR100). Africa Open DEAL data is integrated into the FAO Hand-in-Hand initiative geospatial platform and is accessible to all via EarthMap.org \*

**REFERENCE:** FAO, Africa Open DEAL 2022.

**CONTACT:** Dr Moctar SACANDE, Mr Danilo MOLLICONE and Mr Antonio MARTUCCI, FAO, Rome, Italy

### Titre

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## ■ RESTORATION IN ACTION AGAINST DESERTIFICATION

This manual for large-scale restoration to support rural communities' resilience in Africa's Great Green Wall aims to support a resilience-building approach in the field implementation of land restoration. It supports field activities and socio-economic assessments, drawing on five years of experience acquired through FAO's "Action Against Desertification" (AAD). This practical manual is designed for those involved in the field, partners, non-governmental and community organizations to guide the implementation of large-scale restoration operations, while providing detailed concrete instructions drawn from success stories. The approach consists in combining direct seeding and enrichment planting over large areas, using local woody and herbaceous fodder species, and soil preparation to improve rainwater infiltration and retention. The second part of the manual introduces a methodology for socio-economic assessments, a user-friendly approach based on household and community surveys which can be used by experts to monitor, measure, and assess the socio-economic impacts of large-scale restoration. These household surveys are also used to collect key information from communities and better design land restoration interventions. \*

REFERENCE: FAO, 2020

CONTACT: Dr Moctar SACANDE and Mr Marc PARFONDY, FAO, Rome, Italy



## ■ ECONOMIC EFFICIENCY AND SETTING TARGETS FOR RESTORATION INTERVENTIONS IN THE GREAT GREEN WALL

We assessed the economic costs and benefits of land restoration as part of the GGW initiative. We applied different scenarios that account for both market-priced and non-market benefits from restored ecosystems and consider the heterogeneity of local decision-making contexts in terms of investment planning horizons, discount rates, and the time needed for the restored ecosystems to start yielding their benefits in full. The results show that every US dollar invested into land restoration yields on average US\$1.2 under the base scenario, ranging from US\$1.1 to US\$4.4 across the scenarios. At most, ten years are needed for land restoration activities to break even from the social perspective, accounting for both market-priced and non-market ecosystem benefits. Violent conflicts in the Sahel are estimated to reduce the accessibility to these degraded ecosystems from 27.9 million hectares to 14.1 million hectares. The study highlights activities and locations where land restoration is both economically attractive and ecologically sustainable, even after accounting for lower survival rates of planted trees and grasses, persistence of land degradation drivers and the growing number of violent conflicts hindering land restoration in the Sahel. This information can help improve the targeting of future land restoration activities in the region. \*

REFERENCE: Nature Sustainability 5(1):1-9

CONTACT: Dr Alisher MIRZABAEV, University of Bonn, Germany and Dr Moctar SACANDE, FAO Rome, Italy





# Rolling out large-scale land restoration techniques and approaches

## ■ RESTORING SAHELIAN LANDSCAPES WITH PEOPLE AND PLANTS INSIGHTS FROM LARGE-SCALE INTERVENTIONS

This article on strategic issues in ecosystem restoration presents evidence of successful large-scale restoration interventions combining traditional knowledge and scientific expertise of local plants, to reap effective socio-economic benefits, improve nutrition and the livelihoods of rural communities in the Sahel. Socio-economic and biophysical data from 2015 to 2020 collected from the GGW in Niger, Nigeria and Senegal show not only the ecological benefits of land restoration, but also improved livelihoods and health, which are critical factors underpinning restoration success. Communities experienced a significant decrease in food insecurity in 2020 compared to the 2016 baseline, as well as an increase in income generated from herbaceous forage species planted in restoration plots. Over a period of 5 years, these GGW restoration interventions benefitted to more than 90,000 village households who participated in the rehabilitation and re-vegetation activities of 60,000 ha of degraded land. \*

REFERENCE: Restoration Ecology 30 (8)

CONTACT: Dr Moctar SACANDE and Dr Giulia MUIR, FAO Rome, Italy



## ■ WAYS OF RECONCILING PASTORAL USES WITH REFORESTATION CONSTRAINTS IN FERLO, SENEGAL THE APPROACH OF THE “DUNDI FERLO” ACTION RESEARCH PROJECT

The Ferlo is commonly known as the sylvo-pastoral zone of Senegal, and is characterized by extensive transhumant livestock rearing on shared pastures, rangelands and boreholes. This age-old activity is threatened by the effects of climate change, observed since the great drought of the 1970s and marked by a major decline in vegetation cover. To counteract this degradation, reforestation initiatives such as the Great Green Wall (GGW) have been launched in the area to restore degraded agro-forestry ecosystems, promote the conservation of natural resources and improve the resilience of pastoral communities. A consortium made up of the NGOs AVSF and WeForest, and research institutions CIRAD and ISRA, has been formed to carry out 10 000 ha reforestation project over a 10-year period (2022-2032) in the Labgar, Younouféré and Vélingara Ferlo pastoral units within the GGW core area. The Dundi Ferlo project aims to bridge the information gap and reconcile pastoralism and reforestation through the involvement of agro-pastoral communities, the main beneficiaries, in the co-construction and implementation of socio-technical innovations conducive to the reforestation success of pastoral lands in the Ferlo while not compromising its pastoral uses.

Participatory mapping workshops have helped identify sites to be reforested and prioritized the five (5) forest species of community interest (*Acacia senegal*, *Adansonia digitata*, *Ziziphus mauritiana*, *Balanites aegyptiaca* and *Moringa oleifera*, as an exotic food species). Capacity-building for pastoral communities on technical itineraries for the production and planting of forest species has enabled planting more than 495 ha of degraded land in 2022 and 2023, and planning 505 ha for 2024. The mobilization of accompanying modeling tools such as PARDI (*Problématique-Acteur-Ressource-Dynamique-Interaction*) has enabled the co-construction of conceptual models of the socio-

## ➤ Déployer des techniques et des approches de restauration des terres GMV à grande échelle



ecosystems integrating reforested sites. Enclosed, these plots contain a significant quantity of fodder used during the lean season to improve the resilience of pastoral communities (indigenous, non-indigenous and transhumant), and sold at a price set by local sites management committees. The establishment of a multi-actor consultation framework bringing together all stakeholders (local authorities, technical services, pastoralist transhumant reception and environment commissions, women's group representatives, plot management committee members, etc.) has enabled sustainable fodder management rules to be drawn up. These results provide evidence that it is indeed possible to reconcile pastoralism and reforestation. Such a cohabitation requires i) a common understanding of the issues and dynamics of shared resources in agro-sylvo-pastoral systems, ii) participatory identification of degraded areas to be reforested, iii) co-design of solutions with local populations and iv) their ability to sustainably manage these restored resources. \*

**REFERENCE:** <https://www.avsf.org/senegal-assurer-une-reforestation-utile-et-perenne-grace-au-projet-dundi-ferlo/>

**CONTACTS:** Marième Fall Ba, Penda Diop, Fallou Seck, Khady Cissé, Seydou Badji, Ababacar Ndiay1, Germaine Neyra, Jean Daniel Cesaro et Tamsir Mbaye, Senegal

### ■ RESTORATION SEED SUPPLY OF ADAPTED LOCAL AND NATIVE SPECIES

Amongst the key large-scale dryland restoration efforts undertaken over the years, is the Great Green Wall (GGW). It offers the dual benefit of biophysical as well as socio-economic enhancement, yet efforts towards combating desertification require substantial investments in technological equipment, germplasm mobilization and capacity building. In addition, the strong support of appropriate policy framework, governance mechanisms, and stable financial commitment are key recipes for successful large scale land/landscape restoration. FAO has embarked on a joint initiative with GGW countries proposing to lead multi-country *Scaling-Up Resilience in Africa's Great Green Wall* (SURAGGWA) project, aiming to achieve specific climate change mitigation and adaptation impacts. In that framework, germplasm mobilization capacity was assessed within eight participating

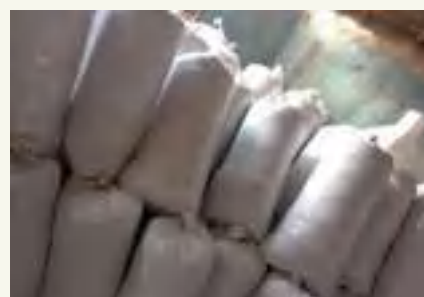
countries, including Burkina Faso, Chad, Ghana, Kenya, Mali, Niger, Nigeria and Senegal. Seeds of the 189 native woody and grass fodder species produced are well-matched to the preferred species by most communities in the GGW. Despite existing challenges, fodder seed and fodder value chain was found to be a profitable venture with great potential in enhancing household income and improving livestock production. Recommendations are made to strengthen the capacity of state institutions and relevant authorities to spearhead the training of seeds/seedling dealerships within the national seed systems; to promote the use of more native species in large-scale restoration, with high quality, reliable and sustainable seed sourcing; and to strengthening coordination and networking for synergies, mutual support and complementarities. With adequate support to research in native seed handling and propagation science and promotion of large scale dissemination of the technologies and the required training, restoration seeds supply can scale-up the production of preferred and well-adapted species to respond to the huge demand of GGW and other ambitious restoration projects. \*

**REFERENCE:** FAO-FORIG report, 2020; FAO-KALRO report 2021.

**CONTACT:** Dr Moctar SACANDE, FAO, Rome Italy; Dr Desterio NYAMONGO, Dr Peterson Wambugu, KALRO, Nairobi, Kenya; Dr Joseph ASOMANING, Pr. Daniel OFORI, FORIG, Kumasi, Ghana; Dr Sidi SANOGO, IER, Sikasso, Mali and Ms Edith DABOUE, Mr Regis OUBIDA, CSNF, Ouagadougou, Burkina Faso



Stored restoration seeds (I-CNSF; R-KALRO)



➔ Déployer des techniques et des approches de restauration des terres GMV à grande échelle

### ■ VEGETATIVE BEHAVIOR OF LOCAL SPECIES IN ASSISTED NATURAL REGENERATION (ANR), PLANTATION AND ENRICHMENT SOWING IN VILLAGE LANDS IN MALI

Ethnobotanical and socio-economic surveys of populations in the Mopti and Kayes regions of Mali allowed to identify 103 local useful plant species (including woody, herbaceous and vegetable species) out of which the 15 most appreciated and prioritized woody species are *Adansonia digitata*, *Tamarindus indica*, *Faidherbia albida*, *Parkia biglobosa*, *Scleocarya birrea*, *Lannea microcarpa*, *Balanites aegyptiaca*, *Vitellaria paradoxa*, *Ziziphus mauritiana*, *Detarium microcarpum*, *Acacia senegal*, *Acacia seyal*, *Acacia nilotica*, *Cordyla pinnata* and *Hyphaene thebaica*, in addition to 8 herbaceous useful species (*Andropogon gyganteus*, *Andropogon pseudapricus*, *Cymbopogon giganteus*, *Pennisetum pedicellatum*, *Cenchrus biflorus*, *Eragrotis tremula*, *Alysicarpus ovalifolius* and *Stylosanthes hamata*).

These species have been used since 2013 to restore 5 sites and 82 hectares of degraded land. The land was first ploughed mechanically before the direct sowing of the 8 herbaceous species. These plants are mainly used in crafts and as fodder. Natural regeneration was carried out on 6 fallow sites of 24 hectares where more than 100 species of pre-existing plants were identified as useful plants by the communities. 15 months after the sowing of

herbaceous seeds (especially *Andropogon gayanus*) these sites were found to provide shelter for small animals and birds, and communities began to harvest the herbaceous biomass to feed their livestock. The main results regarding ANR show a good growth in diameter and height suckers, with average annual increases in diameter at the base of 1.1 cm recorded for assisted suckers, which is twice as much as unassisted suckers (0.6 cm). Their growth in height was also observed to be much greater (185 cm) as compared to unselected suckers (147 cm). *A. digitata*, *B. rufescens*, *A. nilotica*, *S. birrea* seedlings show good survival rates (30-45%) and good growth in height 4 years after planting. However, survival rates dropped sharply (0-8%) for *T. indica* and *F. albida*, *K. senegalensis*, *C. micranthum*, *L. microcarpa* in all sites, indicating their unsuitability to be used in these areas. It can therefore be concluded that assisted natural regeneration with site enrichment by direct sowing is a preferred approach to successfully restore degraded land. It is less expensive and well known by the communities who put it into practice on their farmlands. \*

REFERENCE: IER Technical report, 2023.

CONTACT: Dr Sidi SANOGO, IER, Bamako, Mali and Dr Moctar SACANDE, FAO, Rome, Italy

### ■ BOOSTING LAND RESTORATION SUCCESS IN THE GREAT GREEN WALL THROUGH THE USE OF SYMBIOTIC MICROORGANISMS FOR PROPAGATED TREE SEEDLINGS IN BURKINA FASO

Several studies have clearly demonstrated the effectiveness of using symbiotic microorganisms for plants in terrestrial ecosystems. The main objective of this study was to rehabilitate degraded lands in the Sahel GGW zone of Burkina Faso by using rhizobial and mycorrhizal symbioses through inoculation techniques. Native rhizobia infective strains were isolated from soil samples before being tested in the laboratory and in a greenhouse for their effects on nodulation and growth of *Vachellia seyal* (a gum-producing acacia). Three promising strains were then selected to form a complex which was used with and without arbuscular mycorrhizal fungus for the inoculation of nursery seedlings and of seeds for direct sowing in the field, in plots totaling 150 hectares in the Soum and Seno provinces. Results show an increase in growth of the seedlings inoculated with symbiotic microorganisms in degraded



Planting line of 34 months old *Lannea microcarpa*, on farmland in the village of Dimbal (Mopti).



Restoration site where direct sowing of *Andropogon gayanus* was combined with planting of woody species in Dimbal (Mopti).



➤➤ Déployer des techniques et des approches de restauration des terres GMV à grande échelle



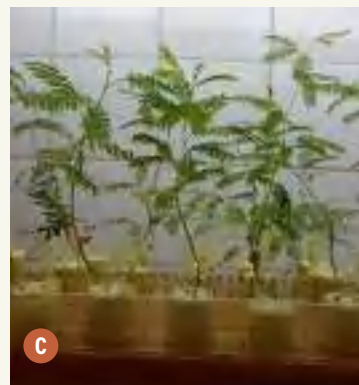
soil in the Sahel zone after two rainy seasons (14 months), with a collar diameter increase between 1 and 2 cm on average, twice as much as the non-inoculated control. In addition, seedling height varied from 1 to 1.5 m for the inoculated plants compared to 70 cm for the non-inoculated controls. Survival rate was also higher. Double inoculation (arbuscular mycorrhizal fungus + rhizobia) was more successful than single inoculation (arbuscular mycorrhizal fungus or rhizobia). An assessment of soil fertility in initially degraded and restored areas shows that the symbiotic microorganisms introduced into the environment have multiplied well with values of mycorrhizogenic infectious potential (MIP) of up to 60,502/g of soil and rhizobial potential with a maximum of 60,66.103 CFU/g of soil. Chemical nutrients such as nitrogen and carbon slowly accumulate in the soil while assimilable phosphorus and exchangeable potassium are actively taken up by plants. This study allowed to show that inoculation of *V. seyal* with symbiotic microorganisms promotes rapid rehabilitation of the vegetation cover of degraded soils from the first year. It also allows the improvement of the soil microbiology. In view of these promising results, we recommend inoculation of seedlings for greater success of restoration plantations in the Sahel. \*

**REFERENCES:** Int. J. Biol. Chem. Sci. 14(1): 110-125, January 2020; Doctoral thesis, 2021, Joseph Ki-Zerbo University, Ouagadougou, Burkina Faso.

**CONTACT:** Dr Barkissa FOFANA, CNSRT, Ouagadougou, Burkina Faso and Dr Moctar SACANDE, FAO, Rome, Italy

## ■ MULTIFUNCTIONAL HALF-MOONS, AN INNOVATIVE TECHNIQUE FOR IMPROVING THE ENVIRONMENTAL AND COMMUNITY RESILIENCE OF THE GREAT GREEN WALL OF NIGER

In the Sahel, one of the techniques currently being promoted by development players to combat encrusted soils rich in fine particles on gentle slopes and restore their productive potential is the multifunctional half-moon. This captures run-off water and the sediments it carries. Eight models have been introduced in Niger by the World Food Programme since 2018. They are designed to capture run-off water by means of catchment pits and zaïs, to improve water infiltration, and to enable effective sowing in internal



### TRAPPING/ISOLATING RHIZOBIA IN GIBSON TUBES ON VACHELLIA SEYAL AND SENEGALIA SENEGAL PLANTS

A - *Vachellia seyal* seeds

B - *Senegalia senegal* seeds

C - *Vachellia seyal* seedlings in Gibson tubes

D - *Senegalia senegal* seedlings in Gibson tubes

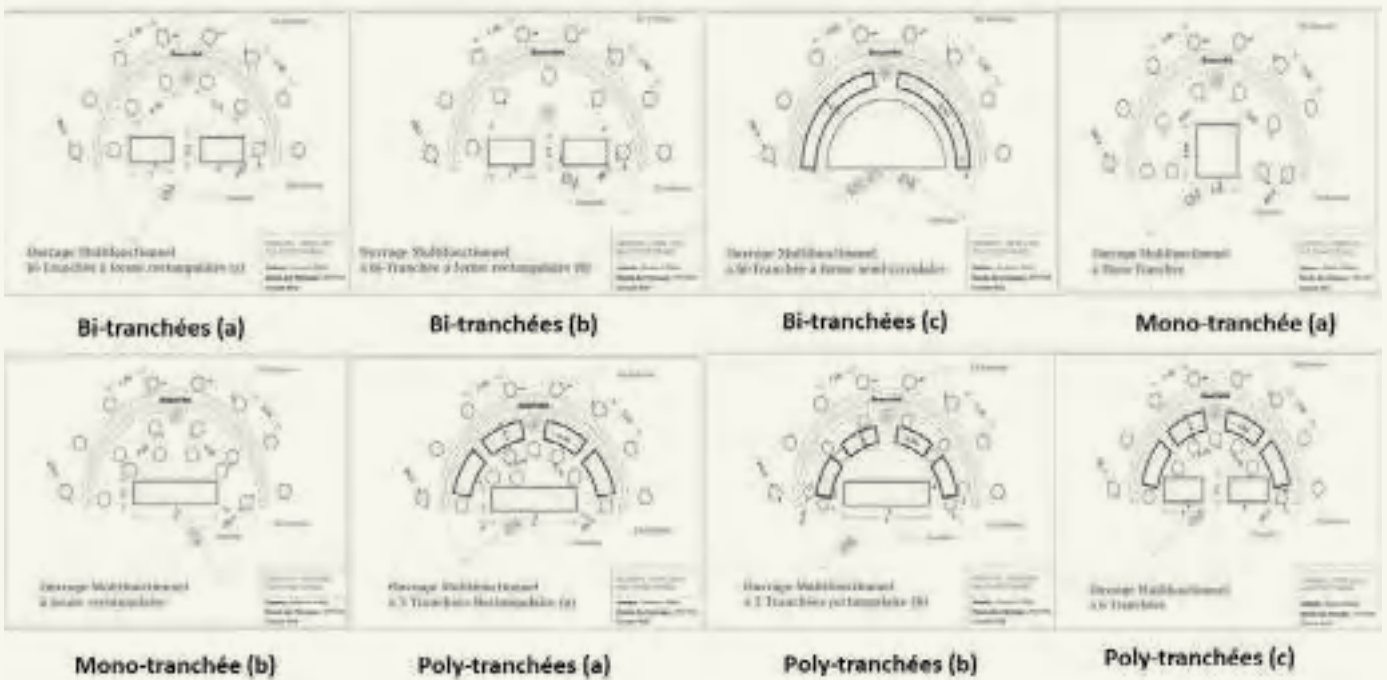
(Photo credits: B. Fofana)

and external zaïs enriched with organic matter. The multifunctional dimension of these types of structure lies in the fact that they can be used chronologically and sometimes simultaneously to grow rainfed crops, plant woody plants, produce fodder and produce in the water catchment pits at the end of the rainy season. The results of the evaluation of the development of their potential showed that crop yields were well above the average for the study area, soil quality was improved in the zaïs sector and in the water catchment pits Through better infiltration and significant



- Déployer des techniques et des approches de restauration des terres GMV à grande échelle

➔ SCHEMATIC VIEW OF THE EIGHT MULTIFUNCTIONAL HALF-MOON MODELS



Pictured here: View of traditional half-moon planting and pits with niébé (*Vigna unguiculata*)

improvement in chemical fertility. With these models, the return on investment is expected just after the second season on agricultural sites where cowpeas or millet are grown, and after 3 to 4 seasons on pastoral sites. On the basis of these initial results, it is clear that this new soil restoration technique for improved agroforestry productivity and rehabilitation

of degraded land can be extended to other Sahelian countries suffering from soil degradation. \*

REFERENCE: European Scientific Journal, ESJ, 17(34), 112.

CONTACTS: Drs Tidjani Adamou Didier, Seidou Ousmane Idrissa and Ambouta Karimou, Université Abdou Moumouni de Niamey, Niger; Dr Oumarou MALAM ISSA, IRD-Reset\_GMV, Paris, France

## ESTIMATION OF SEASONAL RAINWATER USE BY FAIDHERBIA ALBIDA PLANTS IN SENEGAL AGROFORESTRY PARKLANDS

Very little is known about the water uptake of *Faidherbia albida*, a local Sahelian multi-purpose species, used as a soil fertilizer and for the fodder it provides. An assessment of the water balance at ecosystem level is therefore crucial in the context of climate change. The average annual water consumption of *F. albida* was estimated at around 40,000 l per adult tree per year, or 27 mm per tree per year, which represents 5.3% of the annual precipitation in 2019 (513 mm). The significant correlation between water consumption and leafing-out phases ( $R^2 = 0.81$ ) opens the possibility of a simple model to estimate water use by trees. This research opens perspectives for optimizing tree density in *F. albida* agroforestry parks. \*

REFERENCE: *Biotechnol. Agron. Soc. Environ.* 2023 27(3), 196-204

CONTACT: Dr Mame Sokhna SARR, ISRA, Dakar, Sénégal and Dr Frédéric C. DO, IRD, Paris, France

## DEFOLIATING INSECT INVENTORY FOR NURSERY AND PLANTATION SUCCESS IN THE GGW

The GGW restoration is based on active reforestation operations using local forest species that are adapted to the climatic and physical conditions of the Sahelian environment and can be used by local people. These species are subject to numerous biotic attacks, particularly insects in both the nurseries where the young plants are produced and in reforested plots where they are planted. A study combining field ecology in the Ferlo, a sylvo-pastoral zone of the GMV in north-eastern Senegal, and a molecular Barcoding



Biotechnol. Agron. Soc. Environ. 2023 27(3), 196-204



### Estimation of seasonal water use of *Faidherbia albida* (Delile) A.Chev. in a Sahelian agroforestry parkland

Mame Sokhna Sarr<sup>1D</sup>, Khalise Doull<sup>1D</sup>, Ousier Roupaud<sup>1,4,5</sup>, Alan Rocheteau<sup>1D</sup>, Didier Oriagré<sup>1D</sup>, Christophe Jourdan<sup>1,4,5</sup>, Ibrahim Diefeliot<sup>1D</sup>, Justine Seghier<sup>1,4,5</sup>, Frédéric C. Do<sup>1,2,3</sup>

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<sup>2</sup> Ecole Nationale Supérieure d'Agronomie (ENSA), Université de Thiès (Senegal)

<sup>3</sup> UMR Eco-Sys: Univ. Montpellier, CIRAD, INRAE, Institut Agr. IRD, Montpellier (France)

<sup>4</sup> CIRAD, UMR Eco-Sys, RPL06, CTR022, Dakar (Senegal)

<sup>5</sup> LMH 0006, Centre IRD URSA de Bot. Ag. RPL06, CTR022, Dakar (Senegal)

<sup>6</sup> French National Research Institute for Sustainable Development (IRD), RPL11, Dargatoupan (1) (Senegal Forest)

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approach set out to determine the specific diversity and richness of the community of insects causing damage to 3 acacia species, *Senegalia senegal*, *Vachellia nilotica* and *V. tortilis* subsp. *raddiana*. Based on sampling carried out in 2022 and 2023, 39 caterpillar species belonging to 8 families have been identified, with 5 species accounting for 57% of specimens. Only 22 of these are found in nurseries, among which is *I. pulinda* subsp. *deerraria* (Geometridae), a species never described locally, but responsible for serious leaf damage on *V. nilotica*.

- A - Acacias seedlings nursery in the Ferlo
- B - Defoliating caterpillar *I. pulinda* subsp. *deerraria* feeding on *Vachellia nilotica*
- C - Adult *I. pulinda* subsp. on the ground
- D - Sampling by shaking an Acacia tree in the wild

(Crédits photos: H. Jourdan, IRD & A. Diop, UGB)





➔ Déployer des techniques et des approches de restauration des terres GMV à grande échelle



All the results obtained will be published and placed in the local and wider context of continental GMV, to support the sustainable management of nurseries and associated reforestation programmes. \*

REFERENCE: HAL Id: hal-03691040 <https://hal.science/hal-03691040>.

CONTACTS: N. Gauthier, H. Jourdan, A. Diop, IRD, France and M. Touré, S.N. Sall, A.B. Bal, UGB, Saint-Louis, Senegal (Université Gaston Berger (UGB) [Saint-Louis, Senegal]; Institut de Recherche pour le Développement (IRD) [France & Senegal], supported by 2 OHMI-Téssékéré projects (LabEx-DRIIHM).

■ **EARLY SEXING OF PALM TREES, AN INNOVATIVE APPROACH FOR SUSTAINABLE DEVELOPMENT IN THE GGW**

Reproducing palm trees by seed is a traditional method that enables the multiplication of varieties adapted to local environmental conditions and the needs of local populations. It also helps to preserve a wide range of agrobiodiversity, guaranteeing the sustainability of palm-based agroforestry systems and their resilience to pests and climate change. The effectiveness of this approach

is hampered by the need to identify female palms at the seedling stage. We have developed and optimised techniques for the early determination of the sex of palms, particularly date palms (*Phoenix dactylifera*), Doum palms (*Hyphaene thebaica*) and roasters (*Borassus aethiopum*), using low-tech approaches based on PCR technology. These approaches have been successfully transferred to Djibouti. This innovative approach, which makes it possible to identify fruit-producing female palms at the seedling stage, will speed up the introduction of sustainable palm-based agroforestry systems in GGW countries. It is a means of making efficient use of resources and optimising reforestation efforts, thereby helping to boost the profitability of the sectors. This work is continuing with an analysis of the socio-economic and environmental implications of early sexing of palm trees, in terms of productivity, biodiversity and resource conservation, in collaboration with stakeholders in the sector - farmers, policy-makers and civil society organisations. \*

REFERENCE: Breves de Valo, 2021.

CONTACTS: Dr Frédérique Aberlenc IRD, France and Dr Abdourahman Daher, ISV, CERD, Djibouti



# Monitoring and evaluation of large-scale restoration

## ■ SOCIO-ECONOMIC IMPACTS DERIVED FROM LARGE SCALE RESTORATION IN THE GGW IN NIGER, NIGERIA AND SENEGAL

FAO supports the implementation of the GGW through community-centered interventions to generate positive impacts on livelihoods and increase the socio-ecological resilience of populations. An assessment of these socio-economic impacts was carried out based on household surveys in AAD intervention areas in Niger, Nigeria and Senegal between 2016 and 2020. Both diachronic assessments (before and after implementation) and synchronic (beneficiaries vs. control group) of the socio-economic status of the communities were carried out using a set of indicators derived from the Sustainable Livelihoods Framework. The results revealed significant improvements in the socio-economic situation of the populations in the intervention areas. Household income improved after the interventions in all three countries, with significant positive differences compared to control groups, particularly in Nigeria and Senegal. In addition, perceived food insecurity decreased significantly in 2020 compared to observations in 2016, falling from 46% to 15% in Senegal and from 69% to 58% in Niger. This study confirms the dual benefit of land restoration, both by increasing vegetation cover and improving the livelihoods of rural communities. \*

REFERENCE: *Journal of Rural Studies* 87 (2021) 160–168

CONTACT: Mr Marc PARFONDY and Dr Moctar SACANDE, FAO, Rome, Italy



## ■ MONITORING LARGE-SCALE RESTORATION INTERVENTIONS FROM LAND PREPARATION TO BIOMASS GROWTH IN THE SAHEL

In this work we demonstrate that restoration interventions in arid to semi-arid landscapes can be independently assessed by remote sensing methods throughout all phases. For early verification, we use Sentinel-1 radar imagery that is sensitive to changes in soil roughness and thus able to rapidly detect disturbances due to mechanised ploughing, including identification of the time of occurrence and the surface area prepared for planting. Subsequently, time series of the normalized difference vegetation index (NDVI) derived from high-resolution imagery enabled tracking and verifying of the increase in biomass and the long-term impact of restoration interventions. We assessed 111 plots within the GGW area in Burkina Faso, Niger, Nigeria and Senegal. For 58 plots, the interventions were successfully verified, corresponding to an area of more than 7000 ha of degraded land. Comparatively, these computerised data were matched with field data and high-resolution imagery, for which the NDVI was used as an indicator of subsequent biomass growth in the plots. The trends were polynomial and presented clear vegetation gains for the monthly aggregates over the last 2 years (2018–2020). The qualitative data on planted species also showed an increase in biodiversity as direct sown seeds of a minimum of 10 native Sahel species (six woody mixed with four fodder herbaceous





species) were planted per hectare. This innovative and standardised monitoring method provides an objective and timely assessment of restoration interventions and will likely appeal more actors to confidently invest in restoration as a part of zero-net climate mitigation.\*

**REFERENCE:** Remote Sensing (2021), 13, 3767

**CONTACTS:** Dr Moctar SACANDE and Mr Antonio MARTUCCI, FAO Rome, Italy

### ■ THE GREAT GREEN WALL RESTORATION MONITORING APP

The recently developed GGW restoration monitoring App is inspired by the FAO's Action Against Desertification which was set up since 2014 to support the implementation of the GGW. We developed it in Google Earth Engine, which is an FAO partner. So far, the monitoring App contains validated and cleared data from 12 GGW countries, starting from 2012 interventions. These data analysed are from 950 restoration sites, covering over 1 million hectares of degraded agro-sylvo-pastoral lands under greening and rehabilitation. The application allows to map and visualize these restored sites by focusing on individual searchable georeferenced plots, and to analyze re-greening progress and biomass increases in a time series. These restoration data are freely available to everyone, including the communities themselves, restoration and monitoring experts, and financial and technical partners around the world. It is planned to further develop the analyses and connect parameters such as related precipitations and soil moistures. We



continue to invite more contributions from countries, agro/forestry sector and restoration projects and programmes (click the link here to fill in for restoration data collection: <https://ee.kobotoolbox.org/x/0kvUJciR>). A screenshot of the Home-page is shown below. \*

**REFERENCE:** FAO-AAD GGW restoration monitoring App (2023).

**CONTACTS:** Mr Antonio MARTUCCI and Dr Moctar SACANDE, FAO Rome, Italy

### ■ VEGETATION ECOTONES ARE RICH IN UNIQUE AND ENDEMIC WOODY SPECIES AND CAN BE A FOCUS OF COMMUNITY-BASED BIODIVERSITY CONSERVATION AREAS OF THE GREAT GREEN WALL OF ETHIOPIA

Undertaking ecological restoration requires an understanding of the scenarios associated with vegetation degradation and reference ecosystems. In this respect, the question of whether or not ecotones support biodiversity conservation (restoration) is less well understood, particularly in the sub-Saharan region. To this end, woody species composition was assessed in ecotones and adjacent vegetation during 2018 and 2019 in Ethiopia. Dissimilarity in woody species composition, differences in species richness and indicator species between ecotones and adjacent vegetation types were statistically analysed. The results showed that woody species composition differed between ecotones and adjacent vegetation types. Species richness was significantly higher in the ecotones than in the adjacent vegetation types. In addition, the number of unique and endemic woody species was higher in the ecotones than in the adjacent vegetation types. The results suggest that vegetation ecotones are the least vulnerable vegetation ecosystems in sub-Saharan Africa, including in the GGW belts. In addition to being promising reference ecosystems and sources of propagules for restoration efforts, ecotones could therefore be the focus of community-based biodiversity conservation areas in the face of ongoing habitat fragmentation. \*

**REFERENCE:** Botany Letters, vol 170, 507-517, 2023.

**CONTACT:** Dr Debissa, University of Addis Ababa, Ethiopia (membre du réseau RESET\_GMV)

# Food and therapeutic uses of local plants,



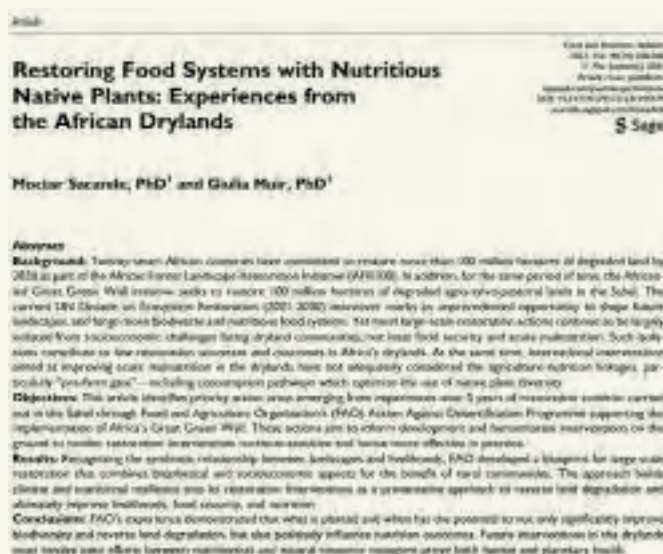
Most large-scale restoration actions continue to be largely isolated from socioeconomic challenges facing dryland communities, not least food security and acute malnutrition. Such isolations contribute to low restoration successes and outcomes in Africa's drylands. At the same time, international interventions aimed at improving acute malnutrition in the drylands have not adequately considered the agriculture-nutrition linkages, particularly “pre-farm gate”—including consumption pathways which optimize the use of native plant diversity.

## ■ RESTORING FOOD SYSTEMS WITH NUTRITION NATIVE PLANTS EXPERIENCES FROM THE GGW AFRICAN DRYLANDS

Recognizing the symbiotic relationship between landscapes and livelihoods, FAO is working to improve restoration programming and targeting to consider native, wild fruits, nuts, seeds, and vegetables in species selection to improve availability of nutrients and healthy foods throughout the year, support value chain development for nutritious native fruits, and to integrate nutrition metrics into restoration monitoring. The approach builds climate and nutritional resilience into its restoration interventions as a preventative approach to reverse land degradation and ultimately improve livelihoods, food security, and nutrition. FAO experience demonstrated that what is planted and when has the potential to not only significantly improve biodiversity and reverse land degradation, but also positively influence nutrition outcomes. Household income improved after the interventions in all 3 countries, with positive significant differences against the control groups particularly in Nigeria and Senegal. In addition, perceived food insecurity significantly decreased in 2020 compared to 2016 observations, dropping from 46% to 15% in Senegal and from 69% to 58% in Niger. Future interventions in the drylands must involve joint efforts between nutritionists and natural resource managers to improve both human and planetary health. \*

REFERENCE: Food and Nutrition Bulletin, vol 44(25): 58-68, 2023.

CONTACT: Dr Giulia MUIR and Dr Moctar SACANDE, FAO Rome, Italy



## ■ SAHELIAN PLANTS ADAPTED TO RESTORATION OF DEGRADED LANDS AND THEIR USES FOR HEALTH CASE OF THE SOUM PROVINCE IN NORTHERN BURKINA FASO

Burkina Faso, like the Sahelian countries suffers a major land degradation following successive droughts and human activities. The planting of trees remains the key activity to restore the Sahelian ecosystem. This study aims to make known the uses in traditional medicine



# and impacts on food security, health and nutrition

of the plant species at best to the recovery of degraded lands in the north of Burkina Faso. The results of an ethnobotanical survey conducted in 8 villages in the Soum province of northern Burkina Faso to identify local plants and medicinal uses of populations, showed that 53 species divided into 28 families and 44 genera were listed. Fabaceae-Mimosoideae, Combretaceae, FabaceaeCaesalpinioideae and Anacardiaceae were the most represented families. The most common diseases encountered by the populations living there and treated with plants were infections / infestations (20%), disorders of the digestive system (18%), gynecological and obstetric disorders (14%), skin-dermatological (14%). Leaves were the most recommended parts (43%) in recipes. Decoction (45%) as a method of recipe preparation and the oral route as the method of administration (50%) were the most appropriate. Due to the special character of the study area which is highly pastoral, 19% of the listed plants were also used for livestock care. These results constitute a scientific database on the use of Sahelian species for health in traditional medicine. The valorization of therapeutic virtues of Sahelian plants would contribute to a rational management of plant biodiversity and would be an alternative for a perpetuation of reclaimed land, or even a large-scale reforestation. \*

REFERENCE: Journal of Animal & Plant Sciences, Vol.41 (1): 6767-6783, 2019.

CONTACTS: Dr Ramde/Tiendrebeogo Alphonsine, Dr Roger Zerbo and Mr Adama Doukom

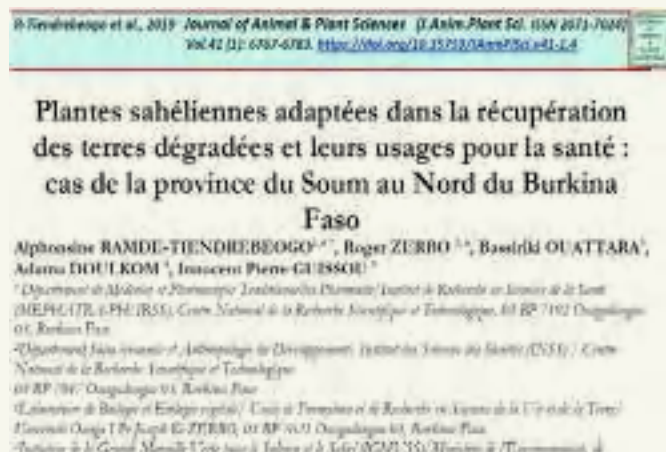
## LOCAL PLANTS FOR FOOD AND HEALTH SECURITY IN SAHEL COUNTRIES

### CASE OF AN AREA IN THE LAYOUT OF THE GREAT GREEN WALL OF BURKINA FASO

The increase in new health problems related to an unbalanced diet calls for promoting local plants with nutritional and therapeutic virtues. A study was conducted in the province of Oubritenga in central Burkina Faso to know these plants. Twenty five (25) nutritional species with therapeutic virtues and high use values (UVs  $\geq 0.50$ ) have been identified. Results also showed that leaves and fruits were the most consumed parts (48%). Leaves were also the most used in medicinal recipes (54%). The trunk bark and fruits were recommended at 28% and 7% respectively. The presence of numerous mineral elements, vitamins, proteins, lipids, carbohydrates and important chemical groups with well-known biological properties justify the use of these therapeutic food plants. Traditional foods can be an important track in finding solutions to chronic disease and malnutrition as well as ensuring food and health security in low-income countries. \*

REFERENCE: Journal of Pharmacognosy and Phytochemistry, Vol. 8, Issue 5, 2019.

CONTACT: Dr Ramde/Tiendrebeogo Alphonsine and Dr Roger Zerbo, CNRST, Ouagadougou, Burkina Faso



# Benefits, ecosystem goods and services



**Assessing ecosystem services linked to sustainable land/landscape management (SLM) actions is necessary to understand the complementarities and synergies between services and to assess the associated environmental and socio-economic costs and benefits.**

Biodiversity is a key element of production systems multifunctionality. Its knowledge is key to the success of activities carried out under the GGW. Research actions must integrate its economic, ecological, health and phytosanitary, heritage and cultural aspects. Particular attention must be paid to biodiversity both in terms of the promotion of local biodiversity knowledge and agrosystems biodiversity, but also to the risks of invasive species associated to GGW actions. Moreover, wildlife, typically understood as living, undomesticated animals, interact with other forms of wildlife – including plant species – collectively forming complex networks which structure ecological communities and maintain essential services such as pollination, seed dispersal or biological control (Kremen 2005). These interactions are vital to healthy ecosystem functioning.

## ■ THE GOOD LIFE IN RURAL AND URBAN SENEGAL A QUALITATIVE AND QUANTITATIVE STUDY

Very few studies have analyzed the influence of the environment, rural or urban, on the notion of good life and subjective well-being in sub-Saharan Africa and none, to our knowledge, has combined qualitative and quantitative methodologies for this purpose. The objectives of this interdisciplinary study were: a) to understand the emic representations of the good life in rural and urban Senegal and; b) to compare the levels and determinants of satisfaction with life between these two populations. This study was carried out in Dakar and in a very isolated rural area in the North East of Senegal: the silvo-pastoral zone of Ferlo. A total of six focus groups were conducted for the qualitative phase, while the quantitative phase was conducted on representative samples of the populations living in Dakar (N = 1000) and Téssékéré (N = 500). Our results indicate that, against all expectations, life satisfaction is better in the Senegalese Ferlo than in the capital, Dakar. This difference may be the joint result of less meaningful social comparisons and a relationship with nature as a source of stress restoration in rural areas. However, the lifeworld of the rural Fulani of the Ferlo is being undermined by global climatic disturbances, which imposes rapid adaptations of pastoralism; otherwise this activity, that is not only subsistence but also identity-based, may disappear. ✨

REFERENCE: Plos One, 2021

CONTACTS: Drs Priscilla DUBOZ and Sidy SECK





# from large-scale land restoration and GW ecosystems

## ■ BIRD DIVERSITY IN A SAHELIAN ECOSYSTEM UNDER RESTORATION A STUDY IN THE GREAT GREEN WALL EXTENSION AREA OF SENEGAL

In this study, we survey the avian biodiversity in Koyli Alpha, Senegal, located in the extension area of the Great Green Wall (GGW) project in Senegal to restore the degraded ecosystems by the long years of drought during the 1970s in addition to anthropogenic pressures. Data are collected during a period of 52 days between July 2019 and Jun 2021 in Koyli Alpha and their surroundings, we identified the presence of avian species through daytime focal observations using transects, fixed points and trapping cameras. Thus, we recorded the presence of 198 total bird species. Species composed of 143 landbirds and 55 waterbirds distributed in 22 orders and 59 families. The most common were granivorous birds such as the Golgen sparrow (*Passer luteus*) and the Red-billed quelea (*Quelea quelea*). Among these inventoried species, three are categorized as critically endangered species (CR) (IUCN Redlist). They are the Rüppell's vulture (*Gyps rueppelli*), the White-backed vulture (*Gyps africanus*) and the hooded vulture (*Necrosyrtes monachus*). Additionally, the Martial eagle (*Polemaetus bellicosus*) is categorized as endangered (EN), and the Great grey shrike (*Lanius meridionalis*), the Abyssinian ground hornbill (*Bucorvus abyssinicus*) and the European turtle dove (*Streptopelia turtur*) are categorized as vulnerable species (VN). Furthermore, 37% of observed birds are palearctic migratory species.\*

REFERENCE: Acta Ecologica Sinica, 2023.

CONTACT: Dr Papa Ibnou Ndiaye

## ■ LAND USE CHANGE AND MIGRANT BIRDS IN THE GGW SAHEL

Many birds that migrate between Africa and Europe are in decline. They face threats in their breeding, wintering and staging areas. The Sahel is a key wintering region for these birds. Birds in the Sahel share semi-arid farmlands, grasslands and woodlands



that are closely managed for agriculture and livestock husbandry. Within the Sahel, policy needs to be integrated to address the needs of the rural poor and of declining migrant birds together. More research is urgently needed on the impacts of agriculture, livestock keeping and woodland management on migrant birds in the Sahel. \*

REFERENCE: Research Briefs, Land use change and African-Palaeartic migrant birds (access 2024).

CONTACT: Prof Bill ADAMS, Department of Geograpy, Cambridge University, UK; Mr Danilo MOLLICONE, FAO, Rome, Italy

➤ Avantages, biens et services écosystémiques provenant de la restauration des terres à grande échelle et des écosystèmes de la GMV

## ■ A LARGE MAMMAL SURVEY IN KOYLI ALPHA COMMUNITY WILDLIFE RESERVE AND ITS SURROUNDINGS IN SENEGAL GREAT GREEN WALL

Wildlife in the Great Green Wall (GGW) area, northern Senegal, is threatened by the cumulative effects of anthropogenic activities, drought, and climatic changes. To support conservation planning in line with the GGW management objectives, we studied large mammal diversity in the Koyli Alpha Community Wildlife Reserve in the GGW extension area. We interviewed local communities, made reconnaissance & transect walks, placed camera traps, and carried out fixed point surveys to map the distribution of mammals & to estimate their relative abundance. The surveys were conducted between May 2017 and December 2019. We identified the presence of nine mammal species belonging to six families: one lagomorph, Cape Hare *Lepus capensis*; seven carnivores, Common Jackal *Canis aureus*, Pale/Sand Fox *Vulpes pallida*, Wild Cat *Felis silvestris*, Marsh Mongoose *Atilax paludinosus*, Honey Badger *Mellivora capensis*, Zorilla *Ictonyx striatus*, Common Genet *Genetta genetta*, and one primate, Patas Monkey *Erythrocebus patas*. Our results indicate that the most of the observed species range broadly across the Koyli Alpha Reserve. The Wild Cat and the Sand Fox were also found outside the reserve around the village of Koyli Alpha. Camera trapping events of humans and domestic animals were high throughout the survey area, and the majority of the large mammals observed were mainly nocturnal. The diversity of large wild mammals identified during this study points to the urgent need for the implementation of a management plan of the biodiversity in this area of the Ferlo. \*

REFERENCE: *Journal of Threatened Taxa*, vol.13, (9) 2021.

CONTACT: Dr Anna Niang and Dr Papa Ibnou Ndiaye



## ■ CLIMATE CHANGE PERCEPTION AND ADAPTATION TO NATURAL RISKS IN THE CENTER-NORTH AND CENTRAL PLATEAU OF BURKINA FASO

Climate change and variability are global phenomena that affect the way of life of societies in different ways and at different levels depending on the country. Their effects vary, because political, economic and social vulnerabilities are different. This is why taking into account territorial specificity is key to choose the most appropriate climate change adaptation and resilience strategies. The objective of this study is to understand how populations perceive climate evidence, based on their social positions and characteristics of their environment. The study was conducted in two rural communes of Burkina Faso located in the intervention zone of the Great Green Wall for the Sahara and the Sahel Initiative. Probabilistic sampling was used to select farmers. Three hundred and nineteen households were surveyed. Quantitative data was collected using the Kobo Toolbox data collection platform. The study reveals that climate change related events and their negative impacts on livelihood resources are well perceived by the populations of the study sites. Local adaptation measures to the effects of climate variability and change have allowed to apply a variety of available resilience techniques. \*

REFERENCE: *Espaces Africains (Revue des Sciences Sociales)*, 2022.

CONTACT: Dr Roger Zerbo





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**Recording comparative data on the growth of inoculated seedlings in the field, June 2018, Djibo, Burkina Faso.**







who are the authorities responsible for defining these rights and ensuring that they are respected. Countering land degradation requires that land tenure rules adapted to ecosystems and socio-economic conditions encourage virtuous practices and that authority systems are able to enforce them. These rules, which specify who can exploit resources and under what conditions, must be able to evolve to allow land tenure systems to adjust to changes in the environment. Implementing a rehabilitation project requires local negotiations to identify converging interests and build compromises. Land rehabilitation cannot be based on individual initiatives alone: these initiatives need to be coordinated across a given area or catchment basin if they are to be ecologically effective. \*

REFERENCE: Policy brief IRD/COP 15 UNCCD, 2022

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## ■ GENDER INEQUALITIES IN LAND MANAGEMENT AND RESTORATION IN THE GGW COUNTRIES

Several case studies have demonstrated the active roles of women in practices with high potential for achieving the objectives of the GGW program. Women are investing in sustainable land management (SLM) practices based on traditional knowledge and beneficial in terms of biodiversity conservation (agroecology, agroforestry, conservation agriculture, cultivation and development of legumes, etc.). These strategies, knowledge and skills

are insufficiently recognized, excluding women from the direct benefits of GGW activities. Although women's investment in these practices is a way of improving food security and the sustainability of farming systems in line with the objectives of the GGW, little is known about the specific roles of women as agents in the implementation of the GGW programme. We analysed several parameters of gender inequality in rural areas of six GGW countries (Chad, Niger, Senegal, Djibouti, Mali and Burkina Faso) using bibliography and databases of the countries' statistical institutes and international organisations (FAO, UNDP, IFAD, UN-Women, ADB, OECD). The results show significant disparities between men and women in terms of access to productive resources and economic opportunities. The masculinity indices recorded vary between 93% and 99%, indicating that women outnumber men in rural areas. They are heavily involved in the agricultural sector, where they represent 59% to 74% of the working population, but hold only 9% to 21% of agricultural landholdings, and their rate of access to land is barely 45%, compared with 78% to 90% for men. Women's access to credit (6 to 14%) and their participation in household decision-making (10 and 21%) are also lower than men's (13 to 28% access to credit; over 90% participation in household decision-making). In addition, almost 15% of women have been denied access to economic resources and opportunities in the course of their lives, compared with only 4% of men. The indices of gender inequality in rural areas deduced from these data

vary between 0.4 in Djibouti and Senegal, 0.49 in Burkina Faso, 0.5 in Niger and Mali and 0.7 in Chad. These results suggest that the specific features of gender inequality in rural areas need to be taken into account in order to increase the mobilisation of women and ensure that they share in the direct benefits of land management and restoration actions linked to the implementation of the GGW programme. \*

REFERENCE: Doctoral School of IRD and Sorbonne University, 2022-2025

CONTACTS: M. Ousmane NDIONE, Dr Florence BOYER, Prof Oumarou MALAM ISSA, IRD, Paris, France





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Collection of biophysical data on agriculture, environment and land use, using FAO's Collect Earth tool, which enables statistics to be compiled on the restoration and rehabilitation of sites and restorable degraded land (Africa Open DEAL). Here, an FAO Mapathon, July 2024, Kano, Nigeria.



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► [www.grandemurailleverte.org/images/ENG-DPIP.pdf](http://www.grandemurailleverte.org/images/ENG-DPIP.pdf)

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**CONTRIBUTORS:** FAO-AAD, IRD-RESET/GGW, CNRST, IER, CNSF, KALRO, FORIG

FAO-AAD/GGW A programme dedicated to Action Against Desertification (AAD) in support of the implementation of GGW.

→ [www.fao.org/in-action/action-against-desertification/en](http://www.fao.org/in-action/action-against-desertification/en)



Food and Agriculture  
Organization of the  
United Nations

IRD-RESET/GMV A Scientific Partnership Network on Sustainable Land and Water Management (Research, scientific expertise and knowledge for the sustainable management of land and landscapes of GGW) supported by IRD and bringing together African research institutions and international cooperation institutions.

→ [irn-reset-gmv.org](http://irn-reset-gmv.org)



CNRST Brings together all the multidisciplinary research and development institutions, in health science, agricultural and environmental research, and in forestry production research.

→ [fr.council.science/member/burkina-faso-centre-national-de-la-recherche-scientifique-et-technologique](http://fr.council.science/member/burkina-faso-centre-national-de-la-recherche-scientifique-et-technologique)



IER Mali's leading agricultural research institution, with its forest resources programme based at the Sikasso Centre, which houses its national herbarium and seed collections.

→ [www.ier.ml](http://www.ier.ml)



CNSF A forest seed centre and its branches aiming at establishing a national system for producing and disseminating seeds and seedlings in sufficient quality and quantity. The CNSF contributes to combating desertification in a context of and against a backdrop of climate change. These missions include the reconstitution of vegetation cover, the conservation of plant biological diversity, farmer promotion and scientific research into local and native forest species.

→ [www.environnement.gov.bf](http://www.environnement.gov.bf)



UE - INTPA Supports the regional project on Knowledge for Action in the implementation of the GGW (K4GGWA project) covering the 11 GGW countries and extending to 7 other countries in the Sahel, for funding and a duration of 2023-2028. It is being implemented by FAO and CIFOR-ICRAF.

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