



Inspiring stories of
African agriculture, Volume 2

Stories of change featuring
One Planet Laureate Candidates



AgSpirations: Inspiring stories of African agriculture, Volume 2

Stories of change featuring One Planet Laureate Candidates

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Acronyms

ALV	African Leafy Vegetables	SUA	Sokoine University of Agriculture
AST	Advanced Science Training	TARI	Tanzanian Agricultural Research Institute
AWARD	African Women in Agricultural Research and Development	WHO	The World Health Organization
CIAT	International Center for Tropical Agriculture		
CIRDES	International Centre for Research and Development on Livestock Farming in Sub-humid Zones		
CSA	Climate-Smart Agriculture		
EIAR	Ethiopian Institute of Agricultural Research		
FAO	The United Nations Food and Agriculture Organization		
FAW	Fall armyworm		
GDP	Gross Domestic Product		
IAAS	Integrated Agriculture- Aquaculture Systems		
ICGEB	Biopesticide Group of the International Centre for Genetic Engineering and Biotechnology		
IDRC	International Development Research Centre		
IFFN	Ivory Coast Forest Inventory		
INERA	Institute for Environment and Agricultural Research		
IPCC	Intergovernmental Panel on Climate Change		
IRSAT	Institute for Research in Applied Sciences and Technologies		
JICA	Japan International Cooperation Agency		
JKUAT	Jomo Kenyatta University of Agriculture and Technology		
SDGs	Sustainable Development Goals		

Overview

African Women in Agricultural Research and Development (AWARD) is a convener and partner that, among other priorities, invests in building a pool of African researchers leading agricultural research and developing innovations to improve smallholders' productivity. Our mission¹ calls for sustained investments in equipping African researchers with the tools and skills to connect, communicate with, and convince a wide range of stakeholders in agricultural research and development.

That is why, toward our mission, we implement bold solutions to enhance African researchers' visibility, influence, and ability to engage and inspire stakeholders in agricultural research and development.

Communicating in concise, compelling ways has become one of the most critical skills of the 21st century. Storytelling provides a natural method of allowing others to connect with what matters to you – an idea, a process, or a new product. Stories firmly grounded in universal human principles provide an ideal conduit to building coalitions, gathering compatriots, and communicating change.

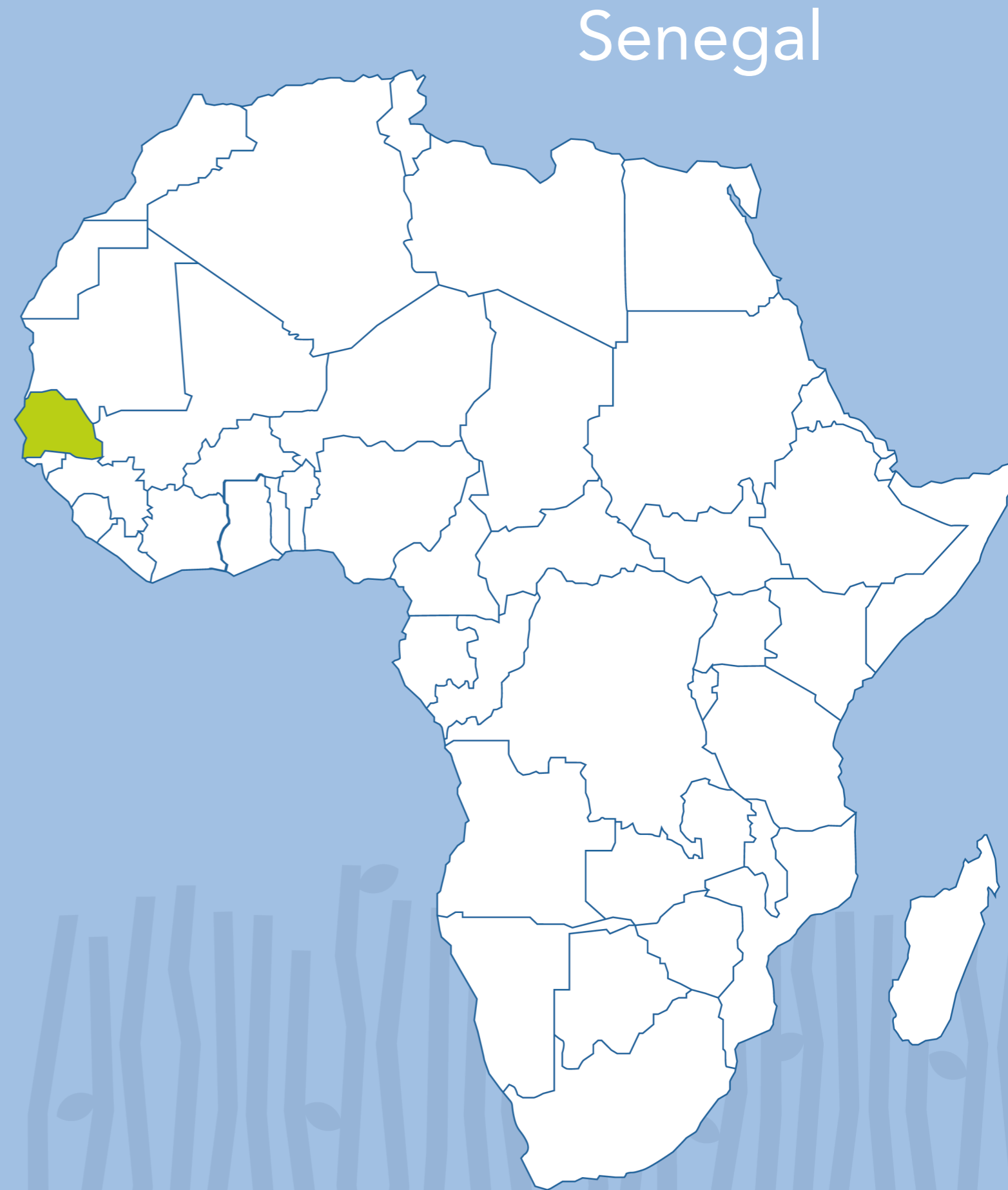
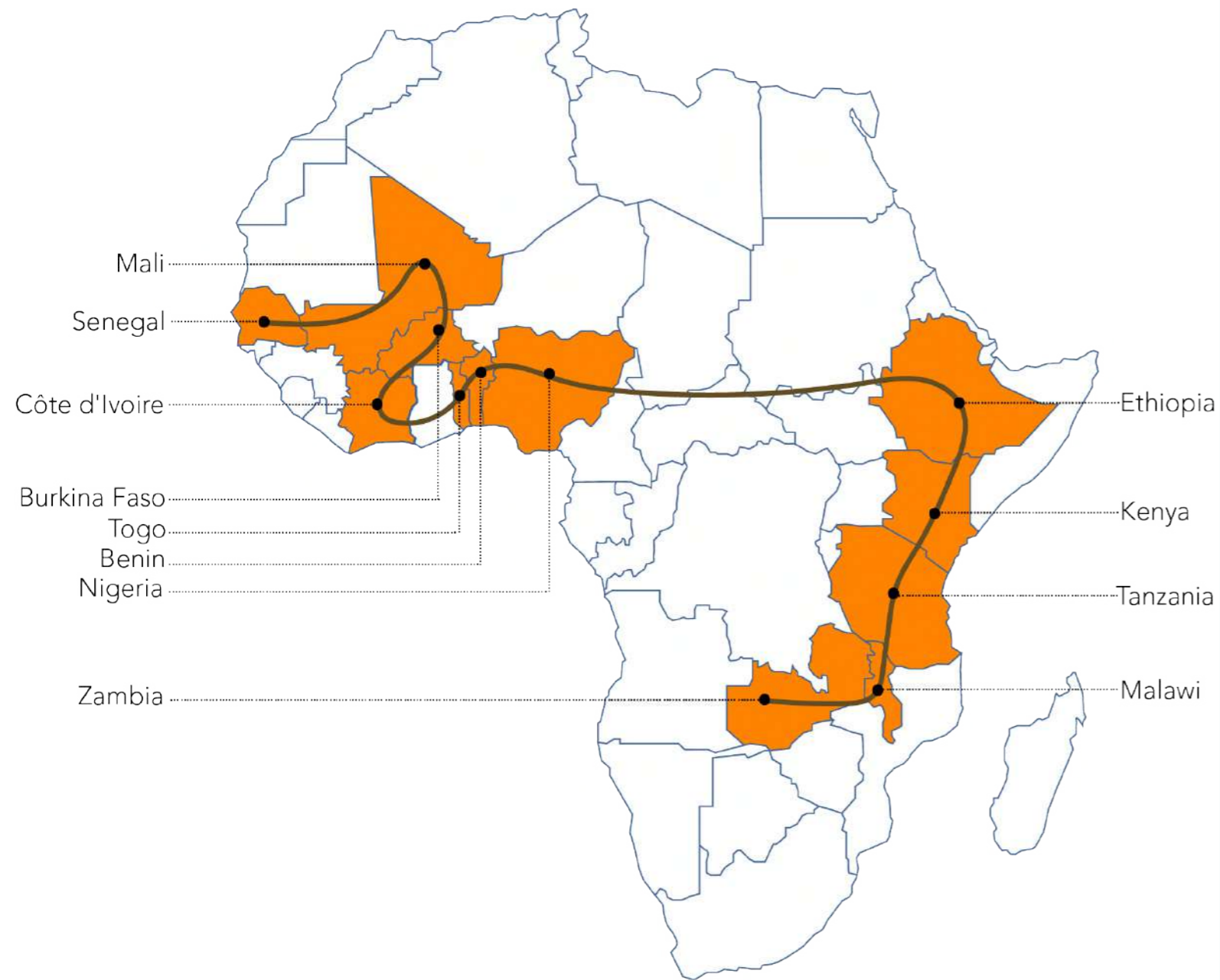
In April and May 2022, we trained selected researchers participating in the One Planet Fellowship on the art of storytelling to communicate their research. The immersive two-month training course focused on building an appreciation of the foundational skills in the art of storytelling using the Public Narrative methodology. Participants gained practical tools, skills, and confidence to develop and share narratives around their research.

In this publication, we are delighted to share a collection of stories featuring the researchers who participated in the training. These are some of the One Planet Laureate Candidates working to develop solutions to help African smallholders cope with the changing climate and transform the continent's food systems.

These stories will take you on a journey through 12 countries, from Africa's most western point to a land-locked country whose borders are home to one of the world's largest waterfalls. You will meet researchers working to ensure no child goes to bed hungry; develop solutions to improve soils, ensure women fish traders have safer, better processing of their produce, and smallholders are included in research to utilize their knowledge, among others.

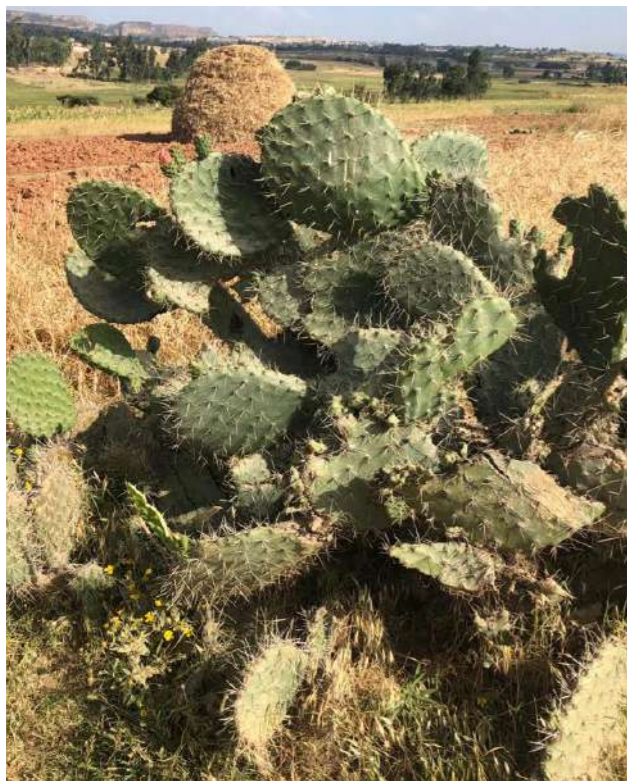
We hope you enjoy the stories as you get to discover some of the leading researchers across the African continent.

¹ <https://awardfellowships.org/our-strategy/>



A Prickly Solution to Global Environmental Challenges

Mame Sokhna Sarr was born and raised in Saint-Louis, Senegal. A researcher at the Senegalese Institute of Agricultural Research, and a 2019 One Planet Laureate Candidate, Mame, as her friends fondly call her, moved to Dakar, the country's capital, after obtaining her Bachelor's degree in 2001. Every year, Mame travels to Saint-Louis to visit her parents and siblings, not without a stop-over at Ndiébène Gandiol, a picturesque region located 20 kilometers south of Saint-Louis. Like the rest of Senegal, the area has a warm and tropical climate, and the cacti dominate the landscape, which captured Mame's attention during one of her visits.



Mame's curiosity drove her to research the thorny fleshy plants in 2018, and she was amazed by the findings. The prickly pear cactus, as she discovered, not only has the potential to rehabilitate arid land and sequester carbon, it has a wide array of medical benefits, including lowering blood glucose by decreasing sugar absorption in the stomach. Some researchers think it can reduce cholesterol levels. Since then, Mame has committed to researching cacti better to understand its adaptation traits in a hostile climate and promote its use for land reclamation.

The prickly pear cactus has been the subject of numerous studies worldwide. The cactus works well as a bioenergy crop because of its versatility. When not harvested for biofuel, it works as a carbon sink, removing and storing carbon dioxide from the atmosphere. The crop is also used for food and forage by communities in many semi-arid areas worldwide because of its low-water needs compared with traditional crops. The cactus fruit is rich in magnesium, calcium, and vitamin C and can be used for jams owing to its high sugar content. The pads are eaten either fresh or as a canned vegetable. Because the stems are made of 90 percent water, their use as fodder would reduce the water needs of livestock.

With the United Nations classifying 42 percent of the world's land area as arid and semi-arid², cactus has enormous potential for carbon sequestration in abandoned places that may



not suit other crops. The cactus is adapted to dry marginal areas, increasing its possibility of combating desertification and soil erosion. In Senegal, the plant has notable success in fixing dunes. While in Madagascar, cactus cultivation has become an alternative source of livelihood³ for vulnerable communities in arid and semi-arid areas of the country.

Despite little knowledge and research on cacti and their products in Senegal, Mame is glad that some small and medium-sized enterprises are already actively processing and marketing cactus products like seed oil. Today, as humanity grapples with the challenges of global change, research represents a powerful instrument to accelerate the domestication of these stereotyped plants and tap into their numerous benefits.

2 https://www.un.org/en/events/desertification_decade/whynow.shtml

3 <https://www.jstor.org/stable/3774032>

How can Senegalese Women Access Land Rights? Multi-Stakeholder Dialogues can Move the Needle

Marie-Therese, a young scientist passionate about women's contribution to agriculture, advocates and champions dialogues to change mindsets about women's land access and ownership in Senegal. It is undeniable that women are critical actors in every part of the global food system, from research, farming, harvesting, processing, storage, and consumption. Despite their significance, restrictive social norms, discriminatory laws, and rapidly changing technological, environmental, and economic landscape mean their potential is often subdued. A report by FAO⁴ indicates that if women farmers had equal access to resources as the male farmers, they could potentially eradicate malnutrition for 100-150 million people.

The World Bank estimates⁵ women's labor share in African agriculture at 60-80 percent. In Senegal, women are the backbone of the country's agriculture, feeding a population of 16.7 million despite the country lying within the drought-prone Sahel. Yet, the women farmers have limited access to land, financial resources, markets, and skills compared to their male counterparts.

Growing up in Koalack, southeast of Senegal's capital, Marie-Therese Daba Sene, a Ph.D. student at Gaston Berger University and a 2020 One Planet Fellowship Laureate Candidate, experienced first-hand the struggles women and smallholder farmers underwent. During the holidays, she would accompany her father to the village, a trip she dreaded since it meant leaving her friends behind.

Over the years, Marie-Therese noticed her father's active participation in development activities in the village, especially in supporting rural women to farm vegetables for household consumption and as an income-generating activity. This experience informed her decision to focus on women farmers in agroecology while undertaking her Master's degree research.

Marie-Therese notes that women's land access is imperative to enhance food security. She believes that agroecology is a solution for rural women to access land, which she attributes to sustainable development. Although the Senegalese Constitution⁶ provides for equal access to land ownership, cultural practices and customary laws deny women that right. Women's tenuous access to land emerged as a critical issue for Marie-Therese.



She sees immense value in engaging various stakeholders in conversations about the benefits of equal rights to land access and ownership. These dialogues, if sustained, can help unpack the provisions in the Constitution and facilitate the implementation of the policies.

During her field study visits in the southwest region of Fatick, Marie-Therese works with women agricultural associations that request farming land from rural councils. The official records help association members access to credit and receive seeds distributed through different government programs. Marie-Therese highlights this as an avenue to self-sufficiency for the women involved since it provides food security for their households and an additional source of income from the sale of surplus produce.

Gender inequalities in Senegalese land governance can be attributed to the lack

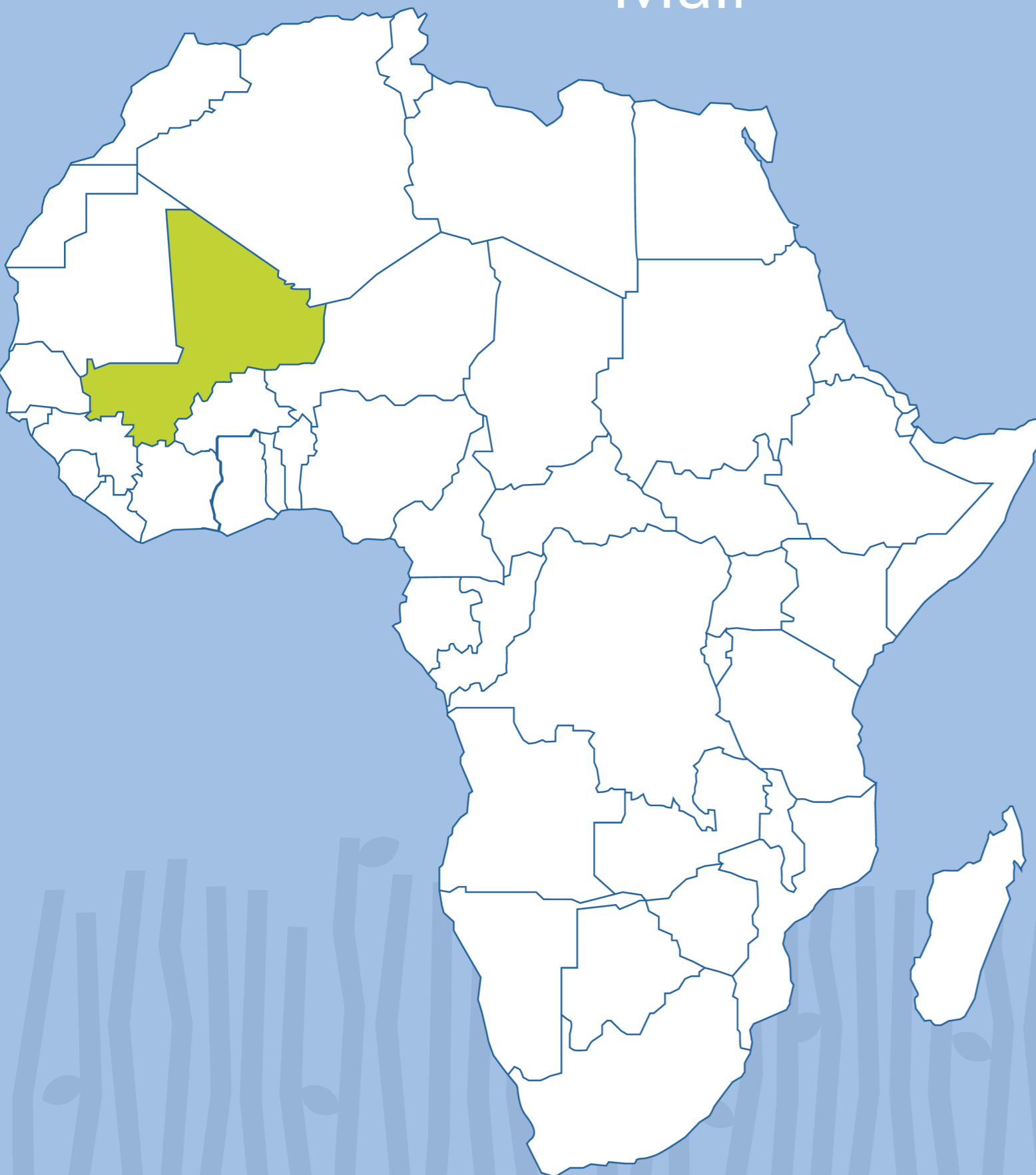
of women's involvement in local decision-making processes about land. Through her interactions with women, Marie-Therese noted that although some are aware of their legal entitlement to land, they often tend not to 'demand their right.' In the numerous participatory workshops she has attended, the shifts in women's and men's positions on land ownership reveal a recognition of the discriminatory customary gender laws and a yearning to change. To this end, Marie-Therese advocates for the need to foster dialogues on land ownership policies through advocacy and awareness campaigns. In her words, "if I don't do it, who will? and if I don't do it now, when will I ever do it?"

4 <http://www.fao.org/news/story/en/item/52011/icode/>

5 <https://www.worldbank.org/en/programs/africa-myths-and-facts/publication/women-agriculture-and-work-in-africa>

6 <https://advocatanmoy.com/2022/06/04/constitution-of-the-republic-of-senegal/>

Mali



Fighting a Modern Enemy Using Indigenous Knowledge and Science

Climate change⁷ is spurring the proliferation of new crop pests that seriously threaten African farmers. From leaf-eating caterpillars to fruit-pricking flies and tree-drilling beetles, these invasive species are a food and financial threat contributing to an estimated loss of 49 percent of annual yields, according to CABI⁸.

Cereals like rice, sorghum, and maize, Africa's most imperative food crops⁹, have not been spared. Maize, which is severely affected by pests, is the continent's most widely grown cereal crop, with over 300 million¹⁰ people in sub-Saharan Africa depending¹¹ on it as a staple food. A further 500 million to 1 billion Africans¹² consume root tuber crops, including potato, yam, sweet potato, and cassava, the latter being the most popular. While cassava is tolerant of drought and other extremes, it is vulnerable to pests. These insect pests can spread into new areas¹³ due to climate change and trade, and the resulting outbreaks can destabilize a country's food security. Climate change facilitates the spread of pests due to the creation of suitable weather conditions and new habitats for growth. The emergence of the fall armyworm is a good example.

The response to these pests has often been haphazard and ineffective. Farmers rely heavily on pesticides over traditional pest control methods, which presents several challenges.

According to scientists like Moussa Kante, a teacher-researcher at the University of Segou, Mali, integrated pest management offers farmers the prospect of higher profitability and lower production costs. Born in Sougoula Mali, Kante, a 2020 One Planet Laureate Candidate, lived in different countries in the sub-region while growing up, depending on where his father, an agricultural engineer, was assigned to work. The second born of six siblings, Kante has fond memories of growing up with his agronomist father, whom he would often accompany to meet farmers in the fields. This influenced his career path in agricultural engineering.



7 <http://www.nature.com/news/crop-pests-advancing-with-global-warming-1.13644>

8 <http://www.cabi.org/projects/food-security/tackling-pests-diseases/>

9 https://www.afdb.org/fileadmin/uploads/afdb/Documents/Events/DakAgri2015/Cereal_Crops_-_Rice__Maize__Millet__Sorghum__Wheat.pdf

10 <https://wema.aatf-africa.org/project-brief>

11 http://www.vib.be/en/about-vib/plant-biotech-news/Documents/VIB_MaizeInAfrica_EN_2017.pdf

12 <http://blogs.worldbank.org/african/cassava-production-poverty-alleviation-and-intra-regional-trade-in-sub-saharan-africa>

13 <http://www.fao.org/emergencies/emergency-types/plant-pests-and-diseases/en/>

Growing up in different regions exposed him to the everyday challenges farmers experienced, including the effects of climate change, the high cost of inputs, and pest management. He was observant and worried about the farmers' use of pesticides, oblivious of the risks these chemicals posed to them and the consumers. He also noted how expensive the pesticides were and that some farmers had little or no profit after harvesting.

Kante's research focuses on the fight against crop pests using biopesticides, anchored on indigenous knowledge - which he refers to as 'Africulture' - to help smallholder farmers. Integrating indigenous knowledge makes it possible to apply common strategies of problem-solving and thinking. According to Kante, communities have a vital role in safeguarding and preserving nature as they have done for millennia. Using a participatory approach, Kante taps into the farmers' wisdom and skills, which are based on a sophisticated understanding of their local surroundings.

The farmers often prefer repelling pests rather than killing them. This informs Kante's recommendations on using biopesticides from naturally available materials like plants, e.g., neem, chili, tobacco, garlic, acacia, and certain minerals. Natural products have a long history as crop protection agents, and pesticides are usually referred to as 'biopesticides' when formulated using these substances. As nature continuously provides almost unlimited bioactive natural products, today's farming model of exclusively relying on synthetic chemicals is beginning to change. With the help of scientific research, these biopesticides' efficiency has continuously improved.

Kante envisions his research will transform small-scale farming into an economically viable and environmentally sustainable practice for the communities in Mali and Africa. His commitment to helping smallholder farmers, whom he interacts with during field visits, is the ember that keeps his flame burning.



Côte d'Ivoire



Cocoa-Based Agroforestry can Sustain Cocoa Production and Save Côte d'Ivoire's Trees

Chocolate is often referred to as food for the soul. But could your sweet tooth be a contributor to the obliteration of animal and plant biodiversity? Cocoa, the key ingredient in chocolate, is traditionally cultivated in regions with dense and diverse tree canopies, and Côte d'Ivoire is the world's top cocoa producer. The country accounts for nearly half of the world's supply. However, according to the Ivory Coast Forest Inventory (IFFN), the West African country has lost 90 percent of its forest cover over the last 60 years,¹⁴ primarily attributed to cocoa farming. Over the decades, a lack of improved germplasm, inadequate farming inputs, and increased demand for cocoa has seen smallholder farmers clear new forest land every planting season. Did you know that the demand for chocolate means that a West African country is

staring at a crisis of rampant deforestation and increased vulnerability to climate change?

In recent years, a new generation of Ivorians, including Akoua Tamia Kouakou, a landscape ecologist and a Teacher-Researcher at Jean Lorougnon Guédé University, are striving to change a farming sector that has long left cocoa farmers in poverty. Tamia, a 2019 One Planet Laureate Candidate, dreams of a world where vegetation cover and natural resources are respected. Born in the eastern region of Côte d'Ivoire, her passion for the environment started at an early age as she joined her father for gardening sessions on the family farm. Her schooling years also allowed her to travel across the country, discovering the richness of her country's landscape and the different vegetation roles for diverse communities.



Tamia believes that agroforestry could help solve the challenge of deforestation in Côte d'Ivoire and bridge the gap between cocoa production and protecting the country's rainforest. Integrating other tree species and perennial food crops in cocoa plantations would limit deforestation and boost the dwindling tree cover, worsening the effects of an already changing climate. This practice is already in use by some farmers, although in a limited way since the decision of trees to plant is solely guided by their perceived usefulness for firewood production, thus limiting the diversity and density of the trees they grow. There's a need to consider the tree-planting practice beyond merely planting trees. We need to consider the tree species, planting density, and how these trees would complement the cocoa farms.

According to Cocoa Barometer,¹⁵ cocoa agroforestry systems have an extensive range of ecological benefits, including; carbon sequestration, preserving soil moisture,

controlling microclimates, biodiversity conservation, and pest control. However, a vast rift separates agroforestry's current reality and potential in the cocoa production sector.

In Côte d'Ivoire, increased awareness of cocoa's social-ecological impacts is pressuring the cocoa value chain actors to source from sustainably-produced systems that minimize degradation of biodiversity and deforestation and allow smallholder farmers to earn a decent income. Through her research, Tamia seeks to support cocoa producers adopt new cultivation practices, improving the livelihoods of the country's majority. By identifying tree species and ideal planting densities, her research could provide additional economic returns for the farmers, e.g., from selling fruits or timber and increasing food security. In the long-term, these cocoa agroforestry systems may result in higher yields than monocultures.

Tamia believes her experience with the One Planet Fellowship will help her share the knowledge she has gained with colleagues and students and in outreach activities with farmers in her home country.

14 <https://www.ignfi.fr/en/portfolio-item/inventaire-forestier-et-faunique-national-cote-divoire/>

15 <https://stories.mightyearth.org/voice-network-agroforestry-in-cocoa/index.html>

Scientist Turned Entrepreneur's Quest for Safe Crop Protection Options for Côte d'Ivoire Smallholders

Howélé Michaëlle Touré's passion for agriculture started while she was in high school. A native of Cote d'Ivoire, she obtained her Bachelor's degree in Abidjan, where she was born. Her father, a primary school teacher, instilled a love for work and respect for others.

Michaëlle, a postdoctoral researcher at Université Félix Houphouët-Boigny and a 2019 One Planet Laureate Candidate, was shocked to see farmers recklessly using chemical pesticides during a routine field mission. She was perturbed that the farmers were oblivious of the dangers of overusing pesticides and even more disturbed that safer options were not readily available.

Inappropriate application of pesticides can be detrimental to human health. Insufficient knowledge on safe pesticide handling by farmers in developing countries, illiteracy, and ignorance of biosafety measures are among the variables exposing them to the risk of pesticide poisoning. Some of the unsafe practices exhibited by farmers in Côte d'Ivoire and the developing countries, in general, include mixing highly toxic pesticides, unsafe transport and storage, improper disposal of empty pesticide containers, and even reusing the empty containers for food and water storage, and using obsolete pesticides. A study of global data on pesticide poisonings¹⁶ revealed a shocking increase in the number of farmers and agricultural workers harmed by pesticides. The study estimated the total fatalities worldwide from unintentional pesticide poisonings at 11,000 deaths annually.

The more she interacted with farmers, the more Michaëlle wanted to find a solution to curb the reckless use of pesticides among smallholder farmers. Her interest sparked entrepreneurship thoughts, and she set up a company to produce organic alternatives that would be readily available to the farmers. Although her research focuses on a solution for the bacterial blight cassava, Mica, as she likes to be called, has a newfound love of organic agriculture which has taken root. She believes organic agriculture respects the earth's ecological limits while promoting agri-food systems that strengthen food security and improve living conditions.



Only 0.2 percent of agricultural land¹⁷ in Africa is dedicated to organic farming. Challenges such as limited research on organic agriculture, lack of national organic agriculture policies, high cost of certification, and underdeveloped markets in most countries hamper the widespread adoption of organic agriculture in the continent. Although her company is still in the start-up phase, Mica soon expects to provide healthy food to consumers in Côte d'Ivoire. To reduce production costs and put organic products on the market, Mica works with researchers in related fields to prioritize healthy eating for her countryfolk.

16 <https://pubmed.ncbi.nlm.nih.gov/33287770/>

17 https://www.researchgate.net/publication/283507768_Organic_Agriculture_and_Food_Security_The_Story_of_Africa

Enhancing an Unassuming Local Staple for Improved Nutrition in Côte d'Ivoire



Côte d'Ivoire vibrates with the rhythm and flavors of its fertile land. The country's rich cultural heritage is spurred by the more than 60 ethnic groups that call it home. Despite the varying diets, the people of Côte d'Ivoire generally rely on tubers and grains to sustain their diet. Rice and cassava are the two most important staple food crops, with cassava having an annual output of 5,238,244 tons in 2019.¹⁸ The country's widespread cultivation and consumption of cassava are linked to the tuber's high drought adaptability, resistance to pests and diseases, and primary production techniques. Attiéké, a dish made

from fermented cassava, is the most famous traditional cuisine, but it contains insufficient quantities of proteins and micronutrients.

Studies record that more than half of Côte d'Ivoire's population consumes attiéké at least once daily. So popular is the dish that it dominates mealtimes across the country. However, because of its low nutritional value, most populations suffer severe undernutrition, particularly the poor households that consume attiéké without complementing other foods. According to the Food and Agriculture Organization of the United Nations, almost a quarter of households in rural Cote d'Ivoire suffer from food insecurity and malnutrition.¹⁹ Malnutrition presents significant threats to human health. The World Health Organization (WHO) attributes better nutrition to improved health,²⁰ longevity, and a lower risk of diseases. The significant nutritional challenges that most of Côte d'Ivoire's citizens face are what drove Kouadio Christelle Marina Kouakou, a postdoctoral researcher at the Nangui Abrogoua University in Abidjan and 2020 One Planet Laureate Candidate, to specialize in nutrition and food security.

Christelle's research focuses on widely consumed foods with low nutritional value. Through her research, she established that consuming large amounts of starch and lacking vitamins and minerals in diets made the Ivorians susceptible to nutritional deficiencies. Christelle is convinced that the widespread consumption of attiéké in Côte d'Ivoire means that improving the nutrition of the country's

population lies in identifying ways of enhancing the popular staple dish.

In developing countries, micronutrient deficiency and protein-energy malnutrition are the most common nutritional problems. Through fortification, the nutritional quality of different foods can be improved.

Christelle's research indicates that the nutritional rate of attiéké can be increased by incorporating other foods rich in vegetable protein and minerals, especially soybeans. The beneficial effects of eating enriched attiéké have been proven,²¹ and the results are promising. Furthermore, her research affirms the need to intercrop and substitute chemical

fertilizers with organic options for increased yields and nutritional quality.

Christelle also notes that promoting the production of soybeans to incorporate into attiéké has a double-edged benefit, as it supports smallholders to improve their soils. Due to their nitrogen-fixing capacity, legumes reduce the need for synthetic nitrogenous fertilization.

Christelle believes that scaling up the production of legumes rich in vegetable proteins and cheaper than animal proteins would encourage the population to consume more and fix the country's soils while at it.



¹⁸ <https://www.selinawamucii.com/insights/market/ivory-coast/cassava/>

¹⁹ <https://reliefweb.int/report/c%3%B4te-divoire/c%3%B4te-divoire-malnutrition-worsens-fao-says>

²⁰ <https://www.who.int/health-topics/nutrition>

²¹ <http://www.sciepub.com/ajfst/abstract/8965>

Burkina Faso

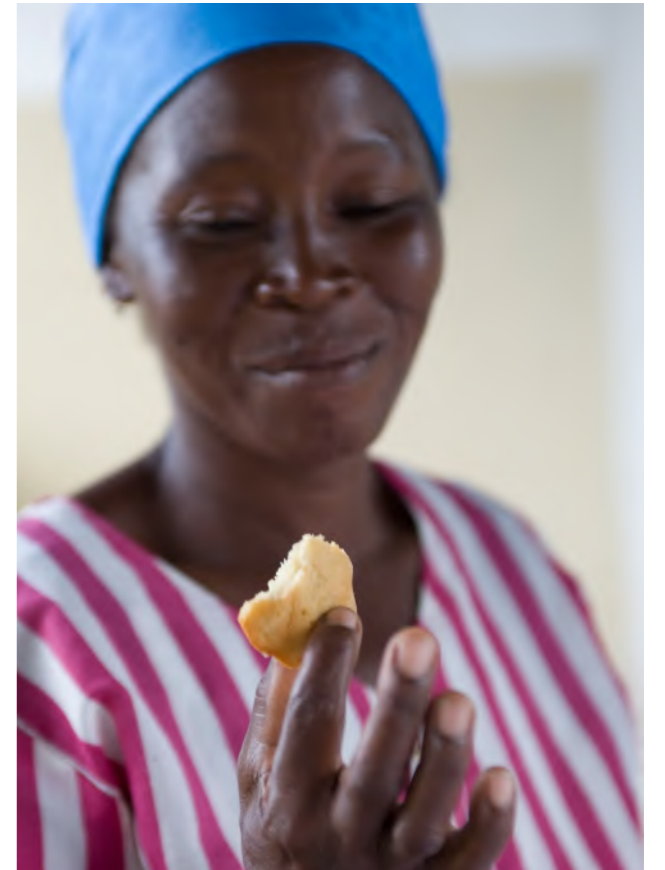


A Touch of Science to Improve a Traditional Condiment, While Lightening Women's Burden

Sumbala, a popular condiment in West Africa made from fermented African locust beans (*Parkia biglobosa*), is not only an essential source of nutrients for low-income households but is also a key income generator for rural and urban women in Burkina Faso. However, the work involved in preparing this traditional delicacy, primarily done by women, is restrictive and arduous. The process consumes significant amounts of firewood and water and takes considerable time. Furthermore, the nutritional benefits of sumbala have led to increased demand, resulting in the adoption of unhealthy practices to facilitate the cooking process, including industrial chemicals. The resulting product is of poor nutritional and health quality.

Driven by her passion for transforming local products for family consumption, Miriam Coulibaly Diakité, a Food Research Engineer at the Institute for Research in Applied Sciences and Technologies (IRSAT) and 2020 One Planet Laureate Candidate, is working to optimize the traditional sumbala production process. Her research focuses on developing an innovative resource-saving production process that will eliminate some of the production constraints. Miriam incorporates science into the traditional preparation to create a process that uses less energy and water, ultimately reducing the processing time.

The traditional sumbala preparation process takes up to five days. It entails cooking the seeds for 18 to 20 hours, which consumes colossal amounts of firewood, and about 40 liters of water to produce one kilogram of sumbala. This process takes a toll on the



women and the environment, given the vast amount of water and firewood required. Diakité's research is improving the working conditions of Burkinabè women and allowing them to produce better quality sumbala. These improvements have made it possible to promote entrepreneurship around this activity among the youth and diversified the forms of sumbala available in the market.

Born into a large family in Bobo-Dioulasso, Miriam recalls watching cooking shows with her father as a child, which perhaps sparked her interest in agri-food engineering. She hopes to benefit from the One Planet Fellowship's



mentoring program to facilitate the effective transfer of skills from established scientists around the continent. She is keen to compete for the Fellowship's Advanced Science Training (AST)²² to gain an opportunity to access modern laboratories for the latest technologies in food research and develop fruitful collaborations. Upon completion, she would like to share her experience with colleagues at her institution, which she has already started through discussions with colleagues.

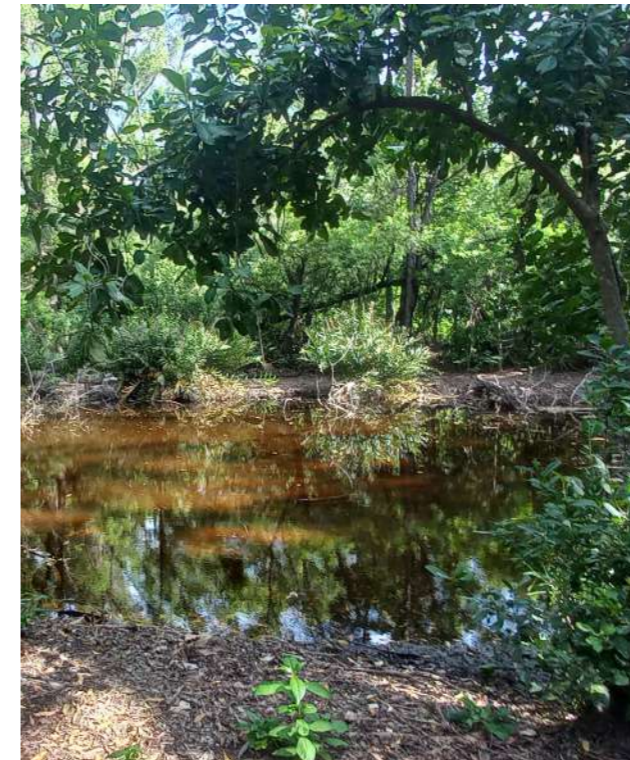
With recent reports painting a gloomy picture of the state of malnutrition in Burkina Faso,²³ Diakité envisions her research and work on this traditional condiment, packed with nutritional and microflora properties,²⁴ as a solution to a looming nutrition crisis.

22 Advanced Science Training (AST) is a three to nine-month program within the One Planet Fellowship offered to post masters and post-doctoral Candidates for research placements in state-of-the-art European agricultural research institutions

23 <https://reliefweb.int/report/burkina-faso/burkina-faso-acute-malnutrition-analysis-august-2021-july-2022-issued-january>

24 <https://www.journalcra.com/article/process-production-and-valorization-sumbala-african-mustard-review>

Can Review of Women's Land Rights Improve Adoption of Stormwater Management Options? A Sociologist Dives to Find Out



Born in Burkina Faso to a father who was a forester and a mother who was a nurse, Inès Fabienne Rouamba, a 2019 One Planet Laureate Candidate, would often help her father plant trees around their compound. What she enjoyed the most was watering the trees, and at an early age, she became interested in environmental studies.

At the university, Fabienne joined the sociology faculty because, in her final year in high school, one of the teachers she admired was a sociologist, and she admired his mastery of the course. Additionally, reading Jacques Chevrier's "African Anthology" book made her

consider studying anthropology. She actualized this dream by enrolling in the faculty of sociology. After obtaining her master's degree in sociology, she landed a job as a Research Engineer in Rural Sociology at the International Institute of Water and Environmental Engineering (2iE) in Ouagadougou.

In her role, Fabienne works on the development and sustainable management of runoff collection basins (BCER project) for supplemental irrigation in Burkina Faso. This project, also implemented in Mali and Niger, promotes optimized management of stormwater retention basins to strengthen farmers' resilience to climate change in the Sahel.

In ideal situations, only a small quantity of rainwater becomes surface runoff. This runoff usually flows into the nearest wetland, creek, stream, lake, or river; however, due to the depletion of vegetation cover and degradation of the natural environment, runoff increases and causes flooding. Today, retention basins (ponds that store and filter rainwater from sediment) are commonly used for stormwater treatment. The retention ponds impede the adverse effects of excess stormwater, prevent frequent flooding, and further recharge groundwater.²⁵

Fabienne is responsible for evaluating the social, cultural, economic, and environmental impacts of the construction of stormwater retention basins. Her research entails assessing the basins built in Burkina Faso. She evaluates

25 <https://sswm.info/water-nutrient-cycle/reuse-and-recharge/hardwares/recharge-and-disposal/surface-groundwater-recharge>

the effectiveness of the waterproofing techniques, their degradation (stability, loss of capacity), use of these basins, and any factors constraining and/or facilitating their proper use. Her research further identifies the gender aspects that may influence the adoption of retention basin technology.

In Burkina Faso, she works in the northern Sahel zone, where women, despite their pivotal role in farming and other income-generating activities, have no rights to land ownership. Fabienne has observed that regardless of their involvement in constructing the retention ponds, women have limited access to the farms, thus crippling their ability to fully benefit from the technologies.



Her research findings have made Fabienne appreciate the lack of gender parity in the adoption of sustainable options for stormwater retention and the development hurdles the rural Burkinabe women face. Her desire to contribute to improved living conditions for these women has fueled Fabienne's interest in gender and agriculture. She is conceptualizing a research project to demonstrate how women's ownership and management of retention basins can improve resilience of farming communities in the northern region of Burkina Faso. Through her new project, she will promote the leadership of women farmers in the face of a changing climate. Fabienne identifies capacity building as necessary to encourage more excellent women leadership within farmers' and rural producers' circles. She believes women need access to the latest information on agriculture, production, and coping with climate change. They also need to acquire skills in leadership, marketing, entrepreneurship, and the ability to discuss and negotiate with authorities.

However, all her plans have been put on hold due to the unprecedented crisis in Burkina Faso²⁶. Sadly, the political instability has aggravated the dire situation for women and marginalized communities who are forced to flee their homes and have become even more vulnerable.

Promoting gender equality and women's empowerment in Burkina Faso's farming systems has gained ground and is slowly taking root. Fabienne believes that despite the current situation in the country and the challenges of inequality, the time is ripe for women smallholder farmers to gain recognition for their contribution to agriculture and towards achieving global food security.

26 Burkina Faso has been experiencing escalated political instability following a series of military coups since late 2021 (<https://www.aljazeera.com/where/burkina-faso/>)

A Scientist Living her Dream Includes Smallholders in Research to Boost Innovation Adoption

Inspiration is the impetus to move ahead, and people have sought it from the most unlikely places. Born in a modest family in Ouagadougou, Burkina Faso, Alimata Arzouma Bandaogo, a 2019 One Planet Laureate Candidate, recalls seeing a beautiful house on her daily route to school as a child. She was fascinated by the house's beauty, and upon inquiry, she learned that the owner was an agricultural engineer. Immediately, she told her friends she would be an agricultural engineer too when she grew up. Bandaogo, an agripedologist at the Institute for Environment and Agricultural Research (INERA), Burkina Faso, now lives her childhood dream. She works on, among other things, finding strategies to improve soil production. She also researches improved crop varieties and their introduction in rural areas.

Alimata recalls her allure to trees, animals, water, and nature from an early age. This developed her interest in environmental studies and helped her develop a good

aptitude for science subjects. In 2005, she obtained her General University Study Diploma (DEUG – Diplôme d'Etude Universitaire Générale) at the University of Professor Joseph Ki-ZERBO, where she pursued her dream of becoming an Agronomist Engineer. After passing the entrance test to the Institute of Rural Development, she naturally chose to study agronomy. Her passion for this profession was unwavering, and she sailed through her agronomy engineering degree in 2008.

During her training, Bandaogo comprehended the challenges that plagued her country's agricultural sector, including soil degradation, declining yields, and climate change. Agriculture is the backbone of the Burkinabe economy, and smallholder farmers constitute 80 percent of the country's agricultural community²⁷. The sector is characterized by scarcity of secure arable land and markets, limited access to quality inputs and services, and unavailability of financial services.



27 <https://sswm.info/water-nutrient-cycle/reuse-and-recharge/hardwares/recharge-and-disposal/surface-groundwater-recharge>

High rainfall variability characterizes the climate of this Sahel country, making farming difficult for most smallholders since there is little access to irrigated water supplies. Climate change is compounding this problem, leading to an increase in the magnitude and frequency of extreme weather events and a general decline in rainfall.

To improve Burkina Faso's agriculture sector and uplift the livelihoods of vulnerable households and communities, the focus should be on revamping agriculture production by promoting best practices that integrate sustainable use of natural resources and climate risk management. In this spirit, Alimata changed her research focus to extend innovative and climate-smart production systems, including organic manure, crop rotation, soil conservation, and integration of high-yield crop varieties. Working closely with the farming communities, she co-designed these systems to enable better adoption. Her solutions were met with genuine enthusiasm from the farmers, who gladly adopted the new technologies. Her most successful work involved optimization of the use of nitrogen in irrigated rice farming with Deep Placement of Urea (DPU) supergranules technology to manage the different nitrogen loss mechanisms. She conducted the experiments at INERA in Burkina Faso's three central irrigated plains and trained producers to use DPU through field schools and guided tours.

Thanks to this project, the adoption of DPU technology has surpassed expectations on the rice plains of Burkina Faso. Because of community involvement in the planning and execution, the chance of continuous implementation going forward is greater. The yields have increased by 25 percent, and the farmers are still working together to achieve the common good.

Although Alimata's work produces the desired results, many more challenges remain in the Burkinabè agricultural sector. Through national policies, concerted efforts are required to

provide safe and nutritious food, improve market systems, and reduce smallholder farmers' vulnerability to climate-related risks.



Exploring Research-based Solutions to support Artisanal Fisheries

For as long as he can remember, Toundji Olivier Amoussou has been passionate about fish. Born in the commune of Savalou in Benin, Olivier, a 2019 One Planet Laureate Candidate, began his primary studies in Parakou. After attaining his bachelor's degree, he enrolled at Abomey-Calavi's Polytechnic School to study livestock production. In the second year of his master's degree, he obtained an internship at the International Centre for Research and Development on Livestock Farming in Sub-humid Zones (CIRDES) in Bobo-Dioulasso Burkina Faso, where he is currently a Post-Doctorate Researcher.



Olivier's vision of improving the lives of rural fishing communities has always been his driving force. Burkina Faso's artisanal fishing value chain is extensive - from farming, and input production, to processing and marketing. This chain has the potential to generate employment for many youths and enormous profits for business people.

It contributes to job creation, poverty alleviation, and food security.

Unfortunately, most of Burkina Faso's aquatic resources are being degraded and are under imminent threat by multiple human-induced pressures. The principal stresses on these resources include wetland encroachment, development of agricultural projects along water sources, and unregulated water abstraction from underground and surface water tables. Pollutants such as pesticides, heavy metals, and sediment degrade wetlands and affect water quality.

During his master's fieldwork in the village of Bama, 20 kilometers from Bobo-Dioulasso in Burkina Faso, Olivier had an epiphany about how the livelihoods of the fishing community in this region would benefit from his research. The Kou Valley Lake in Bama is a critical source of livelihood and nutrition for the communities. However, the lake is gradually decreasing due to the conversion of its perimeters for agricultural activities, including rice fields and banana plantations.

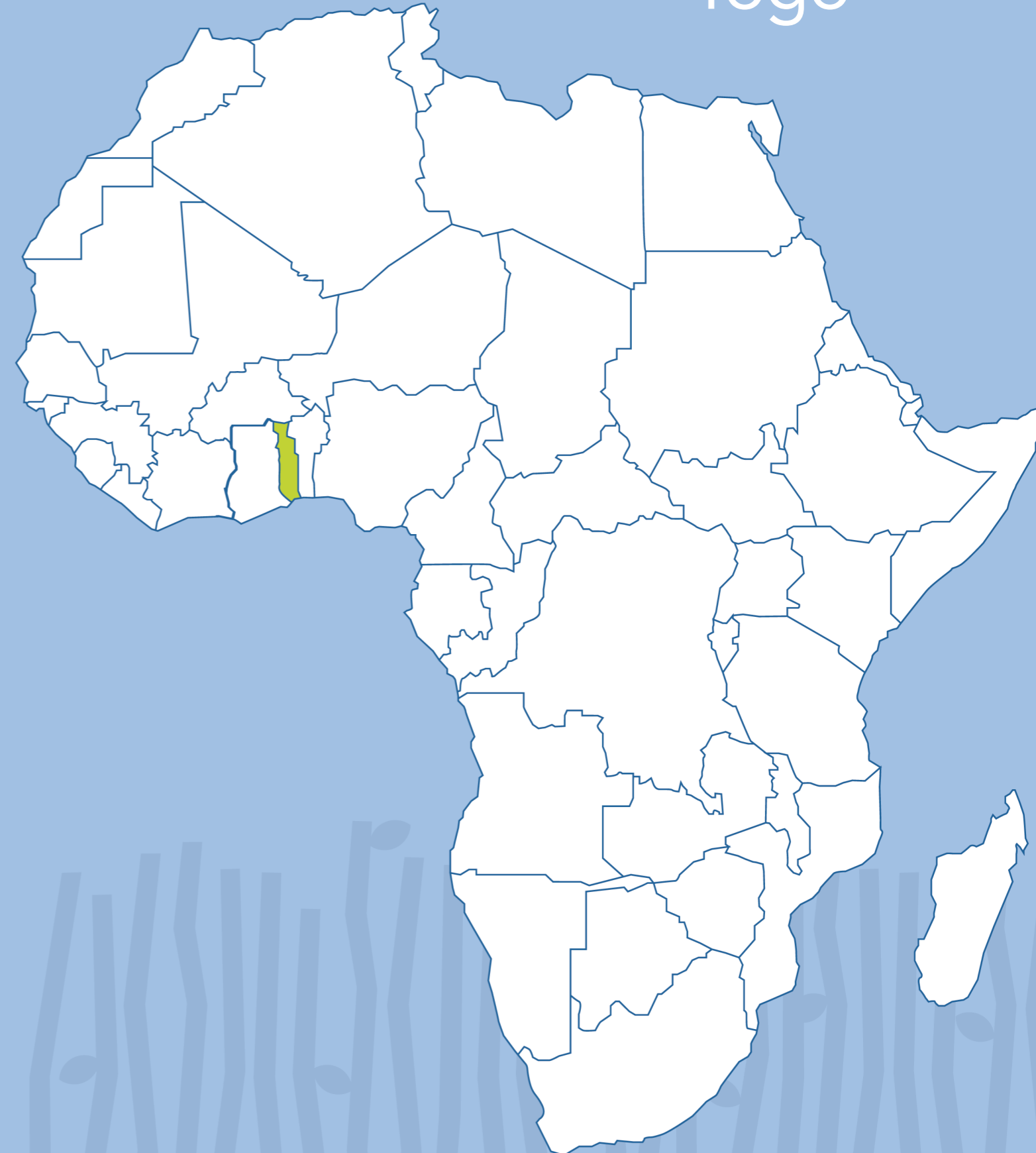
By integrating with the Burkinabe fishing communities, Olivier has navigated complex social-ecological challenges and integrated their traditional knowledge into his research to ensure they fully adopt the learnings. His scientific approach aims to find innovative solutions for managing fishing communities while preserving the natural environment. The study focuses on the conservation and environmental sustainability of aquatic genetic resources - plants and animals.

Olivier notes that more effort is required to develop an ecosystem services framework that articulates social and ecological benefits. The unifying goal of his research is to balance the ecosystem and human needs so that aquatic resources are sustainably managed for the benefit of future generations.

Toundji Olivier Amoussou is among a growing number of candidates selected to participate in the One Planet Fellowship - a career development initiative that builds a robust pipeline of highly connected, inter-generational scientists equipped to use a gender lens to help Africa's smallholder farmers cope with climate change. He believes the Fellowship will offer him an opportunity for personal development and integration into a network of African researchers. He notes that the scientific and proposal writing skills garnered from the Fellowship will contribute to improving project writing and increase his funding opportunities. Additionally, lessons learned from his European peers during Advanced Science Training will provide the tools to impact the fishing communities he's passionate about.



Togo



Incentivizing Communities to Participate in Forest Fires Management

Bush fires are a significant threat to forests worldwide. Research in the West African savannas²⁸ indicates that aside from the commonly cited reasons - hunting, paving the way for farmland, and improving grazing grounds – communities set up fires to increase the supply of particular forest products and deter wild animals. In Togo, poor forest resource regulations, insufficient knowledge on sustainable land management and conservation, and a lack of awareness by the local communities have increased bushfire occurrences. A report by Global Forest Watch²⁹ states that Togo lost 63 hectares of tree cover between 2001 and 2021 due to the fires.

In the last decade, bush fire outbreaks in the West African country have become a considerable challenge to soil fertility, biodiversity conservation, and the development of the agricultural sector. This is because the fire outbreaks have destroyed vast tracts of farmland and forests, leading to the loss of farm produce and the loss of property, and lives in some cases.

Dahan Kueshi Sémanou, a Ph.D. student at the University for Development Studies in Ghana and a 2019 One Planet Laureate Candidate, has encountered the devastation caused by bushfires in his home country Togo. Growing up in Ahlon-Tinipe, a small village in Togo's plateau region, he witnessed his communities' suffering from the annual bush fires that often destroyed everything in their wake during the dry season. This experience informed his research area - fires, plant dynamics, climate

change, forests, and remote sensing - and a drive to find probable solutions to stop or reduce this disaster. One of his research areas explores the socio-economic and sociocultural aspects that fuel bushfires and the environmental conditions that catalyze their spread.



Dahan's research also analyzes the damage caused by the fires to determine the most affected landscape entities. These fires also significantly impact the environment in the form of air pollution since they release millions of tons of carbon dioxide and other greenhouse gasses into the atmosphere, contributing to climate change.



His research recommends establishing policies for monitoring and raising awareness of at-risk areas while incorporating all stakeholders, particularly the local communities. Additionally, he calls for increased attention to the impacts of bushfires on the communities and other stakeholders in the country, including the Regional Directorate for the Environment and Forest Resources, whose role is to protect the country's forests.

Passionate about natural resources and the need to preserve them, Dahan decided to investigate the local communities' stake in natural resources and how best they can participate in their management.

Dahan advocates for community training in small-game farming, which will help communities obtain meat products and a source of income that will reduce hunting and bushfire practices. Training the locals in beekeeping and installing the beehives within forested areas will also oblige them to protect the forests. He also notes that training the

communities in sustainable farming techniques will avoid using bushfires for land clearing.

Dahan believes that only through political commitment and prioritization of these actions under sustainable development policies will such measures be effective in tackling this recurring phenomenon.

28 https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjZ9Yy1_8v5AhVQt6QKH-Q8sBpg4ChAWegQIIBAB&url=https%3A%2F%2Fd-nb.info%2F10148869%2F34&usg=AOvVaw0EnOriTKDPj_oQxqTQj4Ac
29 <https://bit.ly/3wERPjP>

Benin



Mission Possible: Seeking Safer Pest Control by Weaving Indigenous Knowledge Into Science



The widespread use of synthetic pesticides in the early 20th century revolutionized the farming industry across the world.

In Africa, agricultural pesticides have increased production in livestock and crop enterprises since farmers now have the upper hand in the fight against pests and parasites. With an estimated population of 1.3 billion and expected to double by 2050³⁰, there is enormous pressure on African food systems, often inundated by low productivity. The continent is rapidly developing dependence on pesticides for crop protection, especially among smallholder farmers who account for over 75 percent of food production on the continent³¹.

For the West African Republic of Benin, the consumption of pesticide residues through contaminated food products receives little

attention, which has brought to light the alarming pesticide practices in the country³². Laura Estelle Yêyinou Loko, a Senior Lecturer at the National University of Sciences, Technologies, Engineering, and Mathematics in Benin, and a 2020 One Planet Fellowship Laureate Candidate, seeks to secure agricultural production in the country by merging indigenous knowledge and science for pest control. During her thesis research, a field visit informed Estelle's interest in pest control. She was perturbed by the massive post-harvest losses farmers faced caused by insect pests, which led to their use of highly toxic pesticides. During one of the field visits in Northern Benin, she learned about an entire family wiped out due to food poisoning linked to the consumption of yams treated with synthetic pesticides.

30 <https://www.worldometers.info/world-population/africa-population/>

31 https://www.researchgate.net/publication/242759117_Smallholder_Agriculture_in_East_Africa_Trends_Constraints_and_Opportunities

32 https://www.ishs.org/ishs-article/1007_44

“Learning that an entire family died because of hunger since the only way they could respond to hunger was by consuming contaminated cassava was devastating. I knew I had to do something. I found my purpose then. That is why I have committed myself to develop alternative biological control methods that respect human health and the environment for post-harvest protection”, shares Estelle.

Estelle believes that farmers embody plenty of valuable knowledge, which can be harnessed to provide safer pest control solutions. Recalling her childhood memories in the small town of Kribi in Cameroon’s equatorial forest, she remembers observing nature and realizing that insect pests have natural enemies, which she refers to as “farmers’ friends.” Her research includes finding strategies to utilize these natural enemies in managing crop pests. These strategies combine scientific practices with traditional knowledge acquired by Beninese farmers over many centuries, like using oils and powders from certain plants with pesticide properties. Estelle seeks to promote the use of these methods, which are quickly being replaced by harmful pesticides. She scientifically evaluates each strategy to ascertain its effectiveness.

Estelle and her team are ambassadors of sustainable and organic agriculture. She firmly believes that organic farming is a powerful way for farmers to develop resilience against climate change. The extensive use of pesticides has dramatically degraded the soil, resulting in the desertification of large land areas. Organic farming can counteract this challenge and increase agricultural productivity.

Another component of her work is to teach farmers the best agricultural practices and raise their awareness about the negative impact of the abusive use of pesticides on human health and the environment. Through the One Planet Fellowship, she has gained skills that have improved her interaction with farmers as she continuously spreads knowledge across local communities in Benin.



With the advent of climate change, Estelle has begun focusing on the proliferation of new pests in her home country. Her work is fundamental to Benin’s future and exemplifies how science, traditional knowledge, and sustainable practices can be combined to change a country’s food systems.

Fishing Innovative Options to Promote Fish Farming

In much of rural Africa, fishing tends to be overshadowed by agriculture and livestock keeping, despite not being a marginal sector. On the continent, fishing provides a direct income for over 10 million people³³ and contributes to the food supply of over 200 million more people. Data from the WorldFish Centre³⁴ indicates that 22 percent of animal protein for Africans is from fish and the rate is as high as 60 percent in some countries. Fish is also a great source of essential minerals, fatty acids, vitamins, and other nutrients necessary for a healthy diet. Fishing is also a significant economic contributor. According to the UN Food and Agriculture Organization (FAO)³⁵, fish products constitute over 10 percent of the total value of national exports in 11 African countries. However, under the current fishing practices, Africa’s inland fisheries and marine are reaching their limits.

Data from the Japan International Cooperation Agency (JICA) indicates that Benin’s fishing industry employs about 15 percent of the working population³⁶ and provides 30 percent of the animal protein consumed in the country. Yet, domestic fisheries production provides only 45,000 tons of products annually, about half of the consumption; imports of frozen fish products fill the gap. This situation calls for a need to increase the productivity of domestic fisheries, stimulate domestic producers, and curb the outflow of foreign currency.

Growing up in rural Benin, Rodrigue Pèlèbè Edéya Orobiyi, a Research Assistant at the University of Parakou and a 2021 One Planet

Laureate Candidate, recalls how his mother would always include fish in his meals. Like many Beninese people, fish was the first source of animal protein as a child. Unfortunately, in recent years, several threats, including climate change, still weigh on national fishing and fish farming production, which is not enough to meet domestic demand. Rodrigue is a well-equipped specialist in innovative, resilient fish farming and fishing practices. His research interests include aquaculture, aquatic



ecotoxicology, molecular identification and population genetics of fish, and smart, sustainable climate change-resilient fish farming and fishing practices.

33 <https://www.un.org/africarenewal/magazine/april-2006/africa-starts-fishing-%E2%80%98revolution%E2%80%99>

34 <https://www.worldfishcenter.org/research/aquatic-food-systems>

35 https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwil_MGdpcz5AhVD2KQKHVvCvAQFnoEC-BUQAQ&url=https%3A%2F%2Fwww.fao.org%2F3%2Fca9229en%2Fca9229en.pdf&usq=AOvVaw3PIAwXGatLz6C3Y0z0NS0M

36 <https://www.jica.go.jp/benin/english/activities/development.html>

Working closely with fish farmers, his research evaluates different fish farming systems in the country, creating a repertoire of practices that adapt to the effects of climate change while improving the productivity of fish farming. He also studies the different socio-economic reasons why fish producers adopt these practices.

Rodrigue envisions a time when local fish farmers will meet Benin's domestic demand and adopt fish farming systems documented through his research. The One Planet Fellowship has provided a platform to develop collaborative networks with other scientists and researchers across Africa and Europe. Although research funding is still a massive obstacle in his career path, he believes that when researchers and farmers share their common language, they can mitigate the effects of climate change in the fishing sector and contribute to Benin's food security.



Nigeria



A Scientist's Quest to Empower Women in the Fishing Community in a Nigerian Lagoon

Oceans and other natural water bodies are often perceived as natural resources that can never be depleted and are invulnerable to collapse. Still, they have taken a pummeling and face three major threats: pollution, climate change, and overfishing. Research shows³⁷ that oceans could drastically change, within our lifetimes, if we do not stop.

Growing up in Epe, a small community in Lagos State, Nigeria, Toyosi Fadekemi Igejongbo, a 2021 One Planet Laureate Candidate, has first-hand experience of the drastic changes our oceans are experiencing. Though tiny and rural, Epe is a world-renown seafood export collection point and is popularly known as the fish basket of Lagos State. Fishing is the primary occupation for the community here, and the Epe lagoon is their lifeline.



Epe lagoon is connected to the Atlantic Ocean via the Lagos lagoon, and due to its geographical position, the lagoon is rich in different fish species. Toyosi is filled with fond memories of her childhood in Epe. She recalls always going home to different meals like dried shawa fish and fried prawns prepared by her mother. She would even cook egusi ijebu (Melon soup) with giant crabs freshly caught in the lagoon. During the weekends, her father would take the family to the lagoon's adjoining beaches, where they would relax and relish in the serenity

Toyosi enjoyed accompanying her mother to the market to purchase fresh fish off the boats. Along the way, they would interact with the women trading on the lagoon shores, and she reminisces two particular women; Iya Nura and Iya Nofisat. She was intrigued by their hard work, going offshore to fish and spending entire nights processing the fish while tending to their children. Women are the primary occupants of the market at various levels of the value chain.

Epe was home and fun, but Toyosi knew she had to leave one day. She left Epe for her university studies in Akure, a city in the southwestern part of Nigeria. During her enrollment, Toyosi was offered a course in animal science and fisheries management, against her choice, but she studied through her first and second degrees as a fisheries scientist. During her Ph.D. studies, Toyosi struggled to get into the world of academia. She faced backlash from society, which prescribed that

because she was a woman, she did not have the tenacity to pull through academics.

"All these comments made me reminisce about women like Iya Nura and Iya Nofisat working tirelessly back home at Epe Lagoon, and I was more determined."

Toyosi did her Ph.D. fieldwork in Epe Lagoon with the rationale of giving back to the community that raised her. During her research, she made some intriguing discoveries about the lagoon – it was diminishing. The physical and chemical parameters of the lagoon were gradually becoming unhealthy for aquatic life sustenance due to climate change and human activities. The diversity of seafood Epe was once known for was progressively reducing. Upon completing her Ph.D. research, Toyosi felt obliged to provide solutions to the challenges.

Over the years, her research has focused on working with fishing communities to mitigate the threats to aquatic biodiversity, identifying threatened species to ensure their continued existence, and helping manage fishing economies. In managing these economies, Toyosi believes it is essential to honor and amplify the struggles of women like Iya Nura and Iya Nofisat. They play a significant role in small-scale fishing communities.



She believes it is time to give women at the lower end of the fish value chain a voice and involve them in the decision-making. It is time to place them as significant stakeholders in the fisheries sector. It is time to create access to technology that could ease and improve their work and carry out research not oblivious of their existence.

This is Toyosi's clarion call to empower women in fisheries for sustainable livelihoods. She believes it can be done together because there is no reason to fear the wind when the root is deep.

37 <https://www.nhm.ac.uk/discover/will-the-ocean-really-die.html>

No Child Should go to Bed Hungry: A Scientist's Motivation to Reduce Food Waste

"No child should go to bed hungry. As a child, I grew up on a farm surrounded by yam, cassava, fruits, and vegetables, yet I experienced food insecurity. The fact that my parents were subsistent farmers did not mean we always had adequate food," Bolarinwa Islamiyat Folashade, a Food and Nutrition Scientist, recalls her childhood. Bolarinwa is also a 2020 One Planet Fellowship Laureate Candidate.

Bolarinwa says her family's story is replicated each day where she lives, Oyo State, Nigeria, and across the country.

In sub-Saharan Africa, food losses are estimated to be worth \$4 billion annually³⁸, posing a considerable threat to food security. In Nigeria, the estimated annual loss stands at a staggering \$12 billion³⁹, adding more pressure to a country widely known as the world's poverty capital.

Nigeria's government has responded⁴⁰ in many ways to improve its citizens' living standards by promoting technology in food production, agricultural research, and supporting initiatives that empower rural women.

Beyond that, individual scientists like Bolarinwa are leading transformative innovations toward boosting Nigeria's agricultural production. "If we want to be closer to ending hunger by 2030, then we must work as a collective," she says.

Her research focuses on food and nutrition security, specifically post-harvest management, to help farmers extend their food products'

shelf life, especially fruits and vegetables. She affirms that the research will lead to the resilience of small-scale farmers by increasing the availability of nutritious foods and helping reduce post-harvest loss, thus alleviating hunger.

"This study is particularly close to my heart. I remember the losses my parents would incur while attempting to get our farm products to the market, like transport and drying issues. That is why my research is not only looking at nutrition but also market opportunities," she emphasizes.

Bolarinwa explains that she has worked on value addition to preserve vegetables and fruits outside the season to enrich children's diets. She has also developed new nutrient-rich staple foods and snacks from underutilized



food crops that are cheap, readily available, and drought-resistant to ensure that safe food is available for everyone.

Bolarinwa's research aligns with indicator 12 of the Sustainable Development Goals (SDGs)⁴¹ on reducing post-harvest loss and the environmental impact of organic waste. "I am so glad that this SDG exists because it encourages other scientists with similar experiences to re-imagine and produce working solutions to reduce post-harvest loss," she reiterates.

Finally, she points out that given that we are all facing current harsh realities like high food prices, the COVID-19 pandemic, and uncertain weather patterns, it is more incumbent to ensure that food from the farm makes it to the plate and market. She emphasizes that these interventions should not represent farmers' efforts and livelihoods that had gone to waste.

"Today, my story is no longer unique. We must collectively come together and act to make food available for millions across the continent. No child should go to bed hungry," she concludes.

38 <https://www.unep.org/thinkeatsave/get-informed/worldwide-food-waste#:~:text=In%20Sub%2DSaharan%20Africa%2C%20pos-t,of%20the%20total%20crop%20harvested.>

39 <https://www.ripplesnigeria.com/nigerias-annual-post-harvest-loss-hits-12bn/>

40 <https://www.devex.com/news/opinion-beyond-covid-19-addressing-food-insecurity-in-nigeria-98658>

41 <https://www.fao.org/sustainable-development-goals/indicators/1231/en/>