CLIMATE CHANGE, ADAPTATION AND THE POTENTIAL OF AGROECOLOGY

ADAPTATION, RESILIENCE, AND AGROECOLOGY

Climate change is undermining the health and capacity of agricultural systems due to more intense and increased shocks, including prolonged floods, heatwaves and droughts, increased pest and disease outbreaks, and persistent seasonal changes.

The **climate crisis is straining farmers' ability to ensure yields and secure sustainable livelihoods, threatening global nutritional security**, and underscoring the vulnerability of monocrop & industrial food systems to these increased disasters. In this context, **agroecology – an ecologically, socially and economically sustainable approach to food and farming** – demonstrates numerous agronomic, social, and economic benefits that will prove paramount to our ability to mitigate and adapt to a rapidly changing climate.

Benefits of agroecological systems

Resilience

Sustained yields

Improved livelihoods

Food Security

Data Sourcing
The data cited in this document, including the case studies, primarily come from studies published in the last five years (2017-2022). They include research from Africa, Asia, Europe, and the Americas, though Africa & the Americas are most well represented. The studies measure a wide range of environmental, economic, and social indicators. Crop yield, farmer income or profitability, and social capital or level of self-organization were the most commonly measured indicators of resilience. Crop diversity, food security, dietary diversity, ecosystem services, and financial capital were also measured.

CLIMATE CHANGE, ADAPTATION AND THE POTENTIAL OF AGROECOLOGY

RESILIENCE

Agroecological farms are more resilient to climate and environmental shocks

- Agroecological farms in Cuba have been shown to suffer **50-60% less** crop damage than conventional farms in the wake of hurricanes, and recover faster, reaching the same level of recovery at **2x** the speed.
- Sustainable land use practices on agroecological farms in Nicaragua decrease soil erosion and improve vegetative cover, conserving **40%** more topsoil than conventional plots and lowering the incidence of landslides by **48%**.
- Driven by the sharing and co-creation of knowledge among farmers, communities, researchers and other stakeholders, the practice of agroecology is also associated with greater social resilience among its practitioners across a diverse range of contexts.

"Increasing resilience of the food system through agroecology and diversification is an effective way to achieve climate change adaptation."

IPCC Special Report on Climate Change and Land

CLIMATE CHANGE, ADAPTATION AND THE POTENTIAL OF AGROECOLOGY

GREATER YIELDS

*Agroecological farms have been shown to produce **similar** or **higher yields** relative to conventional farms if **total output** - rather than yield from a single crop - is measured. Stable **long-term yields** also require **sustainable management** of land and surrounding ecosystems.*

Agroecological practices produce an average **16%** greater yields across a diverse set of regions.

Across South Asia, the use of agro-ecological techniques has been shown to increase yields by an average of **5.8%**, with even higher gains for wheat & maize-based farms.

Maize-grain legume intercropping has been shown to:

↑ yield & income

↑ rainfall infiltration for soil health

↑ resilience to unpredictable rainfall

Smallholder households practicing agroecology had higher yields than conventional counterparts by:

17% **Senegal**

32% **India**

26-48% **2 states in Brazil**

Agroecological practices have an overwhelmingly positive relationship with ecosystem services including pest control, soil fertility, water flow, and pollination.

CLIMATE CHANGE, ADAPTATION AND THE POTENTIAL OF AGROECOLOGY

FOOD SECURITY

Agroecology can improve food security and nutrition outcomes through increased economic resilience, and greater self-sufficiency and dietary diversity

- Agroecological farmers in Guatemala make more than double the income of farmers using mainly conventional agricultural practices, spend **½** as much on groceries, and produce **27%** to **62%** more plant species during the dry and rainy seasons for market & household consumption.

- Coffee farming communities in Nicaragua cut their lean season in **½** by adopting agroecological practices over a **4** year period. Households consuming more than **6** food groups daily also increased from **12%** to **82%**.

- **99%** of peasant households surveyed in Guatemala named agroecology as a key determinant of their family's food security, despite the potential increased income from cash crops through a monocultural system.

Increasing production diversity has been shown to have a **positive influence** on dietary diversity and quality across **14** low and medium-income countries.

CLIMATE CHANGE, ADAPTATION AND THE POTENTIAL OF AGROECOLOGY

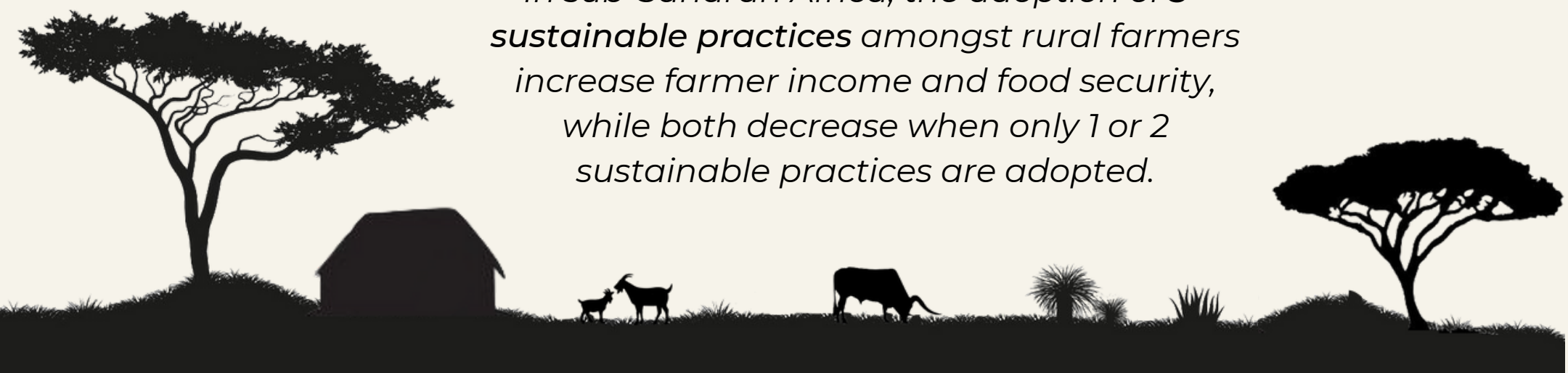
IMPROVED LIVELIHOODS

Agroecological farming can increase farmer income

- Some agroecological farms produce **63%** more financial capital than their conventional counterparts across a diverse set of countries.
- The incomes of agroecological livestock farmers in Europe are significantly above the average on a range of indicators, including **60%** more income per dairy cow & **73%** more per family worker, despite subsidy structures which favor conventional farms.
- Smallholder households practicing agroecology have higher incomes than their conventional counterparts, by:

49%	**Senegal**
14%	**India**
26-49%	**2 Brazilian States**

*In sub-Saharan Africa, the adoption of **3+ sustainable practices** amongst rural farmers increase farmer income and food security, while both decrease when only 1 or 2 sustainable practices are adopted.*



CLIMATE CHANGE, ADAPTATION AND THE POTENTIAL OF AGROECOLOGY

Photo: UNCCD©

MALAWI

80% of Malawians rely on agriculture for food and income, with **¼** of households experiencing chronic food insecurity exacerbated by increasing droughts and temperatures.

In 2011, **425** highly vulnerable smallholder farming households were selected to take part in agroecological activities organized by Soil, Food, and Healthy Communities (SFHC). The households took part in agroecological training and discussions on social inequities over 4 years.

Farmers diversified their crops to improve harvest yields during droughts, by incorporating legumes, indigenous grains, sweet potatoes, and dry season vegetable gardens alongside maize. The use of legumes and organic materials like compost increased soil fertility and its ability to retain moisture during drought.

Photo: EC|RCE

In the dry season vegetable gardens (*dimbas*), farmers used legume crop residue cover in addition to compost to improve soil aeration and prevent erosion.

In the first **2** *years, the farmers experienced an average:*

21% → 28% **increased food security**

54% → 67% **dietary diversity**

Spouses who discuss farming were x2.4 more likely to be food secure.

Source: Kerr, R.B., et al. (2019). "Participatory agroecological research on climate change adaptation improves smallholder farmer household food security and dietary diversity in Malawi". *Agriculture, Ecosystems & Environment 279*. https://doi.org/10.1016/j.agee.2019.04.004.

CLIMATE CHANGE, ADAPTATION AND THE POTENTIAL OF AGROECOLOGY

Photo: UNCCD©

PHILIPPINES

MASIPAG, a network of organizations reaching **30,000** farmers directly – works on farmer-led and participatory learning, rice breeding, and sharing. Through its farmers, the organization has collected more than **2,000** rice varieties **better adapted** to extreme conditions and no chemical inputs.

Photo: IRRI Photo: Atlas of the Future©

This includes **12** flood-tolerant varieties, **18** that are drought-tolerant , **20** salt-water tolerant and **24** that are pest and disease tolerant. In the face of increasing and intensifying floods and typhoons due to climate change, farmers in the network have credited these agroecological practices for their faster recoveries from climate shocks compared to conventional counterparts.

Photo: MASIPAG©

The organization emphasizes crop and habitat diversity by integrating fish ponds with raised beds, cultivating a variety of vegetables, and incorporating livestock, fruit, and native trees onto farms. The biomass product of this system is cycled through the farms by composting or mulching, enriching the soil.

Source: MASIPAG National Office, "Amidst Crisis, Farmer-Scientist group launch Climate-Resilient Rice Varieties", Los Banos, Laguna, Philippines, 14 September 2019./

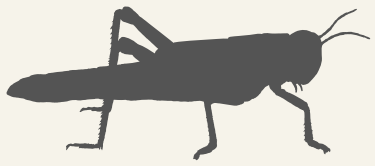
CLIMATE CHANGE, ADAPTATION AND THE POTENTIAL OF AGROECOLOGY

Photo: UNCCD©

SUB-SAHARAN AFRICA

Climate change is increasing plant pest risks globally. In sub-Saharan Africa, stem-borers, whose range is likely to extend with increased temperatures, have caused yield losses as high as **80%** . The parasitic *Striga* weed can have an even greater impact, with **30-100%** losses recorded in East Africa.

Thousands of Kenyan smallholder farmers and researchers co-created push-pull technology, an agroecological intercropping strategy for pest management. Nitrogen-fixing *Desmodium* planted with cereal crops repels (push) stemborers, attracts their natural predators, and releases chemicals which poison *Striga*. The stemborers pushed away are also attracted (pull) to Napier grass planted at the plot's border, where the pest's larvae are killed by the plant's sap.



Sources: Madsen.S & Wezel. A., 2020 "Agroecological technology controls pests and weeds with locally available plants". *Agroecology for Food Insecure Countries, JRC.* Fischler, M. 2010. Impact assessment of push pull technology in eastern Africa. Intercooperation, Switzerland, ICIPE Science Press, Nairobi.

>280,000 farmers adopted push-pull across SSA

x1.75 - 4 increase in maize yields

x2 increase in sorghum yields

milk and meat production from fodder

soil organic matter & water retention

carbon sequestration

self-sufficiency from pesticides

Photo: *Maize grown with the push-pull technology on the left, without it on the right. © Peter Lüthi/Biovision*

CLIMATE CHANGE, ADAPTATION AND THE POTENTIAL OF AGROECOLOGY

Photo: UNCCD©

UK

In Britain, farmers faced agricultural **losses of over £1 billion** due to drought in 2011 followed by record flooding in 2012. Smallholders on marginal farmlands (farmland least hospitable to farming) employed agroecological practices, drawn from a knowledge base formed from pre-existing difficulties to adapt to the **increasing extremes** of flooding and temperatures, wind, drought, and lack of sun.

In response to flooding, farmers planted trees and added organic matter to soil to prevent erosion and help soil moisture retention - which also benefits soils in droughts. Farmers created heat-generating decomposing organic matter 'hotbeds' to tackle extreme cold, and employed trees and hedges to form natural windbreaks. Farmers also shifted to crops adapted to the specific weather conditions, such as low-light crops and native species.

Photo: Marginal Lands Project©

Many of these agroecological adaptation measures employed on marginal farmlands can be taken upon conventional farmland, providing **long-term solutions** to the region's challenges with flooding and drought and **increasing the resilience** of the local food system.

Source: Speakman, D. (2018). "Growing at the Margins: Adaptation to Severe Weather in the Marginal Lands of the British Isles". *Weather, Climate, and Society 10:1*. https://doi.org/10.1175/WCAS-D-16-0113.1

CLIMATE CHANGE, ADAPTATION AND THE POTENTIAL OF AGROECOLOGY

Photo: UNCCD©

What is agroecology?

Agroecology is a set of practices, a transdisciplinary science, and a social movement. It is an approach to food systems that **promotes climate adaptation and mitigation, long-term sustainability, and equitable access to food**.

Unlike conventional agriculture, agroecology is based on bottom-up and context-specific processes to deliver local solutions to local problems. While agroecology varies depending on local conditions, the UN Food and Agricultural Organization (FAO) identifies **ten principles** underpinning agroecology.

Agroecology centers diversity, synergies within ecosystems, efficiency, and recycling to build resilient and sustainable food systems. It relies on the co-creation of traditional, indigenous, and global scientific knowledge, while prioritizing social values and cultural traditions. Broader systems of responsible governance and circularity enable agroecology's success. **Agroecological practices ensure more sustainable livelihoods for farmers and resilience for farming communities in the face of climate change.** They are particularly well-suited to small-scale food producers, who frequently rely on low-tech and labor-intensive practices.

Data Sourcing
The data cited in this document, including the case studies, primarily come from studies published in the last five years (2017-2022). They include research from Africa, Asia, Europe, and the Americas, though Africa & the Americas are most well represented. The studies measure a wide range of environmental, economic, and social indicators. Crop yield, farmer income or profitability, and social capital or level of self-organization were the most commonly measured indicators of resilience. Crop diversity, food security, dietary diversity, ecosystem services, and financial capital were also measured.