ICARDA
Science for resilient livelihoods in dry areas

CGIAR
INITIATIVE ON
Livestock and Climate

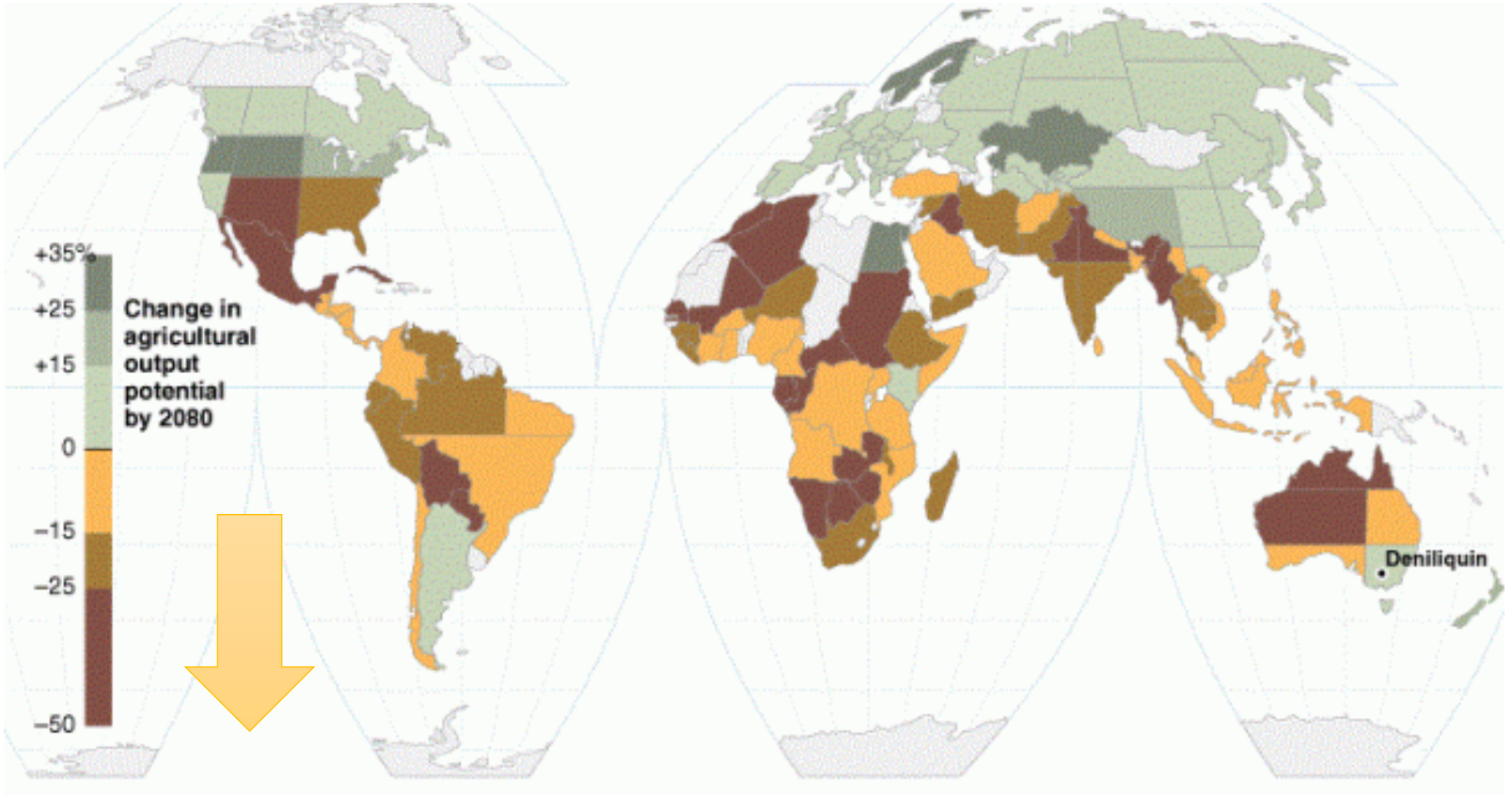
Agroforestry Guide for Sustainable Land Use Practices

Integrating Trees, Crops, and Livestock for Resilient Ecosystems

Sawsan Hassan and Mounir Louhaichi

Challenges

Crop forecasts show how much countries will be impacted from warmer world by 2080.



Challenges

- Increasing land degradation and soil erosion due to unsustainable farming practices.
- Declining soil fertility in agricultural lands.
- Loss of biodiversity caused by deforestation and monocropping.
- Increased vulnerability to climate change, such as droughts and floods.

Despite challenges.. There are opportunities

Source: Global Warming and Agriculture: Impact Estimates by Country. By William Cline, 2007

Why Agroforestry is Needed?

Agroforestry: A sustainable land-use management system that combines trees, crops, and livestock to create a diverse and productive ecosystem.

Agroforestry: offers solutions to these challenges by improving soil fertility, diversifying incomes, enhancing biodiversity, and increasing resilience to climate change. It aligns with global efforts for sustainable agriculture and land restoration

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Forestrypedia

Agroforestry Benefits

Environmental

- Reduction in soil erosion through enhanced vegetation cover.
- Increased biodiversity
- Increase in carbon sequestration contributing to climate change mitigation.
- Improvement in water cycle regulation aiding in drought resilience..

Economic

- Reduction in production costs through cost-effective land use and reduced input.
- Diversification of income sources by producing high-value products such as forage, and livestock.
- Access to financial incentives.

Social and Community

- Promotion of community engagement.
- Enhancement of household income and nutrition through diversified production.
- Integration of traditional knowledge into agroforestry practices

Agroforestry Practices

Alley Cropping

Cultivating **crops** between rows of **trees/shrubs** to maximize land use and yield.

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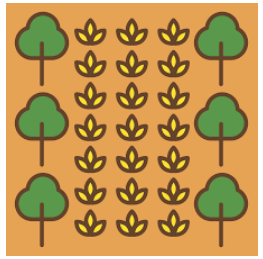


Silvopastoral Systems

Integrating **livestock** with **trees/shrubs** and **pasture** systems for mutual benefits.

Windbreaks

Planting **trees** to protect **crops** and soil from wind erosion.

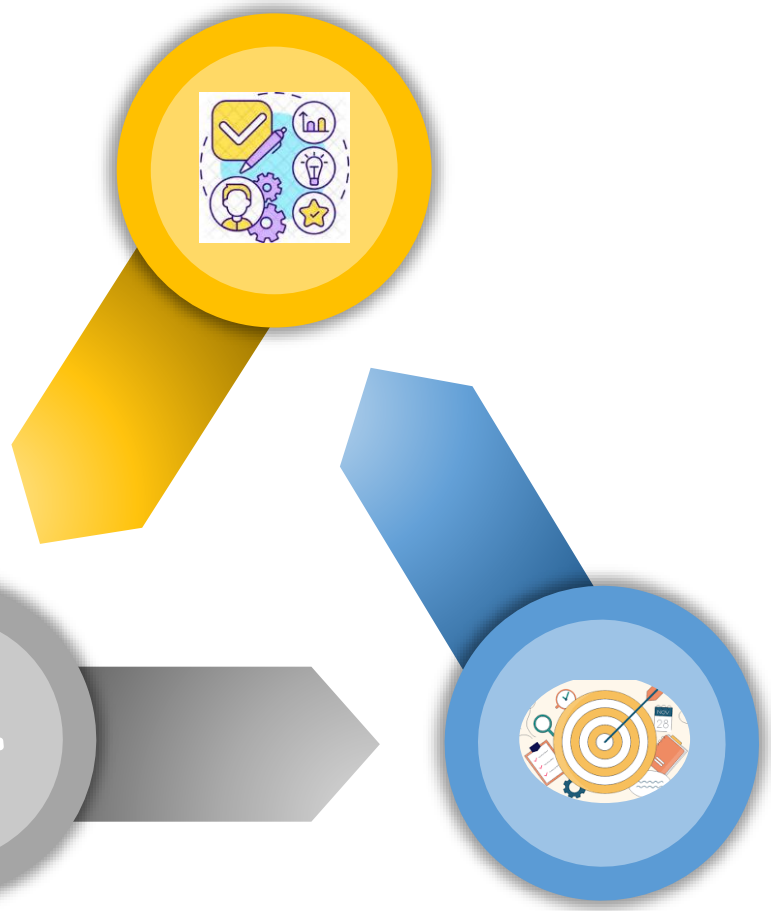
Forest Farming

Growing shade-tolerant **crops** beneath **forest** cover to utilize available resources**.**

Planning Agroforestry Systems

SITE ASSESSMENT

Evaluate soil type, climate, and water availability to determine suitability for agroforestry.



STAKEHOLDER ENGAGEMENT

Involve farmers, local communities, and experts in the planning process to ensure inclusivity.

GOAL SETTING

Define objectives such as productivity enhancement, conservation, or a combination of both.

Designing Agroforestry Systems

01

Selecting Species: Choose suitable tree, crop, and livestock species based on compatibility and ecological suitability.

02

Spatial Arrangements: Determine the layout—rows, clusters, or mixed arrangements for optimal resource use.

03

Timing: Plan phased planting and harvesting schedules to maximize productivity and sustainability.

Agroforestry Implementation Techniques

Agroforestry

Site Preparation

: Conduct land clearing, soil preparation, and establish fencing to protect the area.

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Planting Methods

: Utilize techniques like direct seeding, transplanting, and grafting for successful establishment..

Livestock Integration

Manage stock density and implement rotational grazing to enhance pasture health.

Management and Maintenance

01 Pruning and Thinning: Regularly manage plant growth to ensure optimal health and productivity.

02 Weed and Pest Control: Employ Integrated Pest Management (IPM) strategies to minimize crop loss.

03 Fertilization and Soil Management: Use both organic and inorganic methods to maintain soil fertility.

03 Grazing Management: Use grazing strategically to optimize forage recovery, allow vegetation regrowth, enhance biodiversity, and ensure the sustainable use of resources.

Monitoring and Evaluation

01 Limited knowledge and skills among farmers regarding agroforestry practices need to be addressed.

02 Initial implementation costs that may deter adoption must be tackled.

03 Land tenure and policy issues affecting the sustainability of agroforestry systems require navigation

Challenges in Agroforestry

01 Key performance indicators, such as tree survival rates, yield, and biodiversity metrics, should be established.

02 Tools for monitoring, including satellite imagery and field surveys, should be utilized.

03 Adaptive management strategies should be implemented to respond to changing conditions and improve practices.

Policies and Support

- Government and NGO initiatives promoting agroforestry adoption should be highlighted.
- Financial incentives available for farmers transitioning to agroforestry systems should be outlined.
- Policies ensuring land tenure security for practitioners need to be discussed.

Case study

Sbaihia site sets a model for agrosilvopastoral practices

TUNISIA

Presenter: Mounir Louhaichi, *Research Team Leader of Rangeland Ecology and Forages, International Center for Agricultural Research in the Dry Areas (ICARDA)*

The state-owned Sbaihia Site in Zaghouan, Tunisia, spanning 4,700 hectares, hosts a mosaic of croplands, rangelands and patches of Aleppo pine and Thuja forests. The site is key for agrosilvopastoralism, supporting 70 households dependent on sheep and goats and olive farming. However, it provides only 60 percent of livestock feed requirements, prompting overgrazing.

Between 2017 and 2019, ICARDA, FAO, and the Direction Générale des Forêts de Tunisie collaborated to restore the agrosilvopastoral system. The project implemented practices like water harvesting, selection and transplant of highly nutritive and palatable shrub and tree species (carob tree and tree medic), reseeding with sulla, a native forage legume species, and fee-based grazing according to number of animals and carrying capacity.

As result, the biomass at the restored site exceeded the control site by up to tenfold, and the cost of feeding dropped from TND 0.9 to 0.35 per day per head. The use of sulla, a melliferous species, also allowed local communities to begin beekeeping and hence diversify their incomes.

https://openknowledge.fao.org/server/api/core/bitstreams/4687c80b-d473-498d-8189-15a3bd5decfd/content

Future Prospects of Agroforestry

- The role of agroforestry in combating climate change and enhancing ecosystem resilience.
- The potential for scaling up agroforestry systems globally.
- Highlight innovations in agroforestry practices and technologies that can drive future success..

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