AgMIP The Agricultural Model Intercomparison and Improvement Project

Sustainable Land Management to Ensure Food Security
Perspectives from the IPCC Special Report on Climate Change and Land




Cynthia Rosenzweig, NASA GISS | Columbia University

UNFCCC Agriculture Workshop

June 1, 2021

NASA

COLUMBIA UNIVERSITY

AgMIP The Agricultural Model Intercomparison and Improvement Project

Guiding Principles

Sustainable Land Management

Stewardship and use of land resources, including soils, water, animals and plants, to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions'.

Food Security

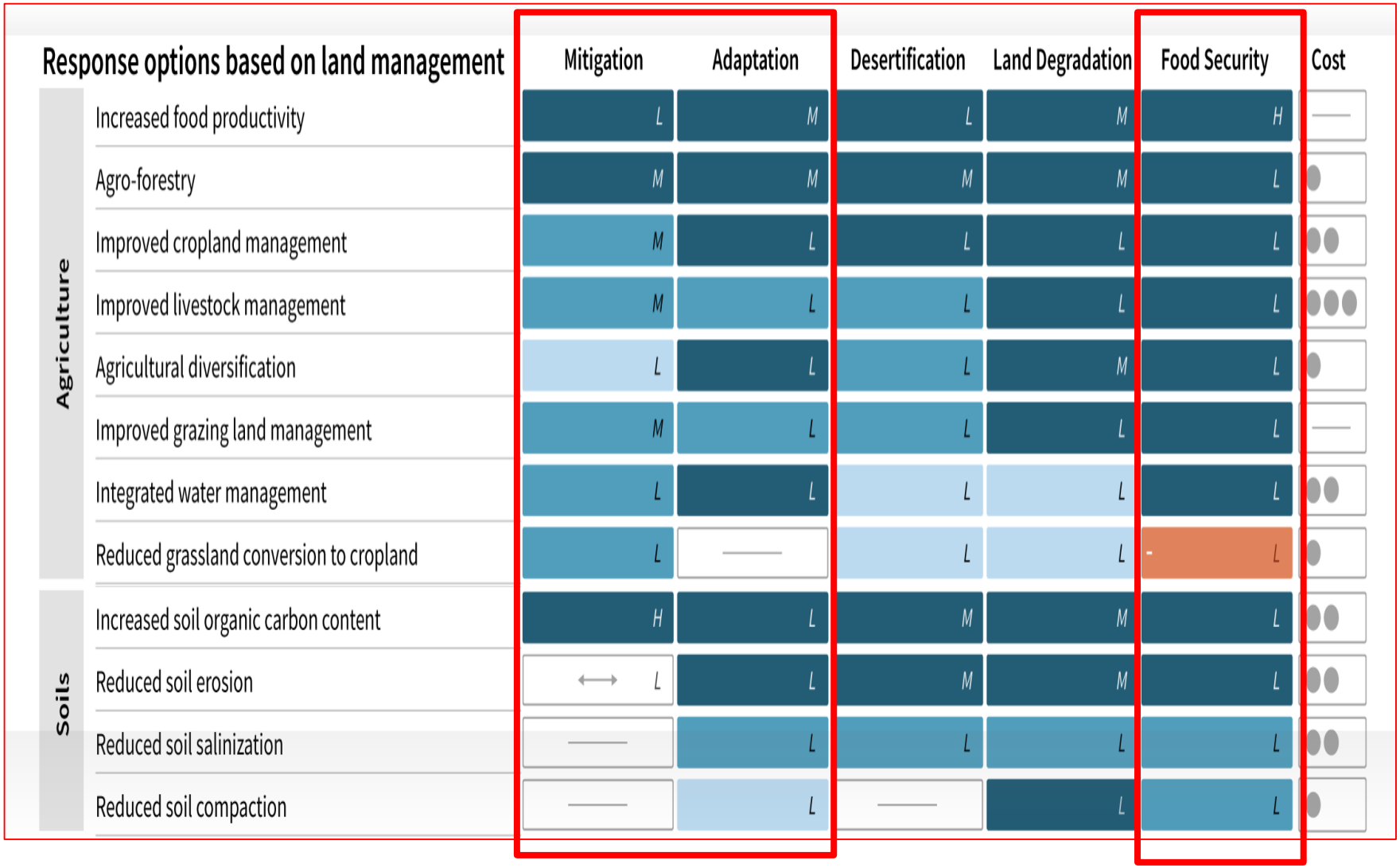
Situation that exists when all people, at all times, have physical, social, and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life'.

IPCC Special Report on Climate Change and Land, 2019

AgMIP The Agricultural Model Intercomparison and Improvement Project

Based on your experience, how can more sustainable land management ensure food security in the context of climate change?

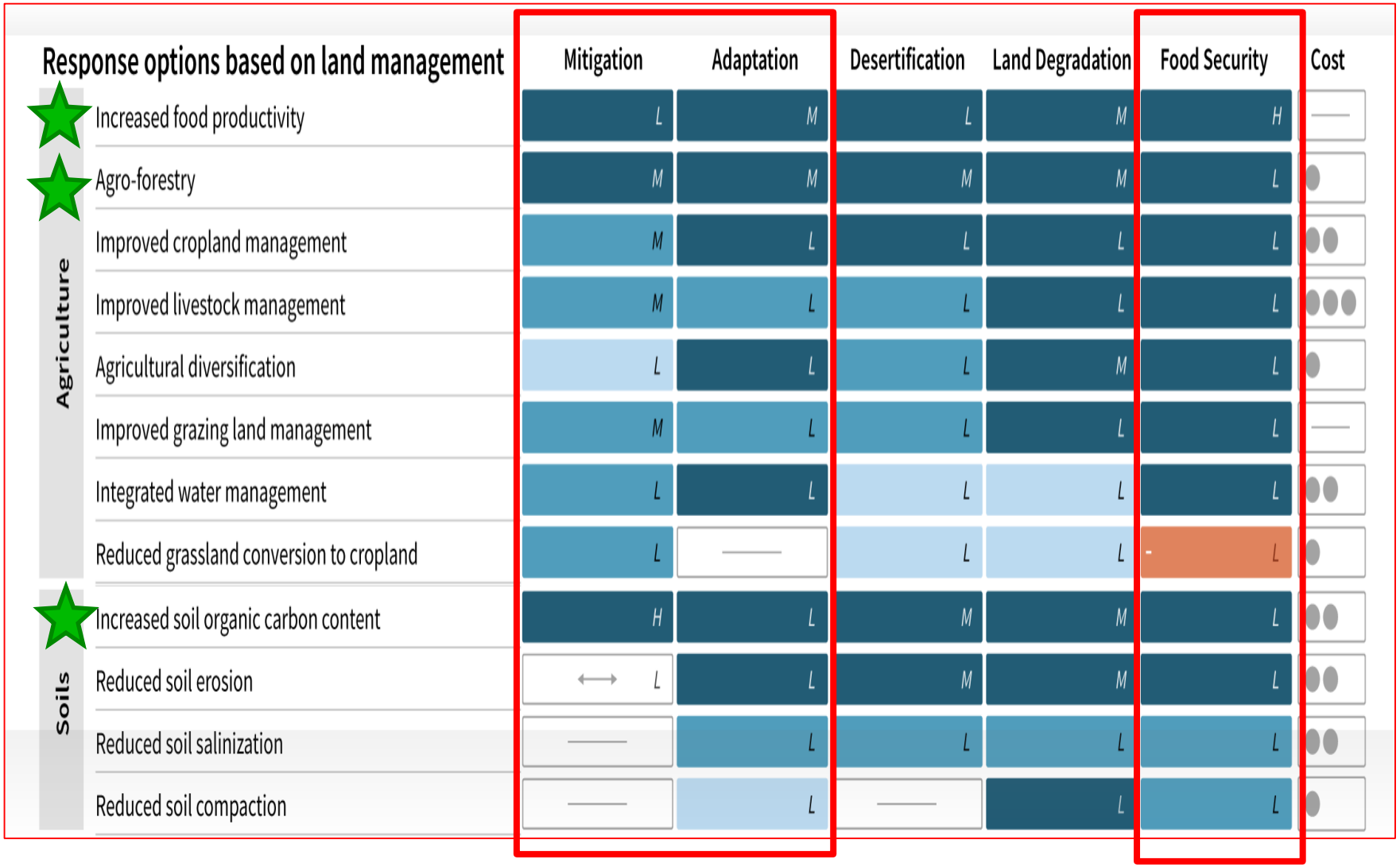
IPCC SRCCL Land Management Options



Response options based on land management		Mitigation	Adaptation	Desertification	Land Degradation	Food Security	Cost
Agriculture	Increased food productivity	L	M	L	M	H	—
	Agro-forestry	M	M	M	M	L	●
	Improved cropland management	M	L	L	L	L	●●
	Improved livestock management	M	L	L	L	L	●●●
	Agricultural diversification	L	L	L	M	L	●
	Improved grazing land management	M	L	L	L	L	—
	Integrated water management	L	L	L	L	L	●●
	Reduced grassland conversion to cropland	L	—	L	L	- L	●
Soils	Increased soil organic carbon content	H	L	M	M	L	●●
	Reduced soil erosion	⟷ L	L	M	M	L	●●
	Reduced soil salinization	—	L	L	L	L	●●
	Reduced soil compaction	—	L	—	L	L	●

IPCC SRCCL Chapter 6

IPCC SRCCL Land Management Options



Response options based on land management		Mitigation	Adaptation	Desertification	Land Degradation	Food Security	Cost
Agriculture	Increased food productivity	L	M	L	M	H	—
	Agro-forestry	M	M	M	M	L	●
	Improved cropland management	M	L	L	L	L	●●
	Improved livestock management	M	L	L	L	L	●●●
	Agricultural diversification	L	L	L	M	L	●
	Improved grazing land management	M	L	L	L	L	—
	Integrated water management	L	L	L	L	L	●●
	Reduced grassland conversion to cropland	L	—	L	L	- L	●
Soils	Increased soil organic carbon content	H	L	M	M	L	●●
	Reduced soil erosion	⟷ L	L	M	M	L	●●
	Reduced soil salinization	—	L	L	L	L	●●
	Reduced soil compaction	—	L	—	L	L	●

Sustainable Land Management
Increased Food Productivity

Increased food productivity

- Improved cropland management
- Improved grazing management
- Improved livestock management
- Sustainable intensification

→ Reduction in demand for land conversion

Links to Food Security:
Availability and Affordability

Agro-forestry

- Tree planting in croplands & silvo-pastoral systems
- Leguminous trees increase soil fertility
- Reduction in erosion and nutrient leaching
- Increase in soil quality and water-holding capacity

→ Increase in above-ground and soil carbon

Links to Food Security:
Availability, Affordability, Reliability

Sustainable Land Management
Increased Soil Organic Carbon Content

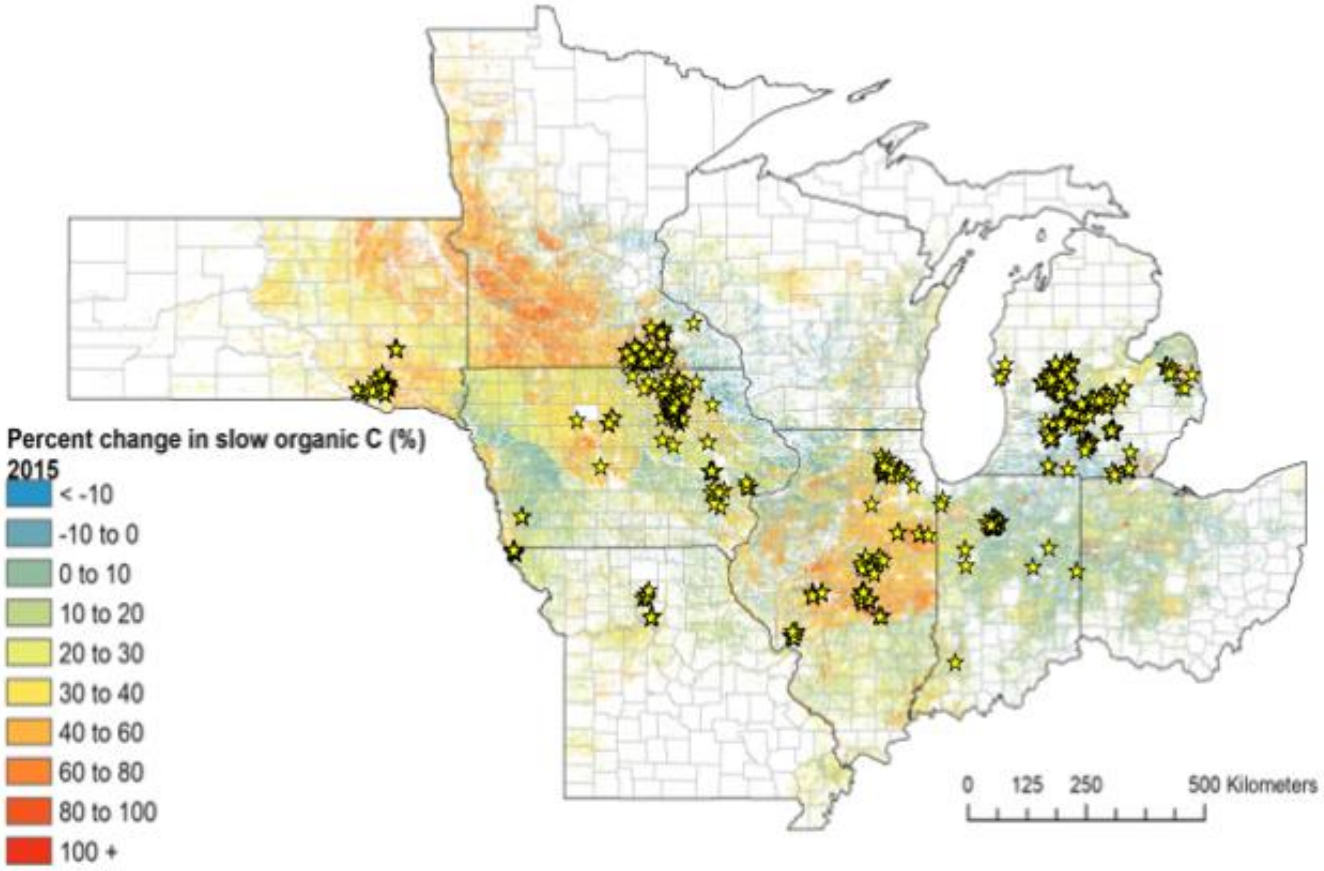
Increased soil organic carbon content

- Cover crops, perennial crops, rotations
- Reduced tillage
- Increased organic matter input
- Reduce soil erosion, soil salinization, soil compaction

→ Increased water-holding capacity

Links to Food Security:
Availability and Reliability
(some evidence)

Evidence Base for Policies



From conventional tillage to no tillage and cover crops

13 states, 1,631 fields, 6730 yield maps

Basso et al., 2021

Role of Diversification, Indigenous Knowledge, and Gender

Diversification in the food system (e.g., implementation of integrated production systems, broad-based genetic resources, and heterogeneous diets) is a key strategy to reduce risks (medium confidence)

Indigenous and Local Knowledge can contribute to enhancing food system resilience (high confidence)

Empowering women and rights-based approaches to decision-making can create synergies among household food security, adaptation, and mitigation

Links to Food Security Nutrition and Reliability

AgMIP The Agricultural Model Intercomparison and Improvement Project

Which policies and incentives can effectively support the implementation of sustainable land management to ensure food security while maximizing synergies and co-benefits?

AgMIP The Agricultural Model Intercomparison and Improvement Project

Policies and Incentives Enabling Environments

- Secure Land Tenure; Rights-based Decision-making; Empowering Women
- Sustainability Standards and Certification Programs
- Creation and Regulation of Markets
- Public-Private Partnerships
- Metrics for Measuring Progress towards Goals

Policies and Incentives

- Increased Food Productivity
  - Investments in Agricultural Research and Extension; Technology Transfer
- Agro-Forestry
  - National-level Agro-Forestry Plans; Targeted Micro-finance
- Increase Soil Organic Carbon
  - Farmer Incentives for Sustainable Practices, Carbon Credit Programs

AgMIP The Agricultural Model Intercomparison and Improvement Project

How can international cooperation support the implementation, upscaling and measuring of impacts and benefits of sustainable land management to ensure food security?

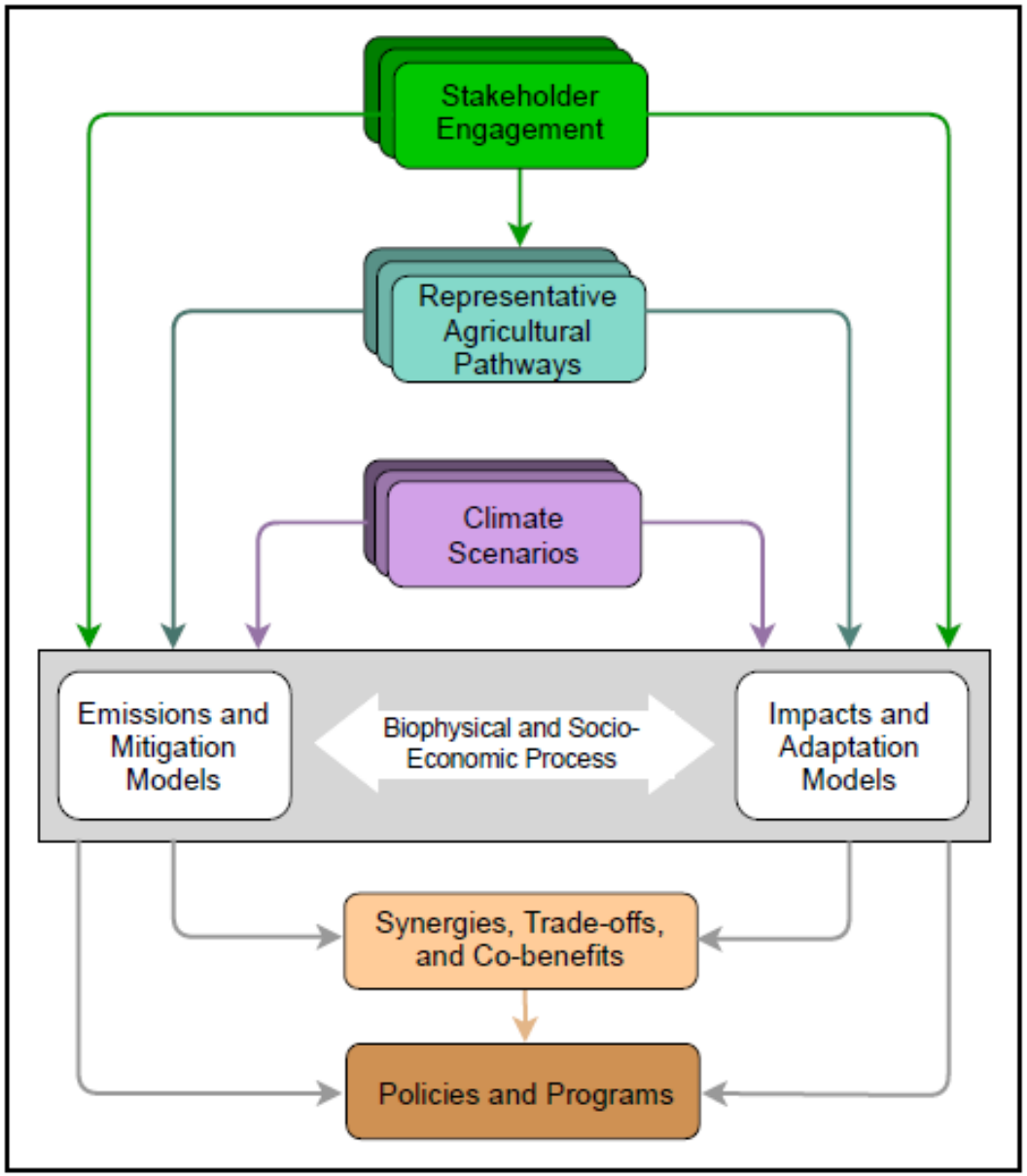
Mitigation and Adaptation Co-Benefits MAC-B

To promote climate change action and fulfill the SDGs, there is growing attention by policy-makers, stakeholders, and researchers on interventions* that contribute to mitigation and adaptation and food security co-benefits, trade-offs, and synergies

COP21·CMP11
PARIS 2015
UN CLIMATE CHANGE CONFERENCE

*e.g., sustainable intensification, agro-forestry, soil carbon sequestration

MAC-B Assessment Framework



Gender Nutrition Food Security

AgMIP Farming System Mitigation and Adaptation Co-Benefits (MAC-B): Seed Project in Bangladesh

ACIAR

Capacity Building

MAC-B project aims to increase in-country capacity to co-develop information products of value to stakeholders

This involves continuing training and experiences using 'best practices' in modeling and stakeholder engagement

Final Thought

Key reason for emphasis on mitigation-adaptation-food security co-benefits is that mitigation actions may not be possible to implement unless they deliver direct co-benefits to farmers and citizens.

Thus, co-benefits at regional and local scales are particularly important.

However, there is limited knowledge at regional and local scales of the potential for co-benefits, including ease of adoption and associated socio-economic impacts (including on gender and nutrition outcomes).

Through international cooperation we can work together to develop mitigation/adaptation/food security interventions and policies that farmers will actually adopt because they have direct incentives to do so and that will enhance food security for all.

AgMIP The Agricultural Model Intercomparison and Improvement Project

For protocols, up-to-date events and news, and to join AgMIP mailing list, visit www.agmip.org