

2021 Symposium on Resilience Research for Global Development Challenges

**Food, Wood and Wild Fruit:  
considering ecosystem services in  
food systems resilience**

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Research is supported by The Arizona Institutes for Resilience International Programs

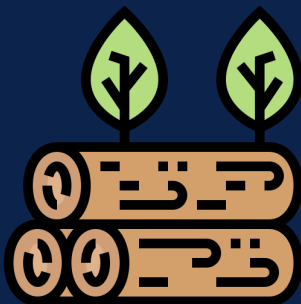
# The Top Ten Likelihood Risks for 2021-2031



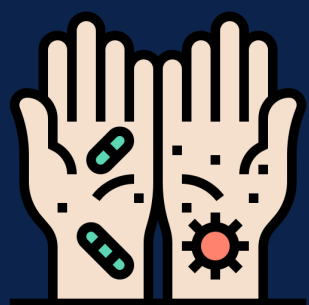
**1. Extreme weather**



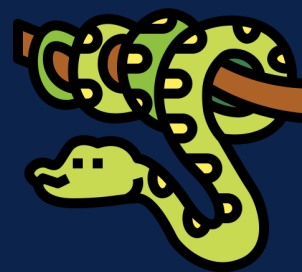
**2. Climate action failure**



**3. Human environmental damage**



**4. Infectious diseases**



**5. Biodiversity loss**



**6. Digital power concentration**



**7. Digital inequality**



**8. Interstate relations fracture**



**9. Cybersecurity failure**



**10. Livelihood crises**

# The Impact of Natural Hazards on Food System

Food system elements / Impact	Inputs	Production	Harvest and processing	Post-harvest storage and transportation	Retailing	Cooking and consumption
<b>Direct physical damage</b>	Damage to grain reserves and seed stocks; irrigation facilities; farm tools and equipment; livestock shelters and veterinary services; fishing boats and equipment; aquaculture equipment and hatcheries	Damage to crops, aquaculture, livestock mortality	Damage to agricultural infrastructure: buildings and equipment	Damage to storage facilities, transport and communication such as farm access roads	Damage to civil engineering structures, power outages,	Damage to food preparation facilities, contamination of water and food
<b>Losses across the food value chain</b>	Losses to suppliers of inputs and lower sales/supply of agricultural inputs (seeds, fertilizers, feed, tools, etc.)	Decline in output in crops, livestock, fisheries, aquaculture, forestry	Lower revenue and higher operational costs	Personnel and equipment shortages	Lower supply of food and agricultural commodities to traders, markets, wholesalers and retailers	Increased household expenditures
<b>Impact on livelihoods, food security and nutrition</b>	Increased imports of inputs	Increased cost of production from higher outlays on farm inputs (fertilizers, seeds, livestock feed and veterinary care)	Disruption of farmer organizations and social networks	Disruption of power, fuel, water supply	Income loss and lower purchasing power for retailers	Reduced food consumption and dietary quality of food

Based on: *The impact of disasters and crises on agriculture and food security 2021, FAO*

# Research Niche

## BUILDING CAPACITY FOR RESILIENT FOOD SYSTEMS via ECOSYSTEM SERVICES

### Research questions:

What constitutes both food systems and ecosystems resilience capacities and how they relate to each other?

Which ecosystem services-based resilience measures can be applied to food systems to cope with shocks and stresses triggered by natural hazards?

# Interaction between the generic food system and ecosystem services

Ecosystem Services Classification (CICES V5.1)				Food System Elements					
Section	Division	Group	Class	1	2	3	4	5	6
Regulation & Maintenance (Biotic)	Transformation of biochemical or physical inputs to ecosystems	Mediation of wastes or toxic substances of anthropogenic origin by living processes	Bio-remediation by micro-organisms, algae, plants, and animals						
			Filtration/sequestration/storage/accumulation by micro-organisms, algae, plants, and animals						
		Mediation of nuisances of anthropogenic origin	Smell reduction						
			Noise attenuation						
			Visual screening						
		Regulation of physical, chemical, biological conditions	Regulation of baseline flows and extreme events	Control of erosion rates					
	Buffering and attenuation of mass movement								
	Hydrological cycle and water flow regulation (including flood control, and coastal protection)								
	Wind protection								
	Fire protection								
	Lifecycle maintenance, habitat and gene pool protection		Pollination (or 'gamete' dispersal in a marine context)						
			Seed dispersal						
			Maintaining nursery populations and habitats (including gene pool protection)						
	Pest and disease control		Pest control (including invasive species)						
			Disease control						
	Regulation of soil quality		Weathering processes and their effect on soil quality						
			Decomposition and fixing processes and their effect on soil quality						
	Water conditions		Regulation of the chemical condition of freshwaters by living processes						
			Regulation of the chemical condition of salt waters by living processes						
	Atmospheric composition and conditions		Regulation of chemical composition of atmosphere and oceans						
			Regulation of temperature and humidity, including ventilation and transpiration						

*Note:* Fragment of the table. Darker shaded cells indicate more obvious and relevant linkages that lighter colored cells, although this does not necessarily mean that they have no direct or indirect linkage with food system elements and ecosystem services; 1 to 6 are the components of food system: 1 – inputs; 2 – production; 3 – harvest and processing; 4 – post-harvest storage and transportation; 5 – retailing; 6 – cooking and consumption.



# Resilience Coping Strategies of Food Systems

No	Author	Study Title	Study Location	Target food system	Backbone ecosystem services (ES)	Natural hazards	Consequences to food systems	Resilience Interventions based on ES	Outcomes
1	M. Marie, F. Yirga, M. Haile, F. Tquabo (2020)	Farmers' choices and factors affecting adoption of climate change adaptation strategies: evidence from northwestern Ethiopia	Gondar Zuria District characterized by a semi-arid climate, northwest Ethiopia	Mixed farming (crop production and livestock rearing (90%). Major crops include wheat, sorghum, pea, teff, maize. The livestock population in the district is equivalent to 207,000 tropical livestock units.	Cultivated terrestrial plants and reared animals; regulation of soil quality; surface water used for nutrition, materials or energy.	Climate variability and extreme weather events	Crop failure, severe soil erosion and shortages of water.	Farmers have implemented mixed farming, mixed cropping, early and late planting (changing sowing period), use of drought-resistant crop varieties, application of soil and water conservation techniques, shifting to non-farm income activities and use of irrigation	Future resilience strategies should focus on improving climate change information access, improving market access and enhancing research on the use of rainwater harvesting technology.

# Case study

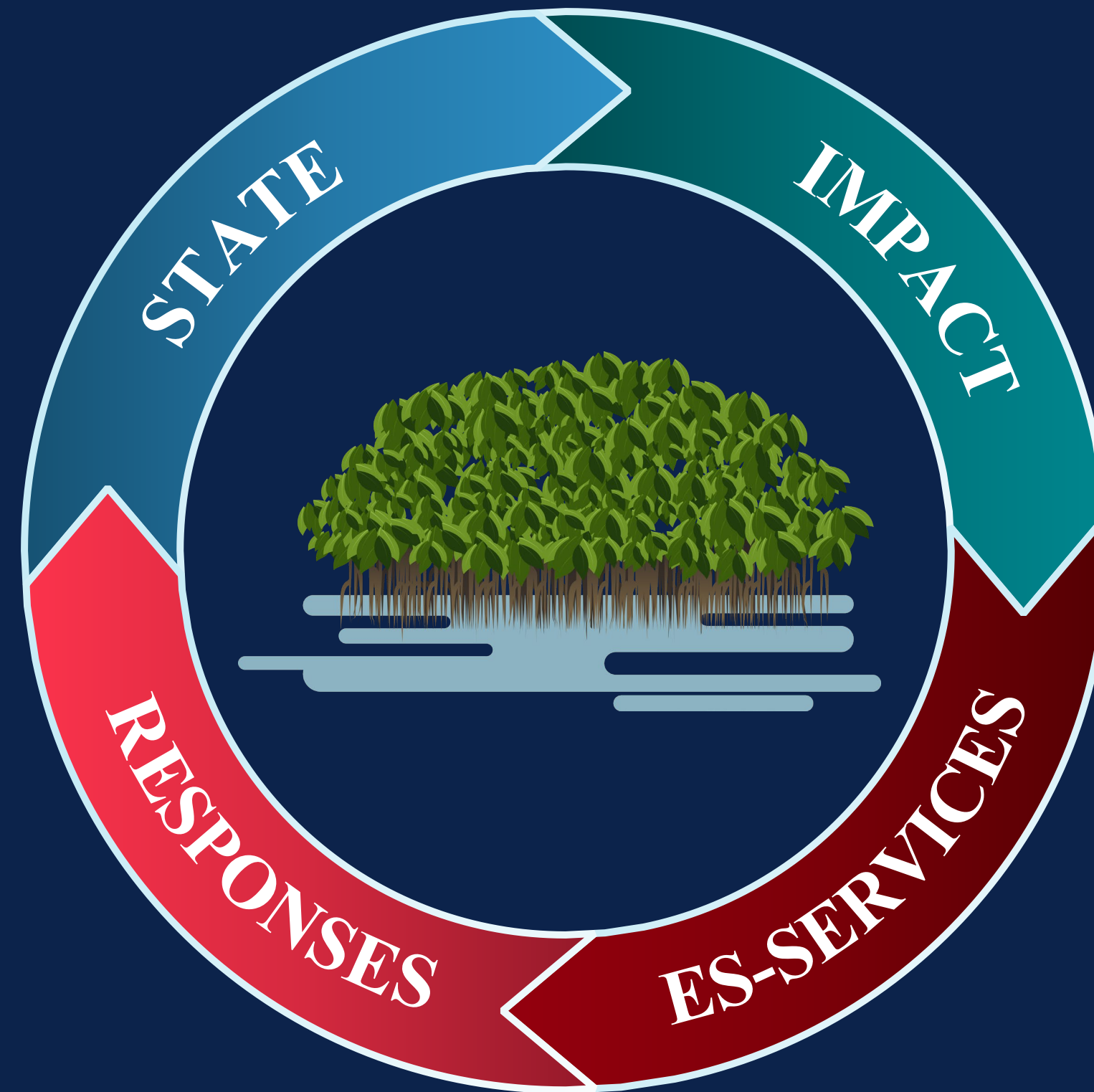
## Koh Klang island: building resilience through mangrove ecosystem services

### SOCIO-ECONOMIC SYSTEM

- Koh Klang is an island on south of Thailand.
- 4500 inhabitants subsist on small-scale fishing, rice growing, prawn culture and servicing tourists.

### RESILIENCE RESPONSES

- Providing shelter for the mud crab;
- Serving as a nursery for all aquatic animals;
- Protecting the canal bank from erosion;
- Reducing wave impact on seashore;
- Adding recreational value for livelihood diversification.



### IMPACT TO SOCIO-ECONOMIC SYSTEM

- The 2004 Indian Ocean tsunami flooded the island, damaged houses along the shore, and washed away villagers' boats, fish rafts, and farms.

### ECOSYSTEM SERVICES

- Koh Klang is comprised of flat land, with mangrove forests covering 80% of the total land area.
- Biogeochemical cycling, carbon sequestration, livelihood support and disaster protection.

# Ecosystem Services-Based Interventions



**Promoting food system diversification**



**Increasing cohesion between technological innovations and nature-based solutions**



**Utilizing indigenous traditions and local knowledge**



# PROJECT FINDINGS



Ecosystem services are food systems' airbags for supplemental protection and passive safety in case of natural hazards



Homegrown characteristics of nature in conjunction with food system patterns are vital to co-design resilience framework suited for local communities



Food system susceptibility to natural hazards is often related to the failure or insufficient provisioning, regulation and maintenance ecosystem services



Most food system resilience strategies in low- and middle-income countries are applied using local ecosystem services, knowledge, and experience