
HARNESSING MULTIPLE BENEFITS FROM RESILIENT MANGROVE SYSTEMS: INSIGHTS FROM SCENARIO EVALUATIONS

Scenarios are a popular approach used to evaluate different perspectives on change and can be used to inform decision making about the future. In this research we selected some important drivers of change in the mangrove systems in the Red River Delta, Vietnam and used them to develop possible future scenarios for the year 2040.

Six scenario workshops were held: three in Kim Trung and three in Thuy Truong in February 2020. Our aim was to understand how societal groups with different adaptive capacities perceived the possible future scenarios and to identify key considerations for decision makers.

Coping households generally have a weak asset base, learning capabilities, and social support because of low household occupancy and/or limited extended networks. They tend to be affected by many things beyond their control, often because their ability to adapt has been removed by ill health or caring commitments, and they survive primarily on waged labour, remittances, and/or state assistance.

Flexible households have varying access to physical and financial assets. Many have good learning capabilities, flexibility and attribute success to their own efforts and abilities. These households tend to exercise their agency to diversify to progress, or to maintain (sometimes limited) livelihood and household stability.

Accumulating households typically have good levels of agency, learning capabilities, social networks, and access to financial and physical assets. They maintain back-up income sources, but have largely prospered by specialising in aquaculture and associated industry, which may leave them vulnerable to sector specific shocks

Four different plausible scenarios were presented for the year 2040.

Scenario 1: URBANISATION

A large economic zone comprises diverse industries, with 70% of the zone urban land and the remainder rural. Thuy Truong and Kim Trung are mostly urban residential, home to those working in the economic zone. The population is double the current size. No agriculture exists, but aquaculture has expanded. New sea dikes have been constructed. Access to mangroves, mudflats, and open water is the same as now. Mangrove planting still occurs.

Scenario 2: CONSERVATION

Natural areas on the seaward side of the dike have been designated a Wetland Reserve for wildlife. Access to mangroves, mudflats and open water is strictly banned. The population is 25% larger than now. Agriculture is similar to now. Aquaculture on the seaward side of the dike has been banned to allow mangroves to regenerate naturally. Sea dikes are the same as now. Mangrove planting is not allowed.



Under a conservation scenario, access to mangroves, mudflats and open water is banned to protect wildlife, but focus group participants feared this would limit their livelihoods, despite potential benefits for human wellbeing from a protected mangrove area (above)

Scenario 3: AQUACULTURE COLLAPSE

Clam and pond aquaculture is on the verge of collapse due to the combined effects of pollution, disease and hot weather. The population is about 25% larger than now. Agriculture is similar to how it is now. Access to the natural areas (mangroves, mudflats, open water) is the same as it is now. Sea dikes are the same as they are now. Mangrove planting still occurs.



Scenario 4: CLIMATE CHANGE

Temperatures have increased and heatwaves last longer, but with fewer cold days and nights. The summer monsoon starts earlier and finishes later, and there is 20% more rainfall. River flows have increased, particularly during the dry season. Storms hit towards the end of the storm season, fewer than now, but huge storms and typhoons are more frequent, bringing higher storm surges. Sea level is 20cm higher. The population is 25% larger than now. Land use is similar to now. Access to natural areas is the same now. Sea dikes have been improved and/or increased. Mangrove planting still occurs.

Scenarios were evaluated in relation to: livelihood diversity, income, natural resources, housing, education, health, civic membership, access to credit, access to clean water, information on storms and demographics and ranked according to perceived benefits/harms (left).

Key findings

Few differences in perspectives emerged between groups with different levels of adaptive capacity (Table 1). Key concerns about the future centred on livelihood opportunities, income, health and education, with focus group participants most worried about scenarios that showed potential to undermine these aspects. Aquaculture collapse and conservation were most feared in terms of limiting livelihood options and income, with concerns that the challenges these scenarios bring could cause people to migrate to cities and/or reduce abilities to afford education and healthcare. Even though the urbanisation scenario was considered the least risky of those evaluated in all focus groups, issues were raised about the need to ensure urbanisation happens in such a way that environmental health and water quality are not reduced. Climate change impacts to 2040 were considered largely manageable provided there is sufficient government investment in constructing and maintaining dikes, though it was recognised that increasing extreme events required upgrading of current infrastructure, including housing.

Table 1: Scenario rankings by focus groups with different adaptive capacities in Thuy Truong (TT) and Kim Trung (KT), where 1 = least concern; 4 = most concern. Darker shading represents higher concern.

	Accumulating TT	Accumulating KT	Coping TT	Coping KT	Flexible TT	Flexible KT
Urbanisation	1	1	1	1	1	1
Conservation	3	2	4	3	3	4
Aquaculture collapse	4	4	2	4	4	3
Climate change	2	3	2	2	2	2

Modelling how scenarios might influence the values people put on places within the mangrove system in the future can provide insights that help explain key concerns, and offer opportunities for feared impacts to be considered during planning processes.

Social values are influenced by multiple, complex, interacting factors. Based on current relationships with geographic features, we modelled how values for some of the services perceived most important might change in relation to major land cover/use changes under scenarios 1-3.

Table 2: Social values were modelled in relation to their current relationships with 7 variables: land cover/use, distance to aquaculture, housing, dike, and accessible channels, and sedimentation and buffering capacity. Key differences between the modelled scenarios are described above.

	Mangroves	Aquaculture	Proximity to housing
Urbanisation	Planting has extended forest seawards. Access to channels unchanged.	Ponds consolidated and slightly expanded	Distance increases as rural households are relocated
Conservation	Forest has aged, extent is largely unchanged. Access to channels almost entirely restricted	Ponds on sea-side of dike replaced by sustainable demonstration ponds with $\geq 60\%$ mangrove cover	Largely unchanged
Aquaculture collapse	Planting has extended forest seawards. Access to channels unchanged.	Almost all ponds are abandoned	Largely unchanged

Preliminary modelling findings

Analysis is ongoing. An initial finding for the conservation scenario indicates that values attached to places supplying services currently important may be substantially altered. In some cases, restrictions on access to areas perceived as important may lead to a reduction in their value. This implies that values attached to the forest may depend on formal access rights, even if the benefit received is not clearly linked directly to physical access.

Models that allow the potential impact of access limitations on social values to be visualised can provide opportunity for alternative options that support wise use through managed access to be explored. Resulting spatially explicit value maps need validation by households, but may offer promise as a starting point for consultations that can be inclusive of the concerns held by different groups, and that allow social values to be considered in addition to environmental and economic priorities.



Ability to access the mangrove forest appears to be linked to the value placed on many benefits, including protection, leisure and habitat

Policy implications

Urbanisation processes in the two study areas need to be carefully managed so that gains made in terms of job opportunities and subsequent investments in education and healthcare are not undermined by deterioration in environmental quality (e.g. through water pollution from industry and aquaculture contamination). Jobs need to be available to local people and capable of using their existing skills.

Conservation of mangrove, mudflat and open water areas is essential to conserve environmental integrity but further research is needed to ensure any restrictions to access do not undermine local livelihoods and wellbeing. Often the those groups with fewest other options are most dependent on the mangroves and related natural areas for their survival. Any restrictions to mangrove access therefore needs to be properly balanced with other social and economic safety nets following a full analysis of trade-offs, to ensure the adaptive capacity of mangrove dependent households is not undermined.

Climate change considerations will need to be central in policies that pursue urbanisation, conservation and the further development of aquaculture. In this research, each of the scenarios was presented separately. However, in reality, decision makers need to consider them in combination in identifying pathways for sustainable development. Lack of consideration of the interlinkages could result in undesirable impacts that increase livelihood vulnerability and decrease human wellbeing.

Aquaculture collapse is often due to a combination of factors outside of government control. However, **government can play a key role in providing appropriate social protection and safety nets.** Aquaculture collapse is a key concern particularly for the accumulating group of households who have specialised in aquaculture and related industry.

Policy decisions need to be mindful of the different challenges faced by societal groups with different adaptive capacities and should ensure inequalities are not reinforced or exacerbated.

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