

Annex U: Myanmar: Improved Management of Coastal Forests

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Part A: Basic data

A1. Project number & name. [NO NUMBER] Climate Adaptation in Coastal Communities of Myanmar: Improved Management of Coastal Forests.

A2. Interviews. Email correspondence with Hanne Carus (hancar@um.dk).

A3. Dates & financial data. This project is an additional contribution to the Thematic Programme 'Inclusive and Sustainable Economic Growth' of the Denmark-Myanmar Country Programme 2016-2020 and is funded by the Danish Climate Envelope. Budget: DKK 28.2 million (FY 2018/19-2022/23).

A4. Location(s). Myanmar: mainly in Rakhine (Arakan) State, focused on Wunbaik, but with some engagement in Tanintharyi (southern Andaman coast).

A5. Partners. RDE, Yangon. The Forest Department, under the Ministry of Natural Resources and Environmental Conservation (MONREC).

Part B: Purpose and relevance

B1. Purpose. Objective: "Resilience to climate change among vulnerable and marginalised groups increased through sustainable management of mangrove forests." (p. 13). **Outcome:** "Coastal communities' resilience to climate change is strengthened through the presence of healthy mangrove forests and access to more sustainable livelihood opportunities." (p. 21).

B2. Relevance to partners. "The engagement has been formulated based on both the strategic priorities for Denmark's development cooperation with Myanmar and the overall objectives for the Climate Envelope." (page 13). It is aligned with:

- The *Myanmar Climate Change Strategy and Action Plan (2016-2030)* has "six key sector entry points, including a) Sustainable management of natural resources for healthy ecosystems; and b) Climate-smart agriculture, fisheries and livestock for food security."
 - The *National Reforestation and Rehabilitation Programme in Myanmar (2017-2026)* calls for recovering lost ecosystem services and improving the income of local communities and targets the planting of about 12,000 ha of mangroves and 14,000 ha of watershed [catchment] forests, as well as establishing over 300,000 ha of community-owned forest.
 - The *Community Forest Instructions (2016)* aim to meet needs from forests while increasing forest areas and sustainable use, promoting participatory management systems and enhancing environmental services including climate change mitigation and adaptation. They give households the right to join a community forest user group if they live within five miles of a forest or if they have been exercising customary forest management rights.
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B3. Relevance to MDGs/SDGs. Although not mentioned in the programme document, contributions to several of the SDGs can reasonably be expected, including:

- **SDG 1** (*No Poverty*, due to the livelihood support functions of protected and restored mangroves);
- **SDG 11** (*Sustainable Cities and Communities*, due to the environmental security functions of protected and restored mangroves);
- **SDG 13** (*Climate Action*, due to the strong contributions of protected and restored mangroves to environmental security for adaptation and net carbon release reductions for mitigation);
- **SDG 14** (*Life Below Water*, due to the sustaining and conserving effect of protected and restored mangroves on diverse marine organisms); and
- **SDG 15** (*Life on Land*, due to the sustaining and conserving effect of protected and restored mangroves on diverse terrestrial organisms).

In addition, there are aspects of the project that suggest secondary contributions to **SDG 5** (*Gender Equality*, due to the involvement of NGOs and attention to gender in design), and **SDG 8** (*Decent Work and Economic Growth*, due to the many small business opportunities created by or alongside restored mangrove ecosystem productivity).

B4. Relevance to NDC mitigation commitments. Myanmar's 2015 NDC commits "To increase the resilience of mangroves and coastal communities which are at risk of flooding", by "developing a coastal zone management plan to effectively conserve terrestrial and under water resources including mangrove forests." (p. 7). Community forestry is mentioned as a mitigation strategy, and mangrove rehabilitation as an adaptation priority.

B5. Relevance to mitigation. Mitigation verification criteria met: Mitigation ecology (ME), by protecting and restoring mangrove forests and associated coastal ecosystems.

Part C: Narrative overview

Myanmar ranks 7th in mangrove forest area (485,000 ha), with 34 out of global 70 mangrove tree species. Since the 1970s there has been rapid mangrove clearance for rice and shrimp ponds, plus degradation by timber and fuelwood extraction - wood provides 89% of fuel used in Rakhine (Arakan) State. Mangrove loss has been most extreme in the Ayeyarwady (Irrawaddy) Delta, with the area declining from 296,000 ha in 1980 to 25,000 ha in 2007; in Rakhine around 2,000 ha or 1-2% was lost annually in 1980-2015 (the area estimates in the 1980s are between 200,000 and 300,000 ha, loss rates are patchy and measurements inconsistent).

- "Nearly all coastal regions of the country with protected forest, and forest areas proposed for protection - have been severely degraded due to excessive wood extraction, and/or encroachment and clearance of the land for agriculture or aquaculture. In Rakhine, much of the degraded mangrove forest has become overgrown with secondary invasive vegetation that is preventing natural regeneration of the original mangrove species. Rehabilitation (planting mangrove seedlings) and assisted natural regeneration are required on a massive scale in both Rakhine and Ayeyarwady Delta." (MFA & RDE, 2017: 11).
- "Of particular concern is the significant loss of mangrove forest reported in Wunbaik (Yambye Township), which is the only Forest Reserve area with mangroves in Rakhine. The area of dense mangrove forest in Wunbaik declined from 16,672 ha in 1990 to 11,893 ha in 2013 ... equivalent to a loss of about 1.25% annually over the 23 years period." (MFA & RDE, 2017: 7).

Healthy mangroves are highly productive ecosystems, and their loss erodes food security and aggravates widespread poverty (G1). The loss of mangroves is also severely reducing flood and storm protection for coastal peoples (e.g. Cyclone Nargis in the Ayeyarwady Delta 2008, which devastated areas where mangroves had been removed, and powerful cyclones that hit Rakhine in 2004, 2006, 2010, 2015, 2017). The rationale for Climate Envelope funding rests mainly on increased climate resilience, but also the fact that "Mangrove forests can store high quantities of carbon, especially below the surface in the form of their root systems and accumulated organic debris, to the extent that soil carbon can account for up to 90% of the total carbon storage. Although mangrove forests represent only 0.7% of all tropical forest cover, their continuing loss is contributing up to 10% of the global forest emissions (G2). In conclusion, mangroves are an example of *climate change adaptation and mitigation co-benefit* as emphasized in the guiding principles of the Danish Climate Envelope." (MFA & RDE, 2017: 10, italics original).

The Forest Department has jurisdiction but is grossly under-resourced, so "any effort to restore and sustainably manage mangrove forests must involve FD, but it needs to be done in partnership with the local communities and facilitated by civil society organisations and other service providers, as necessary, to help develop the partnership." (p. 13). Thus, the key points of the strategy are:

- **Coastal communities are recognised as key actors**, building on and using the CFI (2016).
- **Experienced CSOs are mobilised to help** coastal villages organise themselves for mangrove planting. Annex 7 lists local CSO active in coastal Myanmar, including Rakhine Coastal Region Conservation Association (RCA), Network Activities Group (NAG), Mangrove Service Network (MSN), Economically Progressive Ecosystem Development Group EcoDev), and Forest Resources Environment Development and Conservation Association (FREDA).
- **Forest Department has clear responsibilities:** (a) to approve Community Forestry applications; (b) to provide free of charge 150 tree seedlings per acre [375/ha - 12.5% of the 3,000 trees/ha that community forestry groups actually want to plant for economic viability - CSO support is needed to grow the rest]; (c) to advise on how to manage the community forest, while assisting with land tenure issues, illegal tree-felling and conflict resolution; and (d) to supervise sustainable harvests and trade in forest products ["Monitoring is not specified within the CF Instructions and the FD appears to have very limited capacity for field-level monitoring" - page 16].
- **Primary field site in Rakhine** (Wunbaik Reserved Forest, established 1931 with 56,633 acres [22,665 ha] of mangrove, and an adjacent mangrove Protected Public Forest, established 2009 with 10,080 acres [432 ha] of mangrove, plus a few fragments of proposed PPF in Sittwe District). Wunbaik was chosen as "the most important mangrove forest in Myanmar's Forest Estate", a high priority conservation area nationally and for Rakhine but facing many threats. A 2009-2011 FAO community-based mangrove project left a status report and management plan as a starting point. The other areas are degraded but valuable and restorable.
- **Secondary field site Tanintharyi**, because: (a) it is less damaged; (b) the local people are more motivated and organised to conserve mangroves so can teach Rakhine how to do it; and (c) there are options for research and lesson-learning on mangrove fisheries values from the Sustainable Coastal Fisheries (Development Engagement C) part of the Thematic Programme 'Inclusive and Sustainable Economic Growth').
- **Full-time international TA**, to advise and help everyone pull together, to strengthen the FD's voice on coastal land designation and land use policies, to bring international knowledge, to guarantee genuinely inclusive community activities, to integrate mangrove management with fisheries management, and to promote knowledge sharing.
- **Paid work for vulnerable households** in mangrove raising, planting and tending (with various criteria to help targeting), with benefits to the wider community coming from

environmental security and livelihood resources.

The project is clearly designed, with a number of conceptual and practical strengths, but there are some questionable assumptions that may jeopardise the start. If communities can be motivated to participate fully, however, and to relax pressure on the mangrove for daily needs (e.g. for fuel wood) quickly enough, the project would likely contribute over several years very significantly to increasing the environmental and livelihood security of the communities affected. By so doing, it would also be likely to conserve and sequester significant amounts of carbon, all within a highly replicable package. **Overall scores:** 4 (moderate) for design; 5 (good) for anticipated performance (potentially 6).

Part D: Design quality

D1. Theory of change. The mitigation effectiveness of the project is completely dependent upon the success of its adaptation (mangrove restoration) component. Notable features of the rationale of the design include: (a) Excellent understanding of the extreme value of mangroves for environmental security in coastal neighbourhoods. (b) Good understanding of the special value of mangrove ecosystems in carbon storage (but no mention of links with coral reefs and 'blue carbon' in general). (c) Good understanding of the special value of mangrove ecosystems in fisheries management (but one wonders why the Sustainable Coastal Fisheries engagement did not *start* with mangrove areas, with which there is almost no overlap - p. 20). (d) Good understanding that mangrove restoration requires long-term community engagement, built on tenure, knowledge, responsibility and benefit sharing, to ensure that seedlings are planted in the right places and tended correctly to ensure survival. (e) Good understanding that Myanmar's membership of the international group Mangroves for the Future offers access to experience in mangrove protection and restoration from Bangladesh (whose Sundarbans is across the Bay of Bengal from Myanmar), the Philippines, Thailand and Indonesia.

The project document is unusual in spelling out a theory of change, which in summary is that mangrove ecosystems will be restored and multiple benefits in environmental security and livelihoods will be received by the entire local population (as well as carbon co-benefits by the world at large) if five things are done in a coordinated way: (1) Build (and supplement with TA/CSO help) capacity of the Forest Department to help communities manage mangrove forests. (2) Build (and supplement with TA/CSO help) capacity of the communities to manage mangrove forests. (3) Build awareness and understanding of how and why to manage and restore mangrove forests. (4) Offer employment to vulnerable households in mangrove management tasks. (5) Offer small projects to be defined and requested by the communities to spread benefits and alternatives sources of income and fuel wood, to take the pressure off mangroves.

D2. Assumptions underlying the theory of change. The project document is unusual in spelling out the assumptions linked to its theory of change, which are in summary:

Assumption 1. That communities will be open to the idea of being mobilised (or mobilising themselves) to protect and replant mangroves in their own long-term interests, through the effects of: enhanced tenure and responsibility for local mangrove ecosystems, and/or environmental education about the ecology, utility and value of mangroves, and/or a more co-operative relationship with the Forest Department, and/or cooperation with CSOs from elsewhere, and/or employment opportunities targeted to 'the poor', and/or small community development project grants to be determined, and/or awareness of new employment and small-business opportunities that might arise from restored mangroves, and/or a general vision of a safer and more prosperous community in which to live.

Assumption 2. That the Forest Department will respond to training, travel, income and other opportunities by becoming more inclined to help communities manage mangroves.

Assumption 3. That there are local CSOs able and willing to spend enough time and energy with communities in the target areas to help them think through the issues and develop and implement appropriate, inclusive and effective strategies to take advantage of the opportunities offered by the project (i.e. selective employment, small grants, tenure security, environmental security, new income/business options).

D3. Plausibility of assumptions and links.

Assumption 1.

- Several of the interventions are known from elsewhere to be likely to be effective in motivating communities if done properly (i.e. slowly, consistently, participatorily, and with adequate resources and flexibility), including enhanced tenure and responsibility, environmental education, and a sense of alternative and better futures for all concerned (both the more opportunity-minded and the more needy).
 - The perceived value of cooperation with the Forest Department will depend on whether the FD is genuinely able to offer useful support, on the right terms and with the right attitude, and this applies also to outside CSOs.
 - The effectiveness of small community grants depends on how they are selected and managed, generating cooperation rather than competition and friction.
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- The 'offer' of development assistance at the community level is limited to small-grant schemes that are yet to be identified by the communities. This might inhibit the rate at which pressure on the mangroves is reduced. Starting with a package of assistance pre-determined on the basis of consultation during the design phase, for example to relieve demand for fuel wood, might have been a safer strategy to use, pending the expected resurgence of livelihood resources with mangrove regeneration over some years.
 - Employing people selectively from 'poor' households can be divisive, requiring intrusive research to identify 'worthy' targets or else relying on the community to identify them with risks of patronage and elite capture.

Assumption 2. The logic that the FD is so weak that it cannot fulfil its mandated role so requires community/CSO help may work for a while, but as the FD is strengthened there may be unexpected temptations to adopt a more assertive and top-down attitude to the communities. Clear conditionality and steering in line with CFI (2016) policy will be needed.

Assumption 3. The NGO with perhaps the most appropriate capacity is FREDa which has refused to work in Rakhine (p. 63), but others identified seem to have useful capacity, especially including RCA within Rakhine, but also EcoDev (for environmental education) and MSN (for community planning and small project development).

D4. General quality of the project design. Based only on the Development Engagement Document, the project design is clear and well documented, and the theory of change makes sense, but questions arise over some of the key assumptions. **Score: 4.**

Part E: Evidence for mitigation performance

E1. Direct effectiveness. See E2.

E2. Indirect effectiveness. Potentially, if all goes well, at least 8,000 ha of mangrove forests will have come under protection by communities and the FD, within which further degradation will be prevented and natural/assisted regeneration will be underway.

Salem & Mercer (2012) concluded that mangroves sequester (absorb and fix as biomass) carbon at a mean rate of 5.27 t/ha/yr, about double the figure for young secondary tropical forest (*from Verdens Skove review*) but possibly explained by the high productivity of the dynamic mangrove ecosystem, and in this case perhaps supplemented by the effects of active planting and tending.

Depending on deforestation risk assessment for the larger area of intact mangrove forest in the Wunbaik RF, which will presumably be better protected by an empowered Forest Department as a result of the project, some share of the carbon saved there (which Donato *et al.*, 2011 suggest could be over 1,000 t/ha, giving a total of over 20 million tonnes - **G2**) could in principle also be assigned to the project.

A more effective forest department, working with more experienced CSOs, and with successful community mangrove restoration projects to act as demonstration sites, might be expected to result in replication of the whole process in parts of the Ayeyarwady Delta and elsewhere. The key point is that carbon capture and storage within regrowing mangroves is rewarded so quickly and so visibly by enhanced fisheries productivity and environmental security that it ought to be an easily replicable (and even self-replicating) model.

E3. Net GHG emission reductions. See E2. It is reasonable to expect the project to prevent the emission of some hundreds of thousands of tonnes of carbon, to have ensured the net absorption of some tens of thousands of tonnes of carbon per year thereafter by regrowing mangrove forest, and to have high replication potential. While there are uncertainties in the 'expectation figures', and in the delivery process, these mitigation potentials are significant.

E4. Impact effects. See E2: expectation of a more effective forest department, working with more experienced CSOs, and with successful community mangrove restoration projects as demonstration sites.

E5. Sustainability effects. See E2: rewards available to communities from mangrove restoration.

E6. Efficiency issues. See E8: lack of clarity over baselines at outcome and output levels.

E7. Capacity building issues. Pages 13-16 detail the weaknesses of the Forest Department relative to its responsibilities (i.e. its capacity needs), and p. 24 details what will be done with the FD to build its capacity, at least for the purposes of the project, including:

- activities to support knowledge-building (e.g. on "ecosystem-based management, co-management, mangrove ecosystem services, building resilience to coastal climate change and disaster preparedness");
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- activities to support skills development (e.g. on "conducting public consultations, interviewing and negotiating techniques, conflict resolution, and monitoring and evaluation");
- assistance in improving and developing management plans for the existing and proposed PPFs in Rakhine; and
- supply of boats and other equipment to support a surveillance and rapid response capability against illegal encroachment and wood extraction.

In addition, the whole process of participatory awareness-raising, community planning, establishing forest user groups, getting them registered, and taking action and advantage of new opportunities is an inherently capacity-building process for the communities involved.

E8. Baseline and monitoring arrangements. The key outcome indicator for all four outputs is an increased area of mangrove under sustainable management by community groups *and in* PPFs [it is not clear if this is 'and/or' or 'and' - two different things]. The 2018 baseline was yet to be established against which the 2023 target was to be established and success measured [i.e. there was no baseline and no target at outcome or output level when the project document was signed off]. But at least there was the intention to baseline, and key indicators are defined as follows:

- **Output 1 (area of mangrove in reserved forest and PPF):** by year five, four additional PPFs containing at least 20,000 acres (8,000 ha) of mangrove should have come under sustainable management plans supervised by the Forest Department.
- **Output 2 (proportion of potential community groups actually established):** by year five, at least half of the 'potential number of community groups' (not defined) should be up and running, more than 40% [of them or of the potential number - this is also unclear] with FD certificates.
- **Output 3 (area of improved mangrove forest):** by year five, at least half of the national mangrove planting, restoration and rehabilitation target for the five-year period [not defined, but presumably within the 12,000 ha national goal] should have been achieved.
- **Output 4 (number of community groups benefiting from mangrove restoration):** by year five, at least 30 groups have been "supported with demand-driven activities that contributes to sustainable mangrove management in particular with fuel wood" (p. 29).

E9. Overall conclusion on mitigation performance. Even though the project is grounded in adaptation, the mitigation consequences of success are inevitable and significant, and the whole approach is highly replicable. A score of 5 (good, or higher if the design issues prove unfounded at mid-term evaluation) for anticipated performance might be given in the expectation of reasonable efficiency, sustainability and modest but highly replicable impact on emissions.

Part F: Other aspects of design and performance

Part G: Sources on mangrove values and restoration

G1. Economic values of mangroves (Salem & Mercer, 2012).

Abstract. "This paper presents a synthesis of the mangrove ecosystem valuation literature through a meta-regression analysis. The main contribution of this study is that it is the first meta-analysis focusing solely on mangrove forests, whereas previous studies have included different types of wetlands. The number of studies included in the regression analysis is 44 for a total of 145 observations. We include several regressions with the objective of addressing outliers in the data as well as the possible correlations between observations of the same study. We also investigate possible interaction effects between type of service and GDP per capita. Our findings indicate that mangroves exhibit decreasing returns to scale, that GDP per capita has a positive effect on mangrove values and that using the replacement cost and contingent valuation methods produce higher estimates than do other methods. We also find that there are statistically significant interaction effects that influence the data. Finally, the results indicate that employing weighted regressions provide a better fit than others. However, in terms of forecast performance we find that all the estimated models performed similarly and were not able to conclude decisively that one outperforms the other. [Table 1]."

Table 1: Average values for mangrove goods and services in South-east Asia

| Mangrove goods and services | Median value (USD/ha/year) |
|-----------------------------|----------------------------|
| Forestry products | 627 |
| Fisheries products | 576 |

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|---|---------------|
| Coastal protection | 3,604 |
| Water & air purification/waste assimilation | 5,801 |
| Recreation and tourism | 1,079 |
| Total | 11,687 |

G2. Mangroves and carbon (Donato *et al.*, 2011)

Abstract. "Mangrove forests occur along ocean coastlines throughout the tropics, and support numerous ecosystem services, including fisheries production and nutrient cycling. However, the areal extent of mangrove forests has declined by 30–50% over the past half century as a result of coastal development, aquaculture expansion and over-harvesting (Alongi, 2002; Duke *et al.* 2007; FAO, 2007; Polidoro *et al.*, 2007). Carbon emissions resulting from mangrove loss are uncertain, owing in part to a lack of broad-scale data on the amount of carbon stored in these ecosystems, particularly below ground (Bouillon *et al.*, 2009). Here, we quantified whole-ecosystem carbon storage by measuring tree and dead wood biomass, soil carbon content, and soil depth in 25 mangrove forests across a broad area of the Indo-Pacific region—spanning 30° of latitude and 73° of longitude—where mangrove area and diversity are greatest (Giri *et al.*, 2011). These data indicate that mangroves are among the most carbon-rich forests in the tropics, containing on average 1,023 Mg [*tonne*] carbon per hectare. Organic-rich soils ranged from 0.5 m to more than 3 m in depth and accounted for 49–98% of carbon storage in these systems. Combining our data with other published information, we estimate that mangrove deforestation generates emissions of 0.02–0.12 Pg [*billion tonnes*] carbon per year - as much as around 10% of emissions from deforestation globally, despite accounting for just 0.7% of tropical forest area (van der Werf *et al.*, 2009)."

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Part I: Acronyms and abbreviations

| | |
|-----|-------------------------|
| FD | Forest Department |
| PPF | Public Protected Forest |

RF

Reserved Forest
