

Expert responses to participants' questions and comments at the 3rd Mekong Mangrove Forum

1. Why is Bangladesh not included ?

- Benno Böer:

'The 1st, 2nd and 3rd Mekong Mangrove Forums dealt primarily with mangrove ecosystems in Cambodia, Myanmar, Singapore, Thailand, and Viet Nam, due to UNESCO's structure of field offices. Specialists from Bangladesh, and many other countries, however, have been invited to participate the forum. Moreover, a blog contribution of Mangrove Biodiversity in Bangladesh has been placed on the associated blog at our new 'Open Sciences Platform' <https://quest4action.org/mangrove/> All mangrove stakeholders globally are welcome to make use of the open science platform, including, of course, Bangladesh, and all other countries, with or without mangroves. We are currently discussing how to organize the 4th Mekong Mangrove Forum in 2021, and, hopefully, we will be able to have an inter-regional approach.

- Ben Vickers: No countries are excluded from this forum. Several participants from Bangladesh attended online, including noted experts on mangroves, and their participation is welcome and much appreciated. With the limited time available for this online event, the organising partners assembled a selection of expert contributions which we believe represents a diverse cross section of mangrove-related topics and current developments. We are already discussing plans for a similar event next year and suggestions or contributions from Bangladesh experts are welcome.

2. Is there detailed study on biodiversity of Myanmar Mangroves ?

- Nyi Nyi Kyaw. I am willing to share and send to the person who asked the question. Noteworthy publications for Myanmar mangroves include *Coastal wetlands in Myanmar* (Zöckler *et al.* 2018); Myanmar National Strategy and Action Plan (IUCN, MONREC & Mangroves for the Future 2016); The ATLAS and guidelines for mangrove management in the Wunbaik reserved forest (FAO 2011); Fishery resources in the Wunbaik reserved forest (FAO 2011); and The mangrove vegetation of the Wunbaik forest (FAO 2011).
- Benno Böer: 'The Mangroves of Myanmar' has just been published by Zöckler & Aung *in* Gul *et al.*: *Sabkha Ecosystems Vol. VI: Asia/Pacific* (Springer Nature 511p.)
 - https://themimu.info/sites/themimu.info/files/documents/Atlas_Myanmar_Marine_Biodiversity_Atlas_Dec2016.pdf

3. Is it possible to share ppt and list of participants ?

- Panyot Pattanachodpinyo: We cannot share the list of participants due to privacy policies, however, all ppts will soon be available on <https://quest4action.org/mangrove/>

4. Please provide information on Silvio fisheries and aquaculture best practices in Myanmar

- Toe Toe Aung: It is hard to say which are the best practices of Silvio fisheries and aquaculture in Myanmar. To support the best practices, we are trying to support the local communities demonstration plots in collaboration with the University of Queensland. We are also introducing "Mud Crab-fattening culture in Mangroves" without cutting mangroves, and just introduced and still wait and see the results whether those practices are really effective or not for local communities. We see positive results to some extent, but with the impacts of Covid-19, the markets for

Mud-crabs are now challenging these initiatives. Overall, our key interest is to introduce "Mud-crab fattening culture" without cutting mangroves as the best aquaculture practices in the coastal areas.

- Karsten Schröder: On aquasilviculture
 - While the mangrove forest serves as pool of resources for local communities' livelihood since many generations, 'Aquasilviculture' – more commonly known as Mangrove Friendly Aquaculture (MFA) - has been practiced in Myanmar for more than 20 years; yet, the development of (semi-) industrial shrimp industry development, with its known negative impact on the environment, particularly on the mangrove ecosystem, has led to a controversial discussion regarding promoting or prohibiting any kind of aquaculture activities in or next to mangrove areas;
 - There's an overdue need to clarify the meaning of the term 'mangrove friendly aquaculture'. Establishing a clear picture on resource management, and the resulting rights and responsibilities for aquaculture operation, can have a positive impact on the socioeconomic development in the coastal areas;
 - Small scale shrimp farmers (as well as farmers who operate polyculture systems) base their business usually on the concept of 'trap-and-hold' for shrimp (and fish) grow out, taking advantage of the primary production of the waterbodies. Enclosures in the mangrove system, as well as simple ponds, operated in an extensive manner - often on a family basis – rely entirely on the tidal water exchange system. Based on the influx of shrimp and fish larvae, this concept bears high economic potentials for local communities;
 - Clarifying land-use and operation of aquaculture business in the mangrove area, historically under the jurisdiction of Forest Depart (Ministry of Agriculture, Livestock and Irrigation, MOALI), will serve as a basis for furthering MFA following proven technical concepts and will result in a substantial increase of annual yield without compromising the natural carrying capacity of the mangrove system and the conservation aspect of the mangrove system itself.
 - As a way forward, the Department of Fisheries -with the assistance of the GIZ – MYSAP (Myanmar Sustainable Aquaculture Programme) project is finding solutions: A specific guideline on mangrove friendly aquaculture practices. The mangrove friendly aquaculture is mentioned in National Aquaculture Development Plan, the output: '2.3: Rice-fish systems and mangrove friendly farming systems are developed and promoted'
 - This strategic step will set the direction for future synergies between resource conservation and sustainable utilization and calls for a multi-sectorial dialogue, involving the relevant government agencies as well as representatives of the immediate resource users, and other actors within the value chain.

On aquaculture best practices

- MYSAP is also facilitating a Myanmar Standard on Good Aquaculture Practices in Myanmar which has reference to the FAO (2012). Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security.
- This Myanmar GAQP has technical compliance measures on aquaculture site selection, quote:
'The construction of the farm should not disturb the ecosystem and no forest or other natural habitats should be cleared for construction, nor should any natural waterways be drained, blocked or diverted';
- It is foreseen that this standard is voluntary but may be inspected and certified in the future.

5. So, in third world countries, a lot of people who aren't aware of the importance of mangroves, and they end up cutting down forests. So how do you believe we should go about informing people about the harms of such actions? It is very important to raise awareness on the importance of mangrove ecosystems. Three quarters of the world's people are in Asia. Humans and mangrove ecosystems have co-evolved together but we need to inform the public on the importance of these ecosystems. Humans and all other life forms that depend on mangrove ecosystems are increasingly vulnerable to the impacts of climate change but also from unsustainable coastal development.
- Ben Vickers: This is an excellent question and goes to the heart of what we hope to achieve through the Mangrove Forum and associated initiatives. Providing information to local people of the importance of mangroves is a necessary part of a coordinated effort to preserve these ecosystems, but will rarely be sufficient to incentivise changes in behaviour. We need to explore ways in which the preservation and restoration of mangrove ecosystems can deliver measurable, attributable economic or livelihood benefits to marginal communities.
 - Benno Böer: UNESCO warned against the unbridled exploitation of natural resources in the late 1960s, when the concept for the Man and the Biosphere Programme and the World Network of Biosphere Reserves has been developed. Reconciling sustainable development, human living and nature conservation has become increasingly more difficult. Good environmental management should be a priority to any nation, and for all people. Maybe Covid-19 will trigger more attention to long-term issues, such as biodiversity conservation, climate mitigation and adaptation, natural resources management, and reducing pollution.
 - Charlotte Hicks: I would add that this is not just a challenge in developing countries; in all countries there is a need to better understand and communicate the value of mangroves and other coastal ecosystems
6. Is the marine and river plastic harmful to mangroves ?
- We will develop a blog-post for this question
 - Charlotte Hicks: SEA Circular addresses marine plastic pollution at source, including research and publications: <https://www.sea-circular.org/publications/>
7. Is the forum recorded ?
- Benno Böer: Yes, all participants have been informed that the forum was recorded. The full recording and individual clips are currently being produced and placed onto the media library at <https://quest4action.org/mangrove/>
8. Is a mangrove called mangrove if they grow in freshwater ?
- Benno Böer: All mangrove species occur naturally in full strength seawater, at seawater salinity, or in brackish water. Mangroves do occur sometimes in freshwater situations, normally very localised, and mostly, if not always, planted by people. In natural freshwater situations we find other types of riparian trees, which are tolerant to water-logging, but not to permanently high salinity levels. So, I would say, if a true mangrove tree occurs in freshwater, it is still a mangrove species. By the way, this subject is of importance for deltaic eco-hydrology in times of sea-level rise, when salt-water intrudes areas that currently exposed to freshwater. It will have vast implications on species composition in deltas.
 - Oleg Shipin: Freshwater Mangrove Ecosystems globally. Generally speaking, mangroves dominate the intertidal zone or coastline shores of the tropics and subtropics of the world. However, despite of being halophytic in nature, there are reports on unique natural occurrences of inland mangroves, isolated from the influences of salinity coming from an ocean or sea. This tolerance of mangrove

species to freshwater was for long considered to be not for optimum growth but rather for survival. However, recent research by AIT shows that there is no inferiority in freshwater growth rates of at least major mangrove representatives (10 plus most common species in Thailand). The unique and rather uncommon long term natural freshwater mangrove ecosystems occur in small patches as compared to the extensiveness of coastal mangroves. Notable areas where freshwater mangroves successfully exist under unquestionable freshwater conditions are Hosnies Spring in Christmas Island, Australia (Hale and Butcher, 2010), Lake Sentani in Papua province, Indonesia (Steenis, 1984), freshwater lake in Karif Shoran, Yemen (Spalding, M., 2010; Hogarth, P., 2015), Vaitupu Island, Tuvalu, Oceania. Artificial areas where marine mangroves were planted in fresh water in which they very successfully grown are: Bogor Botanic Garden, Indonesia (Giesen et al, 2006; Ng and Sivasothis, 2014) and several places in Bangkok, Thailand, such as Suan Luang Garden Park, King Mongkut University of Technology, Bang Khun Tien Campus, National Science Museum and AIT campus. As a matter of fact, in Thailand mangroves have been cultivated as ornamental plants and used in landscaping canals, ponds and gardens for many decades. The Thai Royal family was prominent in this process.

9. How to manage people and mangroves living in harmony ?

- Christoph Zöckler: Only by involving of local communities and their needs for mangrove and mudflat resources we can develop a conservation scheme for mangroves in Myanmar. The objective is to sustain the harvest of timber and marine resources from the mangroves and mudflats. To achieve this we need to develop a common understanding of sustainability in terms of the actual products as well as the awareness for the overall ecosystem. The UNESCO MaB Reserve scheme allows for the development of such management and zones as well as providing strict protection of key biodiversity areas. It is important to include local communities in the early stages of any zonation to achieve greatest level of acceptance or less need for law enforcement.
- Naymyo Shwe: Locally manage mangrove area approach toward MAB based on community requirements and site-specific content is fundamental and goal. An area stratifies based on site specific requirements and needs for proper implementations. Livelihood support and sense of ownership on natural resources are major requirement for grass root mangrove dweller in developing countries. In the other hand strong policies and political support in each region is crucial for mangrove sustainability, local communities trust and active participation.
- Mark Grindley: Certainly sustainable management of livelihoods resources in productive natural landscapes like mangroves is a challenge. Government responsibility is often split (eg, between forestry and fisheries administration), and livelihoods uses of communities can easily be seen as negative and destructive. But if we acknowledge that sustainable use is possible, then community-based management starts to look like a much more suitable approach than other, government-centred ones such as 'fence-and-fine' protected areas. Co-management is not however without its challenge, and there are many different models; not all will be most suitable in all contexts. As Nay Myo notes, the Biosphere Reserve programme offers one flexible approach that can be tailored to local circumstances and the needs/desires of stakeholders. Ramsar is another, though we should note that they are not mutually exclusive; Ramsar status might be appropriate for BR core zones in the

context of mangrove, for example. Nay Myo's points on livelihood support and ownership are important considerations also.

- Benno Böer: Mangrove conservation should become a priority in national and local development planning. In addition, it would be important to establish an *ex situ* collection of mangrove germplasm, for example by establishing a World Mangrove Garden. Ecological mangrove forestry needs to be tested, in order to find out the capacity of mangrove forests to provide biological goods to people, without disturbing the balance (within the ecological carrying capacity). Floating mangroves need to be tested as an alternative method for biomass production, as an offset for illegal mangrove cutting.
- Janalezza Morvenna Esteban Thuaud: Provide locally relevant and context-specific incentives, such as mangrove-friendly livelihoods; leverage on existing private-public partnerships based on mutual trust and acceptance; give more space for community-based forestry management; engage the youth and school children in caring for the mangrove forest. For more information, please refer to the article, A review of mangrove rehabilitation in the Philippines: successes, failures and future prospects, <https://link.springer.com/article/10.1007/s11273-008-9101-y>

10. Is there data on carbon sequestration, and economic value of mangroves for carbon trading ?

- Martin Zimmer: There are many attempts to estimate the amount of carbon sequestered in mangrove biomass and sediment - some are reliable, others are obviously less accurate. [One aspect that is very rarely taken into account is that not only carbon contributes to the greenhouse gases, but also nitrogen. Thus, I always recommend measuring organic matter rather than organic carbon; however, there is no market for organic matter or nitrogen, but only for carbon.]
Aboveground biomass (AGB) of mangrove trees and forests can be reasonably accurately estimated(!) from forest structure data, e.g., tree density, tree height, tree diameter-at-breast-height, and wood density. The equations needed for the estimations are both species- and region-specific(!), and only if both is taken into account, the outcome will be acceptably accurate and reliable.
Recently, attempts are becoming more and more common to estimate AGB from remote-sensing data. I am not (yet) fully convinced by this approach, but the models and techniques are improving quickly, and I believe that first sophisticated guesses are possible. However, as for most modeling approaches, we still need more and better ground-truthing!
Belowground biomass (BGB) is even more difficult to estimate from forest structure data. If regional and species-specific equations are used, the outcome of the models might be reasonable (within an acceptable error margin). Any attempt of estimating BGB from satellite data, however, still appears (too) far-stretched to me.
The most accurate and reliable way of determining AGB and BGB still would be to cut trees and dig out all roots and actually weigh the biomass - THIS, however, is -of course- unacceptable on a large scale! It is for this reason that it seems the above approaches are the best choice: we just have to work on improving them to the best of our knowledge! The carbon store in the sediment (or the storage rate) is yet another story. I haven't seen any convincingly reliable approach or model for estimating sediment carbon from forest structure data, not even to mention satellite imagery. Values of carbon stores in sediments are highly variable on a relatively small spatial scale, and the only way of obtaining half-way accurate data is taking (deep!) sediment cores (in sufficient number and spatial distribution) and actually

measuring the carbon content. Taking some other sediment parameters into account, this will yield reliable and accurate estimates of carbon stores in mangrove sediments. There is a plethora of data and estimates "out there" - but we have to be aware of their potential lack in accuracy and reliability...

The economic values of all the above would then depend on the carbon price on the international (or national) carbon-trading market. However, beyond carbon sequestration, there is a multitude of co-benefits of mangrove forests to local and regional societies (and humankind worldwide)! Some of the services provided by mangroves (mostly esthetical, cultural, religious, ...) are difficult (if not impossible) to mark with a price tag; others (e.g., provision of natural resources, such as wood, feed, food, and of nurseries and habitat for seafood species) are not too difficult to quantify; the economic value of coastal protection, e.g., would be quantified indirectly by estimating the costs of building protective structures that would be needed upon mangrove loss. All these benefits should be taken into account in addition to the carbon-market value when estimating the economic value of mangroves (or the economic cost of losing them (not to mention the ecological costs).

- Gerald Prolman: We think about this in several ways:
 - 1) Mangrove restoration/planting projects are comparable to terrestrial aff/ref projects so should at least see similar pricing.
 - 2) What the project costs are for implementing a mangrove restoration/planting project
 - 3) Mangrove projects are the most viable and scalable blue carbon projects we have seen, and the notion of Mangroves has an alluring market appeal. I think people will pay a premium for them but we can look at what prices are they actually getting today?

1. Aff/Ref prices are anywhere between \$15-20/t

2. We have seen a range from \$2.00-\$3.50 per seedling. One conservative approach we have seen from a developer is a requirement for an upfront investment to pay for the seedlings accompanied by an off-take agreement. They ask for \$1.5/seedling upfront and then \$8-10/t on a 10yr offtake. So an example, a 200ha project expects to deliver 18,000 VCUs for 10yrs (so total of 180,000t). Planting Investment = \$750,000 (200ha x 2500 seedlings per ha x \$1.5 per seedling), Carbon Offtake = \$1.8m (180,000 VCUs x \$10). So if everything was to be funded by carbon (summing investment + offtake) you end up with a price of roughly \$14.20/t = (\$0.75m + \$1.8m)/180,000 VCUs. These costs move a bit because some places planting is easier, seedlings cost different amounts in different places etc so I think the range of cost price is something like \$10-15/t for projects that need planting (ref/res), REDD+ would be different for obvious reason.

3. We see a wide range \$10-20/t with an average at \$15/t right now for long term off take agreements. Community benefit sharing and biodiversity protection contributes to the quality of the project enabling yet higher prices. It's early days for blue carbon but I believe carbon credits from Mangroves will be in high demand and the highest market price because it's a reduction as well as sequestration.

- Ben Vickers: The carbon sequestration potential of mangroves, and all other ecosystems, is measured in terms of their 'emission factors' (EFs) or 'removal factors' (RFs), which refer respectively to the tonnes of carbon dioxide equivalent (tCO_{2e}) released through a destructive activity (e.g. clearance of 1 hectare of

mangroves) or sequestered through a positive activity (e.g. plantation or restoration of 1 hectare of mangroves). Mangrove ecosystems are highly varied, so the EFs and RFs are different between and within countries, and require a lot of intensive fieldwork to calculate. See CIFOR's research in Indonesia for some examples: <http://www.cifor.org/knowledge/publication/5095/>. FAO is conducting intensive plot measurements of mangrove ecosystems in Myanmar, which will allow calculation of accurate EFs and RFs for this country. In general, mangroves are among the most biomass-rich forest ecosystems i.e. have high carbon stocks per unit area, but the majority of these stocks are below ground or underwater. The carbon stocks do not necessarily translate into high value for 'carbon trading'. However, if interventions or projects can be designed which will deliver reduced Greenhouse Gas (CO₂) emissions, or increased CO₂ sequestration with high confidence, then high economic returns can potentially be secured with smaller unit areas than would be required with other forest ecosystems. The Voluntary Carbon Market (VCM) standard development organisation Verra has a 'Wetland Conservation and Restoration' methodology guideline, released in 2012, to assist project developers, which is in the process of being reviewed and updated. See <https://verra.org/project/vcs-program/projects-and-jnr-programs/wetlands-restoration-and-conservation-wrc/>

- IUCN is working to release protocol for Mangrove Carbon Credit. IUCN Thailand is working with government focal points to set up "Thailand Mangrove Alliance" which will be the entry platform for Public-Private Sector mangrove carbon credit scheme.

11. How can we obtain permission to use the fotos of the MAP foto-contest ?

- Dominic Wodehouse: 'Thank you. Please email Laura at laura@mangroveactionproject.org and she will sort out permission for usage'.
- Laura Michie: We don't own the rights to these photos, so we cannot give out permission for others to use them. But let them know they can get in touch with me and I'll ask them for a bit more information, if it's only a few photos then I can put them in touch with the photographers.

12. How do you balance salinity percentage in relation to planting mangrove trees in the Arab Region ?

- Ronald Loughland: We always focus on areas that are flushed and well drained through tidal water circulation so as not to have water stagnation and evaporation leading to increased salinity. Salt is a natural stress for mangroves so the less salty the better, however the Gulf has elevated salinities compared to other areas of the world and as such we focus on areas in the Gulf where there is natural groundwater or agricultural (date oasis) seepage into coastal areas, in such places mangrove plantations are more successful
- Benno Böer: The Arab Region is limited in mangrove coverage and diversity. Principally, all areas that are routinely exposed to very cold temperatures, have no mangroves, but they feature salt-marshes instead, often succulent species with high salinity concentration in the tissues. This is why the Mediterranean has no mangroves, but Morocco, and Mauretania in the West, and the Arab States in the Gulf feature *Avicennia marina*, and the Red Sea has *Avicennia marina*, *Rhizophora mucronata*, and *Ceriops tagal*. *Avicennia marina* is highly salt-tolerant upto at least 4,5 % tdS, whereas, for example in the ultra-high-salinity Gulf of Salwa, they still occur in the north, but not in the south, due to high salinity levels reaching up to 7% tdS. *R. mucronata* still occurs on some isolated places in the Gulf.

13. Shall we have presentation on mangrove restoration from India, The Philippines and Bangladesh next mangrove forum ?
- Benno Böer: yes, that would be great. In the meantime, we can make material available on the blog on exactly the same issue. No need to wait until 2021.
 - Janalezza Morvenna Esteban Thuaud: Yes, this is a welcome suggestion for the 2021 event.
14. Should mangroves in restoration projects be planted as a monoculture, or multiple species, and what are the effects ?
- Ben Vickers: Restoration initiatives are highly location-specific. In general, indigenous species should be used, which are appropriate to the project site itself, not merely the country or region. In some cases, mangrove ecosystems are highly diverse in terms of species, in others they may naturally comprise very few (even just one) canopy species. Like plantation initiatives in dryland sites, the ultimate purpose of the plantation largely determines the species composition. If the purpose is solely restoration of the natural ecosystem (or as close to the natural system as possible) then this will not be achieved simply by planting the appropriate proportions of species found in the mature ecosystem. Faster-growing, light-demanding species are usually established first, with shade-tolerant species subsequently. If the plantation objective is commercial production, or for materials valued by local communities for subsistence purposes, monocultures may be quite appropriate.
 - Siriporn Sriaram: It depends on the objectives. It is important to use the application of ROAM – Restoration Opportunities Assessment Methodology. The ROAM provides principles and operation guidance for the Forest Landscape Restoration (FLR). Sound restoration can deliver environmental and socio-economic benefits, which cannot be achieved by monoculture. Another important method that is worth to mention is the Mangrove Ecological Restoration technique (EMR).
 - Janalezza Morvenna Esteban Thuaud: Mangrove restoration should be contextually and scientifically conducted. There are many scholarly articles available, and for a snapshot, please refer to the article -- A review of mangrove rehabilitation in the Philippines: successes, failures and future prospects, <https://link.springer.com/article/10.1007/s11273-008-9101-y>
15. Did the Saudi ARAMCO mangrove project include only planting seedlings, or were there also hydrological interventions ?
- Ronald Loughland: Our projects included examining through surveys the ideal conditions for establishing mangroves, and in most cases natural existing shorelines were selected. In some instances however, we modified the substrate heights to allow greater tidal flushing and drainage, and this ensured maximum success of these plantation sites.
16. Who can contribute to the Blue Carbon Ecosystem book series?
- Bilquees Gul: Scientists and researchers working in the Universities, Research Institutes/Centres, R&D organizations and NGOs can contribute Original Research Articles, Reviews, Case Studies and/or Commentaries about various aspects on Blue Carbon Ecosystems.
17. Can we have a word on blue carbon and peatland ?
- Siriporn Sriaram: It Blue carbon is the carbon stored in coastal and marine ecosystems. Per unit the blue carbon ecosystems store more carbon compare to the

terrestrial forest. Peatlands also an important component of climate change mitigation as they sequester significant amounts of soil carbon.

- Janalezza Morvenna Esteban Thuaud: ASEAN leaders have recognized the role that forests, including peatlands, play in climate change mitigation and adaptation in a number of key policy statements (source: Social forestry and climate change in the ASEAN region, RECOFTC 2017).

In April 2015, the ASEAN Heads of State signed the Declaration on Institutionalizing the Resilience of ASEAN Communities and Peoples to Disasters and Climate Change, committing to a range of measures to reduce vulnerability to disasters and climate-related risks; and to mainstream disaster risk management and climate change adaptation into policy-making at the local, national and regional levels. The Declaration on Post-2015 Environmental Sustainability and Climate Change was issued in November 2015 (ASEAN, 2015). This declaration stated the need to accelerate implementation of climate change mitigation and adaptation measures in line with national policies. It aims to strengthen regional cooperation on climate change, preventing peat soil and forest fires, and sustainable management of forest and peatland ecosystems to reduce deforestation and land degradation. RECOFTC is working continuously with local and national governments across the Mekong (particularly Thailand in the Kuan Kreng Landsape in Nakhono Sri Thammarat) and in Jambi, Indonesia to address peatlands conservation and management. For more information, please contact partnerships@recoftc.org

18. How tough or weak are mangroves to oceanic changes, such as temperature, nutrients, salinity, and pH ?

- Benno Böer: This is specific to the species, sub-species, as well as topographic and conditions. Temperature (air-temperature and water-temperature) is believed to be the limiting factor for species diversity, and the bio-geographical extend into the southern and northern sub-tropics. Cold winter temperatures limit mangrove distribution. A lot of ecological studies have been carried out, and many more need to be carried out, also in view of climate change and mangrove coverage.

19. Are there mangrove restoration projects that have been funded via carbon credit trading ?

- Ronald Loughland: Saudi Aramco are planting mangroves as part of our Corporate Stewardship program, and we highlight the benefits that this has for food security, biodiversity, resilience to climate change and carbon sequestration and storage. We regard mangroves as natural based solutions for carbon emissions and are now working with organizations both within Saudi Arabia and internationally to utilise the protection and restoration of mangrove ecosystems as part of our decarbonisation goals whilst recognising the many co-benefits the protection and restoration of these habitats has for communities around the world. So the future of global mangrove forests will be influences by carbon crediting
- Gerald Prolman: You can find 4 registered mangrove projects in the VCS (VERRA) registry. There are also several other projects in earlier phases of development and they are not yet issuing carbon credits. Also there are a number of reforestation/restoration mangrove projects done as caused based rather than carbon projects (a company does it as a philanthropic exercise). As the demand for offsets from Mangrove projects increases we may see some of these sonar based projects seek verification in order to secure durable financing from the market rather than through donations.
- Charlotte Hicks: In terms of the project-scale, voluntary market, you may also like to look at CCB, VCS and other projects listed here, including projects related to restoration: <https://registry.verra.org/>

20. What are the best practices for the restoration of aquaculture and mining areas with mangroves ?
- Janalezza Morvenna Esteban Thuaud: Please consult the work of SEADDEC and Dr. Jurgenne Primavera, Mangroves and aquaculture in South-East Asia. https://repository.seafdec.org.ph/bitstream/handle/10862/711/RTCCCode_p25-37.pdf?sequence=1&isAllowed=y
21. Will presenting prepublications on the 'Open Science Forum' be a conflict with science journals ?
- Benno Böer: that will depend on the journal. Each author needs to find out for each individual case. The journal publishes material only after a review and revisions process. We can allow authors to place their raw material on the open science forum as und-edited raw-material, without copyright, and with no Science Citations Index value. If there is a conflict with the journal, you need to find out yourself, with your selected journal.
22. How can the conservation and restoration of mangrove forests be an incentive for big business ?
- A blog contribution will be arranged for to respond to this important question. Mangrove forest conservation and restoration are very good incentives for the private sector and business. Please see blog article by Dr David Ganz, Dr Chandra Silori, and Dr Maung Maung Than, To keep our coasts, coastal communities must benefit from sustainable enterprises, <https://www.recoftc.org/stories/keep-our-coasts-coastal-communities-must-benefit-sustainable-enterprises>
23. When will the GIS portal be available and where can we find it ?
- Charlotte Hicks: There are many GIS portals that could be relevant. One is the UN Biodiversity Labs, where users can explore many different layers related to biodiversity and ecosystem services: <https://www.unbiodiversitylab.org/> There is also Global Mangrove Watch: <https://www.globalmangrovetwatch.org/>
24. Mangrove restoration experiences:
- An article for our blog will be composed.
25. What kind of mobile monitoring systems exist ?
- Janalezza Thuaud will compile a blog-article jointly with Dan Friees and Norman Duke.
26. How to make mangrove users environmental stewards for mangrove ecosystems ?
- We will arrange for a sperate blog contribution
27. How to develop synergies between traditional conservation methods and state of the art innovative technologies for win-win-situations ?
- A separate blog-article will be produced.
28. How to generate a synergetic mangrove conservation approach, with multiple responsible authorities, users, private sector, and academia ?

- Benno Boer: Several countries have established MaB National Committees, consisting of stakeholder representatives of various different federal ministries and authorities, as well as regional and local representatives, to ensure a professional dialogue on Biosphere reserve issues and management adaptation.

Additional relevant information:

Web pages:

- FAO page on mangrove ecosystem restoration and management: <http://www.fao.org/sustainable-forest-management/toolbox/modules/mangroves-restoration-and-management/tools/en/>
- FAO page on mangroves: <http://www.fao.org/forestry/mangrove/en/>

Publications:

- Mangrove related policy and institutional frameworks in Pakistan, Thailand and Viet Nam
- Incentive allocation for mangrove protection
- Mangrove carbon estimator and monitoring guide
- Financing for mangrove protection with emphasis on Pakistan, Thailand and Viet Nam
- Common plants of Maldives
- The world's mangroves 1980-2005
- Coastal protection in the aftermath of the Indian Ocean Tsunami: what role for forests and trees?
- The role of coastal forests in the mitigation of tsunami impacts (although actually this is included in the link Ken shared below, "Forbes, K. & Broadhead, J" so probably no need to add)

Articles:

- IISD FAO article "International Day for the Conservation of the Mangrove Ecosystem: Why and How We Need to Save Mangroves" <https://sdg.iisd.org/commentary/guest-articles/international-day-for-the-conservation-of-the-mangrove-ecosystem-why-and-how-we-need-to-save-mangroves/>
- IISD FAO article "Mangroves: A Unique Ally in the Climate Emergency": <https://sdg.iisd.org/commentary/guest-articles/mangroves-a-unique-ally-in-the-climate-emergency/>
- UN-REDD article "'One mangrove, a thousand hopes"- mangrove rehabilitation in Nigeria": <https://www.un-redd.org/post/one-mangrove-a-thousand-hopes-mangrove-rehabilitation-in-nigeria>