RE-ENGINEERING CLIMATE CHANGE SOLUTIONS THROUGH MULTIPLE WINS – THE REWILDING AND CONSERVATION OF TERRESTRIAL AND MARINE TOTALLY PROTECTED AREAS (TPAS) IN SARAWAK

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Abstract

In December 2020, a year after Sarawak Forestry Corporation (SFC) became the sole custodian of Sarawak's National Parks, Nature Reserves and Wildlife Sanctuaries, and nine months into the Covid-19 pandemic in Malaysia, SFC re-aligned some of its thrusts, research and deliverables for conservation, sustainable livelihoods and climate change mitigation. In a series of management discussions, presentations, and workshops, the re-alignment included investing in competent skill sets of new staff, applied research directed towards management and conservation, and finally amalgamating objectives towards a series of collective conservation projects by harnessing the skills of its teams. These re-aligned conservation projects include "Earth, Sea and Sky", "Rewilding" and "Sarawak Reef Ball Project". Inherent in these projects are the restoration of the environment through planting of native trees; creating wildlife corridors; working with B40 communities to offer alternative livelihood streams; use of environmentally-friendly technology, and engaging with the various parts of the corporate sector in a long-term working relationship via their Environmental, Social and Corporate Governance (ESG) goals. One of the wins in the ESG working relationships is long-term carbon sequestration and the liberation of oxygen. The paper delves into potential outputs and outcomes from "Earth, Sea and Sky, "Rewilding" and "Sarawak Reef Ball Project".

Keywords: *Rewilding, Totally Protected Areas, wildlife conservation (plants and animals), climate change, livelihoods, stakeholders, projected outcomes.*

Introduction

The interest in carbon offsets, carbon trading, forest carbon, blue carbon, biodiversity offsets, payment of ecosystem services and others has been circulating in conservation and development circles for over 10 years. In the mid- to late-2000s, the term “carbon-cowboys” was used to refer to the sales-people (middle-men or middle-people) who wandered into government offices with the view of making substantive funds by buying carbon cheap and hiking it higher to sell it to buyers. Whilst the steady stream of carbon-cowboys dissipated by the early 2010s, it came back strong after the Paris Agreement or Accord, where Article 6.2 enabled countries to cooperate with one another directly, for example, climate change mitigation activities can be implemented in one country and the resulting emission reductions can be transferred to another country and counted towards its nationally determined contribution (NDC).The Agreement recognized the rights of parties to use emissions reductions outside of their own borders toward their NDC, in a system of carbon accounting and trading (Stavins and Stowe, 2016).

In Malaysia, there had been several starts in trying to create forest carbon projects. This included the ones in Sarawak (Chua, 2019) and Pahang (Abdullah, 2019). Issues of lack of transparency, leakage, permanence, competence, uncertainty over additionality, legislation and support hampered the smooth progress of such projects in Malaysia. The current amendment to the Forest Ordinance (2015) recognizing Forest Carbon and requiring a license to trade the product, has the potential to hasten the progress not just for forest carbon in the Permanent Forest Estate, but also for forests in Native Customary Rights lands (Ling, 2022).

There was also uncertainty over whether the Forest Carbon in trees from existing or gazetted Totally Protected Areas (TPAs) such as National Parks, Nature Reserves and Wildlife Sanctuaries is tradeable. Whilst trees planted in degraded non-TPA forests represented “additionality” (and hence valued for its carbon), a question hung over whether trees planted in degraded TPAs would be similarly tradeable. The response by late 2020 from various federal agencies indicated that it indeed may be tradeable, once they are proven to be “additional”. This is especially so, once it is proven that it enhances of carbon stocks and/or reduces degradation.

The approach towards protecting Forest Carbon in TPAs yields multiple wins in Sarawak. This paper focusses on these wins in terms of increased biodiversity and wildlife corridor connectivity, better financing for sustainable livelihoods, alternative revenue streams for the state and augmented tourism potential in protected areas from increasing biological carrying capacity. Attention is concentrated on terrestrial conservation due to the nature and theme of this conference.

Moving into Applied Research and Conservation

Sarawak, Malaysia is one of the few global mega biodiversity hotspots. There are numerous iconic species in the state, ranging from primates such as orangutans (*Pongo pygmaeus*) and Proboscis monkeys (*Nasalis larvatus*) to carnivores such as the Bornean clouded leopard (*Neofelis diardi*) and birds such as the helmeted hornbill (*Rhinoplax vigil*). It also contains the most extensive protected areas system in Malaysia and there are currently 67 Totally Protected Areas (TPAs) housing the plethora of biodiversity within the state. To date, the State’s protected area network includes 47 national parks, 5 wildlife sanctuaries and 15 nature reserves. These cover a total area of 2.1 million hectares (terrestrial and marine) (see Figure 1).

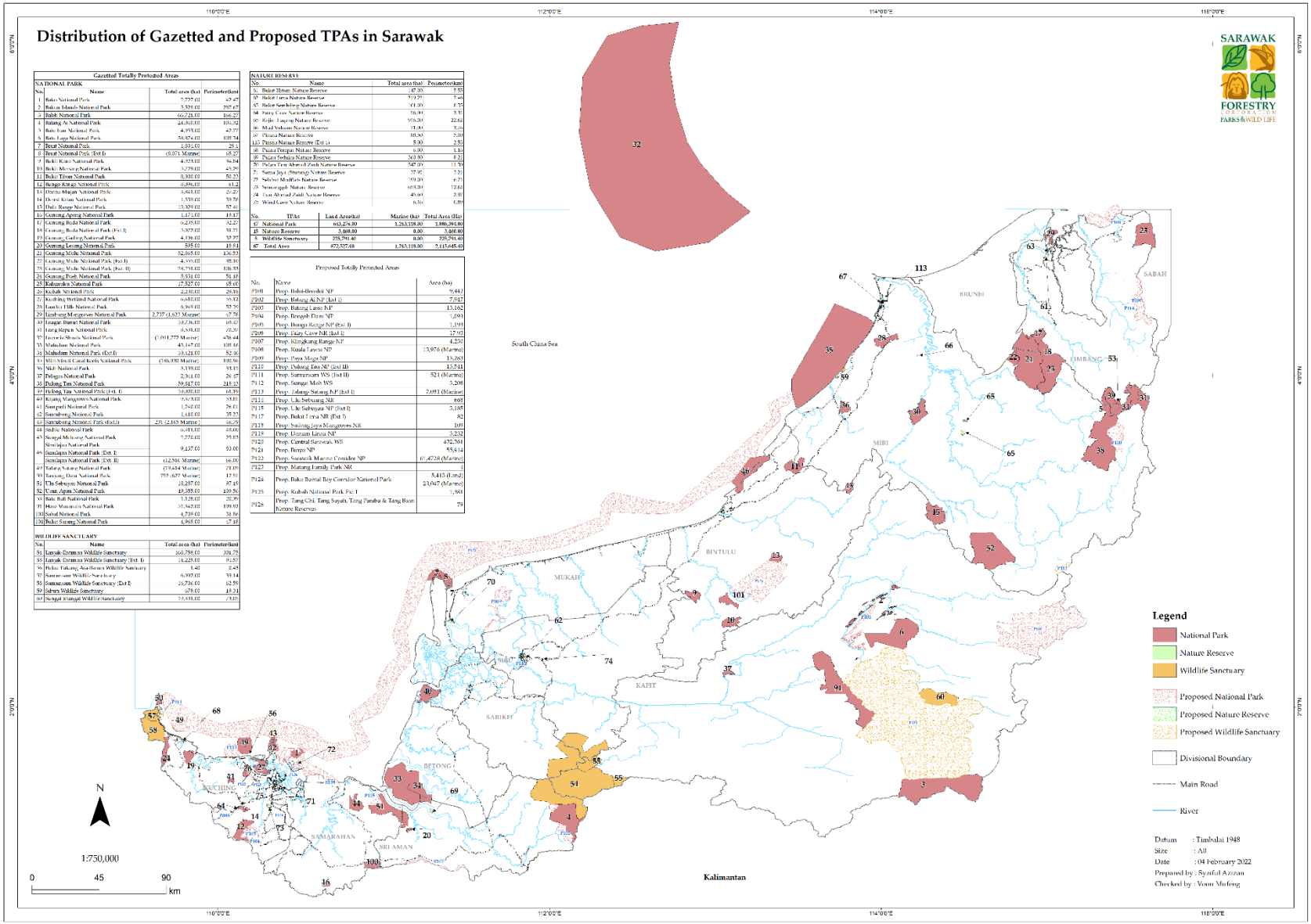

Figure 1. Distribution of gazetted and proposed TPAs in Sarawak. There are 67 gazetted TPAs highlighted in the figure.

The world is facing the "Sixth Extinction" (Kolbert, 2015). Like much of the world, Sarawak has its own biodiversity issues exacerbated by habitat loss and deforestation (e.g. land-conversion and unsustainable logging), illegal wildlife trade, climate change and other unsustainable developments. Solutions to protect and conserve the biodiversity are also beset by issues such as competing land-use, finances, development priorities and staffing requirements.

Over the years, there have been numerous proposed conservation solutions and these range from the "Half-Earth" (Wilson, 2017) approach, to a multi-pronged stakeholder engagement (Corlett, 2019) as well as engaging it with an economics-led approach (Dasgupta, 2021). There are calls for a greater pursuit of science as it will help generate innovative interventions thus prevent the impending losses (Ghazoul and Sheil, 2010). Others do also suggest that we should look at the history of biodiversity loss and learn from there, and understand that the rapid changes will mean that biodiversity cannot cope (May and McLean, 2008). As with many conservation practitioners, Corlett (2019) outlined that the resources available for conservation are limited and that allocation of these resources requires careful planning. Amongst others, priorities for conservation action would be determined by high vulnerability and high irreplaceability (Corlett, 2019).

By December 2020, after nine months of focus on conservation of TPAs and the wildlife throughout Sarawak, it became clear to SFC that the research work needed to be much more focused rather than a 'buck-shot' approach at trying to conduct research on everything. An internal analysis via a workshop was thus conducted, and this included collating all the research conducted by external parties such as local and foreign universities, as well as the interest from within SFC. Subsequently, the outputs of the workshop showed that SFC was engaged in close to 78 research activities. These ranged from 3-year pure academic research to one-year research by students in universities.

Maintaining such a high level of research is taxing on the limited staffing within SFC. This is especially so when each researcher would need an SFC counterpart that follows the field team into the TPA or TPAs and also attempts to learn of the research methods either by co-conducting the work, observing and being trained to conduct the work or merely observing (perceived osmotic learning) (Lago *et al.*, 2011; Tupula, 2019).

Towards refocusing the research, a draft, simple Theory of Change (UNDP, 2020) was developed (see Figure 2) which included prioritizing research for conservation. There are several versions for Theory of Change (Margulois *et al.*, 2013) and it can be explained as how an intervention or a set of interventions is expected to lead to a specific change, drawing on an analysis of available evidence.

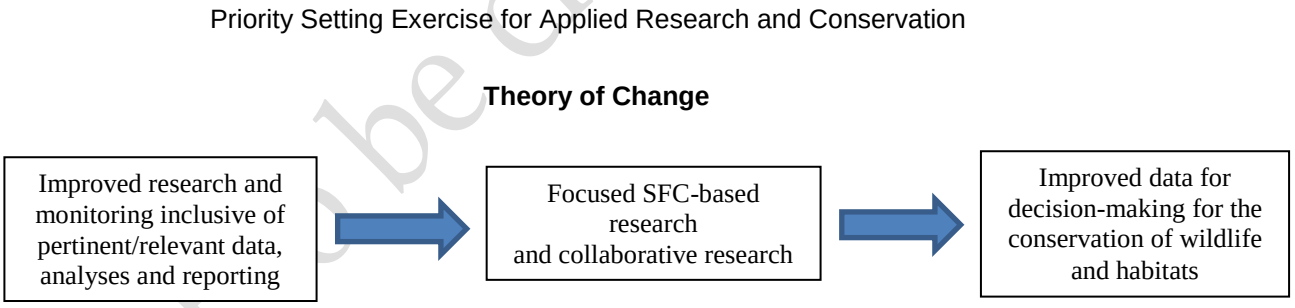

Figure 2. Draft Theory of Change for SFC's Applied Research and Conservation.

Prioritization of research for conservation within SFC

For Sarawak, as it supports the global conservation movement and is bound by numerous policies such as IUCN Red List, CITES Act (2010), Forest Ordinance (2015), National Parks and Nature Reserves Ordinance (1998) and Wild Life Protection Ordinance (1998), prioritization therefore also has to take cognizance of local conditions and management authorities.

Prioritizing species, habitats and ecosystems by their perceived level of endangerment has become a standard practice in the field of conservation biology (Master, 1991; Carter *et al.*, 2000; Stein *et al.*, 2000; Mace & Collar, 2008; Wilson *et al.,* 2009; Rabinowitz, 2014;). As outlined, the need for a priority-setting process is driven by limited conservation resources. It is also necessary as there are distinct differences or a wide gap among species in their apparent vulnerability to extinction or need for conservation action. Understanding how to value species and the urgency required for management is essential for making good decisions. Simultaneously considering species value, financial and technical constraints ensure that cost-efficient management is given priority and will maximize conservation outcomes.

In promoting conservation through single species, one of the questions is how should individual species be prioritized? The common response is to begin with species that are most at risk of extinction; the Rare, Threatened and Endangered (RTE) species. A similar approach is taken for habitats as well as for cross-themed requirements.

SFC considered the species prioritization exercise via the "Noah's Ark Problem". The "Noah's Ark Problem" was examined through solving the core issue of optimal biodiversity conservation/preservation under a budget constraint (Weitzman, 1998). The Noah's Ark problem or framework provides a cost-efficient solution to the problem of threatened-species resource allocation. The framework considers the benefits (i.e., increase in the probability of a species persisting), costs of the project or research, species contribution to diversity (i.e., distinctiveness), and value of the species (i.e., utility of a species).

Subsequent iterations of the Noah's Ark framework included considerations for the probability or likelihood of success of the project or research. A management action that is likely to succeed is given a higher priority than an action that is likely to fail.

The theoretic approach in choosing between projects that aim to conserve a specific threatened species in the SFC's approach is adopted from the Noah's Ark framework with a slight modification, as per indicated by Joseph *et al.* (2008).

The Noah's Ark framework ranks species or species projects on the basis of ranking criterion, R, which is a cost-efficiency metric:

$$Ri = \frac{\mathrm{Wi\ x\ \Delta pi}}{\mathrm{Ci}}$$

Where Δp is analogous to our biodiversity benefits, *B*, and is defined as the chance in survivability of a species *i* and *W* is the sum of distinctiveness and species utility. Further development from Curtois *et al.* (2014) sees the model extended to incorporate species interactions. Nevertheless, the output is still to create a general ranking formula for deciding in-situ conservation priorities under a budget constraint.

Within SFC, the cost-efficiency measure to include the likelihood of success of a project is E_i and it is also called the modified metric the Index of Successful Biodiversity Conservation Value (E_i) (Joseph *et al.*, 2008). It is calculated as:

$$Ei = \frac{\mathrm{Wi\ x\ Bi\ x\ Si}}{\mathrm{Ci}}$$

Where W_i is the species value/weights, B_i is the biodiversity benefits, S_i is the probability of success and C_i is the cost of project.

For SFC, the value of a species revolved around, amongst others: local and international needs and commitments; humanity's needs, funds, staffing; legacy research and monitoring; current and predicted issues, and policy amendments. Policy amendments have also been modelled into Noah's Ark framework in by Martin (2016) and indeed affected the success of a project in India.

A case example – Rewilding

SFC's Rewilding program came into existence in late-2020 as part of the TPA restoration of habitat program. There are 12 guiding principles in SFC's 2021 "*Rewilding and Restoration Within the Totally Protected Areas (TPAs) of Sarawak Programme*" (Connie *et al.*, 2021). The guiding principles and the utility of the project is shown in Table 1.

Table 1. The guiding principles in SFC's rewilding programme and some of the existing and potential outputs and outcomes.

No	Guiding principles	Notes and components of outputs and outcomes
1	Identification and evaluation of degraded areas	Sites are evaluated using drones as well as on-the-ground verification. Total area is mapped and sized.
2	Rapid assessment of biodiversity	Flora and fauna biologists conduct and document rapid assessments of the biodiversity on the site.
3	Native tree species	Only native tree species are to be rewilded onto the site to restore the tree biodiversity. There is a strict avoidance of tree monocultures. The trees are to be the future fruit and flowering trees as well as nesting trees for wildlife. The trees are also to serve as functional wildlife corridors in locations where rewilding is used to connect TPAs.
4	In-site plant nurseries	Small, low-maintenance nurseries are to be located near natural water-sources in TPAs. The plant nurseries are to follow environmentally-friendly principles or non-use of insecticides, pesticides and weedicides.
5	Engagement of local communities	Only B40 villagers from local communities living in and around the TPAs are engaged for the project. This includes collection of seeds, germination to seedlings, hardening of seedlings, transplanting to the degraded TPA site and maintenance of the growth. Dead seedlings or saplings are replaced. In this whole process of engagement, SFC employs Free, Prior and Informed Consent (FPIC) to discuss with the communities on the upcoming work at hand.
6	Enrichment planting concept	Degraded sites are planted with the seedlings/saplings. There is no clearance for large areas even though there is a greater ease of planting or economies of scales in such instances.
7	Tagging and monitoring of growth	B40 villagers and SFC staff monitor the tagged seedlings/sapling from transplanting trees up to maturity. After the third year, the plants are measured for growth once every two years. Field audits are part of the process as audited data is vital for the evaluation of the success of the project.
8	Through experience	B40 communities and experienced SFC staff are encouraged to collaborate and work together in the project. Local experience is vital to understanding site conditions and improves survival rates of seedlings/saplings.
9	Organic fertilisers	Only organic fertilizers are used in the enrichment of site conditions.
10	Use of technology	Drone technology including the use of micasense and the mini hyperspectral scanners mounted on VTOL drones are

		to be used to monitor health of seedlings/saplings. Machine-learning and AI are a crucial component of the data processing of the images from the drones. On-site verifications of the results of the drone's image captures are to be part of the continual data auditing process. SMART* patrols are to be used to document potential threats to the rewilding sites.
11	Engagement of corporations, civil societies and general public	All the stakeholders who contribute to the Rewilding processes have to be constantly identified. This ranges from donors to communities as well as volunteers that want to contribute time to the replanting of seedlings/saplings. Collaboration is deemed as a vital component of the work as it takes the commitment of all to make rewilding a success.
12	Nature-Based and Nature Climate Solutions	A natural output of rewilding is the additionality from the audited and documented growth of seedlings/saplings. With 3.5 million trees to growth, this is seen as a new/alternative revenue stream for Sarawak's TPAs. A natural outcome of this project is CO_2 sequestration and liberation of O_2.

SMART* https://smartconservationtools.org/

Potential outputs and outcomes.

There are numerous potential outputs and outcomes of the projects, ranging from new alternative livelihoods to climate change mitigation such as sequestration of CO_2 and liberation of O_2. In Table 2 is shown the list of items detailed from the workshops and discussions throughout 2020-2022.

Table 2. Potential outputs and outcomes of the various projects. Text on outputs are underlined and outcomes are in *italics.*

Earth, Sea and Sky	Rewilding	Sarawak Reef Ball Project, Phase 1 and 2
• Focused field research on biodiversity (flora and fauna) at 12 terrestrial and five marine TPA sites in Sarawak. • A cadre of conservationists engaged in the project which subscribes to international auditing systems of carbon measurements at plots.	• Tree and fauna data at rewilding sites. • A cadre of conservationists engaged in the project which subscribes to international auditing systems of carbon measurements at plots.	• Temporal and spatial data on marine life at reef balls.
• Audited data on growth of trees, carbon in	• Audited data on growth of trees, carbon in	• Audited data on growth of corals and sea grasses at

standing trees, soil carbon etc.	standing trees, soil carbon etc.	the five sites at Reef Balls as well as the natural soil substrate in the five TPAs.
• Engagement of B40 communities in the project via field work or tree planting at their mutually-agreed OECM sites.	• Engagement of B40 communities in the project via field work or tree planting at their mutually-agreed OECM sites.	
• Liberation of O2 and sequestration of CO2 in the terrestrial and marine TPAs.	• Liberation of O2 and sequestration of CO2.	• Liberation of O2 and sequestration of CO2.
• *B40 communities engaged and aware of conservation.*	• *B40 communities engaged and aware of conservation.*	
• *Restoration of degraded sites and connectivity between TPAs*	• *Restoration of degraded sites and connectivity between TPAs*	• *Creation of a new marine TPA for marine life and their migration throughout Sarawak.*
• *Use of newer technology disseminated through researchers in SFC and with collaborators*	• *Use of newer technology disseminated through researchers in SFC and with collaborators*	• *Use of newer technology disseminated through researchers in SFC and with collaborators*
• *Newer funding streams for conservation*	• *Newer funding streams for conservation*	• *Newer funding streams for conservation*
		• *Creation of new Mariculture sites and domestic industry linked to international trade.*
		• *Improving artisanal fishing and offtakes by local fisher folks*
		• *Increasing the ecological carrying capacity thus improving management via zoning of: a) no-entry zones, b) sustainable tourism and c) potential regulated catch-and-release fishing sites.*

Discussion

Within the confines of SFC's refocusing of its projects, there appears to be potential, attainable multiple wins. Critical to the success of the work is sustained financing so as to ensure lack of funds does not become a restriction or an impediment. Dedicated and well-planned projects with adequate funds tend to benefit and make conversation targets attainable (Dasgupta, 2016). There are on-going discussions with corporate entities to solicit funds for conservation via their Environmental, Social and Corporate Governance (ESG) goals. Care has to be taken to plan effective and valid conservation goals and its thorough implementation and audited measurement of its metrics.

It is also crucial that such projects pursue collaborative engagements with communities living in and around TPAs. Collaborative engagements are also important in non-TPA sites such as "Other Effective are-based Conservation Measures" (OECMs). The latter is potentially the prime mover towards attaining the global goal of 30 x 30 (MacKinnon, pers. comm.). However, though the idea of protecting 30% of the planet by 2030 is a well-intentioned goal of responding to biodiversity loss and climate change, this pursuit of 30 x 30 has the potential to lead to human rights abuses (Mukpo, 2021; https://news.mongabay.com/2021/08/as-cop15-approaches-30-by-30-becomes-a-conservation-battleground/). We must consider the people within and around the conserved/protected area. Community engagements/collaborations should also include and promote local or indigenous issues through embedding Free, Prior and Informed Consent (FPIC) into each collaboration project. FPIC, in line with UN and the international legal framework, will allow our indigenous people to exercise their rights through giving or withholding consent to any project that may affect them or their territories. Collaboration also has multiple benefits as shown by Fidler *et al.* (2022), and these include self-regulation which leads to increased ecological biomass for sustainable use.

Such large projects for conservation need also be viewed as a multi-engagement, collaborative process ranging from verified data to quality research and transparent implementation. This allows for engagement with wary civil society organizations and donors as some of the international standards on data are much more stringent. Towards attaining these standards, domestic and international networking with industry experts needs to be considered and if beneficial, maintained.

Our TPAs in Sarawak are a state, national and international asset. Like any invaluable asset, it has to be protected whether it is via political socialization, community engagement or through a system of observations (remote sensing), and on-the-ground anti-poaching patrols. All these tools have to be used in varying degrees as there is never a single, 'silver bullet' in conservation. Up-to-date approaches such as newer technology, e.g. image sensors, the use of SMART Patrols and even management prescriptions such as Management Effectiveness Tracking Tool (METT) (Stolton, *et al.,* 2019). may have to be used as part of project management.

In a rural as well as in an urban setting, it is often said that it takes a village to raise a child (Clinton, 2006). SFC's approach at these newer projects is akin to that of raising a child. It is new, requires skills and resources and needs much networking and collaboration. Adaptive management is also essential, where a feedback loop allows the team to be nimble and attain the project outputs and outcomes with greater comfort. SFC's work in these projects thus engages with all its different sections and divisions, i.e. our corporate village. It is our collective aim that we deliver these multiple wins and in a global, small way, contribute towards climate mitigation initiatives in Malaysia.

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