

Achieving climate resilience in Small Island Developing States by using ecosystem-based adaptation and local knowledge as a tool for social transformation

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This paper investigates assumptions, and critiques of the assumptions, for climate change and social transformation. It aims to generate new and innovative theory and knowledge on ecosystem-based adaptation (EbA) as a social transformation process. The first aspect, critiquing assumptions behind social transformation, refers to knowledge gaps and the need to understand and detail conceptual issues associated with climate change and social transformation such as terminology/definitions, links, drivers, thresholds, implications, data requirements, methodological challenges, and associated complexities. The second aspect, EbA in Small Island Developing States (SIDS) area makes the analysis more concrete and specific, referring to understanding climate change, local knowledge and adaptation choice debates within the nexus of climate change, environment, and social development along with governance and policy perspectives at different scales ranging from international to local. Therefore, it is important to understand the different conceptual aspects of inter-linkages among social transformation and adaptation while also giving due consideration to their specific contexts such as EbA. The literature review is triangulated by comparing the main assumptions with findings from fieldtrips in Tonga (2010), Barbados (2012) and Seychelles (2013).

Keywords: adaptation, vulnerability, local knowledge, social transformation

Introduction: Background to SIDS vulnerability, adaptation and climate change

Small Island Developing States (SIDS) are said to be one of the most vulnerable groups in the world to the adverse impacts of climate change [13; 16]. The IPCC [13] acknowledges that SIDS will experience significant sea level rise over the next 100 years and some portions of land could be inundated. Other major impacts of climate change might occur such as changing weather, saltwater intrusion into groundwater that leads to land erosion, and freshwater shortages. SIDS societies will face impacts of climate change and if migration scenarios play out, which is not certain, then potential loss of languages, identities, and cultures could result.

The vulnerability discourse has been discussed in the academia since the 1970s. Gaillard [9] provides an in – depth vulnerability literature review and claims that vulnerability in the Global South is more an issue of sustainable livelihoods management. However, recently the vulnerability discourse has been transferred from the academia to the international fora. The two mainstream definitions of vulnerability should be coined to UNISDR [34] and IPCC [13]. UNISDR [34] defines vulnerability as “the conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.” On the other hand IPCC’s 4th Assessment Report [12] defines vulnerability as “the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity.” The main difference is that in UNISDR’s definition the focus is more on the underlying processes and factors, and therefore it complies with the relevant academic literature [11,17,38] whereas IPCC focus solely upon climate change. Kelman and West [15] successfully point out that IPCC should have also included bottom-up consultation to obtain local knowledge and meet SIDS’ residents’ needs in terms of more sustainable solutions. It is also acknowledged by Gaillard [9] that focus on climate change stimuli has been used by the developing countries as a scapegoat from the root causes of vulnerability to natural disasters. Gaillard [9, p. 222] claims that marginalization (geographic, social, economic and political) is the crucial element of vulnerability instead. From the literature review it is concluded that SIDS are socially vulnerable; in most cases they are isolated areas with relatively small populations and limited domestic land-based resources. Pelling and Uitto [29, p. 51] claim that “vulnerability is a product of access to economic, political, social, environmental and geographical assets”. Their societies will face impacts of climate change and most possibly they will experience rapid rural-to-urban migration, potential loss of languages and cultures through migration and gender inequalities [5]

Climate Change Adaptation is defined by the IPCC [12, p. 869]:

Adaptation - Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory, autonomous and planned adaptation:

Anticipatory adaptation – Adaptation that takes place before impacts of climate change are observed. Also referred to as proactive adaptation.

Autonomous adaptation – Adaptation that does not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems. Also referred to as spontaneous adaptation.

Planned adaptation – Adaptation that is the result of a deliberate policy decision, based on an awareness that conditions have changed or are about

to change and that action is required to return to, maintain, or achieve a desired state.

More recently, the IPCC' 5th Assessment Report [13, p. 118] provided a complicated set of vocabulary regarding adaptation to climate change. It defines adaptation as 'the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects'. However, these definitions are highly uncontextualized and overlap. This represents a departure from the 2007 IPCC definition in terms of the breadth and focus. Namely the 2014 definition differentiates between adaptation for human and natural systems, however, the separation of natural and human systems is misleading because they are already connected. Nature has been 'socialised' and there is no nature without human presence.

2. Climate change adaptation actions including CbA and EbA

It has been acknowledged that adapting to climate change without integrating traditional local knowledge might lead to failure and malpractices [25]. The most recent literature on disaster risk reduction (DRR) and climate change adaptation (CCA) converge to that point; a more holistic approach should be adopted in terms enhancing the synergies between DRR and CCA and also combining scientific and local knowledge.

The main constraints of implementing adaptation in the SIDS acknowledged by Mataki et al. [21]; climate change is a futurist threat and decisions might be postponed, low level of public awareness, weak socioeconomic conditions and lack of capacity. Reid et al. [31] define CbA as "a community-led process, based on communities priorities, needs, knowledge and capacities which should empower people to plan for and cope with the impacts of climate change". Therefore, CbA focuses largely on supporting people to help themselves for CCA. Ecosystem-based adaptation (EbA) is an emerging approach that helps people adapt to the adverse impacts of climate change by using biodiversity and ecosystem services to their advantage. EbA promotes sustainable management and conservation and restoration of ecosystems, taking into account anticipated climate change impacts, to increase the resilience of ecosystems and people to climate change impacts [32].

CbA tools for climate change entered academic discourse only recently. However researchers from the scientific fields of DRR and climate change adaptation should be acknowledged for the qualitative turn in the CbA discourse [17]. CbA focuses largely on empowerment or "help people to help themselves" [18]. Kelman et al. [15, p. 52] adopt the "guided discovery" framework as a four-step process that leads to the establishment of long-term cooperative partnerships between communities and collaborators outside the community at national, regional and international levels. Its main strength is that it recognizes scientific and local knowledge as resources for successful strategies to vulnerability reduction.

Thus, the main issue that CBA methodologies should be addressing is the possibility of integrating bottom-up and top-down activities. A major gap in the climate change science already acknowledged by Mercer [23] amongst others is that development practitioners can reject or be unaware of scientific knowledge while scientists that consider themselves experts often do not engage in practice. Thus the main challenge for CBA is to form a new discourse that will bring together local governments, communities, international organizations, researchers and NGOs.

Simultaneously international NGOs with experience in field activities concerning DRR conducted research on new tools for CBA activities. Furthermore, CBA toolkits were analyzed by international environmental NGOs within the context of EbA to climate change see [20, 24]. EbA is a relatively new approach that combines adaptation to climate change, sound ecosystem management and livelihood development. It is particularly promoted by international conservation NGOs such as the IUCN.

Perez et al. [30 pp. 15-16] define EbA as “an approach that builds resilience and reduces the vulnerability of local communities to climate change...EbA integrates sustainable use of biodiversity and ecosystem services in a comprehensive adaptation strategy”. Its main objectives are to promote community resilience through maintaining the ecosystem services, enacting climate change adaptation within disaster risk reduction and preventing mal-adaptation. IUCN has launched two CBA toolkits that focus more on ecosystem-based activities; the CRISTAL (with other agencies) and MESCAL toolkits. However it is acknowledged that they have not yet been implemented in the field. UNEP has implemented the RiVAMP methodology in a pilot project in Jamaica [33]. Marshall et al. [20, pp. 28-29] provide a synthesis of CBA toolkits. Mercer et al. [25] in their gap analysis for EbA in the Caribbean successfully point out that “EbA activities are often not differentiated from non-EbA activities, instead recognizing adaptation as happening or being needed, with some aspects involving or related to ecosystems and other aspects not.”

Fieldwork analysis

This paper aims at producing a critical assessment report on different tools and methodologies for climate based adaptation available to the SIDS. It will use the experience of Tonga, Barbados and the Seychelles in the identification, design, implementation and the monitoring of the community-based (CB) projects related to climate change to highlight key challenges in applying CB CCA tools, and what efforts would need to be made to effectively adopt and apply available CB CCA tools. The main goal is to provide an assessment of various adaptation tools available for SIDS quickly ground-truthed in various locations in all three SIDS and to connect scales in terms of what vulnerability and community-based adaptation means to local

communities as opposed to national/regional NGOs and at international level negotiations.

The fieldwork contributed to the triangulation of the theoretical data by observing, talking and interviewing members of civil society involved in relevant projects. Furthermore, interviews were also conducted with key officers who participate in the international climate change (and other thematic) negotiations processes, representing their community and national interests. Before the field trips, a semi-structured interview questionnaire was developed, listing about a dozen open-ended questions in order to guide discussions with different stakeholders. The interviews were recorded, with the consent of the interviewees and specific data from the interviewees was collected—age, gender, role from individuals and, from the NGOs, approximate size, mandate and location.

Tonga. Implementing CbA and EbA

Tonga has a combined land and sea area of 720,000 km², of which 717 km² is the land area. The country comprises approximately 172 named islands, of which 36 islands totaling 649 km² are inhabited. The country's population is around 106,000 with almost 70% living on the main island, Tongatapu. The main livelihoods are agriculture and fishing, much of which is subsistence-based. These two sectors account for a quarter of Tonga's annual GDP [8, 14]. Remittances from international sources can be up to 50% of a village's income and rarely fall under 15% for any village [7], with a country-wide average of about 39-40% of annual GDP. Aid represents approximately 12% of Tonga's annual GDP.

From the locations visited during the fieldtrip in October 2010 it is evident that successful community-based EbA means linking ecosystems and local livelihood benefits. People are concerned about livelihoods. For instance, in Sopo and Popua, EbA was not feasible because giving people homes was the priority. In contrast, the examples from Ha'apai showed local buy-in when people understood how EbA would support their own livelihoods. Another key message is that showing community benefits from EbA creates local buy-in leading to behavioural change and sustainability. When community benefits from mangroves were shown (e.g. reduced storm damage and livelihoods support), people dumped less rubbish there. Locals saw that their livelihoods would gain from ecosystem restoration, so they did the work themselves. The youth were motivated because the revenues from EbA helped them improve their own livelihoods. EbA requires tackling recent, negative perceptions and attitudes regarding ecosystems such as mangroves. For better and more efficient implementation of EbA the involvement of the elders in explaining indigenous knowledge and ecosystem values led to attitude and behavioural change (e.g. reduced rubbish dumping in mangroves). The concept of learning by doing can enhance local EbA initiatives and traditional knowledge remains an important community asset, contributing to EbA. Involving the elders in community awareness-raising was

successful and their participation ensured that local buy-in was increased by including traditional medicinal knowledge as part of the reason for selecting plants.

Funding and capacity development are challenges for local civil society, so further support in those areas is needed. The local NGOs have neither the resources nor capacity to use information technology to the fullest extent needed. It is acknowledged that gender empowerment and equality is both a means and a consequence of successful EbA. In Tonga, EbA was supported through a women's empowerment project, which then motivated the women to continue EbA activities.

Lack of baseline and monitoring data, including demonstrating evidence of the effectiveness of EbA initiatives, along with lack of access to scientific information, such as appropriate selection of mangrove species, inhibits EbA decision-making with confidence. Evaluating the effectiveness of the local work is not feasible due to lack of time series data. Also, evidence demonstrating and comparing the effectiveness between ecosystems and engineered infrastructure [e.g. sea wall] is lacking. Setting specific goals and targets is difficult due to lack of time series data.

Barbados Tourism and urbanization as a hindrance to adaptation

Barbados is the most easterly of the Caribbean islands, located at 13°N and 59°W, approximately 160 kilometres from the nearest landmass, against prevailing winds and currents. The island is 34 km long and 23 km wide with a total land area of approximately 432 km², 92 km of coastline and an Exclusive Economic Zone (EEZ) of 167, 000 km² [26].

The geology of Barbados explains a lot of today's state of the environment [18]. Most of the island consists of gullies and a complex underground cave system that collect the rainwater and discharge into the sea at the west coast. There is little surface water on the island, with small surface streams found primarily in the Scotland District region of the island. The island is therefore almost completely dependent on groundwater abstracted from the aquifer underlying the island, aside from people purchasing bottled water. The other part of the country mainly in the Scotland district consists of the sedimentary deposits which are susceptible to erosion. Therefore, stricter housing regulations are applied to this area and also there is an ongoing discussion for announcing the Scotland District as an environmental park. Although Barbados lies just outside the recent path of most Atlantic hurricanes, 58 severe rainfall and wind events have been documented from 1955-2000[1]. The last hurricane recorded to cause major damage was Hurricane Allen in 1980. More recently, Hurricane Dean in 2007 caused storm surge and minor damage.

The country faces two main pressures; tourism and urbanization. These two economic activities are the main source of national income but also the main factors for the degradation of the natural environment. Barbados has a long history of environmental mismanagement. Starting from the era of the first settlers that exercised extensive deforestation and cleared the island from forests in about 15 years [1627 – 1640] for

sugar monoculture. As successfully put by Watson [36] until the end of the 18th century the island was a well-cultivated garden. An explorer of his time Edward Thompson wrote that “this island looks like a Christian country than any other of the Caribbees, every spot of it cultivated and cleared of the wood”. This notion of wilderness and nature is the source of modern Barbadian dislike of “bush” or natural foliage and their addiction to manicured lots. At the highest peak of the sugar cane production during the colonization era (or plantocracy) from the total area of 106.000 acres of arable land 30.000 acres were cultivated for sugar cane production, 30.000 for livestock and 30.000 for other agricultural products. During the 1980s with the so-called Tourism Revolution the cultivated garden was transformed to the manicured garden. The abandonment of the sugar plantations led to the rapid urbanization of the country and the creation of the Barbadian middle – class. Therefore urban sprawl to the former sugar cane plantations was a necessity in order to satisfy Barbadian’s housing needs.

From the fieldwork conducted it is concluded that EbA is not a priority for the Barbadian government. It is acknowledged from archaeological evidence that much of the south and west of Barbados was dotted with mangroves before the arrival of the settlers [19]. However most of the mangroves were chopped off by the settlers. In modern Barbadian history mangroves preservation was not a priority as well. The canalization of Constitution River led to the loss of the last significant mangrove area in the island. Today Barbados has the smallest area of surviving mangroves in the Caribbean. Also the expansion of the Bridgetown harbour destroyed the Indian River Swamp. Gullies are perhaps the last surviving ecosystem spots on the island. They face environmental degradation due to illegal dumping and during the past they were usually used as landfills by locals. There was an attempt of planting trees across their coastline but it failed as the locals did not respect the young trees and there was no proper maintenance by the government. The National Conservation Committee which is the responsible government unit focuses mostly upon selling seeds for lawns and gardens. Third, there is evident lack of a vibrant civil society and only a few of them are environmental NGOs. The Future Centre Trust which is formed by expatriates or white Barbadians is perhaps the most active but is viewed as an outsider and elitist. Other organizations such as the Caribbean Youth Environmental Network and the CARIBSAVE target their main activities to other countries in the Caribbean although they maintain their headquarters in Barbados. The reason is the proximity to the headquarters of other international organizations, the safe and stable political environment in Barbados, the weather conditions and the existence of infrastructure able to support their presence and activities.

Most of the communities in the Pacific area share a strong history of successful response to natural hazards since thousands of years and share a unique heritage and also creativity for sustainable livelihoods [27]. On the other hand in the Caribbean most of the communities are not indigenous but were relocated during the colonial times from West Africa. Therefore the absence of community spirit that is dominant in the South Pacific might be a hindrance for implementing CbA in the Caribbean.

Therefore, environmental awareness is not high in Barbados for a number of reasons. First of all, it is the political system's liabilities something common in the SIDS; social fragmentation, clientelism and in the case of Barbados absence of local authorities. People are passive and depend a lot on their MPs for the improvement of their livelihoods. At the same time urbanization is the main cause for the significant erosion of community. As successfully put by [Pelling 28] "rapid material development in Barbados has enabled the privatization of leisure time and a withdrawal from public space and community – based activities. Therefore CbA is not likely to take place unless local buy in is ensured.

Seychelles. Enhancing institutional capacity for adaptation

The Seychelles are an archipelagic nation of Western Indian Ocean that is situated northwest of Madagascar and consists of over 115 islands and 455 km² of landmass. Mahe is the largest island where the highest altitude is at 905 meters above sea level. The majority of the islands are surrounded by coral reefs with an area of 1.690 km². Like the vast majority of SIDS the majority of the population lives in the main island. In Mahe the population density is 434 inhabitants per km² in the capital Victoria whereas in the rest of island is 3000 residents per km². The urbanization rate is 2,2 % per year. Seychelles in contrast to Barbados and Tonga is not a MIRAB (Migration, Remittances, Aid and Bureaucracy) economy but in the contrary it is a host country for immigrants. Tourism and fisheries are the main two sources of national income for Seychelles. In comparison to Barbados, Seychelles have not invested in the mass tourism model and on the contrary promote ecotourism as their main strategy. For that reason since August 2010 they have developed their own certificate for hotels and resorts "the Seychelles Brand" which is a set of standards that hotels and resorts should adopt in order for opening permission to be granted. One case-study worth mentioning is the Port Launay – Port Glaud mangrove area and the construction of Ephelia Resort nearby.

Originally the Port Launay-Port Glaud mangrove area was more extensive and surrounded by coastal woodland. In the 19th and 20th centuries, some areas were drained to provide more land for coconut plantations. There was gradual development of houses along the road next to the river and near the beaches. In the early 1980s one of the National Youth Service residential education 'villages' was located on the Port Launay plateau. The village was later abandoned and then replaced by the five-star Ephelia Resort, which opened in February 2010. The Port Launay Wetlands which are a RAMSAR site (Ramsar Site No. 1432 – 'Port Launay coastal wetlands') are jointly managed by the Constance Ephelia Resort, a five-star hotel that was opened adjacent to the wetlands in 2010, and the NGO "Sustainability for Seychelles" under an arrangement with the Seychelles National Parks Authority (SNPA) and the Seychelles Department of Environment, the official management authority for the site. The local buy-in ensured job opportunities were offered and the organization of field trips for

hotel customers to the adjacent village. The Port Launay Wetlands provides an example of government-private sector-civil society and the local community in order to co-manage the wetland area.

The government of Seychelles has demonstrated strong commitment to fighting climate change and in 1992 was the second country in the world to sign UNFCCC [10]. Two months later, the country established a national commission for coordinating, developing, and implementing a national plan on climate change, for acting as an intermediary between the national plan and the government, and for preparing national communications to the UNFCCC. The country's national strategy for climate change has the main goal of minimising climate change impacts through coordinated and preventative action at all levels of society—deliberately connecting the local, national, and international. The Seychelles' national adaptation strategy has already achieved institutional governance and community engagement through a series of open public consultations. Integrating top-down and bottom-up approaches has ensured progress on CCA despite the problems of funding, slow exchange of knowledge and technology, and continued marginalization of the SIDS.

Discussion and Concluding Remarks

This paper has reviewed theory, practices and policies for EbA and CbA, triangulated with fieldtrips in three SIDS. The approach is linear, in terms of theory informing policy that in turn is transformed into action on the field. The table summarizes the factors that are essential for the successful implementation of adaptation in SIDS. All three countries are physically and socially vulnerable to climate extremes and disasters. Tonga due to its proximity to the Pacific Ring of Fire has to face geological hazards as well [earthquakes and tsunamis] and Barbados could also experience volcanic ash from nearby islands, plus the prospect of a major earthquake in the region.

Geographic isolation, lack of natural resources, distance from trade routes, monocultures and subsistence agricultural production are some of the causes of weak economies in SIDS that lead a significant proportion of their population to migrate. Their remittances often provide a substantial source of income for their kin members in homeland that combined with international aid support the basic functions of SIDS public finance. These funds are allocated by a local bureaucracy that draws its power from the process and usually its decisions are guided by the framework imposed by donors. The concept of MIRAB economies for small island states was popular during the 1980s [3, 37]. However this theory has been criticized descriptively accurate for a subset of island economies and for the non-predictability about the growth of tourism in SIDS [4].

Tonga and Barbados for example are MIRAB economies with minor differences in the application of the model. For instance migrants from Barbados are a case of brain drain whereas migrants from Tonga are not. Seychelles on the contrary is a country

that attracts immigrants from eastern Africa and South Asia. All three countries seek international aid from donor countries and organizations bureaucracy is an important factor for all three countries that is in charge of the allocation of international aid funds and for implementing national policies. The role of local bureaucracies leads to a critical approach of local political institutions in terms of their effectiveness and accountability.

The weak political institutions in Tonga are a hindrance for the sound implementation of CbA and EbA measures as shown in the case of Popua where consolidation of population from the outer islands was promoted instead of the preservation of the mangrove swamp area. In Barbados the over-dependence of local economy to mass tourism model has prioritized in many occasions big investments in resorts development against adaptation measures. In Seychelles political institutions are more accountable and decisions are taken after consultations with local population. The combination of local participation, open democratic institutions and modern environmental legislation are the three pillars of a successful adaptation strategy in Seychelles. Tourism activities in Tonga are restricted to outer islands and not a potential source of income for locals. Seychelles have already adopted strict environmental standards and promote ecotouristic activities. Both Barbados and Seychelles offer university education to their citizens but only in Seychelles there are environmental education courses in elementary and high schools. There is no university education in Tonga and no provision for environmental courses in elementary schools. National identity and culture are crucial elements of the risk perception in each society. All three countries have colonial past with Barbados and Seychelles being colonized and settled in the 18th century. In Tonga the tribal regime with chieftains and the King remained stable and was enhanced with more privileges by the missionaries who drafted the constitution and the legislation that are in action until today. The major breakthrough took place in the Seychelles with the strategic decision of the government in the mid-70s about the promotion of the Creole culture as the basis of a new national identity [2, 6]. A strong national identity is essential for the social capital in a country and for the development of a cooperation culture in which consensus is a sine qua non term for the successful implementation of CCA policies and measures.

EbA is a major opportunity for adaptation at the community level – especially for the world's most vulnerable communities. It addresses many of the existing concerns and priorities of these communities. Consequently, CbA may be a useful vehicle for implementing EbA at the community level. In conclusion, it is clear that no matter what, local communities will have to adapt due to the slow pace of the international climate negotiations, as they have always had to adapt to changes in the environment, irrespective of international environmental negotiations and treaties. Adapting to a changing climate requires that communities be put in the driving seat and lead the CCA actions. CbA and EbA are very useful tools in implementing this approach, although these actions should not be narrowly applied at the local level but should also attempt to cross-over into national and regional levels as well.

The international community of scientists, decision-makers and practitioners over the last few years have increasingly rejected the assumption that implementing adaptation is either a top-down or a bottom-up approach, but instead is a process that should combine internal/external knowledge and local/external support. Community-based and ecosystem-based adaptation overlap and target the same goals: full and fair access to resources in order to secure livelihoods for local communities to thrive and protect their environment. Communities are the most genuinely viable element of sustainable development. Therefore, communities should be at the centre of CCA policies, both external and on the ground. This means that in order to achieve the ideal of ‘putting communities in the driving seat’ the communities themselves should have a say in defining and applying CCA according to their needs.

Global environmental change affects everyone’s lives and therefore CCA actions can and should start now. The urgency of mainstreaming and implementing CCA might bridge the gap between theory and practice and in this manner may help to overcome local and external elites who use climate change as a scapegoat in order to perpetuate their power and malpractices that eventually result in environmental degradation. Climate change is part of the wider environmental change process that already provokes numerous crises at global and local scales, such as food insecurity, energy crises, depletion of water resources, and natural hazards. Therefore, CCA is part of the development process that addresses the aforementioned challenges and not a separate domain.

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