

2023 INTERNATIONAL SYMPOSIUM
**CLIMATE CHANGE AND
COASTAL ECOSYSTEMS**
LIFE ADAPT'ISLAND

SYMPOSIUM PROCEEDINGS

4 > 5

**JULY
2023**

GUADELOUPE



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OPENING REMARKS

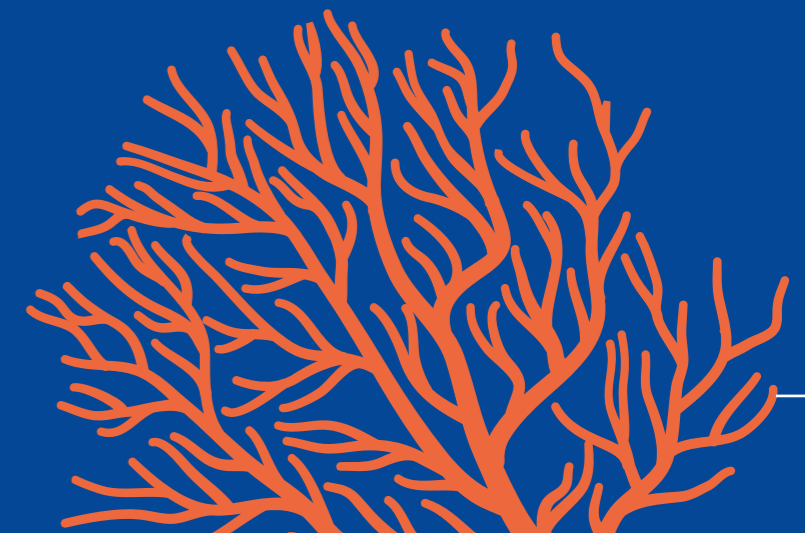


The LIFE Adapt'Island Project, a Port initiative

Since becoming the Grand Port Maritime, the Guadeloupe port has taken on a new mission as a trustee of natural areas. This role is particularly significant in view of Guadeloupe's position as a biodiversity hotspot that is particularly sensitive to human activity and vulnerable to climate change. The "new generation" port project has necessitated large-scale action for the environment in record time. Previously there were no proven solutions for the reduction and compensation of environmental impacts specific to the Caribbean environment. In 2016, the port spearheaded the launch of the CAYOLI program, which tests cross-functional action and innovative methods to preserve and restore biodiversity in the port area. Going a step further, the GPMG, together with its partners, then undertook LIFE Adapt'Island, a project designed to rehabilitate, restore and protect coastal areas. The solutions undertaken are specific and innovative. The project seeks to develop adaptive strategies and disseminate proven techniques. The symposium is an important facet of the project.

Sita NARAYANAN

Facilities and Sustainable Development Manager of the Grand Port Maritime of Guadeloupe



OPENING REMARKS



Building general awareness through communication and public visibility campaigns

The LIFE Adapt'Island project is a crucial step in building a collective commitment to environmental preservation and climate change preparedness. Guadeloupe abounds in natural treasures, and is a precious, but fragile ecosystem. Climate change poses a major threat. URAPEG FNE Guadeloupe was established in 1983 by several Guadeloupean academics and was recognised by the Ministry of the Environment in March, 1989. Its mission is to raise general awareness through communication campaigns on environmental issues and to create public buy-in by including all stakeholders. The Grand Port Maritime plays an essential part in the economic development of the territory while it is also actively involved in preserving the maritime and coastal environment. This international symposium offers a unique opportunity to share experiences and expand the network of committed partners. By working together, it is possible to deal with the challenges our territories are facing.

Pauline COUVIN

Chair of URAPEG FNE Guadeloupe, Co-recipient of the LIFE Adapt'Island project



A favourable international context

The LIFE Adapt'Island project and the Grand Port have been pioneers in Caribbean preservation and restoration through their focus on emblematic marine and land ecosystems, such as mangroves and coral reefs. The methodologies developed in the projects represent a balance between ecosystem protection, action on climate change, individual commitment, and social inclusion. Increasing general awareness is leading toward a growing acknowledgment of the issues involved in ecosystem protection. The international context is highly positive. The 193 UN member states adopted the international High Seas Treaty, the goal of which is the preservation and sustainable use of biological diversity in international waters. Before the signing of this treaty, these areas did not fall under a specific framework. This treaty defines a regulatory framework, recognizes a common heritage, and specifies protected maritime areas for biodiversity preservation, with the goal of protecting 30% of the planet's oceans by 2030. For its part, the European Union has also established the Blue Action Fund.

Pascaline GABORIT

Director of Pilot 4 DEV, Co-recipient of the LIFE Adapt'Island project



IMPORTANT TAKEAWAYS

BY MIKAA BLUGEON-MERED

Professor at the Paris Institute for Political Studies and moderator of the symposium



The experimentation carried out through the LIFE Adapt'Island program in Guadeloupe resulted in solutions that are reproducible elsewhere. Referring back to the UN's sustainable development objectives, the symposium provided an opportunity to delve more deeply into two of the 17 objectives in particular: "Life below Water" and "Life on Land." The holistic approach of the symposium also allowed for discussions of general issues, such as training, the reduction of social inequality, etc.

Despite the numerous conferences held around the world in the last ten years, one conclusion remains unchanged: the earth keeps getting warmer.

To find sustainable solutions, we must get serious about the Paris agreement, make it happen with local solutions, and maintain a holistic, global vision. We must connect the dots between global warming and the crisis of biodiversity extinction.

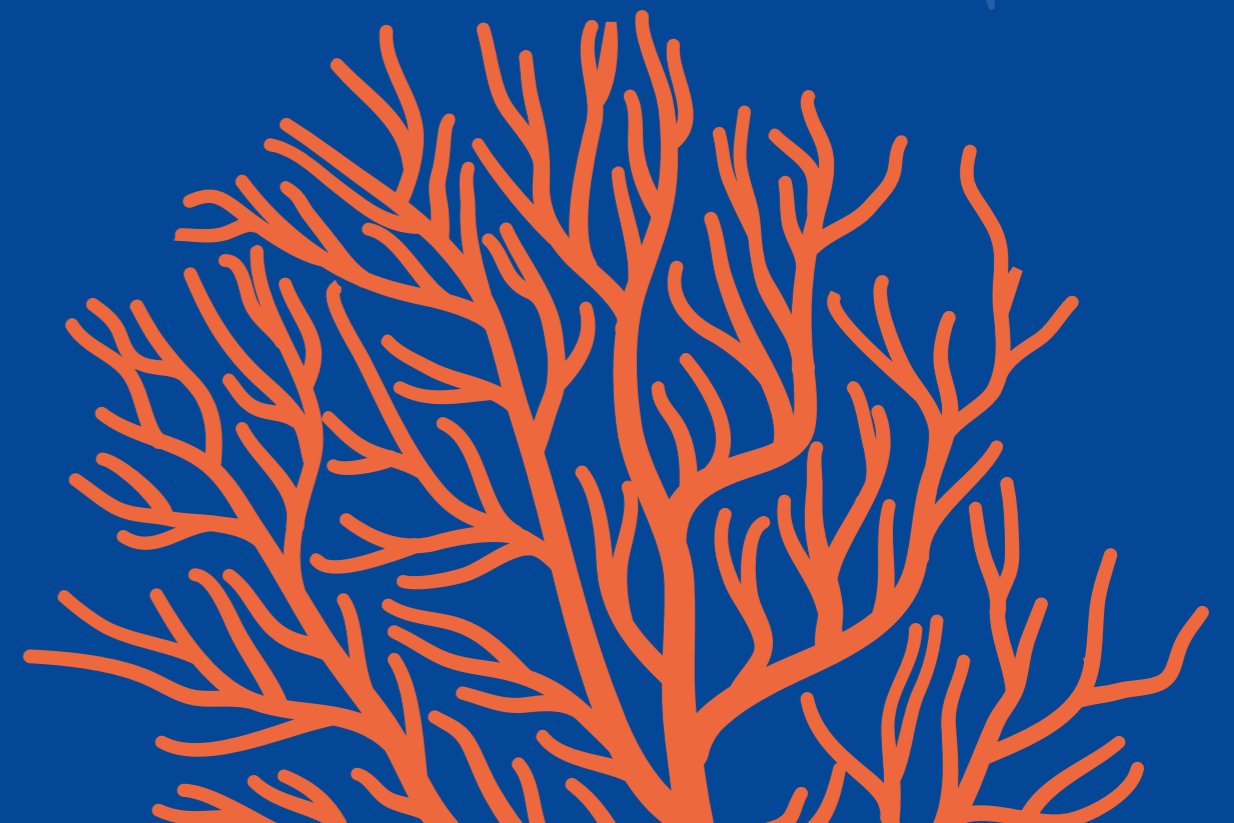
By the end of 2022, six out of nine of the planetary boundaries identified had been exceeded. Everyone with a role to play is duty-bound to raise awareness regarding the importance of these planetary boundaries. Ocean acidification is an imminent risk that must be addressed.

Solutions like the initiative in Brighton, Barbados that was presented at COP27 are being developed in the Caribbean. The objectives are to create a global trust to collect funds, leverage the private sector, and persuade Northern countries to reduce the interest rates for major climate projects.

It is critical to develop ideas that weave together economic and scientific concerns. Programs such as LIFE Adapt'Island are co-financed. More partners are needed to further develop the project. LIFE Adapt'Island is a model project in terms of design, inclusion, management and oversight. When the project ends, new knowledge and training capability should be developed to bring the project to the wider public.

CLIMATE DATA AND A PREVIEW OF A FUTURE REALITY

- + Demonstrated rise in temperatures in the Caribbean, as in the entire world
- + Nature-based solutions observed here can tie in with European projects, in Belgium and France in particular
- + The latest report of the IPCC Working Group I indicates that the atmosphere can still absorb 1150 gigatons of CO2 equivalent and remain below the accepted 2.5° warming threshold
- + There are 26 years left to reach carbon neutrality and limit global warming
- + The BRGM points out that mainland France could be under water by 2100 unless solutions are found, and notes that the ports of Dunkirk, La Rochelle and sections of central Guadeloupe could be submerged, with sea levels rising two meters.



SPECIFIC PROPOSALS FROM THE SEMINAR

Seagrass

- + Develop local education programs modelled on the university's professional oceanography degree to equip young people with the technical skills needed to monitor seagrass beds.
- + Develop communications on the importance and role of seagrasses so that this ecosystem is included in international preservation policies.
- + Create a stock of underwater photos of the seagrass beds to use as additional leverage in public communications.
- + Make use of the Marie Galante underwater trail for awareness-raising on seagrass beds.
- + Carry out a surface assessment in Guadeloupe to gain a better idea of the extent and distribution of new seagrass beds and their composition.

Mangroves

- + Develop a network of local sentinels to regularly monitor Guadeloupe's mangroves, particularly through the use of regular aerial videos and photographs.
- + Design a methodology to restore the mangroves.
- + Study the microbiology, ecosystem activity, and wildlife of the mangroves.

Ecosystem impacts

- + Widely disseminate the checklist on ecosystem impact for use by consultancies and political decision-makers.



TRANSPLANTATION TRIAL AND ERROR TRANSPLANTATION TRIAL AND ERROR DR. REIA GUPPY

Moderator : **Dr. Lou FROTTE (GPMG)**

Panellists : **Dr. Charlotte DROMARD (UA) / Dr. Catherine HERMANT (ARB-IG) /
Simone MEGE (Guadeloupe National Park)**



This presentation provides an overview of strategies currently being used for coral transplantation in the Caribbean, through both asexual and sexual mechanisms. It highlights the key factors for success in transplantation and the efforts undertaken in Guadeloupe as part of the LIFE Adapt'Island project.

Coral reefs are precious assets for ecosystems. They are important food sources that protect coastlines, serve as breeding habitats and are popular destinations for tourists and sportspeople, to mention just a few of their functions and uses.

In the 1990s, the status of the reefs took a downturn as coral immunity declined and the virulence of coral diseases increased.

Coral resilience has also been affected by factors associated with climate change and anthropogenic activities, such as:

- + Rising temperatures,
- + Ocean acidification, which affects the structure of coral,
- + Greater runoff, which enriches the water with nutrients,
- + Reduced salinity,
- + Increased predation,
- + Increased fishing.

Higher stress levels on coral have also limited their energy and ability to reproduce. This must be taken into account for transplantation mechanisms.

Research efforts have been focusing on identifying the totality of the parameters involved and on using transplantation techniques to artificially increase the diversity and density of coral, either through clone fragmentation or through the recruitment of coral larvae.

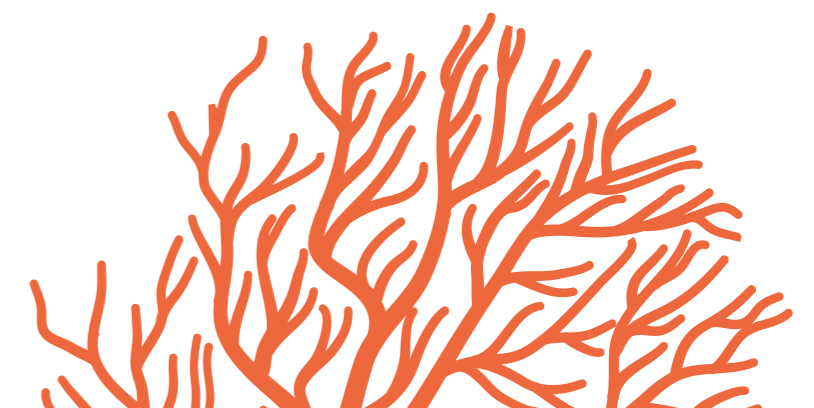
Factors that improve the conditions for transplantation have been identified. These include, for example:

- + Conditions of the transplant ecosystem (temperature, light, etc.)
- + Genetic diversity of the coral (different types of coral vary in their resilience for transplantation)

In general, the success rate is 60 to 65%, particularly with direct transplantation (fragmentation). In Guadeloupe, identical steps were taken over a range of transplant sites after analysing the key success factors, including the existing structures of the artificial substrates, predators and genotypes.

In Guadeloupean waters, the range of coral genotypes is limited. These studies are ongoing to optimize the success rates of the transplants. These are delicate operations, particularly since the water quality factor limits the possible transplant locations.

The ultimate success rate of coral transplantation in Guadeloupe in relation to the amount of effort made is still relatively low.



CORAL RESTORATION STRATEGY: PREFERRED SITES

For Dr. Guppy, waiting for the water quality to be optimal again in order to carry out transplants is not an option. Furthermore, transplantation cannot take place in protected environments alone. The growth of the coral species in the Caribbean is slow. The time to act is now, by selecting the most resistant coral and betting on transplantation of the most resilient species, even in degraded environments.

ZOOXANTHELLA PLAYS AN IMPORTANT ROLE IN TRANSPLANTATION EXPERIMENTS, BUT IS NOT THE ONLY FACTOR...

Zooxanthellae are important, but are only one of the key factors for success. A recent study in the Red Sea showed a new mechanism helping coral thrive, namely, the coral's production of a specific protein that improves the health of coral reefs.

SUCCESSFUL TRANSPLANTATION: MANY FACTORS AT PLAY

In 2016, an experiment was carried out on three species of coral in Guadeloupe. Cuttings were taken from the Grand Cul-de-Sac Marin and transplanted to Ilets Pigeon in the middle of the park; they were distributed across two breeding systems. After three months the survival rates were very high.

Nevertheless, when the cuttings were attached to the substrate, they were invaded by algae and all the colonies died. The team observed that colonies a few meters away had developed naturally and continued to thrive. The question then arises as to human intervention when the environmental conditions are adequate. According to Doctor Guppy, the direction and positioning of the coral must also be considered when transplanting onto the substrate.

For example, some species must be vertical. The success of the experiment is highly dependent on knowledge of the parameters that make it possible for the various species of transplanted coral to thrive. There are countless factors that influence the success rate of transplantation, including the location, medium, environment, species, etc.

RECREATING COMPLETE ECOSYSTEMS: THE CHALLENGE AHEAD

Transplanting a coral species is a good start, but the objective is to recreate a reef with its many species. Branched species are the most frequently used because they grow quickly and provide fast results in transplant experiments. But a complete coral ecosystem requires a wide diversity of organisms that recreate the entire chain of life. In Guadeloupe, the transplanted reefs still lack diversity.

SELECTING SPECIES BASED ON THE ENVIRONMENT TO ENSURE RESILIENCE

For transplantation to succeed, the species selected must be introduced into a suitable environment. The best outlook comes from reintroducing coral into their native habitat. The genotype must still be studied, and this will take some time.



QUESTIONS & ANSWERS

DO CORAL HAVE A FORM OF COMMUNICATION?

Coral use their polyps and brush against each other, and this can lead to intercommunication and can increase transplant success. However, there is not much data on this question yet. Studies are underway on the fluorescence of coral with other reef organisms. It is thought that the larvae have some forms of communication.

DOES RESEARCH ON CORAL RESTORATION RECOGNIZE THE URGENCY, GIVEN THE PREDICTIONS OF ACCELERATED DECLINE OF THESE ECOSYSTEMS?

According to Dr. Guppy, it is difficult to make predictions about the future. There are still many parameters to study. But some coral species are clearly resistant and hopefully the most resilient will survive. It is important to continue these experiments and efforts for environmental protection.

DOES IT MAKE SENSE TO PLACE ECO-MOORINGS NEAR CORAL REEFS?

Coral fish help to maintain the coral structure. Setting up eco-moorings, and thus recreating artificial habitats for these species can be a factor in the chances of survival of the reefs. But the eco-moorings must be sustainably positioned, with small units that are sufficiently complex to support the chain of life.

SHOULD THE ISSUE OF GUADELOUPE'S WATER QUALITY BE RESOLVED BEFORE WORKING ON RESTORATION?

Guadeloupe National Park decided to favour protection of natural reefs over transplantation, given the poor water quality in Guadeloupe. Dr. Guppy believes that the needs are interconnected: we must both protect the reefs and improve the water quality. The existing coral are surviving even in degraded environments..

CAN WE RESTORE THE CORAL WITHOUT TAKING STEPS TO PROTECT HERBIVOROUS FISH?

Policies to protect herbivorous fish must be put in place to ensure their return to the coral reefs.

THE IMPORTANCE OF SEA GRASS BEDS IN ADAPTATION TO CLIMATE CHANGE: FLEXIBLE MANAGEMENT, INTEGRATED TOOLS

DR. FANNY KERNINON

Moderator: **Dr. Jennifer TOCNY (GPMG)**

Panellists: **Isabelle NASSO (Water Authority), Mélima LAURENT (DEAL Guadeloupe),
Dr. Milton BOUCARD (CED)**



This presentation provides an overview of the important role of herbaria in a world under pressure, particularly in the context of climate change. The challenge of observing these environments, in particular for the purposes of documenting long-term changes and identifying their causes, is discussed in the context of the Caribbean seagrass beds.

There are 72 species of marine phanerogams in the world. The hotspot is in the Indo-Pacific region. Five species are found in the French West Indies.

Although seagrass beds exist in many parts of the world, the importance of this complex and productive coastal ecosystem is often overlooked. Herbaria provide many services, including:

- + Reduction in the number of pathogens,
- + Water filtration,
- + Nutritive role,
- + Climate change mitigation

They are also important for nearby ecosystems.

Seagrass meadows are in decline around the world due to multiple pressures, including coastal development, exotic invasive species, dredging, fishing, degradation of water quality, and warming of the waters. With the increase in severe climate events, seagrass beds are also severely impacted, as was seen with Hurricane Irma in 2017, when some areas of the seagrass beds were completely uprooted.

In the Caribbean, severe threats are posed by extreme weather events, population growth, increased human activity and, for the past fifteen years, an invasive exotic species of marine phanerogam. All of these phenomena threaten the integrity of this vulnerable ecosystem and the various species directly associated with it. The Caribbean is also identified as the region of the globe recording the most severe loss of seagrass areas.

For all these reasons, herbaria are increasingly receiving greater attention. Nevertheless, far more data is needed through research and observation. Objectives should be set for the monitoring of seagrass beds, including evaluation of the water quality, the impact of development, and management effectiveness. These strategies may evolve with time.

For example, herbaria are monitored in the Protected Marine Areas of Guadeloupe, Saint-Martin and Saint-Barthélemy; in this way changes in the herbaria and its functioning over time can be documented. Through these observations, the decline of native species has become clear – in fact, two of the seagrass beds have been found to be near collapse. On another observational project, it was possible to confirm the link between degradation of the water quality and the seagrass beds. Indeed, seagrasses are effective bio-indicators of water quality. There is still time to delay or reverse the current trend of decline through effective preservation measures.

The initiatives of the LIFE Adapt'Island project, currently underway in Guadeloupe, are based on nature-based solutions. They concentrate on protective actions, such as the installation of eco-moorings, and restoration trials on seagrass meadows, including seed cultivation and transplantation. It will be interesting to share information on the transplant trial to others carrying out similar projects in the Caribbean. To further raise awareness, a plan is also in the works to install an underwater trail for educational purposes.

LIMITS AND CHALLENGES OF CONSERVATION

There is still not enough observation or restoration of seagrass ecosystems currently underway. This delay is partly explained by the fact that seagrass restoration techniques are complex. For example, seagrass plants are highly sensitive, and are grazed by herbivores, and the costs for monitoring and restoration are high. But international monitoring protocols as provided on SeagrassNet and Seagrass-Watch facilitate data acquisition. The observation protocols are carried out on intertidal seagrass beds, and this helps with the process.

The most important parameters for identifying the state of health of seagrass are the density of the plants, the degree of contamination and the functional role of the habitat in relation to the type of seagrass.

In view of the interconnections between all these ecosystems, it would be worthwhile for seagrass restoration protocols to be carried out in conjunction with coral reef preservation activities.

Another challenge identified, which is specific to the Caribbean area, is the presence of invasive seagrass beds that are more sensitive to uprooting by swells. At this point, the species has established itself and there is no turning back. It is now a matter of living with it. While it certainly provides a certain number of services, the main concern with this invasion is the conservation of native species. Creation of eco-moorings can help to limit the propagation of these plants.

Finally, another important lever is training. Monitoring activities are limited by the difficulty of recruiting qualified professionals locally despite the fact that the younger generation is keenly aware of climate change. More local training opportunities modelled on the university's professional degree in oceanography should be developed to enable young people to acquire the technical skills required to perform this type of observation.



ENVIRONMENTAL POLICIES AND AWARENESS

Better preservation means better understanding and awareness in the general public and amongst policymakers. There are target numbers for reefs and mangroves in public preservation policies. It is therefore essential to communicate the importance and role of seagrass beds so that this ecosystem is included in overall preservation policies.

For example, in the diving community, seagrass beds are less popular, despite the richness unique to seagrass beds, such as emblematic species like green turtles, but also less charismatic species. Underwater photography could be used to add leverage to awareness-raising.

The project originally planned for educational efforts in the schools. Activities were held during the science festival. A traveling exhibit with materials on good practices and the presentation of the three ecosystems will be made available to schools.

INNOVATIVE INITIATIVES AND PROJECTS

The Life project takes a systemic approach that encompasses all the ecosystems. For seagrass beds in specific, the strategy has evolved towards protection of existing seagrass beds, together with an R&D component.

An underwater trail in the seagrass beds will be created in Marie-Galante to raise awareness in the local population. Educational buoys will also be provided to schools to reach as many people as possible.

IS THERE A STUDY THAT MEASURES THE HARMS OF CHLORDECONE, WHICH CAN BE STORED IN SEAGRASSES?

Studies were carried out at UA on the accumulation of chlordecone in seagrasses. Indeed there is an impact. Nevertheless, seagrasses are perhaps not the most relevant vehicle for measuring chlordecone levels since they are at the bottom of the food chain web.

ARE CHANGES IN THE SEAGRASSES MONITORED FOLLOWING THE INSTALLATION OF ECO-MOORINGS?

Monitoring will be carried out in particular to observe the different types of eco-moorings. The moorings will be observed for at least five years.

IS THERE ENOUGH DATA IN GUADELOUPE TO MONITOR CHANGES IN THE SEAGRASS?

Compared with other Caribbean islands, Guadeloupe is well equipped with seagrass monitoring stations. However, there is a lack of surface information, which hinders an understanding of the current extent, distribution and composition of seagrass beds in Guadeloupe.

ECO-MOORINGS PROMOTE BIODIVERSITY. SO WHAT IS THE PURPOSE OF SCREW ANCHORS?

Screw anchors use a more limited surface area, and therefore have a lower impact. They have been installed in areas already under pressure from anchorages.

IN TERMS OF MANAGEMENT PRIORITIES, SHOULDN'T NATIVE HERBARIA THAT ARE STILL PRISTINE BE MADE INTO SANCTUARIES?

Establishing protected areas is in most cases beneficial. But given already existing activities, the gain in generalizing these projects is less clear. New regulatory tools allow for the protection of natural habitats, among which seagrasses are included. Plans are ongoing to put in place protection orders, particularly in seagrass areas.

GIVEN THE RAPID TURNOVER OF ITS BIOMASS, DOES THALASSIA STORE CARBON IN THE LONG TERM?

According to the available literature, the longer a seagrass species lives, the less the herbaria become fragmented and the more carbon they store. While *Thalassia* turnover is rapid it is still a perennial species as opposed to the colonizing species. It likely stores carbon although it may store less than the denser species with complex structures in the Mediterranean.

QUESTIONS & ANSWERS

IS SARGASSUM A THREAT TO SEAGRASS?

Sargassum puts pressure on seagrass beds both from stranding and from the barriers put up to contain it. Various studies and academic papers are now examining these issues. In a few years, information on these questions will be available. In the LIFE project, sargassum is one variable to be considered when selecting transplant sites.

SHOULDN'T THE COLONIZATION OF MOVABLE SUBSTRATES BY INVASIVE SEAGRASSES BE SEEN AS AN OPPORTUNITY?

There is insufficient up-to-date mapping to know exactly how extensive *Halophila* herbaria implantation is. This type of seagrass indeed provides services, but other studies have shown that some species such as the endangered green turtle prefer native seagrasses. The problem is that it doesn't just complement native herbaria, it replaces them, and the seagrass provide quality services. Because it causes environmental problems, it is considered invasive.



MANGROVES :

BARRIERS AGAINST THE EFFECTS OF CLIMATE CHANGE

DR. NORMAN CLIVE DUKE

Moderator: Cléo BARON (GPMG)

Panellists: Dr. Eléonore MIRA (GPMG), Marc GAYOT (ARB-IG), Pr. O. GROS (UA)



This talk presents the fundamentals of climate change and the serious risks it poses for mangrove ecosystems. It also identifies strategies to help preserve and protect these highly valuable natural environments.

Around the world, people are assuming greater responsibility for mangrove ecosystems and are more concerned with the state and well-being of these natural spaces. People benefit from healthy mangroves, since they provide important advantages and services. They provide wood for daily energy needs and construction. They are an essential habitat for fish. They help remove carbon from the atmosphere and protect coasts from increasingly violent storms and rapid rises in the sea level.

A network of mangrove sentinels (MangroveWatch) works to protect these ecosystems around the world, and studies parameters on the health of mangroves and the connections between various habitats such as mangroves, seagrass beds and coral reefs.

But there is still a problem. The benefits provided by these natural ecosystems are limited and vulnerable to ever-growing human demands as populations continue to grow. The effects of climate change, such as rising sea levels, increasing temperatures, and more carbon also put unsustainable pressure on the limited capacity of mangroves and the natural coastal resources they provide.

Mangroves and the wildlife that depend on them are closely linked to climatic and biogeographic factors. As these factors change, mangroves must adapt to survive. In places that are becoming warmer, mangroves are moving to higher latitudes. When precipitation levels increase or decrease, mangrove stands expand or contract locally. When sea levels rise, mangroves gradually move inland, growing in areas above high tide.

As storms become increasingly more severe, the recovery of damaged mangroves sadly approaches a breaking point beyond which the integrity of a habitat can be lost. Oil spills are also a cause of destruction of the mangroves. Not all mangrove species respond in the same way to these pressures. Degradation has been observed in Australia

in Brisbane River, Queensland River and Princess Charlotte Bay. In the Gulf of Carpentaria, a massive dieback of the mangrove was observed over more than 80 kilometres and an explanation was never found. The cause may have been sea levels and global warming.

Guadeloupe could be similarly affected if the precipitation rate decreases.

To protect the mangroves and limit degradation, all the variables affecting their health status should be isolated. A manual on indicators of change is currently being developed. Both education and community participation are essential, in partnership with specialised researchers and government agencies. The knowledge disseminated through partner outreach programs must be accurate, science-based, and trustworthy. It must also have a long-term perspective. This is what is being undertaken in Australia through its sentinel network, which regularly produces aerial videos to observe the mangroves and plan ahead for their restoration. This technique could be applied to Guadeloupe, with both annual and sequenced monitoring carried out by the volunteer network, which passes on its observations to scientists.

THE VARIOUS MANGROVE SPECIES HAVE DIFFERENT RESPONSES TO STRESSORS SUCH AS SEA LEVEL RISE

During sea level rise events, some species exhibited the same behaviour although some were in the coastal zone and others further upstream.

FOREST RESTORATION, BIOGENERATION TECHNIQUES AND TRANSPLANTATION

Transplantation techniques can be used. First, the mechanisms of degradation must be understood to isolate the stressor on the mangrove and determine whether there is an intermediate solution. There is still work to be done on habitat restoration methodology.

INDICATORS OF DECLINE

Fauna is the first indicator of decline; flora generally fall into decline later. This has been the case with some oil spills. So it is worthwhile to observe both the flora and fauna in the mangrove ecosystem, on the ground and in the canopy.

PRESERVATION METHODS AND UNIQUE FEATURES OF THE MANGROVES IN GUADELOUPE

In Guadeloupe, 80% of the mangroves still exist – a positive distinction. The need for restoration is therefore less pressing than in neighbouring areas. The problem of mangrove restoration is tied to the settlement of the area, as in Jarry. Mangrove restoration essentially involves reclaiming the territory. Taking the example of Volvo Cama: the dealership was asked to reduce its embankment, and the mangrove then naturally recolonized the wasted space. Using a simple restoration technique, the mangrove quickly regenerated. The challenge in Guadeloupe is to anticipate the consequences of climate change. Mangroves are connected to swamp forests. Rises in the sea level must be anticipated by reserving land so that these spaces can recede with the rise in the water. Fortunately for the mangroves, there are no invasive species in their ecosystems in Guadeloupe, unlike with swamp forests which are more difficult to restore.

ARTIFICIAL ESTABLISHMENT OF MANGROVES TO CREATE A COASTAL PROTECTION SYSTEM

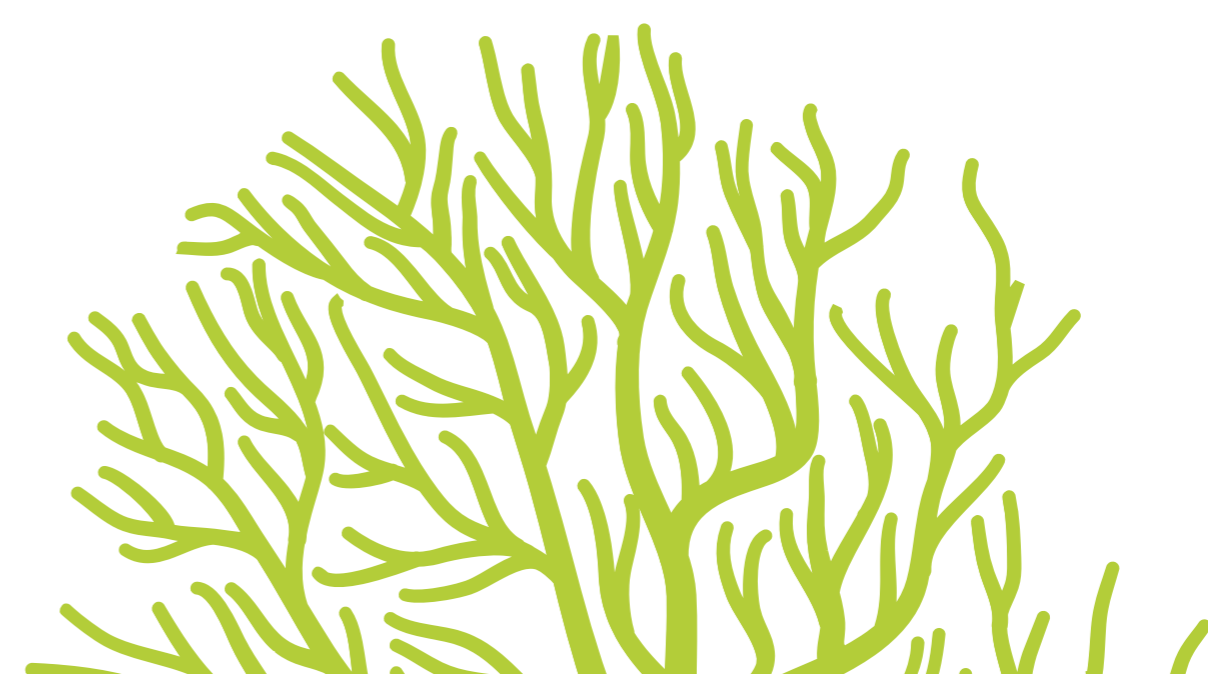
Before restoration can begin, existing mangroves must be observed, and the data analysed in order to fully understand the endogenous mechanism of Guadeloupe's mangroves. The durability of the buffer zone must also be checked as the mangroves are at risk of drowning during periods of rising sea levels.

NEED FOR FURTHER STUDY

There is a lack of research on the shoreline area of the mangroves. Much remains to be learned about the microbiology, ecosystem activity, and wildlife of the mangroves, such as how the various species function, and their responses and resilience with regard to the climate.

MANGROVES AND SARGASSUM

The stranding of sargassum in mangroves can have negative effects if it stays in the mangroves because it produces large amounts of anaerobic organic matter through the release of sulphide. In the case of the Manche-à-Eau lagoon however, once the sargassum was swept away through the movement of the water, the mangrove was able to regenerate.



QUESTIONS & ANSWERS

ARE MANGROVES MORE RESILIENT ECOSYSTEMS THAN REEFS AND CORAL?

Mangroves can be stressed by factors such as chemicals and pesticides but also by factors such as increasing sea salinity. The vulnerability of different species and the influence of the environment on mangroves should be documented as precisely as possible in Guadeloupe. In any case, it is a resilient ecosystem. We must not forget that mangroves have existed for over 50 million years, despite many variations in the sea level. One particular reason for their hardiness is their propagules.

IS HUMAN INTERVENTION NECESSARY, AND WHAT ARE THE COSTS & BENEFITS OF THE EFFORT REQUIRED AND THE NEED FOR RESTORATION?

The methods used must all be low cost. Volunteers and local residents can carry out the observations. But mangrove forests planted by humans can be expensive to create. For this type of rehabilitation project, the shoreline must be cleared, and small mangrove areas then identified and allowed to spread.

HOW CAN THE COMMUNITY BE RECRUITED TO JOIN THE VOLUNTEER NETWORK?

In Australia, calls for volunteers were made following a flagship cultural event held to create interest. There is no lack of enthusiasm. People are naturally interested when scientists share their knowledge. The equipment required is not particularly expensive and scientists are able to gather key data in this way.



EVALUATING NATURE-BASED PROJECTS FOR COASTAL RISK REDUCTION: LESSONS LEARNED FROM A CARIBBEAN PROJECT

DR. VIRGINIE DUVAT
AND INES HATTON

Moderator : **Mélissa DALLE (GPMG)**

Panellists: **Thomas PLEYBER (ONF) / Christophe BLAZY (CAR-SPAW)**
/ Dr. Cynthia CAROUPANPOULLE (CANBT)



This presentation introduces a methodology to evaluate nature-based coastal protection projects. The study also emphasizes levers vs. major obstacles in the success of nature-based solutions.

Due to the concentration of human activity in coastal areas and increasing climate-related pressures, the small tropical islands are hotspots for coastal risks around the world (Magnan et al., 2019). Over the past decade, these areas have experienced increased flooding, coastal erosion, and salinization of the soil and groundwater (Mycoo et al., 2022). There is still very little data on adaptations or their effectiveness in reducing risks (Nicholls, 2018; Magnan et al., 2019). It is therefore urgent to evaluate these responses in order to inform the design of effective and context-appropriate climate adaptation policies and to improve the understanding of adaptation levers (Klöck and Nunn, 2019).

Evaluating adaptation measures is a methodological challenge. As discussed by L. Ruangpan and her colleagues (2020), most evaluation frameworks for nature-based solutions (NBS), are ex ante and are therefore designed to guide implementation. There are very few ex post evaluation frameworks, with the exception of the recent IUCN standard for NBS (IUCN, 2020). However, this standard has not been widely applied, and its usefulness and ability to track NBS progress remains unknown.

The study carried out first made it possible to propose an operational methodology for evaluating nature-based coastal defence projects. As a starting point, the framework used the existing IUCN standard together with an extensive literature review. It was designed jointly by scientists and practitioners involved in nature-based coastal defence projects for the small tropical islands. It takes into account eight areas to cover during an ex post evaluation of nature-based solutions: (1) the local context, (2) governance agreements, (3) financing, (4) social acceptability, (5) technical effectiveness, (6) studies, follow-up and evaluation, (7) co-benefits and disbenefits, and (8) the project's contribution to progress on adaptation.

Secondly, the framework aims to provide a

preliminary assessment of nature-based defence of the coast in the Caribbean region based on the application to ten projects in Guadeloupe and Martinique.

The evaluation showed that:

- + Since the early 2000s, nature-based coastal defence has begun in the islands studied. Most of the projects are small-scale pilot projects. Since these are new findings, the technical efficiency cannot yet be assessed.

- + The diversity of the NBSs used: some projects target either marine or land ecosystems, or both; some projects aim to preserve healthy ecosystems and the physical dynamics contributing to their persistence, while other projects work on restoring ecosystems, or even recreating vanishing ecosystems.

- + The important role of public authorities in the design and operation of these projects and the currently limited involvement of the private sector.

- + The diversity of funding sources used to promote NBS (local, national, European).

This study also emphasized certain major levers and obstacles to the success of NBS. The main levers include:

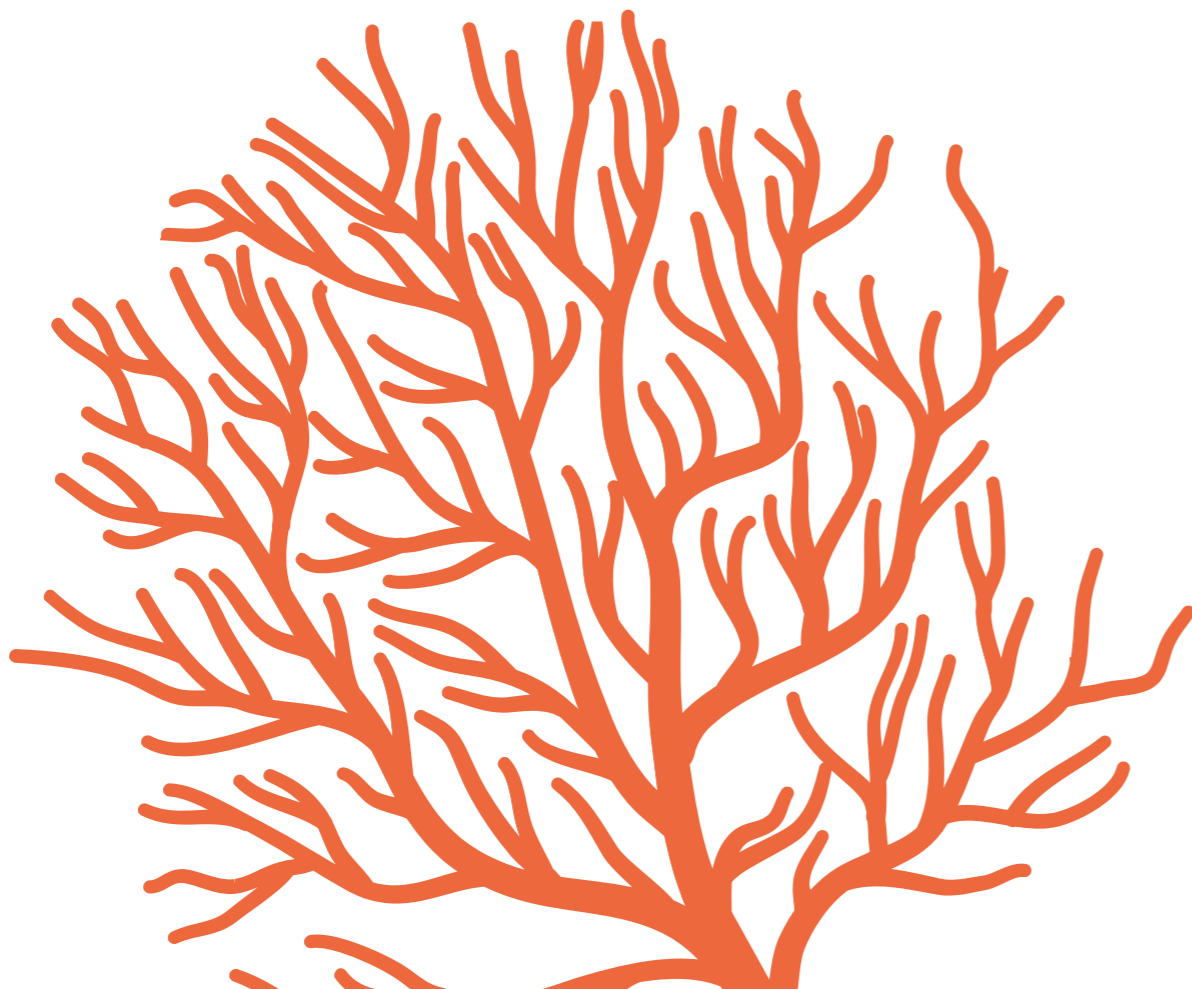
- + Strong social acceptance

- + Local skills and experience regarding local solutions for coastal vegetation restoration technology

- + Mechanisms for transferring technology between the various sites, islands, and types of stakeholder;
- + The many co-benefits and limited disadvantages arising with NBS; The main obstacles are:
- + Inadequate local technical, human and financial capacity to carry through on the projects; this is addressed through external collaboration, for example, with experts from mainland France and the Caribbean;
- + Insufficient scaling of projects, i.e., reaching the landscape level; this limits the potential impact on risk reduction;

+ A failure to look to the future and for stakeholders, including public authorities, to use climate and socio-economic models and integrate NBS projects into a broader adaptation strategy.

This study provides a reproducible, operational methodology, co-designed and backed by the relevant stakeholders. It highlights the strengths of existing projects as well as the main obstacles to NBS, all of which should be taken into account to more effectively promote NBS in the future.



REPLICABILITY OF INDICATORS

This chart of indicators presents features that are sometimes left out of project evaluation. These indicators were designed specifically to evaluate projects aimed at risk reduction. They were used for two other projects of a different scope. The objective was to test the indicators to improve and extend their spectrum of use. The checklist could therefore be used for other locations and projects with some modification, as for example, in the traditional rules and regulations of New Caledonia, etc.

CASE OF THE CARIB COAST PROJECT

The study gave the Carib Coast project a good rating first of all for its wide social acceptance, in which local stakeholders were consulted in advance. Not to be overlooked is the significant funding which also served the project well. We must remember that these projects are designed to serve the common good, and visible results boost the image of the project. Finally, the French National Forest Office has extensive expertise in reforestation and particularly in the revegetation of backshore areas. Long-term follow-up is a key success factor. Nevertheless, even higher rates of success should be strived for; the monitoring indicators also serve to aim higher.

USE OF THE EVALUATION CHECKLIST: NORD GRANDE TERRE VIEWPOINT

The Communauté d'Agglomération du Nord Grande Terre took up this issue early on with an action plan on climate change. To follow through on the action plan, the organisation responded to calls for proposals and received several labels including the TEN (Territoire Engagé pour la Nature) label which allowed for further funding. These actions are carried out in partnership with municipalities, institutions and the community.

The checklist could complement the grid developed by CEREMA for the evaluation of public policies. Here, the challenge is long-term monitoring since communities must dedicate specific human and financial resources internally for follow-up. Furthermore, political and scientific schedules do not always line up. This sort of approach also sometimes requires partnerships with neighbouring territories, which can present an additional challenge.

INVENTORY AND EVALUATION OF ECOSYSTEM SERVICES IN THE EVALUATION CHECKLIST

The ecosystem service of coastal protection is included in the technical section of the study according to the scale of the solution deployed. Other ecosystem services are listed as project co-benefits. There is no specific dedicated section. For the LIFE Adapt'Island project, the evaluation could perhaps cover each ecosystem rather than the project overall, which would impact the rating.

PRACTICAL USE OF THE EVALUATION TOOL

Ideally, this tool could be used as a long-term monitoring tool, with regular evaluations to check whether the indicators are stable or improving. It could be used by consultancy firms, making it a useful practical tool rather than simply an abstract tool for theoretical research.

With the political will on the part of decision-makers wish, the tool could also be used by politicians to bring attention to the ongoing efforts for coastal resilience in a national European or even international framework.

The tool could ultimately be recognized through the creation of a label for ethical and effective projects.



IS THERE AN INSTITUTION THAT OVERSEES ALL THE NATURE-BASED SOLUTIONS? WHAT ARE THE CHALLENGES, PARTICULARLY WITH PROJECT SCALABILITY AND LIMITED RESULTS?

The effectiveness of nature-based solutions alone is an insufficient basis for judgement. The scale of the projects is limited in scope when compared to studies mentioned in the literature. This is a real challenge. Beyond mandates, there needs to be the political will to base policy on the value of the relationship that exists between humans and living things. All these initiatives can contribute to this. There is also uncertainty as to whether benefits can continue long term in light of climate change. We must envision combinations of solutions. A number of organisations are building an inventory of nature-based solutions, including the OFB (Biodiversity Bureau), the IUCN, CEREMA, the French Ministry of the Overseas, the Regional Biodiversity Agency of the Guadeloupe Islands and various territorial observatories.

SHOULD NBS BE INTEGRATED INTO PUBLIC POLICIES TO LEVERAGE DEDICATED FUNDS?

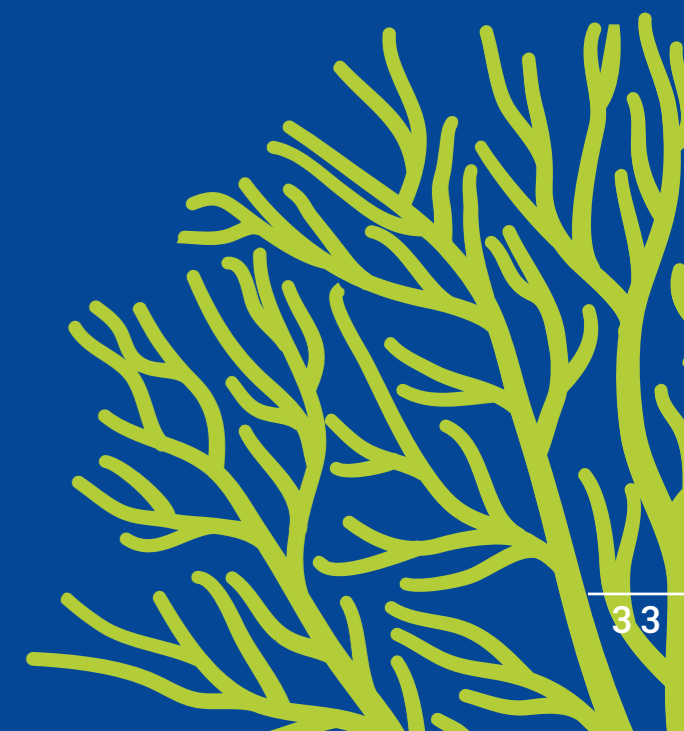
While no funds are targeted for climate change adaptation, there is funding for biodiversity. This line appears to some extent in the new operational policy but is not sufficient to effectively implement nature-based solutions. The Climate Commission emphasises the importance of earmarking funds for climate change as one of its recommendations. It is also included in the government's +4° plan.

HOW WERE THE PROJECTS EVALUATED IN ADAPT'OM SELECTED?

The projects in existence during the study period in 2022 were inventoried mainly through the partner network and the internet.

WHO HAS ACCESS TO THIS TOOL FOR USE IN THE TERRITORY?

This depends on who is running the project. There is the National Forest Office serving as the coastal conservatory, but there are also the municipalities. The November seminar will probably provide the opportunity to identify project leaders.



SYSTEM TO EVALUATE AND MONITOR SOCIO-ECONOMIC IMPACT DR. DONOVAN CAMPBELL

Moderator: **Sita NARAYANAN (GPMG)**

Panellists: **Dr. Nicolas DIAZ (Guadeloupe Region) / Dr. Maïtena JEAN (Guadeloupe National Park) / Laurent JUHEL (Geographic Agency)**



This talk presents the results of two case studies on the socio-ecological trade-offs, synergies and co-benefits associated with fish sanctuaries and coastal communities in Jamaica.

Developing strategies to promote local well-being and build climate resilience in coastal systems is a complex process. Coastal development, increasing aquaculture, the expansion of fisheries and climate change with sea level rises and acidification all combine to cause rapid coastal change.

In the Caribbean, fishing is an example of how human needs are intrinsically linked to the health of ecosystems and their preservation. Fish stocks have been in decline in recent decades, and this has brought about ecological, social and food security issues that are exacerbated by climate change. Fishing provides coastal residents with livelihoods and jobs, generating \$4-5 billion annually.

To preserve and restore ecosystems, a multidisciplinary approach is needed. A number of projects have been developed in the Caribbean to protect the coast. These projects take an adaptive approach. They begin with an understanding of the parameters of the area and its communities. Some projects do not require a lot of time or funding and may have short-term effects. To counter chronic overfishing and loss of marine biodiversity, and to improve the well-being of local fishing communities, fish sanctuaries have been established, i.e., special zones for the preservation of fisheries, among other projects.

Two coastal case studies on socio-ecological trade-offs, synergies and co-benefits associated with fish sanctuaries and coastal communities in Jamaica show the importance of:

- + Better knowledge of what motivates or discourages the community in the research area
- + Identifying appropriate – and often non-climate-focused – entry points that enable communities to participate in the change

- + Reconstruction or reform of existing governance systems and institutions since this is less costly than creating new ones (as in Belize)

- + Framing governance from the angle of community well-being (as in Negril, Jamaica)

- + Educating the community to recognize the critical links between social and biophysical systems (as an example, decompression accidents caused by the need to fish at greater depths)

On each stretch of coast where work is carried out, management efforts are also underway. These include joint efforts on newly protected marine areas and conservation areas, accommodations for rising sea levels, and projects to manage interconnected uses of coastal areas, such as tourism, fishing and preservation. The results are already noticeable, particularly on fishery resources in protected areas.

The case studies demonstrate how multidisciplinary approaches can provide socioecological insights for the design and practice of resource management interventions and processes. These approaches can also affect the awarding of resource rights and zoning for protection. They are particularly suitable in rapidly evolving coastal systems.

THE VITAL ROLE OF FISHING COMMUNITIES

Fishing is an ancient practice that dates back to the Palaeolithic era. Sea fishermen are ecological experts since their survival depends on this resource. With their knowledge accumulated over generations, they therefore have an important role to play in the technology. These traditional skills and knowledge must increasingly be applied in the construction of protected marine areas. This approach is growing worldwide. It should become customary in the Caribbean as well. Fishermen also have expertise to offer in the design of underwater trails. It is far better to collaborate with fishing communities on these projects than to exclude them.

Fishing is prohibited in the heart of the Grand Cul-de-Sac park in Guadeloupe National Park. At Ilets Pigeon, fishing areas are regulated and accessible only to professional fishermen. The park and the regional fisheries committee have entered into win/win agreements specifying fishing gear marking, collection of unmarked nets, sustainable fishing, and the monitoring of conch.

CHALLENGES TO COMMUNITY INVOLVEMENT

Asking fishermen for a significant commitment is problematic since pressures on the environment often come from elsewhere. Fishermen also suffer from rising waters. Furthermore, international agencies and funders seek community commitment yet require rapid results as well; this is sometimes in contradiction with a longer timeframe.

BENEFITS AND LIMITATIONS OF MARINE PROTECTED AREAS: CONFLICTS OF USE

It can be difficult to collaborate with fishing communities on the enforcement of marine protected areas intended to reduce overfishing, especially when the communities customarily use the areas for fishing. In addition, designating an area as a marine conservation area can sometimes open the floodgates to tourists, and this can have a counterproductive aspect for bordering communities. Projects should be evaluated both initially and throughout the project to avoid unintended consequences. The budget should also be planned accordingly, in its design as well as its sustainability and oversight. The pressures on the site should be studied to provide answers to fishermen and nearby communities and to limit conflicts of use.



IN THE CARIBBEAN PROJECTS, HOW OFTEN DO FISHERMEN CHANGE CAREERS?

In general, regardless of the options offered, it is difficult to persuade fishermen to retrain professionally, for example as tourist guides. The rate is very low.

WHAT ABOUT CREATING AN INDEX BASED ON RETURN TO NATURE PER RESIDENT AND PER BUSINESS? WHEN WILL THERE BE A REAL CHANGE IN PARADIGM? SHOULDN'T PEOPLE PROVIDE SERVICES TO NATURE AND NOT THE OPPOSITE?

This process is underway. Indicators are helpful but aren't the be-all and end-all. To convince politicians and build political awareness, it is sometimes necessary to quantify what nature provides to humans. Progress is being made, and general awareness is moving in the right direction.

SHOULDN'T WE CONSIDER CARIBBEAN COOKING METHODS AND NUTRITIONAL PATTERNS TO ENSURE THAT PEOPLE HAVE A SUFFICIENT DAILY PROTEIN INTAKE?

Research on more stable and sustainable diets is an additional avenue to explore in parallel with studies on available resources. Many important factors are at play. Nutrition experts should be consulted. In the South Pacific, a Caledonian chef is experimenting with ways to teach communities how to cook in a healthier manner.

HOW SHOULD LIFE ADAPT'ISLAND APPROACH THE CAPACITIES OF THE ENVIRONMENT AND ITS USERS?

Capacities and thresholds must be analysed. This is an essential line of action.



A WORD FROM THE PARTICIPANTS



The symposium was a victory for the team. The quality of the discussions was extremely rewarding. This brought a great deal of satisfaction. Potential partnerships have come out of this symposium with the University of the Antilles and the Regional Biodiversity Agency of the Guadeloupe Island.

Sita NARAYANAN

This symposium was a great success since it was the first time that researchers, administrators of natural areas, associations and local professionals were brought together at a local event to discuss the future of biodiversity in Guadeloupe.

Symposium Participant

I appreciated the testimonials in the videos about Guadeloupe and they strengthened my conviction as an environmentalist.

Symposium Participant

This project has an important place in the fight against global warming at the island level and brought to light many possible solutions for becoming more resilient.

Symposium Participant

The project was very realistic and, we hope, sustainable, and we look forward to a follow-up European program in order to continue the work that's begun (PO 2021-2027).

Symposium Participant

Once again, I would like to thank the organizers. I am feeling more optimistic after listening to all these presentations. This event shows that it is sometimes possible to combine research and action in the effort to protect marine and land ecosystems.

Pascaline GABORIT



THANK YOU.

THANKS TO EVERYONE WHO MADE THIS SYMPOSIUM POSSIBLE AND FOR MAKING IT A MILESTONE IN THE APPLICATION OF NATURE-BASED SOLUTIONS IN GUADELOUPE.

THANKS TO THE PARTNERS, FUNDERS, PORT REPRESENTATIVES, SCIENTISTS, PROVIDERS , INSTITUTIONS AND CITIZENS FOR THEIR INVOLVEMENT AND THE QUALITY OF THEIR CONTRIBUTIONS.

