Protecting Seagrass Through Payments for Ecosystem Services:

A Community Guide

UN environment programme

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Front Cover

Sea turtle resting on a seagrass bed.
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Back Cover

Squids floating on seagrass beds
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Inside Images

We would like to express our thanks and appreciation to
Dr Amrit Dencer-Brown for creating the illustrations within this document.

Degraded seagrass beds due to overgrazing by sea urchins.
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Seagrass meadows occuring adjacent to mangroves.
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Seagrass monitoring.
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Objectives of this document

Seagrasses are an important part of many coastal ecosystems worldwide. They are flowering plants, or *angiosperms*, and grow as 'meadows' in subtidal and intertidal zones in tropical, subtropical and temperate seas. They provide many ecosystem services – the benefits to people provided by ecosystems – to those who live close to them and to people further afield. For example, they act as a nursery habitat for fish and shellfish, many of which are caught by fishers, and so help to boost the populations of marine species which provide food and income. They act as a coastal buffer, protecting the shore from erosion by waves and storms. They also trap large quantities of carbon, helping to mitigate climate change.

Seagrass meadows can be damaged and lost as a result of various human activities. These threats can be direct, involving the physical damage or removal of seagrass meadows (for example by fishing gears), or indirect, including smothering by sediment from land erosion upstream. Globally, the combined threats to seagrass have caused the loss of 29% of seagrass coverage worldwide in the last 100 years.

Seagrass is currently under-recognised by many governments and inter-governmental agreements. This is in part due to lack of recognition of the benefits that it provides to people, and its perceived lack of charisma by the public in comparison to other marine ecosystems such as coral reefs and mangroves, which receive more public attention. Even when appropriate legislation is in place, implementation is often lacking; the funds and expertise may not be available and seagrass is easily forgotten when competing with more obvious priorities.

Community-based conservation provides an opportunity to fill this gap in seagrass protection. Community-based conservation allows community groups to manage natural resources through an inclusive and structured approach

that can be tailored to the needs and resources of the community. The primary beneficiaries and managers of a community-based seagrass conservation project will be the communities who live adjacent to seagrass meadows and depend on the seagrass for sustenance and/or income. Through a community-based approach, communities are empowered to manage the natural resources upon which they depend, delivering positive outcomes for both ecosystems and people.

One means of facilitating and funding community-based conservation is by Payments for Ecosystem Services, or PES. Through PES, stewards of natural resources can receive funds for environmental protection, paid for by individuals or organisations who will benefit either directly or indirectly from their protection. PES transactions are usually regulated by third parties and are based on measurable outcomes – for example biodiversity conserved or carbon sequestered.

To date, no Payments for Ecosystem Services projects are focused exclusively on seagrass conservation. However, there are examples of community groups using PES to facilitate coastal and 'Blue Carbon' conservation projects (examples of these are included here as case studies).

This document will explore the ways in which community groups could use PES to run a seagrass conservation project. It will outline the requirements of running a project and include best-practice guidance on governing and operating a community-based conservation project.

Scope of this document

This document does not provide step-by-step instructions on running a community-based seagrass conservation project; it does however provide guidance and best-practice advice on how to do so and acts as a 'signposting' guide to resources elsewhere. The scope of the document is intended to be global and so details of country-specific legislation, cultural context or other factors that will be key considerations in running a community-based seagrass conservation project cannot be covered. It is intended for use by community groups and project developers with an interest in establishing a community-based seagrass conservation project. It provides general guidance for doing so as well as supplementary information on setting up a Payments for Ecosystem Services (PES) project. Here, we have a particular focus on carbon-based PES. This is because carbon trading provides the only existing global market that is relevant to seagrass, it is one of the best financed and most securely developed and the authors have most experience of dealing with it. However, this is not intended to imply that carbon will be the best or only option for seagrass-based PES in many situations; our intention is to describe features of PES that will be relevant in developing projects providing a range of services, but which generally use examples from the carbon market.

Structure of this document

Sections 1 and 2 provide context for the document, describing the importance and conservation status of seagrass, the issue of climate change and how, in the context of climate change, seagrass conservation can capture and store carbon.

Section 3 outlines the benefits of community-based conservation in contrast to traditional, 'top-down' governance.

Section 4 briefly outlines the factors to be taken into consideration when first planning a community-based conservation project. These are expanded on in section 5, where the requirements are described in more detail. Section 6 encourages the building of professional networks to implement a community-based conservation project, with a case study from the Mikoko Pamoja project in Gazi Bay, Kenya.

Section 7 introduces Payments for Ecosystem Services (PES), with a focus on carbon-based PES. It outlines the principles of PES and how a carbon-based PES project is implemented. It describes the marketing and trading requirements of a carbon-based PES project, as well as the income that can be expected from a project. It outlines an anticipated timeline for establishing a project.

Contact details are given at the end of the document for organisations wishing to seek advice or support in establishing a community-based seagrass PES project.

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Glossary of terms

Above ground biomass (AGB)	Plant matter making up the shoots and leaves of plants
Allochthonous carbon	Carbon in an ecosystem that was produced **outside of** that ecosystem (for example, carbon that flowed down a river into an estuary and was trapped by a seagrass meadow)
Autochthonous carbon	Carbon in an ecosystem that was produced **within** that same ecosystem (for example, seagrass leaves that drop from the plant and are trapped by the sediment)
Below ground biomass (BGB)	Plant matter making up the roots of plants
Carbon accounting	A means of estimating how much carbon a project will sequester (capture) through its interventions
Carbon credit	A unit (typically equivalent to 1 tonne of CO_2) available for purchase representing carbon sequestered (captured)
Carbon sequestration	A process by which carbon is removed from the atmosphere and stored (for example, trees turning carbon dioxide into plant matter)
Carbon standard	A set of specifications required by a certifying body to certify a project under their standard
Ecosystem service	The functions of an ecosystem from which humans benefit (for example food provision or coastal protection)
Nursery habitat	A habitat that contributes disproportionately highly to the number, growth and/or survival of juvenile forms of marine species (for example, fish laying eggs in seagrass)
Payments for Ecosystem Services	Payments made to stewards to enhance or facilitate ecosystem service delivery (for example, paying to plant trees that will capture carbon to compensate for emitting carbon elsewhere)
Sediment carbon	Organic carbon stored in sediment (in this context, in the sediment underneath seagrass meadows)

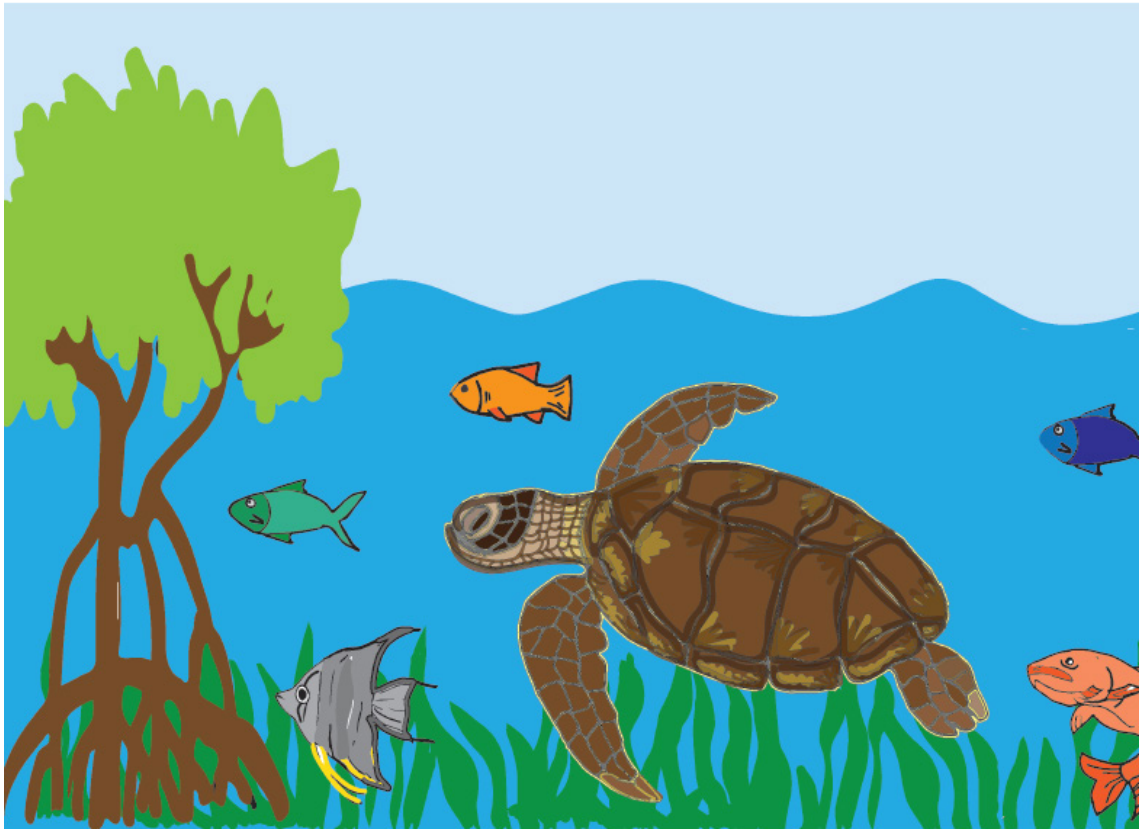
1. Seagrass importance, threats and conservation status

Seagrasses are flowering plants, or *angiosperms*, that grow in intertidal and shallow subtidal zones in tropical to temperate seas across the globe. They form 'meadows' that vary in extent and density according to species and geographic location. Seagrasses provide important ecosystem services to the people who live alongside them and depend on them for sustenance and income, as well as for people worldwide. Healthy seagrass meadows support fisheries through their role as a nursery habitat, giving young fish and shellfish a safe place to shelter and a source of food. By acting as a coastal buffer to waves they protect the shore from erosion, reducing the need for expensive infrastructure such as sea walls and helping to maintain other coastal ecosystems such as mangrove forests. They also provide more far-reaching benefits for climate regulation by sequestering large volumes of carbon in their sediments, preventing its release into the atmosphere as carbon dioxide. The contribution of seagrasses to these ecosystem services have only recently been widely recognised.

Seagrass meadows are at risk of damage or loss due to various pressures caused directly or indirectly by human activities. Seagrass meadows may be removed to make way for infrastructure such as marinas. Boat activity, including anchoring and certain fishing methods such as seine netting and dredging can damage or destroy seagrass. Seagrass health can be affected, in cases to the point of mortality, by pollution and sedimentation caused by land use practices including deforestation and fertilizer run-off further upstream. Collectively, these threats have led to the loss of 29% of global seagrass meadows[1].

This decline in seagrass extent is continuing because seagrass conservation laws are absent or weak, or those that do exist are poorly enforced. The importance of conserving seagrass has only been recognised recently and few countries have enacted laws to protect it; those that have often fail to implement them. If action is not taken to protect seagrass meadows, many of the benefits that we gain from them could be lost.

1 Waycott, M., Duarte, C., Carruthers, T., Orth, R., Dennison, W., Olyarnik, S., Calladine, a., Fourqurean, J., Heck Jr., K, Hughes, R., Kendrick, G., Kenworthy, J., Short, F., and Williams, S. (2009) Accelerating loss of seagrasses across the globe threatens coastal ecosystems. PNAS 106(30)



2. Climate change

Degraded seagrass beds due to overgrazing by sea urchins. *© Ewout Knoester, Kenya*

Earth's climate is changing at an alarming rate, driven by emissions of greenhouse gases including carbon dioxide into the atmosphere. This is causing increasingly extreme weather patterns, loss of biodiversity and growing risks of coastal flooding and storm damage. Conserving coastal ecosystems is very important in the fight against climate change. They help to maintain the ability of the earth to absorb carbon dioxide as well as protect the coast and its inhabitants from the effects of climate change.

Seagrass, along with mangroves and saltmarsh, act as a coastal 'buffer', a physical barrier against the damaging effects of storms, tsunamis and rising seas. They also store large amounts of carbon – often many times more per unit area than ecosystems further inland – hence conserving them helps to prevent this carbon being released into the atmosphere and maintains their ability to capture more carbon in the future. As sea levels rise, healthy coastal ecosystems can help protect coastal communities from rising waters and allow the coastline to adapt to new sea levels, for example by raising their own soil or sediment levels in tune with the rising sea level and by moving with the sea as it comes inland.

3. Benefits of community-based management/ conservation

Community-based conservation is where community groups, sometimes in partnership with governmental and non-governmental organisations, take responsibility for and control of managing their natural resources. This approach to conservation has several benefits over traditional conservation led by governments and large non-governmental organisations:

1. Communities are more likely to benefit from conservation projects. Communities can design conservation projects that are compatible with their lifestyles and livelihoods, and outcomes are planned according to what is important to local people.

2. Community-based projects can reduce conflict between environmental conservation and people's lifestyles and livelihoods. People are not disadvantaged by restrictions imposed by governments and large organisations. By putting people's needs at the centre of conservation, community-based conservation can be beneficial for both people and the natural environment.

3. Community-based conservation provides opportunities for community groups to form a network with international and national organisations, governmental bodies and other community groups to share skills and experience. This can benefit all individuals and organisations involved and improve communication between all levels of society from government to communities.

4. Communities are empowered to manage the natural resources upon which they depend for sustenance and income. Communities can take responsibility for and ownership of natural resource management that is typically held by governments.

5. Where there are insufficient government resources to enforce and manage conservation, local people can be empowered to act as stewards and managers, sometimes without requiring additional salaries, provided they receive some of the benefits of doing so.

Mangroves and seagrasses, among other coastal habitats, benefit fish populations that provide a source of food and income for coastal populations

4. Planning a project

At the early stages of your project planning, community groups should carry out an assessment of if and how the project can be implemented. This will help groups anticipate problems that might arise and take early action to avoid or address them. Factors to consider are:

1. Do you have the technical ability to carry out the project (see section 5.2 Scientific and Technical), or are you able to bring in this capacity through staff or project partners?

2. Do you have the legal right to govern the project area (see section 5.6 Legal rights to govern), or can this right be secured?

3. Do you have the financial resources, or the ability to secure these, to fund the project (see section 5.1 Financial)?

4. Is there community support for the project, or can this be gained (see section 5.4 Community engagement)?

Groups should clearly define roles and responsibilities on the project, including in project planning, and who will hold these.

Groups may also want to consider integrating multiple marine and coastal ecosystems (for example, mangroves and/or coral reefs) alongside seagrass into a single project. This may increase the level of time, resources, skills and equipment required for the project. However, doing so could create a more robust project with greater capacity for income from carbon credits or other sources of funding. Coastal and marine ecosystems are closely linked and a joined-up approach to their conservation will bring more environmental benefits than conserving one alone.

Seagrass meadows occuring adjacent to mangroves.
© (Gabriel Akoko, Kenya)

An integrated coastal ecosystems approach has been taken by the Mikoko Pamoja project in Kenya. The Mikoko Pamoja project operated solely as a mangrove conservation project funded by carbon credits for 6 years before integrating seagrass as an additional benefit. The project design allowed for monitoring of the seagrass that was robust yet simple and less costly than a full monitoring programme that would be required if the seagrass were to be certified alongside mangroves. The project, with the approval of the carbon standard, will market the seagrass conservation as an 'added benefit' of the project to raise additional income. This approach allowed the project to avoid the heavy financial and technical burden of certifying seagrass under a carbon standard, and instead include it as an 'add-on' to an existing certified mangrove project.

Thorough and considered planning at an early stage will help to create a robust and effective project

5. Requirements of a community-based seagrass conservation project

5.1 Financial

How a project will be funded must be considered at the project planning stage. Do not cut corners here: a project that is sufficiently funded in the planning stages will have an increased chance of success further down the line.

Community groups are likely to need to apply for grants or other sources of funding at least to plan and initiate the project, even if the project is to be self-sustaining later. Funding can be secured from governments, NGOs and philanthropic foundations, research programmes and other sources. Partnering organisations can assist in accessing these funding sources (see section 6 Networks).

A plan of how the project will be funded, or at least options for funding, should be clear from the start of the process. Community groups may also wish to explore options for funds generated by the project itself (for example PES), potential funding streams or institutional commitment from external organisations.

Monitoring of seagrass can be time-consuming and costly, involving activities and equipment including diving and use of laboratory equipment (see section 5.2 Scientific and technical). An analysis of these costs should be carried out at the project planning stage. Community groups may need to consult with organisations with relevant experience in this area to accurately estimate the

costs of these activities. Even if PES funding is brought in by the project, this may not be enough to cover monitoring costs and supplementary forms of income may need to be identified.

A means of receiving funds that is transparent and accountable should be set up. This should be a bank account that is controlled by a constituted body. Structures to facilitate democratic decision-making, such as an elected committee, may strengthen the position of the organisation by demonstrating community engagement and input to donors. If this does not exist, you may wish to receive funds by an existing organisation under an agreement for the use of the funds. This will give funders the assurance that their money will be responsibly handled.

5.2 Scientific & technical expertise/ skills

A seagrass conservation project will involve surveying and monitoring of seagrass meadows. Internationally-used methods can be adopted to ensure that monitoring is scientifically accurate. These protocols are designed to be used by both scientists and non-scientists, and so are simple to follow. They include Seagrass-Watch, Seagrass Spotter and SeagrassNet.

Seagrass monitoring. © by Gabriel Akoko, Kenya.

Monitoring using these methods will involve people being in the intertidal zone at low tide and may (depending on project design) involve wading, snorkelling and/or diving. Those carrying out monitoring activities should therefore be confident in navigating the intertidal zone between tides, and swimming or diving skills may be necessary. Project design can exclude diving or snorkelling activities from monitoring, but if so, the seagrass that can be included in the project area will be limited to intertidal meadows exposed at low tide. This may be a better option for projects with fewer resources as surveying the intertidal region by foot is considerably less time and resource-consuming than snorkelling or diving.

Once monitoring data are collected, data and samples need to be analysed. This will require some scientific and mathematical skills and the use of computers. Depending on the project design, more advanced analysis may require specialised equipment. The use of such equipment may require access to a laboratory. Surveying in the field will at least require appropriate clothing and footwear to safely survey in the intertidal region, quadrats and equipment to take sediment cores. The laboratory analysis of samples may include the use of acid to remove inorganic carbon and a furnace to measure organic carbon content. Scientific skills and technically competent project team members will be required for the analysis of the data produced by these analyses. If these skills are not present within the community group, partners involved in the project may be able to assist with and/or teach these skills. Community groups should plan carefully for the work that is required of a project and involve the necessary team members and/or partner organisations – see section 6 Networks.

5.3 Governance

A community-based conservation project will need strong community-level governance that provides structured oversight of the project, provides strategic guidance and ensures that guiding principles are followed. The following

principles should be considered when project governance is planned:

1. A governing body should be representative of the communities who are involved in the project. This may mean (but is not limited to) taking into consideration geographic locations of communities, ethnic or religious groups, professions or industries that are affected by the project, and minority demographic groups.

2. Governance should respect local and national-level laws and customs. This may mean consulting community leaders and following appropriate customs and procedures while also ensuring compliance at a national level, should this be relevant.

3. A governing body should establish and follow clear and equitable procedures. These should include consultation, decision making, financial, reporting and grievance procedures, with clear instructions as to how these processes should be conducted and who is responsible for them. Project participants (including community members) should be made aware that these procedures exist, and the procedures should be made publicly available to community members who wish to view them.

4. A governing body should be accepted and recognised by the communities it represents. Steps should be taken to ensure that community members are satisfied that they are represented and that the governance process is fair.

5. Membership of a governing body should be open and democratic; election to a governing body should be democratically decided by the community and all relevant community members should have the opportunity to be elected to a governing position.

6. Where relevant, provisions should be put in place to allow disadvantaged or minority groups to be fairly represented in a governing body.

Community groups constituted as legal entities will benefit from strengthened governance structures as well as gaining national-level recognition and opportunities for international funding.

5.4 Community engagement

A community-based conservation initiative is already founded in community values and likely has the support of at least part of the community. This existing support will be strengthened, and further support gained, by a formal community consultation at the project planning stage and ongoing engagement throughout the project.

An inclusive community consultation should invite all members of the community to discuss the proposed project and how it may impact on their activities; in particular concerted efforts need to be made to include people and groups who are most likely to be negatively affected by any proposed changes, as well as those who for cultural, geographic or financial reasons are most often forgotten. Running a formal consultation creates an open and welcoming space where community members can learn more about the project and have a say in it. It ensures that all stakeholders are involved from the start and avoids unexpected conflicts further into the project by ensuring that stakeholders are well informed of, and have had the opportunity to comment on, project design. Crucially such a consultation must genuinely seek consent. So project proposers must be ready to modify or to abandon their plans if community consent is not possible.

Engaging the whole community in the consultation will benefit the work by bringing in ideas from more people and groups that may not have been considered by the project team. This could include traditional knowledge, professional experience and creative and innovative ideas from across the community.

Ongoing community engagement throughout the project is important to maintain community support. This process can be built into the project's governing procedures, and existing community gatherings or processes can be used to hold these consultations. Clear and transparent processes should be in place to allow community members to contribute in a constructive way and

Consulting with stakeholders and the wider community will ensure that the project is well-supported, as well as providing an opportunity to gather ideas and knowledge from a wide range of people and organisations.

ensure that their views are heard and considered by the right people.

5.5 Benefits sharing

Environmental conservation projects can bring costs and benefits to local people who rely on natural resources. Fair and equitable benefits sharing is an important component of a community-based conservation project, addressing inequalities that projects may create in access to resources.

The benefits of conservation can be: income generated directly by project activities or indirectly through increased tourism; enhanced and secured ecosystem services; enhanced biodiversity; opportunities for recreation, education and research; or cultural or historic preservation. It is important to demonstrate to stakeholders where these benefits are linked to the conservation project to highlight that the costs of such a project are balanced by positive impacts.

A project design should plan for diverse benefits and not be solely reliant on, for example, increased income from tourism (which is notoriously vulnerable to changing markets and political shocks). Relying on one or two benefits increases the chance of failure if that benefit does not materialise – for example, if external factors cause tourist numbers to fall.

The benefits of environmental conservation are diverse and more difficult to directly measure than costs. For this reason, comprehensive and ongoing discussions with stakeholders regarding both costs and benefits are needed to ensure that benefits sharing it equitable and individuals and/or groups are not unfairly disadvantaged by a project.

Benefits may not consist of direct handouts in the form of cash or other resources to individuals; if direct financial benefits are generated by project activities, these should be spent to maximise the wider community benefit and avoid individuals benefitting disproportionately; especially where resources are owned and managed communally, benefits must be shown to benefit all those who contribute and not only a few more powerful individuals. Should financial benefits be created by the project, the funds must be responsibly managed by a central and accountable body to ensure appropriate spending.

5.6 Legal rights to govern

To be able to manage an area of land and benefit from conservation, community groups should ensure that they have the legal right to do so through land tenureship, land ownership or contractual agreements with the landowners (who in most cases will be the government). This will help (and in many cases will be essential) in securing funding and will allow the community to legally enforce their management measures.

6. Networks: value and how to engage

Community-based conservation does not need to be carried out solely by the community group themselves. Partnerships in many types of project can enhance their success by engaging a range of skills and expertise. Community groups may benefit from support and partnerships from external organisations including government bodies, non-governmental organisations and research institutions, without detracting from the community's autonomy and ownership of the project. These partnerships and collaborations can and should be beneficial to all involved: communities can develop skills and experience through support from external organisations, while the project may provide opportunities for research and for collaborative work.

External contribution can be direct, through financial or staff contributions to the project, or through skill sharing and opportunities for learning. Many organisations seek collaborations with community groups to carry out research and conservation activities, and so these partnerships can and should be beneficial for all of those involved. Many research organisations and NGOs welcome proposals from community groups interested in working together. Community groups should have a clear plan of what support they need and identify partners who may be able to provide this before approaching potential partner organisations.

Governmental support and partnerships

For management measures within a community-based conservation project to be legally enforceable, governmental approval and recognition of the community group as the managing body is needed. Engagement with relevant governmental bodies (for seagrass, these will be bodies with responsibility for marine and coastal management) should take place early in the planning stages of a project.

Some governments may allow for co-management of natural resources. Under a co-management arrangement, community groups and governmental bodies share management responsibilities to allow communities to benefit from management rights and governmental recognition and enforcement of management measures. Relevant legislation and government agencies should be consulted regarding provisions for this.

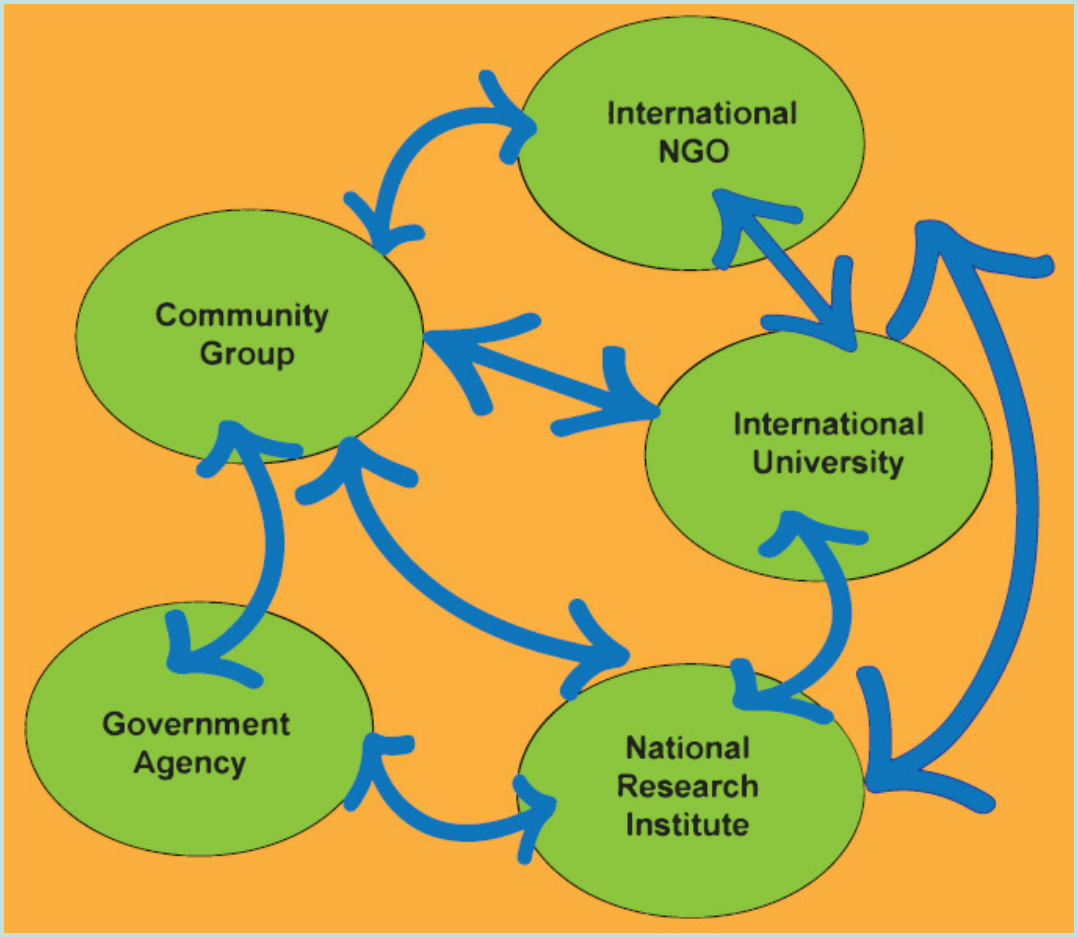
Co-management arrangements should clearly define roles and responsibilities of parties within the arrangement, and these should be constructed so that communities are the primary beneficiaries of the project.

Case study: Mikoko Pamoja blue carbon project, Kenya

The Mikoko Pamoja blue carbon project on the southern coast of Kenya is run by the Mikoko Pamoja Community Organisation (MPCO). MPCO, whose objective is to restore mangroves through the sale of carbon credits, consists of two project staff and an elected committee from the surrounding community, as well as an expert Steering Committee. MPCO has the on-site support of the Kenya Marine and Fisheries Research Institute (KMFRI), a government body which hosts the staff and provides scientific and technical advice and assistance. The project area is governed under a co-management agreement between MPCO and the Kenya Forest Service (KFS), a government organisation which is responsible for forest management. In addition to KMFRI, MPCO collaborates with international universities for scientific and technical support and ACES, a UK-based NGO, to market and sell their carbon credits.

Through these collaborations the Mikoko Pamoja project gains skills, experience and services that may not otherwise have been available to the Community Organisation alone, as well as exposure on international platforms. The collaborating organisations gain the opportunity to conduct research and to assist the Community Organisation in innovative blue carbon climate mitigation activities.

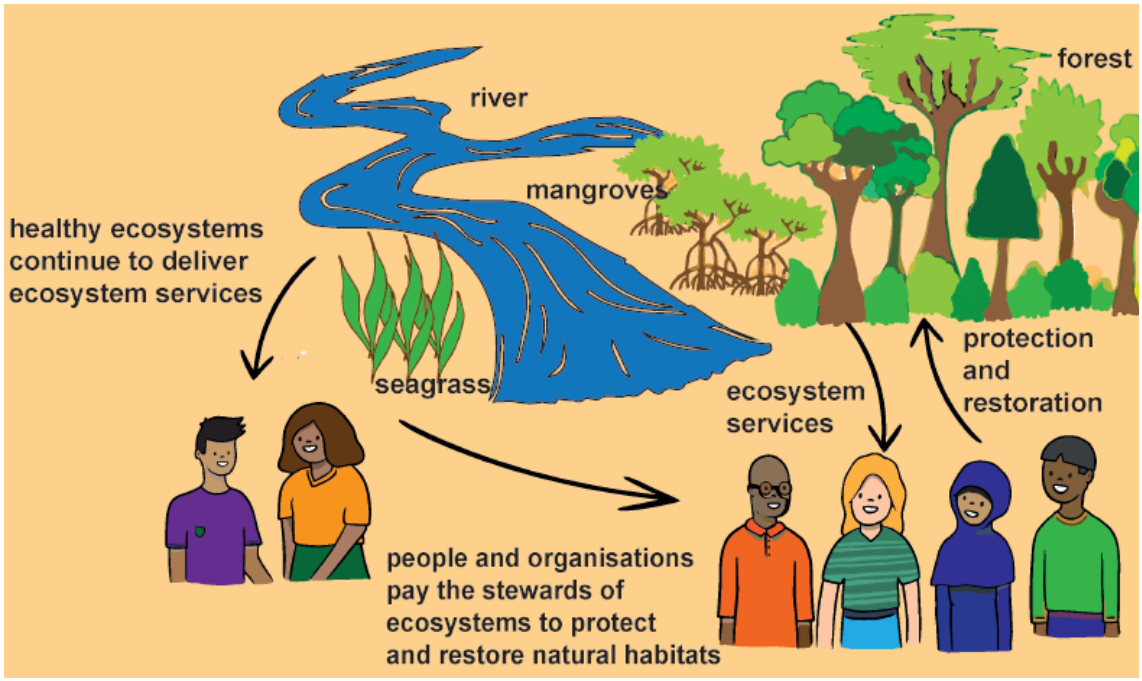
These partnerships were built over years of exchanges and collaborations between the organisations involved. The project's successful network building has come as a result of clear roles and responsibilities, shared trust developed over many years as well as mutual benefits from involvement in the partnership. Mikoko Pamoja's success is mainly attributed to its community engagement, support from a scientific institute, government support and international networks.



The Mikoko Pamoja project has engaged a wide range of organisations, both national and international, to create an effective project.

7. Payments for Ecosystem Services

7.1 What is PES?



PES projects involve those who benefit from ecosystem services paying the stewards of the ecosystem

Payments for Ecosystem Services, or PES, is a mechanism for environmental protection through which individuals and organisations pay managers or stewards to carry out activities that preserve or enhance the provision of ecosystem services, sometimes to make up for damaging activities, such as carbon emissions, elsewhere.

Those who pay for PES are motivated by direct or indirect benefits. Manufacturers of food and drink, for example, could benefit from improved water quality for their products and so may pay for environmental protection that enhances water quality rather than pay for expensive water treatment facilities. Other 'beneficiaries' of PES may be indirect; a common example is the purchasing of carbon credits, where individuals or organisations whose activities (such as flying by aeroplane) emit carbon pay for activities such as the planting or conservation of trees that sequester (trap) that carbon elsewhere. This allows individuals and organisations to minimise their environmental footprint.

PES transactions are generally regulated by independent organisations. The benefits that they deliver (such as biodiversity conserved or carbon sequestered) are measured and sold as units, such as 1 tonne of carbon dioxide sequestered. The independent organisations inspect monitored data for the project and certify that these units have been created by the project's activities. This allows them to be sold. This independent oversight gives PES buyers assurance that when they make payments, their money is going to a trustworthy source.

7.2 Principles of carbon PES

There are several principles that you must keep in mind when designing a PES project to ensure that it has a real benefit to the environment. These are known as permanence, leakage and additionality and are explained below. A standard will provide guidance on each of these and how it expects projects to address them.

7.2.1 Permanence

The permanence of a project is the length of time that the carbon storage (or another ecosystem service) will be delivered for. A project must be able to demonstrate that the benefits delivered will not be reversed, for example by deforestation or natural processes, for a reasonable timescale

after the PES have been made. This is normally assumed to be 100 years. It is of course challenging to demonstrate now what will happen to an ecosystem in 100 years' time, however project planners should consider how the land might be managed after the end of the project period. For example, are there national or local policies allowing for community ownership of land, that could prevent development? Is the ecosystem at risk from other environmental factors outside the project's control that could damage the ecosystem, and what is the likelihood that this will occur? Seagrass sediments, when left undisturbed, are known to sequester carbon over hundreds to thousands of years, and scientific evidence demonstrating this will support projects in demonstrating permanence.

7.2.2 Leakage

Leakage is the risk that damaging activities excluded from a project area by management measures or protection will simply occur elsewhere instead, rather than being decreased or prevented altogether. For example, excluding wood cutting from one forest may simply force people to cut in a nearby forest. A project must be able to demonstrate that it has taken measures to prevent this activity from happening anywhere, not just in the project location. This can be difficult to assess and prevent, but standards recognise this and can accept a project if reasonable steps have been taken to prevent or compensate for leakage. For example, if anchoring is a local driver of degradation in seagrass and this is prohibited in a protected seagrass meadow, designation of anchoring points (potentially including fixed points embedded in the seabed) would prevent boats anchoring in non-protected seagrass nearby.

The Mikoko Pamoja project in Kenya established community woodlots of *Casuarina* trees, a terrestrial tree that could be harvested to compensate for the loss of timber for building and firewood resulting from the mangrove protection. The woodlots were harvested and sold at a low cost to community members, with income re-invested into the community.

7.2.3 Additionality

Proving additionality requires projects to demonstrate that their activities are **additional** to what would have taken place in the absence of the project. This may mean demonstrating that existing effective protection is not already in place, that current trends will result in degradation or removal of the ecosystem service under business as usual scenarios or that alternative funding has not already been secured to finance the same work.

Project developers will be required to assess the baseline conditions – what state is the ecosystem in now and the trends in condition of the ecosystem. By understanding these trends and predicting the improvements in ecosystem condition that the project will bring, the additionality of a project can be demonstrated.

Project developers should also assess legal frameworks and designations in place, such as Marine Protected Areas, when considering additionality. The presence of an existing protected area should not automatically disprove additionality; the effective management of the area is vital and if this is not being delivered, then a PES project within an already protected area could be considered to be additional.

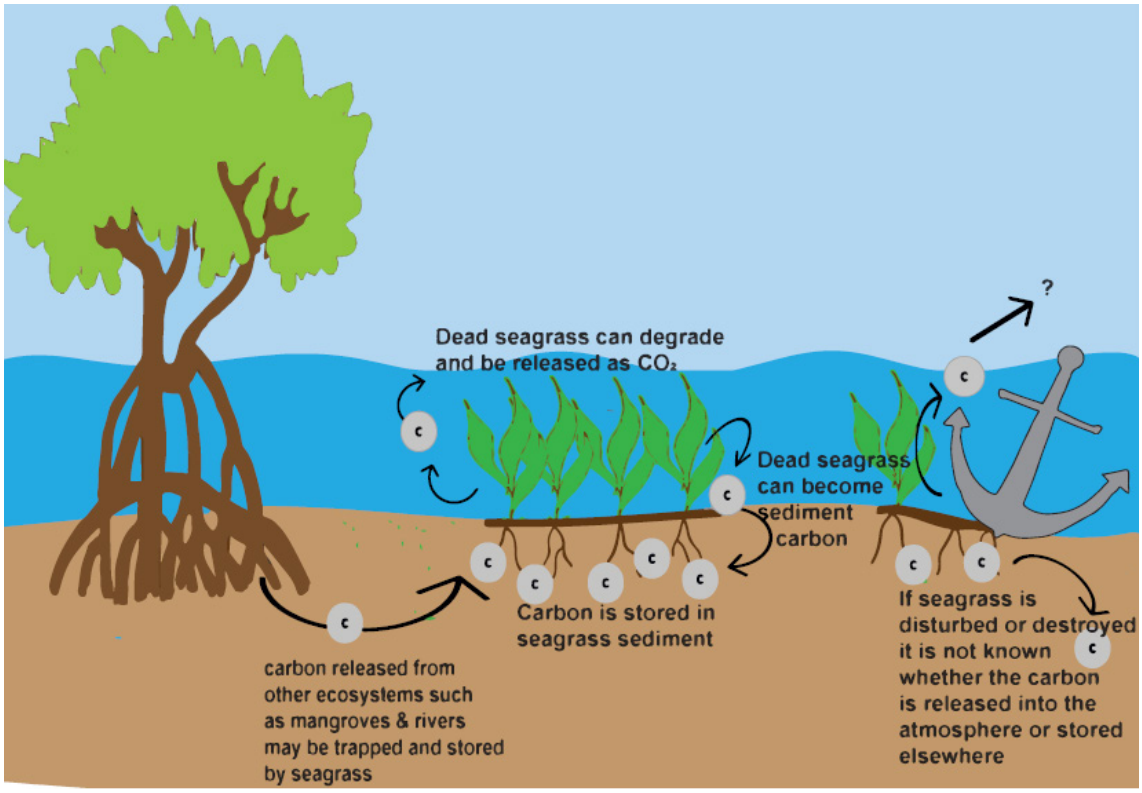
7.3 Operating a carbon-based seagrass PES project

7.3.1 Choosing a standard

If carbon-based PES is chosen as a means of funding a project, a 'standard' must usually be chosen to certify the project against. This is a set of guidance and rules by which a project must adhere to be certified under that standard. Standards are administered by organisations linked uniquely to each standard; for example, the Plan Vivo Foundation administers the Plan Vivo Standard and Verra administers the Verified Carbon Standard.

Several different standards exist, each suitable for different types of projects. A community-based seagrass conservation project should select a standard that is tailored towards small-scale, community let projects such as the **Plan Vivo Standard** or the **Verified Carbon Standard**.

Project developers should evaluate different standards and select one that is well-suited to their individual projects. Developers can and should open discussions with the administering bodies of these standards to discuss their projects at



Carbon can travel between and be stored within marine and coastal ecosystems

an early stage, as the standard will guide project design. It is possible for PES projects to operate without accreditation, in which case they must rely on existing networks and trust in order to sell their ecosystem services; if you intend to access the open market and sell to new buyers, certification by a standard will make it much easier.

7.3.2 Carbon accounting

To fund a project through carbon-based PES, a project must be able to estimate how much carbon its activities will allow to be sequestered. This may be the carbon sequestered by new trees planted, or by the trees that were prevented from being cut down. You will need to set out 'baseline' (the condition of the ecosystem and trends in this condition at present, or before the project start) and 'project' (the anticipated improvements that the project will make to ecosystem condition) scenarios for carbon sequestration. There are several methodologies for doing this: these are called **carbon accounting methodologies**. The most appropriate of these for small-scale community projects may be the *Verified Carbon Standard methodology for Tidal Wetland and Seagrass Restoration*[2]. The carbon accounting methodology used must be recognised by the standard chosen by the project. The standard may have its own methodology (for example, the VCS Methodology for Tidal Wetland and Seagrass Restoration) or they may recognise a third-party methodology. This can be discussed with the body who administers the standard.

Carbon accounting methodologies are complex and require strong scientific skills to interpret and apply. If these skills are not present in a community group, they will need to be sources elsewhere through contractual support or through partnerships with academic institutions or science-based NGOs.

7.3.2.1 Carbon storage in the ecosystem

A carbon PES project must take into consideration where carbon is stored within the ecosystem.

Carbon can be stored in the **biomass** of seagrass (the plant itself) and in the sediment beneath it. Biomass carbon is categorised into **above ground biomass** (leaves, stem and shoots) and **below ground biomass** (roots). Seagrass biomass is very minimal (with the exception of the below ground biomass of *Posidonia* species) and is likely to be transported out of the seagrass ecosystem and degraded when the seagrass dies. For this reason, it is not expected that it would be included in a carbon PES project. The **sediment carbon**,

2 https://verra.org/methodology/vm0033-methodology-for-tidal-wetland-and-seagrass-restoration-v1-0/

however, is a much larger and longer lasting carbon store. A carbon PES project is likely to be based on this carbon.

7.3.2.2 Where did the carbon come from, and where will it go if the seagrass is disturbed or destroyed?

A carbon PES project must consiader where the carbon sequestered within the project area came from as well as what would happen to it if the seagrass meadow is damaged or destroyed.

Carbon stored in seagrass sediment can come from two sources. It can come from the seagrass itself, as dead plant matter is incorporated into the sediment - this is known as **autochthonous carbon**. It can also come from outside the seagrass habitat, as carbon from other sources such as mangroves or rivers is trapped by the seagrass meadow and incorporated into the sediment - this is known as **allochthonous carbon**. It is argued by some that allochthonous carbon should not be included in estimates of carbon storage in seagrass as it cannot be proven that that carbon would not have been stored elsewhere had it not been trapped by the seagrass meadow.

What happens to seagrass carbon in the case of disturbance or destruction of the meadow also needs to be taken into consideration. There is uncertainty about what happens if the seagrass is disturbed or destroyed – if the carbon is degraded and returned to the atmosphere as carbon dioxide, contributing to climate change, or if it is transported into deeper waters and stored there. If it is transported elsewhere when disturbed or destroyed, it cannot be claimed that the seagrass meadow protection is having a positive effect on carbon storage in the long-term. At the time of writing there was no clear consensus within carbon standards on how this should be addressed, but this may develop in the future and the issue should be considered by projects.

7.3.2.3 Organic and inorganic carbon

Carbon can be found in two forms in ecosystems: **organic** carbon (or C_{org}) and **inorganic** carbon (or C_{inorg}). The type of carbon being measured within an ecosystem may have implications for a project.

Organic carbon is the carbon found in, or derived from, living beings or matter – for example, the living tissues of seagrass or in the leaf litter, often well decomposed, within the sediment. Inorganic carbon is carbon stored in minerals – in seagrass ecosystems, this is primarily in the form of the calcium carbonate shells formed by shellfish which live among and feed upon the seagrass and its sediments.

Calcium carbonate is formed by a process called calcification. Although this process ultimately stores carbon, the process under which it forms emits CO_2, resulting in a net loss of carbon overall. This means that inorganic carbon cannot be eligible for carbon credits.

The only carbon standard to address this at the time of writing is the VCS Methodology for Tidal Wetland and Seagrass restoration. This standard requires calcium carbonate to be removed from samples prior to measuring total carbon, **if it is present in significant quantities**. This will have technical implications for the processing of sediments to calculate total carbon content, as calcium carbonate will first need to be dissolved.

No other carbon standards give guidance on how a project should address the presence of inorganic carbon in the ecosystem; this may develop if and when other carbon standards develop guidance for seagrass carbon.

7.3.3 Monitoring targets

Carbon standards require projects to set out how they will monitor the project's progress and whether it is meeting its aims. These monitoring targets should be clearly defined, measurable and achievable in the context of individual projects. These monitoring targets may include (but are not limited to):

- Seagrass coverage of the seabed;
- Seagrass species composition;
- Biodiversity indices.

The targets that you select may be specified by, or identified in conjunction with, the carbon standard.

You may wish to align these targets, where possible, with the data that are gathered by

monitoring methodologies such as **Seagrass-Watch**.

You will be required to report against these monitoring targets on an annual basis, although data can be gathered more often than annually (the robustness of your data will be improved by multiple surveys each year). Your project will be subject to auditing by a third party periodically (e.g. every 5 years), during which the accuracy of this data will be independently checked. You should retain all original data collection sheets and other materials used (e.g. aerial photography) for inspection during these audits.

7.3.4 Annual reporting

You will be required to report to the carbon standard annually. This is to ensure that the project is meetings its aims and objectives (or, if it isn't, to communicate on challenges and barriers to doing so). The annual release carbon credits generated by a project is dependent upon this report so that buyers can be sure that the carbon that they are offsetting is being sequestered elsewhere.

This report will include (but is not limited to):

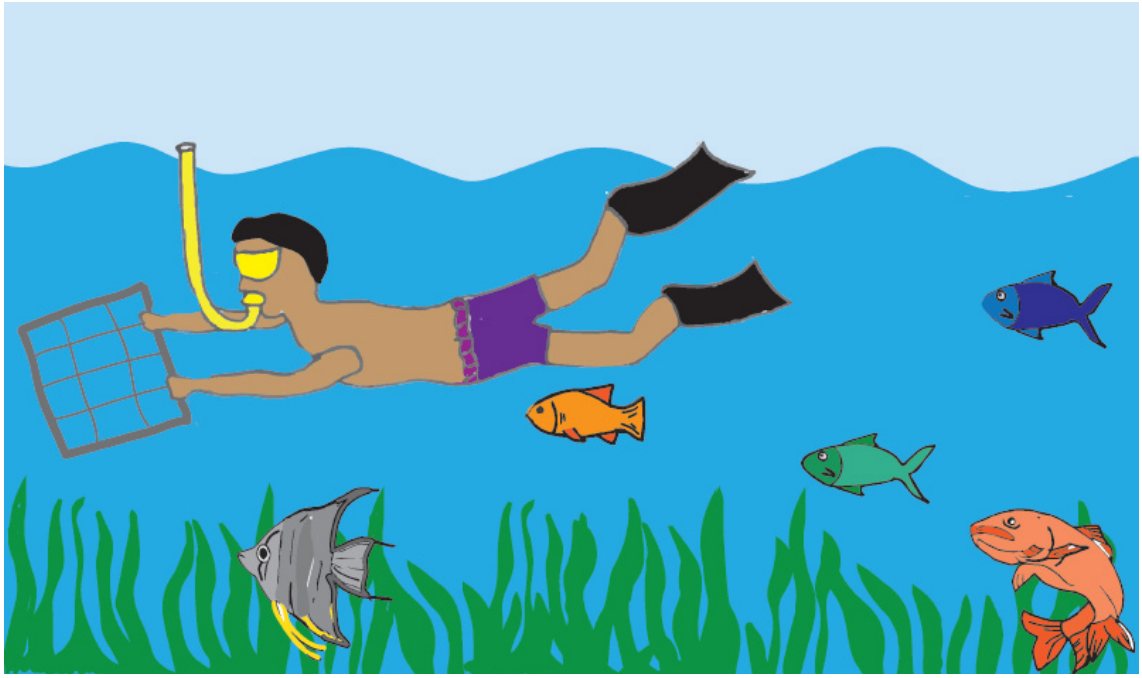
- Reporting against monitoring targets (see 7.4.3 Monitoring targets);
- Reporting against any additional benefits that your project may aim to deliver, for example community benefit/development projects;
- Key events and successes throughout the year;
- Community participation and involvement;
- Sales of carbon credits

The writing of these reports will require strong literacy and numerical skills and the ability to interpret and present scientific data.

7.3.5 Marketing and sales

Once your project is certified under a standard and generating carbon credits, you will be able to sell these to the public and organisations. You will need to market your project's carbon credits and find buyers. These buyers may be national or international organisations or individuals.

Carbon markets are broadly categorised into 'voluntary' and 'compliance' markets. The voluntary carbon market refers to transactions made voluntarily – individuals or organisations who are under no obligation to offset their carbon footprint but choose to do so. In contrast, the 'compliance market' refers to the trading of credits required by law – for example, large polluting organisations who, under national and international obligations, are obligated to



A seagrass protection or restoration project will involve surveying the seagrass meadows

reduce their carbon footprint. Small, community-led projects trade on the **voluntary** market; compliance markets demand considerably higher volumes of credits and require certification by standards suited to large-scale projects.

The process of formally receiving and 'retiring' (when you sell the credits to a buyer) is normally done through an online third-party registry. The process for this will be explained by your carbon standard. Projects should have a transparent means of processing sales; if your project is likely to be receiving international payments, a third-party payments system such as PayPal will be helpful.

You may need to invest in marketing and communication materials to publicise your project and sell the carbon credits, including a website, leaflets, posters and information documents. Collect photographs and videos of your work to tell a story about your work to capture people's interest.

Carbon credits can be sold directly to buyers or to 'resellers', who buy credits in bulk and sell them to buyers themselves. There are pros and cons to each approach: selling directly to buyers yourself will allow you to create a more personal relationship with your buyers, leveraging long-term support. Your project will also receive a higher price, as there is no 'middle-man' to pay. However, it does involve more effort for the project in marketing and processing sales. Using a reseller means that you can sell larger volumes of credits at once, minimising the time and resources on marketing and sales. The reseller will buy your credits at a reduced price and keep a proportion of this money for their time spent on the process. The best approach for a project (of course, you can choose a combination of both) is dependent on the project and the team involved, and whether you wish or are able to invest time and resources in sales and marketing.

7.3.6 What income can a project expect from carbon credits?

It is important to have a clear idea from the start about how much income a project can expect from selling carbon credits. You should make a realistic plan of how much the project will cost to run (see 5.1 Financial) and plan how you will secure any additional finances required to establish and operate a project.

The price of carbon credits is variable according to the market for them, which can rise or fall with changing policies and public opinion of carbon offsetting. At the time of writing (late 2019) there was a strong demand for credits on the voluntary market, and projects received ~US$8-12 per tonne of carbon dioxide sequestered. Projects should discuss anticipated carbon prices with the administering body for the standard that they choose, as the standard may have an influence on the price that projects can expect for their carbon. For example, following a standard that has a strong social and community ethos may allow projects to leverage a higher carbon price as this can be seen favourably by buyers.

Seagrass sequesters approximately 1.38t[3] of carbon per hectare per year (although this is an average figure and may be higher or lower in project scenarios). This translates to 1.38 × 3.667 = 5.06 tonnes of CO_2 (note that units can be confusing; most of the voluntary market literature deals with CO_2 not C). The estimated income of a project based on sequestration may therefore be calculated as:

(area of seagrass protected (ha)) x 5.06 x (market price for carbon)

So, for example, if a 100ha site and credits sold at US$10, a project can expect (100 x 5.06 x 10) = **US$5,060 per year**.

There may be additional credits (and income) from **avoided emissions** as well as from anticipated future sequestration. For example, a study in Kenya[4] estimated that 2.28 t C (or 8.36 t CO_2) was lost following the first year of seagrass removal from small experimental plots. If a project can show this is an additional benefit then it could

3 Based on a synthesis by McLeod et al. (2011): Mcleod, E. , Chmura, G. L., Bouillon, S. , Salm, R. , Björk, M. , Duarte, C. M., Lovelock, C. E., Schlesinger, W. H. and Silliman, B. R. (2011), A blueprint for blue carbon: toward an improved understanding of the role of vegetated coastal habitats in sequestering CO2. Frontiers in Ecology and the Environment, 9: 552-560. doi:10.1890/110004

4 Githaiga MN, Frouws AM, Kairo JG and Huxham M (2019) Seagrass Removal Leads to Rapid Changes in Fauna and Loss of Carbon. Frontiers in Ecology and Evolution 7:62. doi: 10.3389/fevo.2019.00062

claim for this carbon as well. A project design can include areas for restoration and/or avoided emissions; for example an area of degraded seagrass that will be allowed to recover as well as an area of healthy seagrass that is protected from damage or removal.

Based on the calculations above, it may not be viable to finance a project solely through selling carbon credits and other sources of income should be sought.

7.3.7 Timeline for setting up a seagrass carbon project

Groups should allow at least two years to establish a seagrass carbon project. Below is a timeline with brief activities. This is intended as a guide and will vary on a project-by-project basis.

Month 1: Project initiation. Gather the relevant people (individuals and groups) and basic information (e.g. types of fishing) for a seagrass project.

Month 2-3: Draft project planning. Gather maps of the area showing the status and distribution/ extent of the seagrass, draft proposed intervention (protection/restoration) areas, identify stakeholders.

Month 4-6: Stakeholder consultation. Ensure all relevant stakeholders (individuals and groups whose activities overlap, directly or indirectly, with seagrass meadows). These may include fishers, recreational users or other types of boats. Several rounds of consultations may be required.

Month 7: Finalise project design. This will be informed by the stakeholder consultation.

Month 8-24: Certification. Formalise project design into a Project Design Document (PDD) under a carbon standard and submit. This may require additional data gathering and consultation with experts. Do not underestimate the time and resources required to complete this. Make full use of advice from the carbon standard and work closely with them to develop the PDD.

8. Conclusion

Conserving seagrass is vital to maintaining healthy coastal ecosystems, including maintaining productive fisheries. As a 'Blue Carbon' habitat, it is an important carbon store and maintaining healthy seagrass meadows will contribute to further carbon sequestration and prevent potential release of carbon dioxide into the atmosphere. As many local communities rely on seagrass meadows to make a living and as a source of food, they are well suited to management under a community-based conservation model that will allow local people to benefit from their sustainable management. This conservation may be based on a Payments for Ecosystem Services model, allowing for results-based financial benefits to local communities for sustainable management of seagrass meadows, which may be based on carbon sequestration or other ecosystem services including fisheries enhancement or coastal protection. The frameworks that provide for this model are in their early stages however, and there are many uncertainties in the science of seagrass ecosystem services that may lead to challenges in such a project. Despite this, PES provides a useful framework for seagrass conservation and community benefit that may become increasingly important as technical and regulatory issues are resolved.

Support for communities interested in seagrass conservation

The UK-based NGO ACES (The Association for Coastal Ecosystem Services), who support community-based coastal conservation, welcome interest from community groups interested in conserving seagrass meadows.

If you would like more information or to discuss this, please see the ACES contact details below along with those of our partners.

UN environment programme

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United Nations Avenue, Gigiri
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