



MANGROVE RESTORATION

Impacts after 10 years of the largest mangrove restoration project of the Livelihoods Carbon Fund in Senegal with Océanium

SUMMARY REPORT



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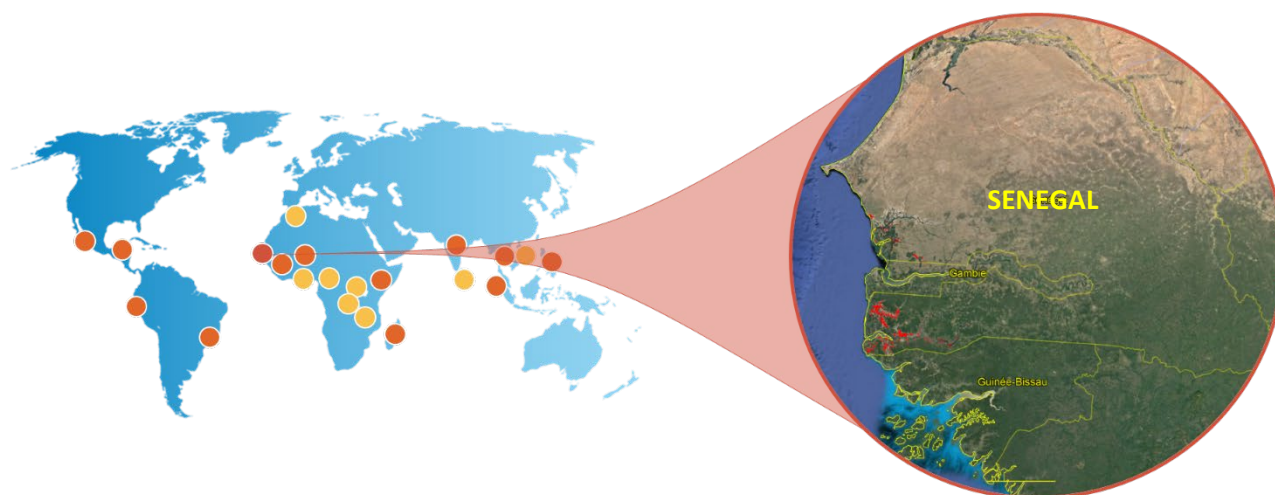
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I. INTRODUCTION

1. CONTEXT OF THE PROJECT

Senegal has 185,000 hectares of mangrove estuaries in the regions of Casamance and Sine Saloum, but they are disappearing at an alarming pace. A quarter of the total surface area, 45,000 hectares of mangroves, has already been lost since the 70's due to droughts and freshwater reduction caused by upstream agricultural practices. Mangrove deforestation, firewood collection, rice cultivation, saltworks and road infrastructure blocking the flow between fresh and saltwater had also caused severe loss of mangrove ecosystems, leading, in turn, a decline in fish stocks.



The **mangrove restoration** project in Senegal, coordinated by the Livelihoods Carbon Fund (LCF) since 2011, aims at restoring an ecosystem that protects arable land from salinization and produces fish resources (fish, shellfish, crustaceans) and wood. The project has been implemented by the Senegalese NGO OCEANIUM that has been working for environment preservation and the restoration of Mangroves since 1984.

With the support of the **Livelihoods Carbon Fund**, the mangrove restoration project in Casamance and Sine Saloum estuaries of Senegal has helped 450 local villages replant 10,415 out of the existing 185,000 hectares of mangrove, between 2009 and 2012. During this period, the planting programme of native *Rhizophora* species has been carried out among the 45,000 hectares of mangroves which had been lost since the 1970s. The planting project involved 2,600 plots and a large participation of more than 200,000 people. This mobilization has been successful thanks to a strong communication programme and a management approach deployed by OCEANIUM NGO, including awareness campaigns, trainings and communication on the benefits of the project.

The project was validated by the **United Nations Framework Convention on Climate Change** (UNFCCC) Board. The PDD (Project Detailed Document) made by Carbon Decisions in December 2010 was audited by Ernst & Young and the DOE in May 2011. The approval of the Senegalese authorities (LoA) was obtained in March 2011 and was subject to a tripartite Memorandum of Understanding of 10 years between Livelihoods, OCEANIUM, and the Senegalese government (Ministry of Environment).

As from 2016, the Livelihoods Carbon Fund has requested support from IUCN (International Union for

Nature Conservation) and Ramsar¹ for their methodology approach. Since October 2016, beyond carbon sequestration monitoring, the project has been seeking to measure and monitor the project's impacts on local communities. It is within this framework that between March and June 2017, the Livelihoods Carbon Fund launched a call for an impact study among Ramsar's expert network.



In 2017, Livelihoods reviewed the available long-term impact measurement methodologies to assess the 10-year results of the project. Out of a dozen approaches, it was decided to use one methodology focussed on communities, the "**Sustainable Livelihoods approach**", developed in the late 1990s by the British Department for International Development² (DFID) and adapted by various research and development institutions. **Tour du Valat** - a research institute for the conservation of Mediterranean wetlands, was appointed for the study. Its proposal was validated end of August 2017 by the Livelihoods Carbon Fund and local project implementer, OCEANIUM.

2. THE SUSTAINABLE LIVELIHOODS APPROACH

As agreed in the methodology prepared in August 2017 and approved by the Livelihoods Carbon Fund in December 2017, the assessment of the human impact of mangrove restoration was conducted by adapting the Livelihoods Methodology to the human and territorial context of the study area, Casamance. Unlike previous territorial and human diagnostic and analysis methods (sectoral approach, systemic approach, territorial approach) the Sustainable Livelihoods approach is a **social approach** resolutely focused on

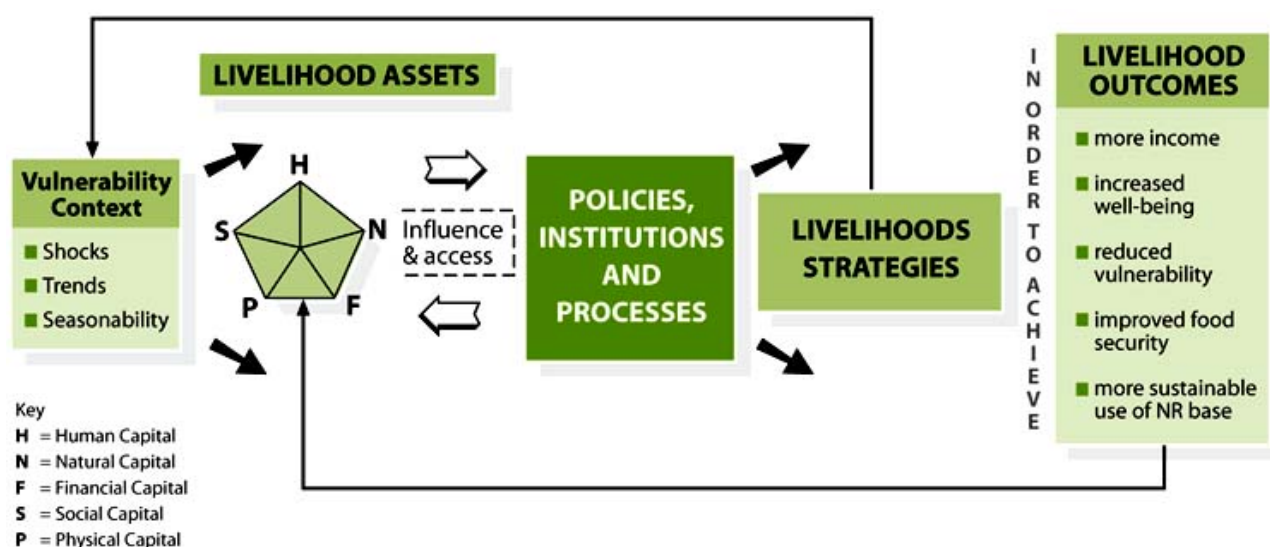
¹ The Convention on Wetlands, called the Ramsar Convention, is the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources: <https://www.ramsar.org/about/the-ramsar-convention-and-its-mission>

² The Department For International Development: <https://www.gov.uk/government/organisations/departement-for-international-development/about>

impacts. It was originally designed and implemented, starting from 2001, to measure the impacts of projects on poverty levels, at the launch of the Millennium Development Goals³ (MDGs).

Main characteristics of the Livelihoods method:

- Social and qualitative approach
- Asset-based (multiple capital)
- Impact oriented
- Vulnerability aspects (shock, psychological state, etc.)
- Macro-micro, institutional and policy linkages
- Adapts to different geographical scales and socio-economic contexts



The Sustainable Livelihoods method combines an integrated approach to understand the social dynamics, including in decision-making, planning, strategic choices, action implementation, monitoring and evaluation. It is neutral in the sense that it does not focus on a specific agenda and favour open questions. It describes the collective and individual dynamics by considering human factors (or internal forces) through 5 levels of capital, external forces (political, institutional, security, market forces, natural events including climate change) and vulnerability factors (anthropogenic and natural).

The Sustainable Livelihoods approach is adapted to individual, household, community, region or country levels. The framework of analysis focuses on the observation that individuals' decisions for growth affect their private environment (household) but also community with which they share a common environment for economic, social, ethnic, religious, environmental and other reasons. The methodology also includes a specific evaluation form on ecosystem services through their contribution to each aspect of the livelihoods of the interviewed households and communities: Human capital (e.g. knowledge), Natural capital (e.g. natural resources), Financial capital (e.g. sources of monetary revenue), Social Capital (e.g. community

³ The Millennium Development Goals were eight international development goals for the year 2015 that had been established following the Millennium Summit of the United Nations in 2000. Each goal had measurable targets and clear deadlines for improving the lives of the world's poorest people: https://www.undp.org/content/undp/en/home/sdgoverview/mdg_goals.html

support) and Physical capital (e.g. tools and infrastructure)⁴.

II. EXECUTIVE SUMMARY

Mangroves have brought at least one positive impact to 95% of villagers

The study conducted by the Tour du Valat revealed an important result: the Livelihoods-Senegal project is still very much in people's minds and is one of the collective actions of which the villagers are the proudest of, to this day. More than 85% of villagers consider that planted mangroves have good growth. During decision making discussions, many residents indicated that they had participated in this project to provide a better environment for their children and grandchildren. Some even think that without the reforestation, they would have left the land of their ancestors. They establish a direct link between the restoration of mangroves and improvements in their living conditions. Thus, 95% of villagers believe that mangroves have had at least one positive impact on their lives, and each household benefited 8 types of impact in average.

The improvement of biodiversity and the increase in the number of fishes and oysters are the economic benefits that top the list of villagers. This increase is directly related to the restoration of the mangrove ecosystem that supports the reproduction, feeding and protection of fish and shrimp. The roots of mangroves favour the attraction of oysters, which in turn find excellent conditions for their development.

Social and human benefits of mangrove restauration are impressive as all communities and households mentioned positive impacts on social mobilization, awareness, collective dynamic, confidence building, experience, technical knowledge and proudness.

Main economic benefits and advantages perceived by local communities

In 70% of the villages, fishermen now have more substantial catches, allowing them to sell their catches in the surrounding villages as far as Cap Skiring. This increase in fishery resources also benefits multi-family households, resulting in improved food security and increased income. Women can once again catch fishes and collect oysters in nearby mangroves for their own consumption or for sale in villages or along the roads. In addition, greater availability of fish in all seasons has led to lower prices on village market, making it more accessible to the most vulnerable families. La Tour du Valat Institute estimates that the restoration of mangroves has led to an increase in fish stocks of more than 4,200 tons per year. Other benefits associated with mangrove restauration came from the increase of number of shrimps, crabs, shells, mangrove salad, honey and fodder.

⁴ See Appendix

Positive impact of mangrove restoration on rice fields

The study also highlighted a related benefit of the Livelihoods-Senegal project on rice field restoration. Planted mangroves now act as a protective barrier against saltwater and waves. Gradually, the rice fields along the coast are emptying all the salt that used to suffocate them. Farmers are harvesting again on plots that they had been forced to abandon because of salinization. Further inland, other farmers are seeing their yields increase as the land recovers its access or accessibility to the sea. The study estimated that 15% of previously abandoned rice fields could be restored and that rice fields further offshore could increase their yields by 10% and more. Although the complete restoration of the rice fields alone is a major project, complementary to the restoration of mangroves, inhabitants believe that the growth and maintenance of good quality mangroves will continue to improve rice growing conditions.

More than 70% of the villages have set up mangroves monitoring

In addition to the direct impact of mangrove restoration on food security, villagers' incomes and climate change, the study conducted by the Tour du Valat highlighted other impacts ranging from strengthening community cohesion to the availability of timber or fuelwood, as well as the beauty of the landscape. What emerges from the surveys is the strong ownership of this project by the villagers. For 93% of the villages surveyed, the reforestation technique proposed by the NGO Océanium, simple and reproducible by all, is the first lesson they retain from the project. 25% of the 450 villages mobilized in the Livelihoods-Senegal project continued mangrove restoration campaigns on their own initiative. And more than 70% of the villages have set up monitoring of their mangroves with rounds to protect their forests from illegal logging and some from fishing in newly planted mangrove. The impact study conducted by Tour du Valat confirmed a key factor for the success of this project: it enabled the villagers to be the key actors in the preservation and sustainable use of their natural resources.

III. MAIN RESULTS

Here are the main results and key figures on the impacts of the Livelihoods-Mangroves restoration programme in Senegal, ten years after the project launch in 2009.

KEY RESULTS	MEASURING UNIT
A strong participation of the populations in the mangrove restoration activities.	80 to 100% of households involved in 91% of the villages: 42% young people, 35% of women and 23% of men.
Positive results on mangrove recovery rates.	The recovery rate of propagules is rated between "good" and "very good" for 89% of villages: 91% of villages and 85% of households have reported a positive mangrove growth between 2009 and 2018.
A very good collective representation of the mangrove swamp.	The mangrove restoration programme is perceived as: the second matter of pride for local communities, among a total of 50 reported matters of proudness: It is also the

	first community action of which the village communities are the proudest of, among the 14 collective actions mentioned.
Mangrove, the most popular village ecosystem among the 5 large ecosystems of village territories.	<p>Mangrove is the most important ecosystem for villages with the following statements:</p> <ul style="list-style-type: none"> • accumulation of benefits and advantages, • priority intention of protection • effectiveness in countering the effects of climate change.
Overall score of the socio-economic and human impact.	4.5/5 - Very good (based on a score system between impact potential and estimated impact).
Number of identified types of impacts.	40 types of impacts identified: 10 in productive and economic capital, 7 in social capital, 2 in human capital, 2 in physical capital, 4 in improving natural capital, 7 in regulatory services, 6 in support services, 2 in cultural services.
Households benefiting from at least one impact of mangrove restoration.	49,763 households: 95% of the total number of households.
Average number of impacts per household.	8.2 impacts on average per household (1 to 17 depending on concerned households).
Most significant impact levels.	<p>Fish catches (70% households), oysters (55% households), shrimps (40% households) and shellfish (20% households)</p> <ul style="list-style-type: none"> • Social impacts: awareness, pride, social mobilization, solidarity. • Regulatory services: less erosion, salt, swell, wind effects, protecting rice fields, coasts, villages and channels (bolongs).
Households that have improved their food diet through mangrove restoration.	49,763 households: 95% of the total number of households.
Households that have been able to improve their financial income thanks to mangrove restoration.	22,524 households: 43%
Impact on household vulnerability.	80% of the 30% poorest households have reported they have managed to reduce their food vulnerability, and 15 to 20% of them managed to reduce their financial and production vulnerabilities.

Specific benefits for women and young populations.	17% of women: increase in oyster production and income related to mangrove restoration 65% of young people: income increase during mangrove restoration activities (for 45% of villages), and fishing activities (for 52% of villages).
Impact value evaluated in 2018 on fish, oysters and shrimp production.	5.68 million euros: estimated value based on individual surveys, % of fishermen and production prices.
Impact value for additional rice production for the 2018 season.	64,000 euros. This is the 2018 value based on: <ol style="list-style-type: none"> 1. the estimated production acquired on rehabilitated rice fields after restoration; 2. the estimated yield increase on intermediate coastal rice fields affected by salt; 3. the producer price of paddy in December 2018.

IV. SOCIAL PERCEPTION ON RESTORATION RESULTS

Mangrove growth level in 2018

In 2018, growth levels of planted mangroves were rated as “good” by 51 villages (91%) and 576 households surveyed (85%), which is an excellent result. If the study could not accurately assess the reality on the ground, similar perception results between community and individual surveys validate this result in theory, especially since communities are in the best position to assess the quality of their ecosystems. This result is also explained by OCEANIUM's monitoring and reforestation policy between 2009 and 2012, which made it possible to take over some parcels that had suffered from lower recovery rates.

Mangrove plantation is a strong matter of pride in the local villages

Among the various elements of pride reported by the village communities and surveyed households, mangrove restoration comes second (27% of villages) along with rice cultivation activities and is ranked just behind community fruit and vegetable gardening activities. Mangrove plantations are considered as a central element of pride and are never mentioned as a source of problem among villages.

If we refer to the elements of pride linked to community actions, mangrove reforestation comes first by far with 34% of the total responses (19 villages). Collective preparation of rice fields is ranked second with 13% along with building an anti-salt dike (13%). In total, 60% of the responses are related to the protection of rice ecosystems. Among the reasons spontaneously mentioned, 75% are related to the benefits of mangrove planting, in particular as a brake on salinity in rice fields, for the return of fish and oysters, for

the income increase through planting allowances that have made it possible to pay for children's school fees, as well as for the rehabilitation of the mangrove ecosystem.

In total, 44 villages out of 56 (79%) reported mangrove restoration in the first three community actions of which they felt the proudest. Other villages that did not mention mangroves are those that are located far from the mangroves and/or for those whose sources of income are linked to plateau production, services and shops in some areas of Bignona Coulaban, Niamone, Mlomp, Oukout and Enampore.

V. MAIN IMPACTS

More positive impacts in a fragile local context

This post-evaluation, six years after the end of the last plantations in 2012, is considered relatively early in the maturity level of the restored mangroves, with populations indicating that all the benefits increase after about 10 years, both in terms of fish resources, regulation and support services. It is therefore very likely that, if these mangroves are well managed, the impacts will increase until 2022 before they level off.

However, poverty levels and poor public infrastructure and services, high unemployment and under-occupation maintain a high rate of often ill-prepared migration, which raises the issue of labour force and succession for the future management of these territories. The decline in rainfall recorded over the past 100 years and the gradual rise in sea level remain major challenges for coastal rice cultivation currently protected by mangroves. These issues are in addition to the lack of interest/absenteeism of a good proportion of rice field owners and the low level of mechanization to compensate for the labour force that has become scarce due to the emigration of young people.

Exceptional socio-economic and human impacts

Overall, the socio-economic and human impact is impressive. Indeed, it is rare, within the framework of a conservation-development programme, to obtain such impacts (scope of diversity) and to increase them six years after it ends. The success factors for this are many, including:

- A strong local commitment of OCEANIUM NGO, combining awareness, organization, monitoring and technical support;
- A state of mangrove degradation whose population was suffering in economic and social terms, hence a real interest in a suitable solution at the launch of the programme;
- A key historical ecosystem in the food strategy of resident rural populations, especially those who do not have other productive ecosystems (forest plateaus in the north-eastern part of Casamance).

40 categories of generated impacts

The impacts are very diversified since we were able to identify 40 impacts, including 10 in productive and economic capital, 7 in social capital, 2 in human capital, 2 in physical capital, 4 in improving natural capital, 7 in regulatory services, 6 in support services, 2 in cultural services.

Apart from the return of the granivorous passerines, if all the impacts have been appreciated, the results show that it is the benefits of fish and oysters, the regulation of salt and the advance of the sea that improve rice fields, social mobilization and pride in this collective project, awareness and knowledge that

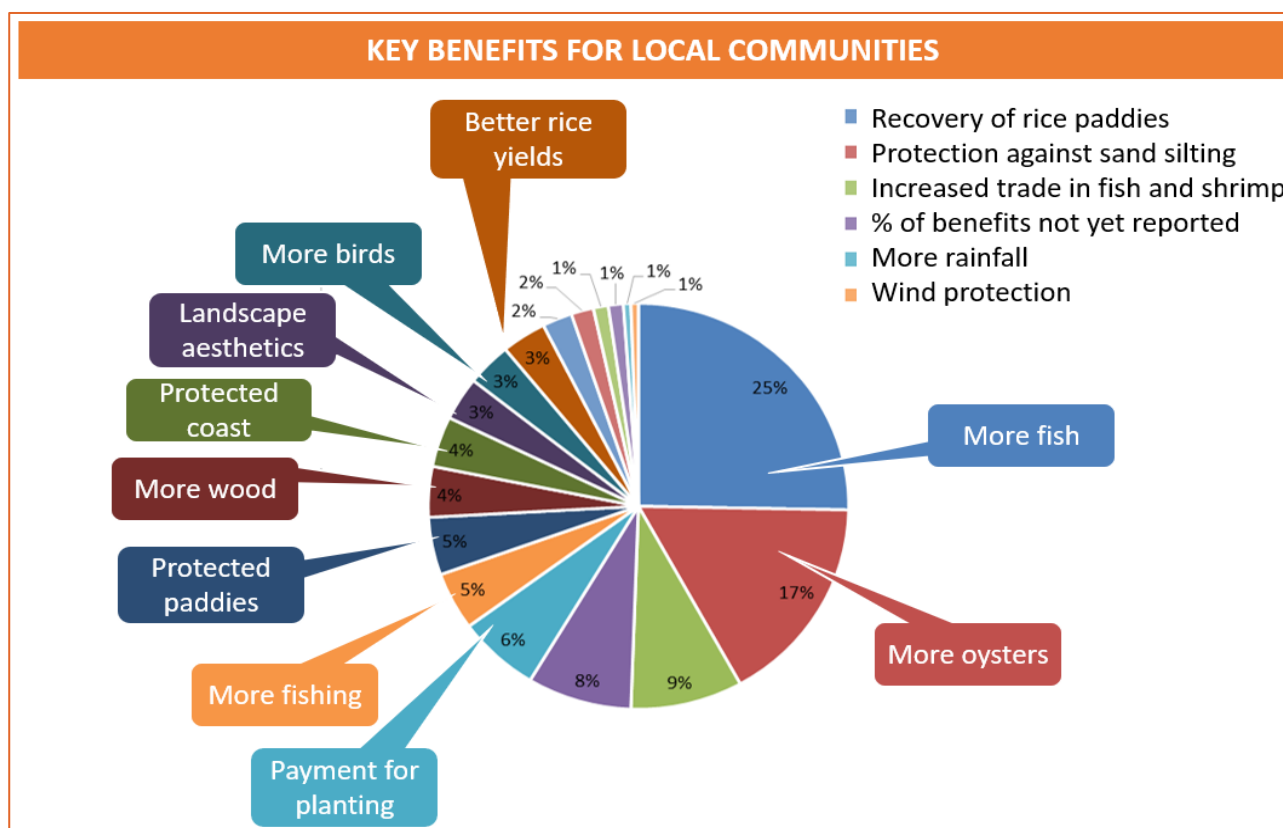
hold the lead. Locally, it is also the regulation against silting, coastal erosion and wind as well as the return of shrimps that have had a positive impact on household life. Over the past two years, the recovery of abandoned former rice fields on the edge of mangroves, the gradual return to normal rice yields and the attractiveness of canoes for commercial fishing are trends that are largely driven by the effects of mangrove restoration.

The impacts have positively affected the 5 levels of household capital (financial, social, human, physical and natural) and improved the benefits and advantages of mangrove/bolong ecosystem services on the four main service categories: supply, regulation, culture and support (see Appendix 1). The only disadvantage related to mangrove restoration comes from the increase in granivorous passerines that cause damage during cereal harvesting periods, and that find shelter in mangroves.

If the impact score is estimated by considering all capital and services and assigning them a maximum potential value of "5", the result is a score of 3.5, i.e. a high and adequate level (see Appendix 1). Human and social capital have the highest scores, with 4.5.

If we only consider the impacts in terms of direct benefits by the categories of households specifically concerned by mangroves when this ecosystem is part of their main livelihood, we obtain a score of 4.5/5. This result is considered very high, due to the relevance of the project and its efficiency (simple technique, participatory, without individual material investment and with a relatively short effect on natural resources and rural economies).

Main impacts linked to fish, oysters, economic and production impacts



Among the 18 elements of cumulative productive and economic impacts identified (graph here above), the return of fish and oysters has enabled more substantial catches in more than 52-60% of villages.

The return of fish products has benefited the 2 - 5% of fishermen and commercial collectors but especially the multifaceted families close to mangroves (50-60% of families in all 56 villages) who had lost these local resources due to the degradation of mangroves.

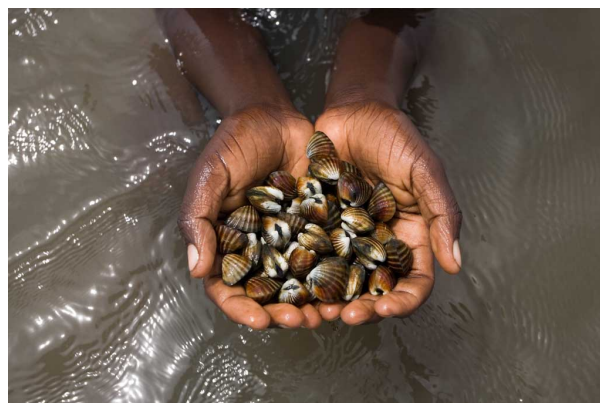
These families, and women in particular, were able to collect more oysters, and some caught small fish. Children and students were able to hook or hawk small fish during their free time, for family needs, for sale in villages or by the roadside or simply for their leisure.

These additional resources contribute to improving food security for most of these households and allow the sale of the surplus at the village level, in neighbouring markets and in Cape Skiring. Indirectly, this improved availability of fish at all seasons at the village level has led to lower fish prices on village stalls, benefiting in particular poor and vulnerable families or those unable to fish (age, sick, disabled, widows, etc.) to be able to buy fish more regularly.

The qualitative responses show that the increase in catches is linked to the increase in fish resources from the fifth year of restoration and oysters after 7-8 years of restoration programme. The increase in resources is directly linked to the ecological improvement of the ecosystem, its functions and reproduction conditions, feeding, protection and development of mangrove roots on the edge of the bolong, which promote the increase of oysters. In some villages, the positive impact of fish has been favoured by the reduction in the silting of bolongs following the restoration of mangroves, which has made it possible for boats to ride again.

The benefits of the return of shrimp are of particular interest to motorboat owners in the 15 villages located around the mangroves and bolongs (about 1 to 2% of families in all villages are concerned).

A quick calculation helps us estimate the absolute value of the overall impact on the 300 villages of €5.68 million for aquatic resources (fish, oysters and shrimp) in 2018.



Impacts on coastal rice cultivation

The decrease in salt, combined with the protection of coasts and rice fields, had gradually led to desalinating the rice fields affected by sea level rise. From the 6th to 7th year after restoration, some have

seen yield gains on intermediate rice fields impacted by salt before 2009, while others have started to recover abandoned rice fields facing the mangroves. It was only in 2018 that some abandoned rice fields could be cultivated again. The benefits will therefore in principle be greater in subsequent years if the mangroves are well managed.

Out of the 20,940 ha of rice fields in the programme area, 1, 570 ha of rice fields were reportedly temporarily abandoned, and 3,665 ha suffered a loss of yield. In terms of the number of tonnes of paddy lost, considering an average yield of one tonne per year, this would make a total of 2, 300 tonnes of paddy lost per year, equivalent to 276, 000 euros in 2017. In 2018, it is estimated that following mangrove restoration, about 15% of the abandoned rice fields are restored and the intermediate rice fields have recovered an additional 10% yield, resulting in a total additional production of 532 tonnes of paddy, equivalent to €64,000. Between the loss value of €276,000 and the current impact of recovering €64,000, there is therefore still room for improvement that could be partially filled in relation to the future development of mangroves.

However, in most cases, a salt-proof dike in good condition is very often mentioned as an additional means to this objective.

Other benefits

Village communities also reported, to a lesser extent, benefits and advantages in terms of income increase during restoration (financial capital), landscape aesthetics (social capital), wind protection (financial capital through avoided costs of replacing straw huts) and availability of wood for fencing, construction, fuelwood and sometimes for sale (financial and human capital through reduced costs and time).

Main memories linked to this activity

Out of the 97 memories linked to the mangrove restoration programme mentioned by village communities, 76 are positive, meaning 78%. They mentioned a certain amount of enthusiasm, joy, solidarity and a great quantity of photos taken. Qualitative responses indicate that these memories, full of emotion and pride, are embedded in the three generations of people who participated in the planting activities. The main bad memories are linked to injuries, the difficulty of transporting propagule bags in the mud, the proximity of dangerous animals like crocodiles or monitor lizards.

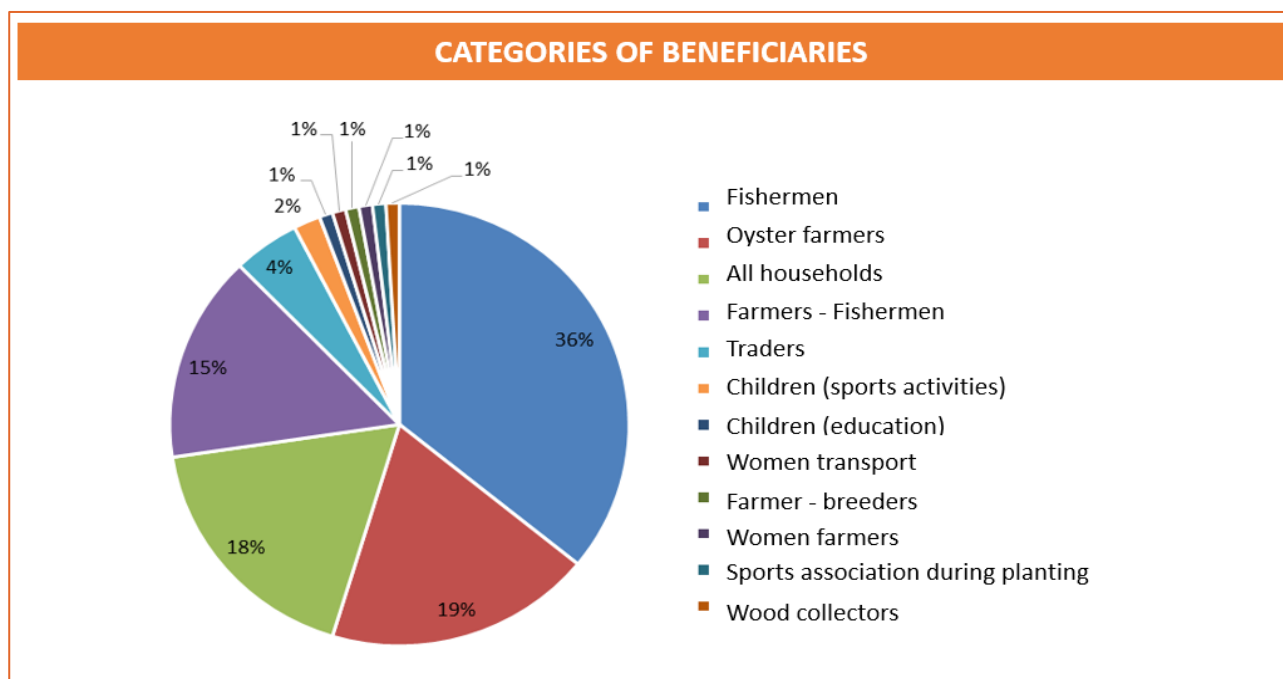


VI. FOCUS ON THE BENEFICIARIES

The study has identified 18 categories of Livelihood groups in the villages, including their proportion in number and their main economic and productive activities. This information was mandatory for targeted estimation of impacts of the mangrove restauration by group, and to assess their relative importance within their households development strategy and economic pattern.

Almost all village households participating in the programme were positively impacted.

Depending on the type of impact, mangrove restoration has impacted between 5% and 70% of the households involved in this programme. In other words, 95% of households (49,763 households) benefited from at least one impact linked to mangrove restoration. The average number of impacts per household is around 8.2.



Those who benefited most in number and diversity from services were groups of rice fishermen, commercial fishermen, small farmers and oyster collectors and those involved in oyster, wood and salt in main occupations (12,567 households), mainly located in low areas west of Casamance and in the west of the intermediate area.

Increase in oyster resources and income during planting activities are the two main benefits that are specific to women. Gender analysis of beneficiaries based on the results of community and household surveys in the 56 villages surveyed shows specific benefits for women.

While 41% indicate that they did not specifically benefit from mangrove restoration, 17% of them particularly appreciated the increase in oyster resources near their homes in 30 villages (54% of villages), 17% the income they received during restoration in 19 villages (34%), which made it possible to finance children's schooling and sports activities but also family's food, 10% the availability of wood for firewood and especially to make fences in their market gardens in the off-season to limit potential damage caused by

livestock (11 villages, 20%) and for 10% occasional local fishing (9 villages, 16%).

Small local fish and income during restoration community work: two most appreciated benefits perceived by the young population

About 65% of the young people say they have specifically benefited from this programme, specifically in terms of remuneration perceived during the restoration activities (27% of the young people, 45% of the villages), then by fishing for small local fish for family needs, leisure or pocket money (30% of the young people, in 52% of the villages). Other impacts are more localized in a few villages. Thus, the benefits of the mangrove operation mainly concern human and financial capital for the youngest populations.

VII. BENEFITS LINKED TO LOCAL LIVING CONDITIONS

Increased food security and income

While the impacts have affected about 95% of households in terms of food security, 43% of them have already been able to increase their income at this stage, particularly through fish, oyster, shrimp and wood, two-thirds of which on average and one-third on a small scale. This result is considered very satisfactory. For financial incomes, it was difficult to imagine a better picture because of two realities: 1) about half of the villages are more focused on the economy of the plateau ecosystem than on the mangrove/coastal rice economy; 2) the food insufficiency affecting about 30% of households means that initially, the objective of increased production or fishing is to feed the family and not to provide income.

A programme that addresses the vulnerability factors of populations

Among the five first levels of vulnerability faced by populations (especially poor and vulnerable) are lack of financial resources, sea level rise in rice fields and salt accumulation in rice fields.

Mangrove restoration mitigate the vulnerability due to sea level rise and indirectly food insecurity (rice and fish resources), income (fish, shrimp, oyster and wood) and drought (wind regulation and microclimate).

Effect of mangrove restoration on household vulnerability levels

Mangrove restoration is beginning to decrease the vulnerability levels of households affected by sea level rise and salinity in rice fields, food and economic insecurity, erosion and wind. However, due to the immaturity of the still young mangroves, the effects are expected to be more significant in the future.

A project that helps decrease poverty levels

Among the many causes of poverty or wealth reported by households, drought, health, declining agricultural production, the rise of the sea and salinity in rice fields are the main causes. Mangrove restoration therefore has a direct impact on the causes of poverty and those of about 20-25% of households. Those causes that can be mitigated by mangrove restoration impact positively on rice production and yields, food security and incomes with fish, oyster, shrimp and wood.

At this stage, there are mainly impacts in terms of food security for poor households, thanks to access to more fishes, oysters, shrimps and wood.



VIII. LESSONS LEARNED

Lessons learned and perspectives on mangrove restoration

The main lesson learned from this experience by the communities (93% of the villages) was the reforestation technique proposed by OCEANIUM, which was recognized for its effectiveness. The participants also associate this propagule planting technique with the organization and awareness that went with it. The second lesson was the recognized importance of mangrove planting in view of the multiple benefits observed a few years later. These results are considered to generate a strong human development impact, through the achievement and adoption of a simple and effective technique within reach of the villagers and through the fact that this activity on a key ecosystem of the territories may have been the engine of solidarity.

Decisions made and what has changed for the villagers

In terms of community surveys, three elements stand out a few years after the mangrove restoration: the return of fish (50% of villages), the community decision to control excessive logging (46% of villages) and the improvement of landscape aesthetics (38% of villages). In other words, about half of the communities

have realized the importance of protecting their mangrove capital and have seen the return of fish (supply service) and more than a third have seen the improvement of landscape aesthetics (cultural service), especially villages located along mangroves that had faced desertification of these key natural ecosystems before 2009.

The high rate of protection decisions is an undeniable impact towards the sustainable management of mangroves. Nevertheless, there is still room for improvement in the implementation of decisions.

At household level, almost all (96% of households) reported the return of fishes. The majority also noted the better regulation of salt in rice fields (84%), the return of oysters (79%), shrimps (55%) and shellfishes (44%). They appreciated the lower rate of land erosion (40% of households) while some (25% of households) reported the higher availability of wood and fodder in the dry season for ruminants.

Measures taken by village communities to manage mangrove growth

Following the mangrove restoration programme, 40 out of the 56 villages report that they have taken measures to protect and manage mangroves, particularly against illegal and abusive cutting of mangrove wood and destructive fishing methods by young mangroves. This awareness during and after mangrove restoration is considered important and indicates a good social potential for the sustainability of this ecosystem. However, of these 40 villages, half acknowledge that decisions are relatively unimplemented and village decision-makers often rely on citizen awareness and volunteers to report abuses.

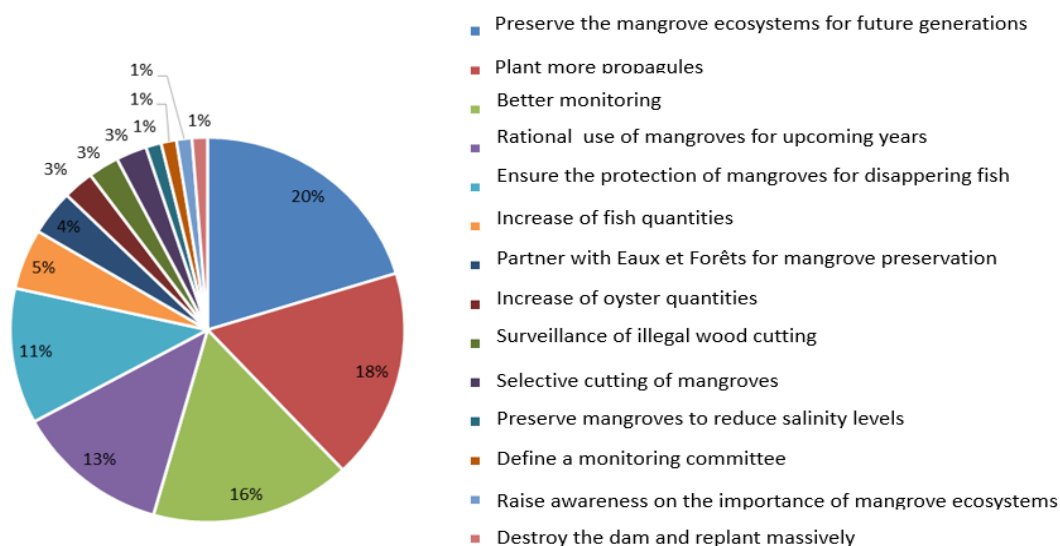
Since 2012, 14 communities have reported planting new mangroves in degraded areas, including 13 on their own initiative and 1 with the assistance of the Water and Forests Department, the public authority in charge of public forest management. This information provides tangible evidence of awareness for the sustainable management of this ecosystem.

IX. FUTURE PERSPECTIVES BY THE LOCAL POPULATION

Future perspectives aim at safeguarding and protecting the natural mangrove heritage, particularly against logging, in order to take advantage of fisheries resources and to slow the advance of salt.

Among the 14 categories of visions shared among the villages communities, the first five with more than 10% of the responses refer to the safeguarding of natural heritage and wise use for future generations (23 villages), the need to continue planting (14 villages), better monitoring (13 villages) and ensuring protection for the increase in fish resources (13 villages).

PERSPECTIVES ON THE FUTURE OF MANGROVES BY THE LOCAL POPULATION



X. CONCLUSION

Without the mobilization of the villagers of Casamance and Siné Saloum and the incredible social engineering of Océanium, the 80 million mangroves of the project would not stand today as a rampart against climate change and at the same time as a nourishing ecosystem for the inhabitants. Carbon finance has enabled vulnerable communities to restore their mangroves through the commitment of private companies that have committed to investing in sustainable projects.

In return of their investment in the Livelihoods-Senegal project, the companies that are supporting the Livelihoods Carbon Fund⁵ receive carbon credits with high social and environmental value to offset their CO₂ emissions. Investors in the Carbon Livelihoods Fund have provided Océanium with the necessary funding for replanting (population awareness, validation of scientific models, intervention logistics, etc.) and are going to continue to finance its monitoring and evaluation until 2029, for a total duration of 20 years.

⁵ Danone, SAP, Hermès, Crédit Agricole, Michelin, Voyageurs du Monde, Groupe Caisse des Dépôts, La Poste, Firmenich, and Schneider Electric.



LEARN MORE ABOUT THE PROJECT:

<http://www.livelihoods.eu/projects/oceanium-senegal/>

APPENDIX 1

Impacts of the mangrove restoration programme

Comments:

- Scores varying between 5 (very strong), 4(strong), 3 (adequate), 2 (low) to 1 (very low)
- Scoring system: referring to a realistic level of impact estimated according to the resources potential, levels of interest and communities' needs.

Levels of impact	Levels of impact within the households	Categories of households concerned	Number or % of beneficiary households estimated
Impact on the production and economic capital (ecosystem supply services)	Score: 3.6		
Food security	Global score: 4,5/5	Vulnerable and poor groups in particular, but also their means.	95% of all households, including: 30% of households: strong impact 65% of households: low impact
Economic income	Global score: 4/5	Wealthy and middle income groups in particular, some of the poor households.	43% of all households, including: 57% of households: no impact 28% of households: medium impact 16% of households: low impact
Fish	Global score: 4,5/5	All households located close to the mangroves.	70% of all households, including: 18% of households: strong 22% of households: medium 30% of households: low 30% of households: no impact
Oysters	Global score: 4,5/5	Poor and medium categories and women in particular.	55%
Shrimps	Global score: 3/5	Wealthy and medium categories.	40% of all households, including: 6% of households: strong impact 12% of households: medium impact 22% of households: low impact 60% of households: no impact
Shellfish and crabs	Global score: 2/5	Poor and medium categories.	20% of all households, including: 100% of households: low impact
Mangrove salad	Global score: 4/5	All households located close to the mangroves.	60% of all households, including: 100% of households: low impact
Wood	No score because wood cutting is technically forbidden.	Mainly vulnerable categories and part of the poorest.	23% of all households, including: 6% of households: strong impact 5% of households: medium impact 12% of households: low impact 74% of households: no impact
Honey	Global score: 2/5		11%

Fodder	Global score: 4/5	Mainly poor and medium categories.	7.3% of all households including: 0.3% of households: medium impact 7% of households: low impact 89% of households: no impact
Pottery mud/vase	Global score: 5/5	Mainly poor and medium categories.	17% of all households including: 2% of households: medium impact 15% of households: low impact 83% of households: no impact
Rice production	Global score: 2/5	Mainly those with waterfront rice fields.	15% of all households including: 100% of households: low impact
Impact on social capital	4.5/5		
Social mobilization	5/5	All	100%
Pride	5/5	All	100%
Raise of awareness	5/5	All	100%
Collective project	4/5	All	100%
Common rules & penalties	3/5	All	100%
Trust relationship	4/5	All	100%
Memories	5/5	Those who have been part of the programme.	90%
Impact on human capital	4.5/5		
Experience	4/5	Tous	100%
Technical	5/5	Tous	100%
Impact on physical capital	2.5/5		
Rehabilitation of rice fields	3/5	Just started	15%
Fish farming projects	2/5	Still rare	3%
Impact on natural capital	3.8		
Restoration of mangrove ecosystems.	5/5	All	95%
Biodiversity restored.	4/5	All	95%
Improvement of mangroves' soil quality and texture.	4/5	All	95%
Micro-climate	2/5	Few households mention it.	10%
Regulatory services	3.3/5		
Sea progress	4/5	All, in particular those with coastal rice paddles.	70%
Salt	4/5	All, in particular those with coastal rice paddles.	70%
Coastal erosion	4/5	All, in particular those with coastal rice paddles.	70%
Swell/waves	4/5	All, in particular those	70%

		with coastal rice paddles.	
Water filtration	1/5	Few mention it.	15%
Sand silting	3/5	All in the sensitive areas.	20%
Wind	3/5	All in the sensitive areas.	25%
Support services	2.8/5		
Restoration of fishery resources.	4/5	All, in particular fishermen.	25%
Feeding fisheries resources.	4/5	Fishermen and oyster collectors.	25%
Biodiversity protection.	3/5	All	15%
More oysters thanks to mangrove roots.	3/5	Women oyster gatherers.	10%
Support for the preservation of wild bees.	1/5	Honey collectors.	3%
Granivorous birds are back.	2/5	Rice farmers.	30%
Cultural services	3/5		
Landscape aesthetics	4/5		60%
Relation of man to nature	2/5		15%