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RESEARCH ARTICLE

INSULARITY, ENVIRONMENTAL VULNERABILITIES AND ADAPTATION STRATEGIES IN THE BLISS KASSA ISLANDS IN CASAMANCE (SENEGAL)

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Abstract

The relationship between the environment and societies is a complex one in terms of the way in which human communities interact with the environment. This relationship is characteristic of the different uses made of the areas in which they live. A segmented approach is therefore needed to understand how these areas are changing, hence the choice in this research to focus on small island areas in the Ziguinchor region of southern Senegal. The article looks at three main challenges identified in this area, including waste production and management, sea encroachment and salinisation. A qualitative approach was adopted in order to gather people's perceptions and experiences of spatial change over time in relation to natural and anthropogenic dynamics, the consequences of these changes and related adaptation strategies. The results of the semi-structured interviews and focus groups show: firstly, a change in lifestyles and an excessive accumulation of plastic waste that popular recycling practices are unable to contain; secondly, a loss of freshwater resources with the accelerated salinisation of groundwater and surface water; thirdly, a decline in socio-economic living spaces with the advance of the sea, which also contributes to salinisation. The findings show that the people of Bliss Kassa are increasingly vulnerable, while the public systems in place to deal with these issues remain embryonic and largely outstripped by the pace of change.

Introduction:-

Climate change is partly the result of actions taken by mankind in a perpetual quest to satisfy the needs necessary for survival and comfort, both individually and collectively. In this quest, various manipulations of the environment are leading to an immanent weakening of ecosystems with the advent of the Anthropocene. There are many areas of research, all equally interesting for understanding the global evolution of the earth in terms of environmental vulnerability. This study therefore focuses on the forms of environmental vulnerability of small island areas in the South, particularly the islands of Bliss Kassa in Casamance in Senegal, including Diogué, Haer, Hitou and Niomoune. The aim is to analyse specifically the socio-environmental issues linked to access to fresh water, the

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advancing sea and waste management in terms of the vulnerabilities produced, in order to discuss the ways in which local communities are adapting and the measures put in place.

The article is divided into two parts: the first sets out the context of the study and the methodological approach used; the second analyses the socio-environmental issues relating to access to freshwater, the advancing sea and waste management respectively.

Background to the study: theoretical and methodological approach

Background to the study

Almost 10% of the world's population lives on islands, and 43 islands are classified as island states (Soulimant, 2011). There are many studies on the geography of insularity, but at the same time they reveal an "epistemological vagueness" (Taglioni, 2006) that surrounds these spaces, due to the ambiguities raised in their characterisation based on "the paradigmatic and metonymic figure of isolation" (Bernardie-Tahir, 2005). We do not enter into the logic of a typology of islands, but in this research we consider these territories not as isolates but rather as territorial discontinuities embedded in networks and spatial practices (Soulimant, 2011), (Taglioni, 2005), open but marked by constraints linked to the use of natural resources and the transformation of landscapes, in order to finally question their integration into territorialised public policy systems and the resilience of island populations in relation to environmental issues.

How does insularity, with all its geographical, historical and economic vulnerabilities, inform the changes underway in the physical and social environment of small island areas?

The relationship between insularity and climate change is widely discussed from two angles. The first focuses on exposure to natural hazards and the second on human manipulation and use (David, 2011), but both are complementary in the process of transformation and/or recomposition of island areas (Bouchard et al., 2011). Studies have shown that island areas are the first to be affected by the rise in sea level associated with exposure to cyclonic activity, flooding, salinity, etc., reflecting physical vulnerability (Goujon et al., 2021), (Bertrand & Richard, 2011), (Philippenko, 2023). Moreover, human activities - nature offers possibilities that man chooses to use or not (De la Blache, 1911) in the sense that land space is first and foremost a resource (mining, energy, fisheries, flowers, etc.) - significantly change the environment to the point of disrupting the natural functioning of a system in which the balance of one component depends on those of the others. As part of this system, humans are involved in individual and collective actions through their use and transformation of the elements of nature. These are designed to satisfy the natural needs necessary for survival, as simple as food, shelter and healthcare. However, the pressure on ecosystems caused by population growth, unbridled industrialisation and changing lifestyles is weakening the global system, with visible and disastrous consequences largely due to "the selfishness of the world's current and emerging industrial powers" (David, 2011). Sustainable development, which is at the heart of environmental preservation objectives, puts human beings in perspective as an integral part of nature in the same way as other elements, and their survival depends heavily on the preservation of these elements, both biotic and abiotic. Hence the importance of 'One Health', which combines human and environmental health (Schneider et al., 2019) in a set of symbiotic combinations. It is thus clear that all the world's territories are linked in terms of global natural and/or artificial dynamics (the greenhouse effect in its natural balance to maintain an adequate temperature at the earth's surface and the overproduction of radiative gases exacerbating global warming), and any imbalance in a given place would disrupt this system. The small island areas discussed in this research are evolving and becoming increasingly vulnerable due to their isolation, despite the fact that they are becoming less isolated as a result of the embryonic development of strategies to open up Africa, particularly Senegal. Indeed, with the trend towards economic efficiency fuelled by the development of means of communication and the expansion of the tourism sector, islands are now undergoing environmental, social and economic change (Dehoorne&Tafani, 2012), (Furt& Antoinette Maupertuis, 2013). For example, there is a strong relationship between tourism and environmental vulnerability, reflected in the accumulation of waste, the loss of biodiversity, etc. (Furt& Antoinette Maupertuis, 2013). In this sense, the islands have served as territories initiating environmental protection policies. However, because of their small size, their diversity and their degree of geographical isolation, a number of issues have yet to be explored, if only in relation to the differences in their capacity to adapt to climate change. It is clear that the issue of environmental vulnerability has been widely documented, but studies concerning islands are largely focused on the global evolution of climate change and sea level rise. Yet issues as simple as waste management and access to fresh water are major challenges to the survival of island populations. Consequently, given the specific nature of islands in relation to certain particular contexts, notably human poverty and the absence of public systems (sometimes

completely disconnected from the territorial logic of the mainland), a singular approach is needed to the challenges and issues raised in these areas, especially in Africa in small island areas such as those of Bliss Kassa in Casamance, Senegal.

This research focuses on waste management, access to drinking water and the advancing sea in Niomoune, Haer, Hitou and Djogué. These islands are located in Lower Casamance in southern Senegal. In this study, we first look at the forms of vulnerability and how they manifest themselves in these small island areas; and then we ask what adaptation strategies have been devised and/or spontaneously deployed in these areas?

Methodology:-

Small island areas are under-researched in Africa. However, they are undergoing a process of change, marked by an opening-up in the context of incipient tourism development, which is gradually driving a change in lifestyles and consumption patterns. The island environment is now subject to systemic change, while popular conservation practices are becoming increasingly outdated. New forms of environmental, social and economic vulnerability in waste management, freshwater supply and coastal erosion are raising questions about how space is used and how it is managed. These are the situations that this article attempts to clarify using a qualitative approach involving students[1] with surveys in the form of semi-structured interviews, a series of observations of the ECRIS type[2] (Enquête Collective Rapided'Identification des conflits et des groups Stratégiques - Rapid Collective Survey to Identify Conflicts and Strategic Groups) (Bierschenk& Olivier de Sardan, 1994) in four islands of Bliss Kassa (Niomoune, Haer, Hitou and Diogué). The people interviewed were local people and socio-economic and political players from the various islands, using thematic grids designed to gather perceptions and experiences of how the environment is used individually and/or collectively, how ecosystems change over time and the related consequences, as well as adaptation and resilience strategies in relation to access to fresh water, the problem of the advancing sea and waste management. Information was collected between 29, 30 and 31 March 2023. In Niomoune, four (4) interviews were conducted with the village chiefs of Elou, Oubac, Some and Essangoulo respectively, and eight (8) interviews with local people, including four (4) fathers, the manager of the water reservoir, two (2) young girls responsible for collecting fresh water for their families and two (2) mothers. In Hitou, a focus group of fifteen (15) people was held, as well as six (6) individual interviews with four (4) fathers, one (1) mother and one (1) young person. In Haer, eleven (11) individual interviews and one (1) focus group were carried out. In Diogué, eight (8) interviews were carried out, including two (2) neighbourhood delegates, the head of an environmental protection association, one (1) woman who processes fish products, one (1) mother, one (1) young person and two (2) fathers.The data was collected by recording, then transcribed and organised by theme. The data is then presented in verbatim form as faithfully as possible.

Study framework

The island areas we are talking about here are small areas that form part of a larger administrative unit on the scale of a country beset by environmental and social risks.

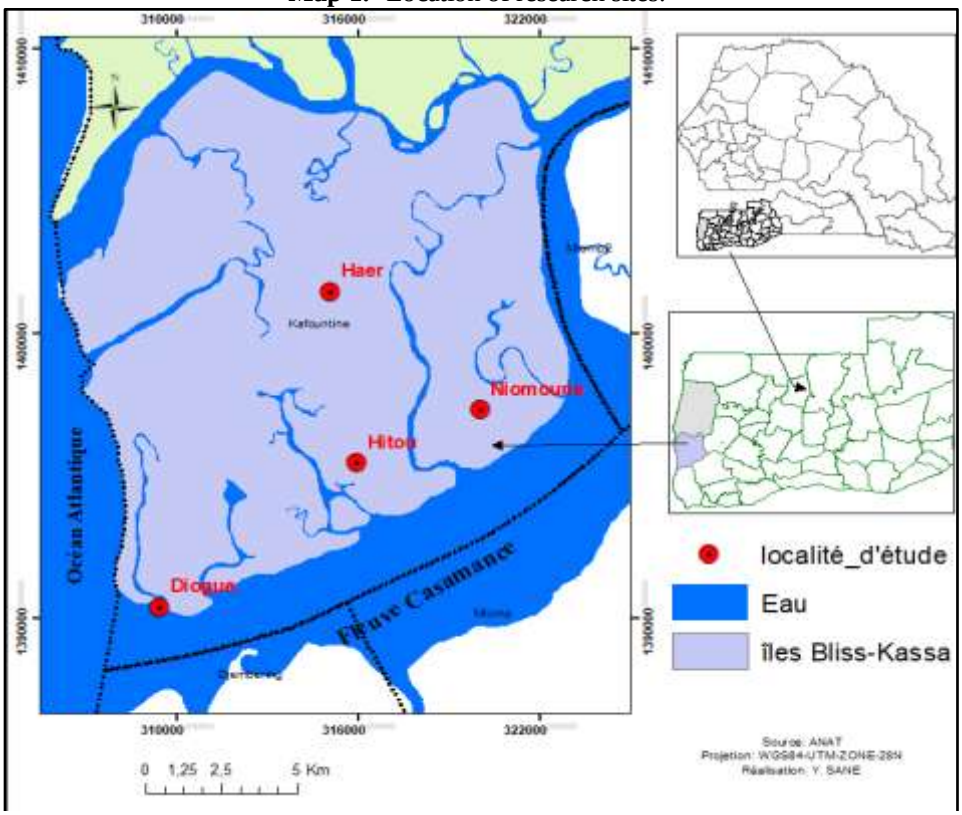
The island area of Bliss Kassa is located in the department of Bignona (Ziguinchor region) and is bordered to the west by the Atlantic Ocean and to the south, east and north by the meandering Casamance River. Bliss Kassa is characteristic of a particular landscape caught between the sea and the Casamance River to form the "bolong", an expanse of water at the crossroads of the sea and a watercourse - river - bordered by mangrove mangroves subject to the tide and accessible only by rowing boat or motorboat. The three main "bolong" are Ounambène, Ouniomouneye and Asséléghène (Diatta& Diouf, 2017). The Bliss Kassa islands have enormous natural potential, with ecosystems rich in biodiversity, vast expanses of mangroves and fishery resources (oysters and freshwater fish) that have ensured the survival of local populations through fishing and rice-growing. However, these areas are isolated and on the fringes of public planning policies, which are reflected in a lack of facilities and socio-economic infrastructure to improve living conditions and social well-being. At this level, for example, there is a lack of connection to the

[1] The Master 1 sociology students and some of their teachers went on a field trip to the Bliss Cassa islands from 28 March to 01 April 2023. The main aim was to provide practical teaching in the field.

[2] There are six main stages in the ECRIS process: an individual scoping survey (rapidly repairing the teamwork, the main local issues and the strategic groups); a preparation seminar (familiarisation with the subject, the method, an update on the documentation, proposals for provisional qualitative indicators, etc.); a collective survey; a review seminar; individual research at each site (additional individual fieldwork); a final seminar (prepared by reports from each site, comparative analysis, debate on the proposed hypotheses, etc.).

drinking water and electricity networks, and a lack of collection and storage facilities for land-based waste. In addition, economic activities such as fishing and rice-growing, which are the main means of subsistence for the local population, are also subject to the hazards of both natural dynamics and human activity. Fishing is traditional, and was once mainly for self-consumption. However, fishermen are now faced with a shortage of fish, due to over-exploitation in the face of increasing local needs and the commercialisation of fish products, whether processed or not. Rice cultivation is threatened by the effects of rising sea levels, which lead to salinisation of the land (Thior et al., 2022).

Map 1:- Location of research sites.



Source: ANAT, adapted by YancobaSané, IEFSG, 2024

The issue of environmental vulnerability is a very real one in this island area, but we have chosen to segment the vulnerabilities and focus specifically on waste, the lack of fresh water and the advancing sea.

Results and Discussion:-

This section presents the forms of vulnerability linked to the presence of waste, difficulties of access to fresh water and the advancing sea, as well as the adaptation strategies in the small island areas of Bliss Kassa. On these islands, the general observation is that waste is reused for agricultural purposes and/or to preserve livestock, build dykes against tides and salinisation and at the same time preserve the rare sources of fresh water. These are socio-technical responses to waste management on a local scale, given the rational accumulation of biodegradable and non-biodegradable waste. However, the increasing presence of plastic waste is calling into question age-old strategies for conserving living spaces, agricultural areas and biodiversity.

Waste management and adapting to vulnerabilities

The production and accumulation of waste plays a major role in the degradation of ecosystems around the world. The pollution caused by waste, with all its negative implications for human, animal and plant health, is a warning about the vulnerability of natural and man-made habitats. With industrial development and mass production, there is a large concentration of waste, 60% of which consists of "disposable and non-repairable single-use products abandoned in marine aquatic environments or connected to the seas" (Galgani&Loubersac, 2016). The sixth

continent, the floating landfill located in the Pacific over an area of around 3 million km² at a depth of 30 m, is a clear indication of the scale of the ecological disaster, and the trend is not slowing down as quickly as the situation of vulnerability requires, given the projections. In West Africa, the overall amount of waste produced was estimated at 174 million tonnes in 2016, and projections suggest that this figure will triple by 2050, according to the World Bank report "What a Waste 2.0" (World Bank, 2018). Among the most vulnerable areas are small islands in low-income countries where waste management systems, if they exist, are difficult to maintain because the rate at which waste accumulates is so high that storage and/or disposal capacities are now well beyond their limits (Dione &Diémé, 2021).

Senegal is no exception, despite the existence of a number of legal texts, including Law 2020-04 on the prevention and reduction of the environmental impact of plastic products [5], and the involvement of a number of ministries, national agencies and local authorities. Small island areas are the most at risk, due to their isolation, the limited availability of space to store and treat waste, the seasonal variation in the volume of waste due to tourism, the absence of a public collection network and the inefficiency of traditional treatment methods (Willmott &Graci, 2012). The island areas in question here, Niomoune, Haer, Hitou and Diogué, are characterised by the inaccessibility of waste collection vehicles by land, the lack of space for landfill and the absence of corrective policies for areas where there is no waste collection service.

Photo 1:- Wild dumps on the island of Diogué.

Sources: field surveys, authors, 2023

Given this situation, what do we do with the waste on these islands?
In the past, in island societies, before the strong presence of plastic, the waste to be managed was mainly biodegradable, such as dead tree leaves, food scraps and domestic animal excrement. After treatment by burial or composting, this waste is reused as fertiliser in market gardening and rice growing (Lohani, 1990), as this respondent in Hitou put it: "tree leaves can be burnt or buried and the ashes and organic by-products are used in the gardens for market gardening and rice growing as fertiliser" (Woman, 42, Hitou, 2023). These techniques help to preserve the environment while ensuring the survival of the island populations by maintaining arable land in small areas. The rare non-biodegradable waste is used to build small dikes to protect against river tides and the advancing sea, as the deputy head of the village of Oubac puts it: "There is some rubbish that is very useful to us, for example shells, glass bottles and tyres, which enable us to stop the sea advancing and protect our rice fields". Even if these methods continue, overall waste management is being put to the test by the high presence of plastic waste in household waste. Plastic waste management also relies on incineration to protect domestic animals that ingest it due to a lack of grazing, with all the negative consequences this has on the quality and quantity of milk due to the toxic chemicals in the plastic (Ouédraogo et al., 2022), (Collin et al., 2021). This was confirmed by a respondent in Haer, who said that "plastic waste incineration techniques are a way of helping to protect goats, cattle and sheep" (man, aged 49 in Haer, 2023). The practice of incineration is not without consequences, with the pollution caused by the presence of smoke and the risk of fire endangering people and also compromising biodiversity.

Photo 2:- Waste incineration on the island of Niomoune.

Source: field surveys, authors, 2023

In any case, it must be recognised that individuals are called upon to adapt in the face of environmental consequences. The adaptation strategies put in place by the inhabitants of this area are analysed and understood through individual and community initiatives led by the young people of the village. The organisation of "set setal[3] " days, the provision to the population of equipment such as dustbins, rakes, wheelbarrows, carts and shovels for rubbish collection and the ban on rubbish dumping are all techniques and social rules that help to explain the coping strategies used to deal with the problem of rubbish in Diogué. Hygiene and sanitation practices are mainly organised by young people in the villages.

Access to freshwater, vulnerability and adaptation

Access to fresh water is a fundamental issue in island regions in general. The level of salinisation is such that freshwater resources are scarce today. Freshwater played a major role in the emergence of an agrarian civilisation in Lower Casamance. Today, the Casamance river functions like a ria, with high concentrations of salt over most of its large basin (Diop, 2020), as reported by a neighbourhood delegate in Niomoune: "Access to fresh water is our biggest problem, we're too tired, you can see the women behind us fetching water, we've dug a well to get it, but the water is not much use, it's not drinkable, it's just good for washing and doing clothes because it's salty".

Photo 3:- Apparent salinisation on the island of Niomoune.

Source: field surveys, authors, 2023

The problem of access to fresh water is a major challenge affecting communities in the Bliss Kassa island area. Because of their specific geography, the islands of Bliss Kassa are heavily dependent on rainfall and an outcropping water table to meet their freshwater needs. This is the case with water from wells dug in wetlands to a depth of around 2 metres. Recourse to these different sources of freshwater supply appears to be a strategy that enables local people to adapt to their own context while satisfying their drinking, livestock watering and rice-growing needs.

[3] Literally means "clean and make clean" in Wolof. Activities focused on street cleaning, sanitation and beautification. This spontaneous youth movement originated in the summer of 1989 in the sports and cultural associations of Dakar's working-class neighbourhoods(https://www.au-senegal.com/+-Set-setal-+.html).

Photo 4:-Freshwatersupplywell.

Source: field surveys, authors, 2023

In addition, both individual and collective strategies have been put in place, with rainwater harvesting on varying scales. In terms of coping mechanisms, households use cisterns to collect large quantities of water during the rainy season, as one Niomoune resident put it: "In almost every family, rainwater is collected in 20-litre drums and/or bottles during the rainy season", woman, 55, Niomoune.

Photo 5:- Rainwater recovery mechanisms.

Source: field surveys, authors, 2023

However, the quantities harvested cannot meet the needs of families all year round. This is why collective solutions have been initiated.

Photo 6:- Rainwater harvesting structures at Niomoune and Diogué.

Source: field surveys, authors, 2023

The lack of fresh water is leading to other forms of adaptation in arboriculture, with practices that involve developing the use of human excrement by installing dry toilets. This practice avoids the use of septic tanks, which can contaminate the groundwater table, the water from which is used for domestic needs (food, washing, etc.).

Photo 7:- Dry toilets in the Niomoune camp.

Source: field surveys, authors, 2023

These toilets take the form of a tank (first photo from left to right) containing the faeces, which are covered with wood shavings (middle photo) after use. The wood shavings prevent odours from rising. Once filled, the contents are transferred to holes prepared for the future plant and covered with dead tree leaves to enrich the soil before planting (next photo).

Photo 8:- Enrichment techniques for recovering human defects.

Source: field surveys, authors, 2023

This technique contributes to the regeneration of biodiversity and the integration of fruit tree species such as the lemon tree, which are difficult to grow in the area because of the salinity of the land. However, this is a small-scale practice implemented in integrated rural tourism accommodation facilities that welcome tourists, such as the Niomoune camp. However, the most widespread practice remains the use of septic tanks by the local population, with all that this implies in terms of contamination of the water table, which in turn provides water for consumption through dug wells.

Photo 9:-Septic tanks in Niomoune.

Source: field surveys, authors, 2023

However, it should be noted that initiatives to connect drinking water to the public supply network are being carried out by the Senegalese government from the mainland. However, this project is still not up and running, at least not until the end of 2023, when we visited the dugout ambulance system, as shown in the following photos.

Photo 10:- Drinking water supply and home installation.

Source: field surveys, authors, 2023

Sea level rise, vulnerability and adaptation

Senegal's islands are being affected by the advancing sea. It has now been established by the Directorate of Classified Establishments of the Senegalese Ministry of the Environment that the coastline loses between 1 and 1.33 metres every year. There are no specific data on the situation of the Casamance islands, even though they are among the most exposed areas, being caught between the Atlantic Ocean and the Casamance River. The few studies carried out on the Casamance islands point to an alternation between cumulative and erosive dynamics as part of a compensatory approach (Thior et al., 2021). In Bliss Kassa, the advancing sea is threatening habitats and arable land, creating vulnerabilities in housing and agricultural production. A neighbourhood delegate in Diogué commented: "On our islands, environmental threats are a real problem, especially with the advancing sea. The sea is taking all our arable land, and our yields have fallen sharply because of the salinisation of the land".

Photo 11:- The sea advancing at Diogué.

Source: field surveys, authors, 2023

However, there are disparities in the level of exposure of the different islands depending on whether they are influenced by the sea or the river. The islands of Niomoune and Hitou are more influenced by the Casamance River, being relatively far from the Atlantic Ocean, compared with Hitou, which is the least exposed zone, being halfway between the river and the ocean. On the islands of Niomoune and Hitou, the river's advance has had a major impact on agricultural yields, with salinisation of the rice fields. This was confirmed by one respondent: "Our land near the river is no longer arable because of the salt, so we have to abandon it to farm elsewhere, except that we are increasingly faced with a lack of arable land". However, Diogué, located at the mouth of the Casamance River and the Atlantic Ocean, presents the most worrying double exposure situation. Here, the island is under the influence of the advancing sea, which poses a major threat to housing, as well as compromising the fishing quay and the areas used for processing fish products. At the same time, factors such as rising sea levels, coastal erosion and the salinisation of the land and freshwater rivers are recurring themes among the people interviewed, as the village chief

of Diogué said: "The advancing sea has completely changed our way of life. Previously, the forest was very dense and there was a lot of sacred wood, but unfortunately the sea has taken almost everything. On several occasions, we have had to move our cemeteries as far as was possible and constantly change habitats. Because of the advancing sea, many of us are no longer able to visit the grave of our parents or a member of our family".

One of the most visible and obvious consequences is the location of the Diogué lighthouse, which is now in the water, the destruction of the vegetation along the coastline, and the relocation of the cemetery and primary school. According to one respondent, "the sea has reclaimed more than 170 metres of land on the island of Diogué in less than 50 years".

Photo 12:-Recedingcoastline at Diogué.

Source: field surveys, authors, 2023

This situation is the result of a combination of natural factors (lack of coastal dunes to protect against the sea, fluctuating tides, variations in rainfall, global warming) and man-made factors (occupation of the coastline, removal of sea sand and shellfish for housing, excessive cutting of wood from the forest). However, in order to survive in the face of the advancing sea, the inhabitants of the Bliss Kassa islands have put in place a wide range of resilience methods. These include, first and foremost, the construction of dykes that open and close according to the tides. However, although this technique has been mastered, it is not flourishing due to a lack of human resources, as one inhabitant of Haer put it: "We can't even build more than one dyke when there are several breaches because all our young people have left for the city to look for work".

Photo 13:- Local strategies to combat rising water levels.

Source: field surveys, authors, 2023

At Hitou, we see more or less the same methods with the presence of mangroves, but here the inhabitants do not use rubbish as a strategy out of a desire to preserve the environment, as one woman interviewed said: "It's not good for the sea or the environment to use plastics, at least we don't want to", man, aged 67, Hitou. Other strategies include the use of fishing nets left behind by fishermen, which are buried flush on the edge of the beach to retain and stabilise the sand created by marine and wind erosion, with the aim of creating dunes.

Photo 14:- Local strategies for combating rising water levels in Diogué and Haer.

Source: field surveys, authors, 2023

Conclusion:-

The encroachment of the sea, waste management and the problem of access to water are major issues and major challenges in the environmental degradation of small island areas. As part of a dynamic of socio-economic development with the opening up of integrated tourism and changes in lifestyle and consumption patterns, these areas are highly exposed to an increasingly uncontrollable accumulation of plastic waste, with traditional mechanisms out of date, with harmful consequences for ecosystems and biodiversity. Freshwater resources are becoming increasingly scarce due to the salinisation caused by the advancing sea. This affects the supply of water to local populations and the upkeep of rice-growing areas. The advancing sea is causing coastal erosion to the point of compromising habitats and socio-economic activities linked to small-scale fishing. Despite the coping strategies developed by the local people, the environment and ecosystems are under serious threat, while the state is still unable to provide an appropriate response to these small island areas, isolated from the mainland, in terms of public environmental management systems in Senegal. This situation is further complicated by the fact that community adaptation mechanisms are not sustainable. This study aims to provide an endogenous approach to the reality of changes in the island environment through the prism of natural and man-made dynamics, based on the authors' observations and the perceptions of local people gathered from their own experience, in order to give the best possible picture of the issues at stake, going beyond the purely scientific aspects of measurement to help decision-making.

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