



CLIMATE CHANGE, LIVELIHOOD AND CONFLICT: A PRACTICAL TOOLKIT FOR ADAPTATION AND INTERVENTION IN COASTAL COMMUNITIES OF WEST AFRICA



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Climate Change, Livelihood and Conflict: A Practical Toolkit for Adaptation and Intervention in Coastal Communities of West Africa

Prepared by

Academic Associates PeaceWorks

for

**Coping with Climate Change as a Cause of Conflict in Coastal
Communities of West Africa (C7-WA)**



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LIST OF ABBREVIATIONS

AAPW	Academic Associates PeaceWorks
ADP	Agricultural Development Program
ADF	Akassa Development Foundation
ANYA	Akassa National Youths Association
CC	Climate Change
CDP	Community Development Plan
CDC	Community Development Committee
CSN	Community Stakeholders Network
EU	European Union
ECOWAS	Economic Community for West Africa
FAIMM	Fondazione Accademia Italiana della Marina Mercantile
HOMEF	Health of Mother Earth Foundation
LGA	Local Government Area
LGC	Local Government Council
NAOC	Nigerian Agip Oil Company
SPDC	Shell Petroleum Development Company
WANEP	West African Network for Peace Building
WACA	

FOCUS AND STRATEGIC OBJECTIVE OF THE TOOLKIT

This toolkit is a collection of verified adaptable resources for communities and development partners to learn about the challenges of climate change and its impact on coastal communities of West Africa and identify applicable approaches for addressing them. It intends to translate climate change theories into practicable and achievable mechanisms. Furthermore, it aims to provide sectoral practitioners, development partners and decision-makers with relevant information on the current knowledge and trends of climate change in coastal communities of West Africa. The toolkit will enable decision-makers to enact effective policies, and legal and regulatory frameworks based on the identified problems and challenges.

The strategic objectives of the toolkit among others are:

- To strengthen and build appropriate capacity for adaptation action and create an enabling environment for effective interaction and adaptation in coastal communities of West Africa
- To develop suitable strategies for climate change, livelihoods and conflict adaptation in coastal communities of West Africa.
- To Strengthen community and government institutions and mechanisms to establish a suitable and functional framework for climate change intervention and governance
- To develop an effective community early warning and early response plan that will facilitate the implementation of climate change actions.
- To increase public awareness and design a coherent approach that will engender funding for the implementation of climate change adaptation strategies

The toolkit, therefore, provides a wide-ranging set of climate change issues with practical adaptation strategies that can be used to engage development partners, government and the private sector.

Climate Change Livelihood and Conflict

The impact of climate change has contributed to the increasing depletion of livelihood which has ultimately exacerbated conflict due to scarce resources that have weakened the social fabric of society and is forcing people to resort to several forms of crime for survival. Conflict oftentimes is triggered by the competition of people over resources for livelihood and when these resources start dwindling, it is expected that people will become insatiable resulting to conflict and other kinds of challenges. In an attempt to find a solution to the emerging climate change issues and conflict in communities, AAPW carried out several community engagement visits and also participated in research conducted by HOMEF on coping with climate change as a cause of conflict in coastal communities of West Africa. Findings in all our community engagement and the research revealed that livelihood depletion is the most critical issue resulting from climate change impact and this has caused violent conflicts in some of the communities.

Findings also show that agricultural livelihoods are the most affected due to the high climate change impact on environment; weather patterns, flooding, erosion etc. In addition, the general health of the people is also affected. It was discovered that due to climate change impacts communities have resorted to behaviours such as poor waste management, increased deforestation for energy and income generation activities.

IMPACT OF CLIMATE CHANGE IN COASTAL COMMUNITIES AND KEY FOCUS AREAS OF THE TOOLKIT

Coastal communities in West Africa are particularly vulnerable to the impacts of climate change, including sea-level rise, increased storm intensity, ocean acidification, unpredictable weather conditions and so on. These effects have led to the destruction of livelihoods, housing, infrastructure, and ecosystems, which have significant social, economic, and environmental consequences.

To address these risks and build resilience, adaptation strategies are developed by AAPW in this toolkit to help coastal communities cope with the effects of climate change. Some of the general adaptation strategies include:

- **Developing early warning systems:** As part of the project, WANEP has expanded their early warning and early response system to include climate change indicators with a wide range of community monitors among whom are the AAPW established Community Stakeholders Network across the five project states. The report will be provided to policymakers and development partners as well as individuals for intervention. For instance, storms and flooding signs will be reported to help people to prepare and move to safer ground before disaster strikes.
- **Coastal Flood Management:** To manage floods and reduce their impacts, coastal communities can use natural and engineered systems such as mangroves, tidal gates, and land reclamation. These strategies can help to protect against flooding and reduce erosion. Coastal communities can also develop disaster response plans to prepare and respond to extreme weather events such as floods, storm, droughts, etc. These plans can include early warning systems as mentioned above, evacuation plans, and infrastructure investment to improve the resilience of the community.
- **Strengthening coastal defenses,** such as sea walls, dikes, and breakwaters, to protect people and infrastructure from the impacts of storm surges and sea-level rise. For instance, in erosion control and shoreline stabilization, coastal communities can use engineering techniques such as gabion baskets, sea walls, and groynes to control erosion and stabilize the shoreline. This helps to protect properties, infrastructure, and communities from the impacts of sea level rise and storm surges.

- Promoting Sustainable Agricultural and Land Use Practices, such as reforestation and erosion control, which can reduce erosion and improve soil quality, thereby increasing the resilience of coastal ecosystems. Coastal communities should adopt sustainable agricultural practices such as crop rotation, intercropping, and agroforestry. This will contribute enhance soil fertility and enable communities to adapt to changing environmental conditions. These practices will help to increase resilience to droughts, floods, and other extreme weather events.
- Encouraging the adoption of climate-smart agricultural practices, such as crop diversity and conservation agriculture, to enhance food security and build resilience among farmers.
- Investing in alternative livelihoods, such as ecotourism and alternative energy development, to reduce dependence on traditional livelihoods that may be vulnerable to climate change impacts.
- Promoting community-based adaptation approaches that build social capital, enhance local knowledge and skills, and foster social cohesion, which can strengthen community resilience.
- Adaptation through fishing and aquaculture: Coastal communities can adapt to the impacts of climate change by developing sustainable and climate-resilient fishing and aquaculture practices. This includes diversifying income sources, conserving fish stocks and ecosystems, and developing alternative livelihoods.
- Capacity building and education: Capacity building and education are important strategies to increase the resilience of coastal communities to climate change. This includes training on adaptation strategies, climate-resilient practices, and sustainable development.
- Collaboration and partnerships: Finally, collaboration and partnerships are key to implementing effective climate change adaptation strategies in coastal communities. This includes partnerships with local authorities, non-governmental organizations, international organizations, etc. to mobilize resources and promote sustainable development.
- Community cluster agriculture, Communities have become increasingly individualistic in their approach to agricultural activities. The challenge of climate change, livelihood and conflict, requires that people need to start a communal system of agricultural practice where a group of persons farm together in an area and watch over one another. What will be new to this approach is to form legally registered groups such as cooperatives in different areas of agricultural practice that will operate under a single community cluster. In other words, the community cluster will comprise different agricultural cooperative groups such as fish farmers, short-term crop farmers, long-term crop farmers, livestock farmers, as well as those involved in the value chain of each activity.

Climate change adaptation strategies in the target coastal communities AAPW has visited focus mostly on improved fishing practices, building and improving community storage facilities, especially using simple local storage systems to avoid wastage, changing or expanding long-term crops to high-value crops such as plantain, banana, yam, cassava with simplified processing facilities as well as adapting to seasonal changes and initiating farming patterns that are in line with the evolving seasonal calendar. However, it is important to note that these adaptation strategies require sustained investments and long-term planning to be effective in the face of climate change. Additionally, while local communities and governments are taking steps to adapt to climate change, reducing greenhouse gas emissions at the global level remains critical to prevent the worst impacts of climate change.

SECTORAL ADAPTATION STRATEGIES TO CLIMATE CHANGE

The adaptation strategies provided below are illustrative and structured in segments to offer possible solutions and adaptations that can address anticipated, current and future climate change impacts in coastal communities of West Africa.

AGRICULTURE

The main source of employment in coastal communities is agriculture but climate change has destabilized agricultural activities and has increased the risk in agricultural investment and livelihood. For instance, the challenging and unpredictable weather patterns, such as heavy rain falls, increasing heat waves, flood and erosion, etc. has increased the volatility of crops and livestock and in some cases, investors stand the risk of completely losing their investment. Thus, most community dwellers engaged in agricultural activities have lost their livelihood. This has contributed to food shortage, increase in poverty and ultimately insecurity and conflict in communities. Below are some adaptation strategies of agriculture and the impact of change in Coastal communities.

1. Fisheries Adaptation Strategies

Climate change has affected the seasonal fishing calendar and fisher folks have found it difficult to cope with the weather patterns, which in some cases result in boat mishaps, while some miss their way. Fishing techniques have remained the same and concentrated in an area. The weather patterns, sea level rise and sea warming have also resulted to migration and extinction of certain species of fishes. This on the whole has resulted generally to poor fish catch. Therefore, some adaptation strategies have been deduced below:

Adaptation Strategy	Adaptation Method	Adaptation Benefits
Salt Water Fish Farming (Tilapia and Catfish)	<ul style="list-style-type: none"> -Establish fish farming networks and cooperatives within and across the target coastal communities -A cluster of fisherfolk training on fish farming with local species of tilapia and cat fish from the salt water -Local fish feeds production training -Fish feeds production -Clear sizeable mangrove area -Dig the chicoco mud to the size of pond needed close to the community -Connect pond to the creek or river to allow water to flow in and out, using strong wire gauge to protect fishes from escaping -The pond should be deeper than the channel for water flow -Fingerlings and tiny fishes caught by fisherfolks will be kept alive with oxygenated bags and cultured in the ponds -Local fish feeds production by interested investor using maize, maize cob, natural calcium materials like snail shells, crab shells, cray fish etc. -Earth worms, fish intestines, food remnants, vegetables etc. can also be used to feed the fishes. Conduct a study to improve on salt water fish farming. 	<ul style="list-style-type: none"> -Salt Water fish farming will be linked to mangrove restoration. Fisherfolks should plant mangroves around their ponds -Conflict between indigenes and Ilaje fisherfolks on over fishing and destruction of fingerlings and tiny fishes will be addressed Alternative livelihood for job creation and income generation as those who cannot engage in sea fishing can take advantage of salt water fish farming.
Fresh Water Fish Farming (Tilapia and Catfish)	<ul style="list-style-type: none"> -Preparation of earthen ponds -Soil and water management -Control of aquatic weeds and predators -Fertilization and manuring of the pond water -Effective fresh water supply system put in place -Selection of good species of fish for stocking in relation to the density of the pond -Feed making, management and control system put in place -Periodic checking, sorting and treatment of issues Harvesting, sales and processing 	<ul style="list-style-type: none"> -Alternative livelihood for job creation and income generation as those who cannot engage in sea fishing can take advantage of fresh water fish farming
Conservation Fish Farming	<ul style="list-style-type: none"> -This requires a collective community decision backed up by community bye-law to conserve certain creeks and canals in the mangrove known to be areas that fishes breed. -Communities have local knowledge on areas where fish breed. Such areas can by law be conserved and exit points blocked to stop the fishes from escaping 	<ul style="list-style-type: none"> -Communities have local knowledge on areas where fish breed. -Communities can introduce fishing festivals during harvest period. This will build community cohesion and peace.

• **Periwinkle Conservation Farming**

Periwinkle is a species of snail that is commonly grown for medicinal purposes and is also eaten in some cultures. Periwinkle conservation farming strategies are designed to manage and preserve periwinkle populations in the wild, while also providing a steady supply for harvest.

Sustainable harvesting practices: To conserve periwinkle populations, it is important to adopt sustainable harvesting practices that do not negatively impact periwinkle populations. This can involve monitoring the number of periwinkles harvested and limiting the amount that can be extracted from each area in the wild.

Habitat restoration: Restoring degraded periwinkle habitat can help to increase populations and maintain a healthy ecosystem. This can include planting native mangrove vegetation that provides a habitat for periwinkles and removing invasive species that compete with periwinkles for resources.

Community-based conservation: Engaging local communities in the conservation effort and educating them about sustainable mangrove utilization that can help to increase awareness and promote conservation efforts in the community.

Research and development: To maintain sustainable periwinkle stocks, research and development activities should focus on improving periwinkle farming technology, developing new products and processing techniques, and identifying new markets for periwinkle.

Overall, periwinkle conservation farming strategies aim to ensure sustainable harvesting practices and promote the health and growth of periwinkle populations in the wild. Through a combination of traditional farming practices, habitat restoration, and community-based conservation, we can help ensure that periwinkle is available for generations to come.

Benefits of Periwinkle Conservation Farming

Periwinkle conservation farming is a sustainable agriculture practice that involves planting and harvesting periwinkle in a way that benefits the environment while providing food and income for local communities. This practice has several benefits that make it an effective climate change adaptation strategy:

Carbon sequestration: Periwinkles can sequester carbon dioxide from the atmosphere and store it in their shells, which can help reduce the amount of greenhouse gases in the atmosphere. This can help mitigate climate change by reducing the amount of carbon in the atmosphere.

Coastal erosion control: Planting periwinkles can help stabilize soils and reduce coastal erosion. This is particularly important in the face of sea-level rise and more frequent and severe storms associated with climate change.

Water filtration: Periwinkles can also help to improve water quality by filtering nutrients and pollution from water, thus improving the health of aquatic ecosystems.

Biodiversity conservation: Periwinkles are an important part of coastal ecosystems and their cultivation can help to restore and conserve these ecosystems. By protecting and restoring mangrove forests, for example, periwinkle conservation farming can provide habitat for a range of species, including endangered species.

Socio-economic benefits: Periwinkle conservation farming can provide economic benefits for local communities, such as income from the sale of periwinkles and employment opportunities.

In conclusion, periwinkle conservation farming can be an effective climate change adaptation strategy that provides both environmental and socio-economic benefits.

• **Oyster Conservation Farming**

Oyster conservation farming refers to the management and cultivation of oysters in a sustainable manner that promotes their growth and ensures their long-term survival. Here are some strategies used in oyster conservation farming:

Sustainable Harvest Practices: Oyster conservation farming practices harvest oysters in a manner that allows for the natural reproduction of oysters. Sustainable harvest practices, such as shellfish seeding and selective harvesting, help to maintain healthy oyster populations. Regulations and monitoring programs can also be put in place to ensure that oysters are harvested in a sustainable manner.

Habitat Restoration: Oyster conservation farming involves improving oyster habitat through oyster reef restoration and creation. The restoration of oyster reefs is an important tool for habitat recovery, as it promotes the growth of oyster populations and restores various ecosystem services, such as filtering and nutrient cycling.

Ecological Engineering: Unlike traditional aquaculture, oyster conservation farming mimics natural ecosystems. Oyster aquaculture systems are designed to provide natural habitats for oysters and other species, such as fish and crabs, that coexist in their natural habitat.

Water Quality Management: Oyster conservation farmers must monitor and manage their environment to ensure water quality and avoid the buildup of pollutants like crude oil and other petroleum products from the surrounding area. This includes controlling runoff pollution and sediment deposits and monitoring dissolved oxygen levels, acidity, and temperature.

Public Awareness and Education: Educating the public on the importance of oyster conservation farming and how it contributes to a healthy ecosystem can help increase support for oyster conservation farming practices.

In conclusion, oyster conservation farming involves the adoption of sustainable practices that maintain healthy oyster populations, promote habitat restoration, and restore ecological services. These strategies offer important benefits, including the potential to restore habitats, foster biodiversity, and improve water quality.

Benefits of Oyster Conservation Adaptation Strategy

Oyster conservation farming is becoming increasingly important as a climate change adaptation strategy due to its numerous benefits. Here are some strategies used in oyster conservation farming and their importance:

- **Carbon Sequestration:** Oyster reefs are a powerful tool for mitigating climate change as they can sequester a significant amount of carbon dioxide (CO₂) from the atmosphere. Oyster shells are made of calcium carbonate, which is a form of carbon dioxide. When oysters die, their shells help to sequester carbon from the atmosphere, thereby reducing greenhouse gas emissions.
- **Protection from Coastal Erosion:** Oyster reefs help to reduce coastal erosion through their ability to absorb wave energy. This reduces the impact of storms and helps protect shorelines, coastal areas, and infrastructure.
- **Improved Water Quality:** Oysters are natural filter feeders that improve water quality by removing pollutants, sediment, and excess nutrients from the water. This is important for human health as it reduces the prevalence of harmful algal blooms and other water quality issues.
- **Restoration of Fisheries:** Oyster conservation farming can provide important benefits for fish populations by creating new habitats for fish and other aquatic species. This helps to rebuild declining fish populations and support the growth of healthy, sustainable fisheries.
- **Adaptation to Climate Change:** Oyster conservation farming helps to adapt to the impact of climate change by creating resilient ecosystems that can cope with the challenges of a changing climate, such as sea level rise and ocean acidification.

In conclusion, oyster conservation farming is an essential climate change adaptation strategy due to its numerous benefits. It can help mitigate greenhouse gas emissions, protect coastlines, support fisheries, and improve water quality. As the impacts of climate change continue to increase, oyster conservation farming offers a sustainable and effective solution for building resilience and adapting to a changing planet.

• **Mudskipper Conservation Farming**

Mudskipper conservation farming strategies involve providing suitable habitats for mudskippers to thrive and survive. Here are some strategies commonly used in mudskipper conservation farming:

1. **Ensuring Adequate Water Supply:** Mudskippers require an adequate water supply to survive. Therefore, the conservation farming strategies should include measuring the water level and using appropriate irrigation methods to ensure that the water supply is enough to support mudskippers.
2. **Maintaining Proper Soil Conditions:** The soil conditions in mudskipper habitats must be maintained in a healthy state. This involves avoiding practices that could cause soil erosion and other disturbances, such as overgrazing, improper drainage, and deforestation.
3. **Habitat Restoration:** Mudskipper habitats are often affected by human activities, such as coastal development and pollution. Habitat restoration involves rehabilitating or restoring the mudskipper habitat by planting mangroves and other vegetation, removing litter, and addressing other forms of pollution, thereby improving water quality.
4. **Education and Awareness:** Raising awareness about mudskippers and their importance in the ecosystem is key to their conservation. Educating local communities and stakeholders about the importance of mudskippers and their roles in the ecosystem can promote appreciation for these creatures and help to reduce their exploitation.
5. **Research and Monitoring:** Ongoing research and monitoring are important in mudskipper conservation farming. Researchers can gather data on the population size, habitat conditions, and other ecological factors that affect mudskippers. This information can be used for adaptive management strategies aimed at improving mudskipper conservation efforts over time.

In conclusion, mudskipper conservation farming involves maintaining proper soil conditions, ensuring a healthy water supply, habitat restoration, education, research, and monitoring. These strategies aim to promote the survival of mudskippers and their importance in the ecosystem.

Benefits of Mudskipper Conservation Adaptation Strategy

Mudskipper conservation farming strategies are important for several reasons. First, mudskippers play an essential role in the coastal ecosystem. Mudskippers contribute to nutrient cycling, provide food for other species, and serve as bio-indicators for ecosystem health. Second, mudskippers are also an essential resource for coastal communities, providing income and food.

Moreover, mudskipper conservation farming strategies can also be used as a climate change adaptation strategy. As climate change affects coastal ecosystems and reduces the water supply, mudskippers may face habitat loss and become increasingly vulnerable to predators and disease. Therefore, mudskipper conservation farming can help to build resilience in the face of climate change by preserving appropriate mudskipper habitats, increasing water supply and improving water quality, and restoring damaged habitats.

Another benefit of mudskipper conservation farming is that it promotes sustainable mangrove use practices. By implementing habitat restoration and maintaining proper soil conditions, mudskipper conservation farming can also reduce mangrove soil erosion and promote sustainable agriculture in mangrove areas such as rice farming, leading to a healthier and more resilient environment.

In conclusion, mudskipper conservation farming strategies are essential for preserving the biodiversity of coastal ecosystems, supporting local coastal communities, promoting sustainable land use practices, and building resilience in the face of climate change.

2. Crop Farming and Adaptation Strategies

Adapting to climate change entails taking the right kind of actions and appropriate adjustments that will reduce the negative impacts of climate change. Such actions and adjustments could be exploring new strategies or exploiting positive outcomes. Accordingly, due to the massive agricultural activities in arid regions, considered to be extremely vulnerable to climate change impact farmers have long been sensitized on crop adaptation strategies such as planting of drought resistant crops, crop diversification, mixed cropping, soil conservation and so on. Contrarily, the wet regions, particularly coastal communities of West Africa, do not have a well-articulated farmer's sensitization and training programmes on the impact of climate change on agriculture, thus, crop adaptation strategies are mostly based on individual farmers initiatives.

Based on research and other fact-finding community engagement processes, AAPW established the fact that communities are increasingly expanding farming of short term crops for income generation rather than for subsistence purpose as it used to be in the past.

Short farming here refers to crops that can be planted and harvested within 6 months' duration. The challenge that was noticed was that communities are not aware of improved farming techniques and type of short term crops that will be resistant to climate change effects. It is also important to explore agricultural solutions that will utilize the mangrove vegetation.

Short term crops are most likely to have less effect from increased atmospheric concentration of carbon dioxide, temperature changes, unpredictable rainfall patterns and rain fall regimes and so on. Communities can predict sea surge and coastal erosion, which have become more frequent, they can also predict flood from heavy rainfall irrespective which is predicted to be around June and July. Thus, naturally, they have started adjusting to the weather conditions by expanding farming of short term crops, reduce farming seasons to one rather than the two farming seasons that was obtainable in the past.

Long Term crops on the other hand are crops that take over 6 months' duration from planting to harvesting. Long term crops on the other hand are more likely to have more negative effects from climate change. e.g. flood, high water content in the soil and increased atmospheric concentration of carbon dioxide, temperature changes etc. Coastal communities of West Africa depend largely on long term crops for food, thus climate change has also affected the nutrition and health patterns of coastal communities. Crops such as plantain, banana, cassava, yam, cocoyam are among the very prominent food crop in coastal communities of the West Africa It important to note that a particular specie of cocoyam (popularly called mama coco or Amasi) is currently going into extinction. It is a crop that grows very well on any soil in the Niger Delta. You can grow the plant from the peel. It's considered the easiest cocoyam specie that can be farmed and will yield well without good care. Presently the crop grows and form yellowish patches on the leaves which later form holes and gradually it withers. If harvested, the crops decay in few days (3 to 14 days) Whereas, it can be stored until the next farming season and rather than decay, it will start germinating. Studies have not been conducted to ascertain the cause of the challenge, but communities are attributing it to climate change and acid rain.

• Short Term Crop within 6 Months Growth Period

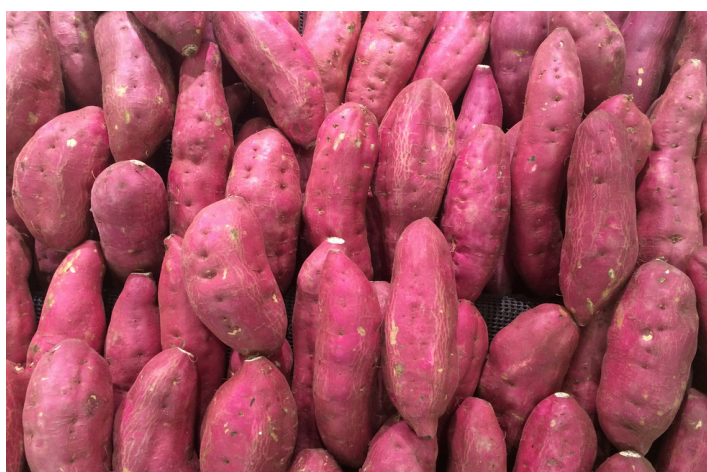
– (Rice, Potato, Maize, Beans, Groundnut, etc. and Vegetables: (Pepper, Tomatoes, Cucumber, Okra, etc.)

Apart from Rice that requires stagnant water, the rest of the short term crops outlined above can be planted and harvested within three to four months. A moist sand-loamy soil is required. Planting can be around late November and early December before water gets dry in the soil. It might require moistening in January and February before harvest. A second round of farming can be repeated from March to May before the heavy rains. Farmers can then wait from June to October and start again by November to continue the circle. Monitoring and recording of crop performance in relation to the weather is an important aspect of farming that has not been strictly followed. Results of farming practices must be recorded with a view to understand climatic and seasonal changes and crop production/yield.

• **Swamp Rice Farming**

Swamp rice cultivation is a very viable agricultural activity that coastal communities should practice. It is technical and requires training. The Fero 44 and Fero 45 species are good varieties of rice that can be harvested in 3 months and 5 months respectively. The cultivation process involves Akassa Development Foundation (ADF) initiated rice farming in Akassa, a salt water coastal community located at the bight of the Atlantic Ocean in Brass Local Government Area in Bayelsa State. An extension officer of the Bayelsa Agricultural Development Program also initiated rice Farming at Sabatoru community in Nembe Local Government Area. Further lessons on the prospects of rice farming can be obtained from the Bayelsa State Ministry of Agriculture and the ADP.

Adaptation Strategy	Adaptation Method	Adaptation Benefits
<p>Swamp Rice Farming</p> <p>As seen in Akassa</p>	<ul style="list-style-type: none"> - Clear a table area in the mangrove where water can be retained - Identify and procure viable rice seedlings - Soak in water for about a day - Remove from water and keep in a damp place prepared for the purpose for about 3 days for seedlings to sprout - Prepare a nursery to propagate sprouted seedlings and protect from birds - Prepare and till the farm land for transplanting within 4 to 6 months - Check/monitor growth and replant in spaces where seedlings did not grow - Observe and take record of findings - Harvest, winnow, process and sale 	<ul style="list-style-type: none"> - Like the salt water farming, coastal communities can farm rice in open swamp areas in the mangrove. - Rice farming in mangrove areas will be a lucrative alternative livelihood and source of income to farmers who have lost their livelihood. - Rice farming will contribute to food security, which is a major challenge in coastal communities due to climate change. <p>There are vast swamp land areas in coastal communities that is considered useless by community members, thus introduction rice farming will create employment in the different areas of rice business value chain</p>



Sweet potato is planted in the north and middle belt region of Nigeria through irrigation, it can grow and bear tubers in coastal areas without irrigation. It is a tropical creeping crop, unlike Irish potato that grows well only on temperate region. Sweet potato can grow both in the temperate and tropical regions. It has a gestation period of about 90 days.

Thus, it can be planted all year round from January to March with a simple irrigation system which will not be required between March to May. While farmers can wait due to the flood from June to September. They can resume planting in October and Harvest in December. As the floods recedes, planting can immediately follow and irrigation will not be required due to water retained in the soil. Sweet potato farming needs annual rainfall of about 1000mm and a temperature of 22°C to 25°C for optimum growth. Framers interested in short term crops can adapt this farming calendar to suit their peculiar environmental conditions. Particularly those within flood prone areas.



Sweet potato farming can be done in sack bags, containers and buckets. This makes it easy for harvesting and the soil can be treated and preserved for the next planting circle. It is also reduces the cost of farm and allows for good farm management.

Adaptation Strategy	Adaptation Method	Adaptation Benefits
Potato	<ul style="list-style-type: none"> • Farmers should be trained on the technicalities of sweet potato farming • Acquire and clear appropriate land with the right kind of soil • Land Preparation, tilling appropriate ridges or beds for planting. It is advisable to cultivate sweet potato on ridges bountiful harvest with huge tubers • Sandy loam soil rich in organic matter is best appropriate for farming sweet potato. • Sweet potato is planted from the stem and vines cuttings from the parent plant. • The vine cutting should be between 20-30cm in length with about 2-3 nodes in each vine. • Plant the vine about 4-6cm deep with part of it above the soil. • Spacing should be about 30cm on ridges and 70cm apart. • Apply organic fertilizers such livestock waste and rabbit urine which can be used as both herbicides and manure • Manage farm effectively especially weeding to curb competition between the potato plant and weeds. 	<ul style="list-style-type: none"> • Climate change impact on potatoes if well managed is very low • Sweet potato can substitute for yam which takes about nine months' gestation period making it difficult for coastal communities that are usually flooded to cultivate. • Potato farming is a means to produce sufficient food for the coastal communities.
Maize	<ul style="list-style-type: none"> • Farmers should be trained on the technicalities of short term food crops. • Acquire and clear appropriate land with the right kind of soil • Land Preparation, tilling and planting • Simple tilling machines can be used for land preparation • Plant early at the beginning of the year and later towards the end of the year 2 crops per year? • Crops will require watering especially commercial farming of short term crops • A simple irrigation system should be constructed • Obtain seedlings from reliable agricultural service providers • Plant seedlings with right spacing • Apply organic fertilizers • Manage farm, harvest 	<ul style="list-style-type: none"> • Climate change impact on short term crops is very low • Short term farming is an approach that will help coastal community produce sufficient food for the local communities. Generally, maize, potatoes, beans, etc. are imported from upland communities, whereas, the - prevailing climatic condition in the community is conducive for short term crop farming. Which can be grown? Probably maize and beans. Can potatoes be grown in the Niger Delta? • Short term crop farming is sustainable and can increase agricultural productivity and income generation • It will also reduce the use of pesticides and herbicides as growth of weeds after tilling can take to 90 days.

Adaptation Strategy	Adaptation Method	Adaptation Benefits
<p>Beans</p>	<ul style="list-style-type: none"> • Site selection: Choose a site where the soil is rich in organic matter, well-drained, and receives enough sunlight. Beans thrive in a pH of 6.0 to 7.5. • Land preparation: Clear the land of all weeds and debris. Plow the land to a depth of 10 to 15 cm. • Seed selection: Choose healthy, disease-free seeds. Opt for certified seeds to ensure high yields and quality. • Planting: Beans are usually planted in rows. Make furrows with a hoe and plant the seeds at a distance of 10-15 cm apart. Cover the seeds with soil and ensure they are uniformly distributed and at the right depth. • Fertilization: Beans require a lot of nitrogen. Apply organic fertilizers according to soil test recommendations by a trainer. • Weed control: Weeding is essential for the survival of the crop. Remove weeds manually or use organic herbicides. • Irrigation: Water is essential to the growth of beans, especially during flowering and pod formation. Irrigation will be necessary during dry seasons. • Pests and diseases control: Monitor the crop regularly for pests and diseases - and take appropriate action if necessary. Common diseases include bean anthracnose, common blight, and rust. Use rabbit urine or other organic pesticides. • Harvesting: Beans usually take about 70-100 days to mature. You can tell they are ready for harvest when the pods turn yellow or brown. Harvest them by handpicking the pods or by using a sickle. • Post-harvest management: Dry the beans thoroughly to prevent spoilage due to mould and store them in a clean, dry place. You can sell them in the local market or store them for personal use. 	<p>Beans farming can be a highly effective climate change adaptation strategy for several reasons, including:</p> <ul style="list-style-type: none"> • Drought tolerance: Beans are one of the most drought-resistant crops, making them an ideal option for farmers in areas prone to water scarcity. As climate change leads to more frequent and severe droughts, beans can provide a reliable food source for communities with scarcity of freshwater • Soil health: Beans fix atmospheric nitrogen, which can improve soil health and fertility. This can benefit not only the health of the soil but also can improve the yields of other crops grown in rotation with beans. • Crop diversification: Beans are a versatile crop that can be grown in many different environments, making them an excellent option for diversifying agricultural - production in coastal communities with lack of arable lands. • By integrating beans into farming systems, farmers can reduce their reliance on other crops, which may be more vulnerable to climate change. • Carbon sequestration: Beans have the ability to fix carbon in the soil, which can help mitigate climate change by removing greenhouse gases from the atmosphere. This can occur through the promotion of intercropping, agroforestry, and use of organic manure. • Food security: Beans are a nutritious source of protein, vitamins, and minerals, making them an important crop for addressing concerns around food security. Investing in beans farming can, therefore, promote dietary diversity, boost incomes, and create new economic opportunities for farmers amidst climate change in coastal communities.

Adaptation Strategy	Adaptation Method	Adaptation Benefits
Groundnut	<ul style="list-style-type: none"> • Identify land fertile land with loamy soil that drains very well • Prepare the land in ridges or beds for planting. Tilling, harrowing and plowing to allow for easy aeration, water infiltration and root growth • Ensure weeds do not grow to compete with sprouting groundnut • Procure the right kind of ground. Advisably the arachis hypogaea L, however, most species of groundnuts are good under good farm management • Prepare the seed: Groundnuts must be shelled by hand one week before planting and stored without the shell in a cool, dry, and well-ventilated place. • Hand shelling insures little damage to groundnut seeds. • Pods shelled long before seed sowing time are likely to suffer from loss of viability, stunted growth and poor yield. • Plant the nuts in the soil about 1 inch deep and 4 to 6 inches apart. Put 4 to 5 seeds in each hole and ensure adequate soil moisture for good growth and yield • Thin the seedlings to one per hole when they reach 2-3 inches tall • Use organic manures • Groundnut takes about 90 days from planting to harvesting and requires watering during the dry season. • There are associated management techniques that should be obtained through training to ensure effective pest and disease control. 	<ul style="list-style-type: none"> • Groundnut plants are generally drought resistant crops; it does not require much water to grow. However, it can grow very well moisturized soils. Thus, coastal communities can effectively farm groundnuts for local consumption and commercial purpose. • Groundnut plants are known to trap atmospheric carbon dioxide in their roots and leaves. Thus farming - groundnut in coastal communities will be of multiple benefits. Income generation, food security and carbon sequestration. • Groundnut plants replenish the soil with nitrogen, phosphorus and potassium which are important nutrients for plants growth. Farmers can practice mixed farming with groundnuts to improve soil fertility and increase crop yield • Groundnut farming can help farmers diversify from single crop production, reducing their dependence on a single crop and increasing their resilience to climate change shocks.
Vegetables: (Okra, Cucumber, Green Leaves, Water melon, Tomatoes, Pumpkin, Pepper etc)	<ul style="list-style-type: none"> • Farmers should be trained in modern techniques of farming vegetables. • Sort out finances; Bank loans, contributions etc. • Get a good farmland • Conduct soil and water analysis • Recruit staff where necessary for soil preparation • Obtain farm inputs, (simple tiller machines, fertilizers, manure, pesticides, knapsack sprayer, seeds, etc.) • Take care of crops • Harvest, marketing and make supplies 	<ul style="list-style-type: none"> • Vegetables have become income spinning agricultural practice as more persons are aware of its health benefits • Long term crop farmers used to plant vegetable on a small proportion of their farm for home use only, they can expand vegetable farming to increase their income • Vegetable farming is easy and quick win livelihood opportunity for farmers.

• **Short Term Crops within 12 Months Growth Period – Yam, Cassava, Plantain, Banana, etc.**

Adaptation Strategy	Adaptation Method	Adaptation Benefits
<p>Sack Bag Farming</p>	<ul style="list-style-type: none"> • Procure sack bags • Fill sack bags with appropriate soil for the type of crop to be planted • Yam require deep loose texture loamy soil that is rich in organic soil • Best planted at the beginning of rainy season 	<ul style="list-style-type: none"> • Farming of tuberous crops such as yam and potatoes, storage root crops like cassava and sweet potatoes as well as cocoyam and taro which are derived from corms i.e. underground stems can be planted in sack bags. • Some of these crops are short-term crops that can be planted normally without bags but farmers who want to have continued productivity of short-term crops during the rainy season can plant both the long and short-term crops in bags in areas where the soil formation is not conducive for such plants. • It is a coping mechanism for flood-prone areas, harvest in bags is easier and requires no tilling or clearing of land once planted. • The use of herbicides is also not required, use of fertilizer will be very low if sack bags or other biologically recommended bags are used. • Bag farming can be used for vegetables and other crops depending on the terrain and soil formation.
<p>Cassava Farming (6-8 months)</p>	<ul style="list-style-type: none"> • Select a suitable land for cultivation • Prepare land, clearing and tilling • Select 6 to 8 months' growth period cassava stem specie that has the ability to grow fast, ability to store well in the soil and withstand pests and diseases, Longer shelf life and high starchy content • Plant and Apply recommended organic fertilizers, local organic manures etc. • Plant late November/December • Harvest July August • Ability to grow fast Ability to store well in the soil • Ability to withstand pests and diseases Longer shelf life High starchy content 	<ul style="list-style-type: none"> • Farming of tuberous crops such as yam and potatoes, storage root crops like cassava and sweet potatoes as well as cocoyam and taro which are derived from corms i.e. underground stems can be planted in sack bags. • Some of these crops are short term crops that can be planted normally without bags but for farmers who want to have continued productivity of short term crops during the rainy season can plant both the long and short term crops in bags in areas where the soil formation is not conducive for such plants. • Cassava can be processed into different food item and stored.

• **Plantain and Banana Farming**

Adaptation Strategy	Adaptation Method	Adaptation Benefits
<p>Micro-Propagation Chamber</p>	<ul style="list-style-type: none"> • Determine size of propagation chamber • Get a carpenter to take instruction from an expert to construct propagation chamber • Procure local materials for construction of local micro-propagation chamber • Procure or source for saw dust and establish fish farming networks and cooperatives within and across the target coastal communities • Select healthy suckers • Disinfect suckers by submerging suckers in water for 20 to 30 seconds • Prepare sucker and cut to required micro-units • Propagate in controlled micro-propagation chamber • Sell or transplant in 4 to 8 months 	<ul style="list-style-type: none"> • Local materials can be used • Farmers can multiply suckers that will mature uniformly. • This will boost local agricultural business organizations that can buy off from farmers for value addition. • During harvest, multipliers of suckers will start the process and sell to farmers by November. Plantain and banana farming can be adapted to seasonal flooding in Delta, Bayelsa and Rivers States respectively. • There will be suckers multiplier value chain addition to the existing plantain and banana value chain.

Owing to the rain and seasonal flooding farmers can start planting uniform plantain and banana suckers by the end of November, when the flood recedes in places affected and harvest by August and September of the following year. All the plantains planted can be harvested. While the 4 to 5 months' specie of banana can be planned to have double farming season yearly, if an effective planting calendar is developed in addition to building simplified and small storage and processing industries at the community level.

- **Mushroom Farming**



Mushroom is a fruiting body of microorganisms that are called fungi. It does not require sun light and so requires damp places. Some varieties of mushrooms are not edible but the edible mushroom is tasty and a beneficial source of nutrients for people. Mushroom farming is popular in vast last areas of the east and other regions but due to climate change and poor water availability, mushroom farming is depleting in these areas.

Unfortunately, its farming is not popular in coastal communities of the West Africa majority of the people in the Niger Delta communalities do not know its importance and do not eat it as well. The advantage is that, while availability of water is reducing it in the east and other regions, the south and particularly coastal communities can be increasing its farming due to the abundance of water and the right environmental condition. Thus. Mushroom farming is a good alternative livelihood for farmers in the south. According to the National Farmers Information Service (NAFIS), Nigeria produces 300 tones of mushrooms yearly, against a demand of 1,200 tones, leaving a deficit of 900 tones. This is a huge gap and an opportunity for farmers to engage and generate income.

• **Mushroom Cultivation**

Adaptation Strategy	Adaptation Method	Adaptation Benefits
<p>Mushroom Farming</p>	<ul style="list-style-type: none"> • Farmers should be trained in modern techniques of farming vegetables. • Mushrooms need a stable water supply for growth • Mushroom requires damp and moist places • It grows in oxygenated shelters that protect it from sun and wind. • Recruit staff where necessary for training and construction of mushroom shelters • Corncob can be used to grow mushroom in sack bags carefully hung in a damp and moist shelter and watered. • Abandoned or dilapidated shelters in the communities can be used for mushroom farming • There are edible and non-edible mushrooms. Advisably the edible mushrooms should be farmed to enhance food security. 	<ul style="list-style-type: none"> • Mushroom cultivation is a lucrative livelihood activity. It can help reduce vulnerability to poverty and strengthen livelihoods through the generation of a fast yielding and nutritious sources of food and a reliable source of income • Small scale growing of mushroom does not include any significant capital investment. • Mushroom substrate can be prepared from any clean agricultural waste material and produced in temporary clean shelters • Mushroom can be farmed all through the year in locally constructed houses with mud and thatches that can be locally sourced • Mushroom farming has little or no impact resulting from climate change • Mushroom requires damp and moist places which is readily available in coastal communities due to frequent rain fall in the region. • The market demand for mushroom is high, even pharmaceutical companies require mushroom for medicinal purposes, when it is cultivated under very hygienic conditions. • Framers who have lost their agricultural livelihood due to impoverished soil, climatic and environmental challenges can be trained on mushroom farming as an alternative. • Reduces environmental pollution • Means of generating employment - It has health benefits

• **Vertical or Hanging Gardens**

Vertical gardening or hanging gardens are methods of growing plants in containers suspended above the ground. This is a technique of gardening that is often used in small or urban spaces where there is limited space for growing plants. It involves placing containers of various sizes and shapes on a vertical surface such as a wall, fence, or trellis or hanging containers on hooks or ropes. This technique makes use of vertical spaces to maximize the number of plants grown in a limited area while adding aesthetic value to the space.

Vertical gardening or hanging gardens have become increasingly popular as a climate change adaptation strategy in coastal communities. The main benefits and importance of this approach include:

1. **Space-saving:** Vertical gardens or hanging gardens help save space, which is particularly essential in urban areas where land is limited.
2. **Improved air quality:** Vegetation in hanging gardens can improve air quality, and reduce greenhouse gas emissions such as carbon dioxide.
3. **Reduced heat island effect:** Vertical gardening can reduce the heat island effect in cities, where temperatures are typically higher than in surrounding areas due to human activity.
4. **Increased food production:** Vertical gardening can provide higher yields of fresh produce, which is crucial in coastal communities where access to fresh food is limited.
5. **Water conservation:** Vertical gardening requires less water than traditional gardening, making it ideal for areas where water is scarce.
6. **Improved aesthetics:** Hanging gardens can add to the ambiance of an urban landscape.
7. **Community building:** Urban gardening projects, including vertical gardens, have been shown to bring communities together by creating communal spaces and fostering a sense of pride in local produce.

Given these benefits, vertical gardening or hanging gardens offer great potential as a climate change adaptation strategy in coastal communities. By employing such approaches, we can improve the resilience of our communities to the impacts of climate change, and enhance their ability to adapt to new and changing conditions.

• **Economic Tree Plantation**

Rural dwellers mostly in the coastal communities plant economic trees within their premises for beautification. There are no deliberate efforts to undertake in economic tree plantations for commercial purposes. However, AAPW team observed a few palm plantations in Kono, Creek Town, Esuk Mba and huge coconut plantation in Eastern Obolo. It was mentioned that some of these plantations were planted as a way of protecting land by owners and not for commercial reasons. As a result, the adaptation strategy is to recommend tree plantations for economic reasons.

Economic trees as the name implies are trees that have profitable value and are resilient to climate change in coastal communities, which can be explored for commercial business purpose. Some of the popular economic trees observed include; Bush mango or African mango popular called Ogbono, Dogoyanro commonly known as pepper fruits, Soursop, Apple, Avocado Pear, Oil Palm, Coconut, Cashew, Guava, Cocoa, Citruses, Odara (African Star Apple), Pawpaw, Walnut, African Bread Fruit, Shea butter, Castor oil etc. See table of list of some economic trees:

S/N	Common/Botanical Names	Uses	Ecological Status
1	African Breadfruit	Food/Medicine	Available but rare
2	Ogbono	Food/Fruit	Available but reduced
3	Dogoyara	Fruit	Available but reduced
4	Pepper fruit	Fruit	Available but reduced
5	Soursop	Fruit	Available but reduced
6	Castoroil	Fruit/Leaves/Medicine	Rare
7	Apple	Fruit	Available but reduced
8	Pear	Fruit/Food	Available but reduced
9	Oil Palm	Food	Abundant
10	Moringa	Leaves	Available but reduced
11	Citruses	Fruit	Available but reduced
12	Avocado	Fruit	Available but reduced
13	Odara	Fruit	Available but reduced
14	Bitter Kola	Seed Fruit/Medicine	Rare
15	Coconut	Fruit	Abundant
16	Cashew	Fruit	Rare
17	Guava	Fruit	Available
18	Shea Butter	Vegtable/Medicine	Rare
19	Rafia Palm	Wine	Available but reduced

• **Economic Tree Plantation for Food**

Adaptation Strategy	Adaptation Method	Adaptation Benefits
<p>Climate Change Resilient Economic Tree Plantation</p>	<ul style="list-style-type: none"> • CSN to engage and agree on designated areas for economic tree planting with community leadership • Agree on the type of economic trees considering the gestation periods and financial benefits to the community • Quick fruiting and economic potential should be planted first as a way of motivating communities when food or fruits are harvested in addition to - beautification of the community where such trees are planted along the streets • Incorporate individuals interested in planting trees on their land • Obtain training on nursery and seedling production as well as tree planting and management system • Stipulate community bye-laws for the protection of trees • Procure tree seedlings • Prepare nursery to cultivate economic tree seedlings • Prepare and till land for transfer and planting • Plant trees, and maintain and manage farms and designated areas where trees are planted. 	<ul style="list-style-type: none"> • Economic trees provide food and fruits in addition to the basic benefits of trees in providing a cleaner atmosphere, it also lowers the risk of airborne diseases /illness and ultimately reduce the cost of healthcare • Economic trees can be planted as an income-generating activity • Trees curb pollution, protect houses and other infrastructure from heavy storms and other climatic impacts • Trees help to reduce heat waves and provide shade from the sun • Trees can also be used to control erosion, etc. • Generally, trees have economic, social and environmental and play significant roles in balancing the biodiversity and ecosystem.

• **Mangrove Restoration and Conservation**

Mangrove forests play a critical role in supporting coastal communities, by providing various ecosystem services such as carbon sequestration, storm surge protection, and habitat as well as breeding ground for fish and other marine species. However, due to human activities such as deforestation, urbanization, and climate change, mangroves are under threat. Mangrove restoration, therefore has become a very important program that offer opportunities for carbon sequestration as well as restore and improve traditional livelihoods of coastal communities. Here are some ways to restore mangrove forests in coastal communities:

- **Community engagement:** The involvement and participation of local communities in the restoration process are essential. Empowering them through awareness-raising and capacity building activities will help facilitate their ownership and commitment to the project.
- **Site selection:** Choosing suitable sites for mangrove restoration is one of the most important factors contributing to the success of the project. The site should be in an area where mangroves used to grow or is near to a healthy mangrove forest.
- **Planting:** Propagation and planting of the appropriate mangrove species are critical, as different species have varying degrees of salt and wave tolerance. In addition, other species such as red and black mangroves help to provide the necessary structural diversity in mangrove ecosystems.

- **Maintenance:** Regular monitoring and maintenance of the plantation are essential to ensure the survival and growth of the mangroves. This can include activities such as weed removal, fencing and watering.
- **Education and awareness-raising:** Involving local school children and community members in the restoration process helps to promote an understanding and appreciation of the importance of mangrove forests and the need to protect them
- **Participatory governance:** The establishment of participatory governance structures to ensure the sustainability of the mangrove restoration project. This means that communities are able to take ownership of the project and manage it in ways that are beneficial to them and the ecosystem as a whole.
- **Benefits and Importance of Mangrove Restoration as Climate Adaptation Strategy**

Mangrove restoration is an essential ecological intervention that can provide significant benefits and importance to coastal communities. Below are some of the benefits of mangrove restoration to coastal communities:

1. **Improved biodiversity:** Mangroves provide a habitat for many marine species, including fish, crabs, oysters, periwinkles, mudskipper, shrimps etc. Mangroves also provide habitat for many animals and birds; crocodiles, monkeys, etc. Hence, it is very important to restore and or conserve mangroves to improve biodiversity, which can have positive impacts on ecosystem health and the livelihoods of coastal communities that rely on fishing, aquaculture and hunting.
2. **Protection against natural disasters:** Mangroves act as a natural buffer against natural disasters such as tsunamis and hurricanes. They help to reduce the impact of waves and wind on the coast, which can prevent property destruction and loss of life.
3. **Carbon sequestration:** Mangroves are efficient at capturing and storing large amounts of carbon. By restoring mangroves, we can help mitigate the effects of climate change by sequestering carbon from the atmosphere.
4. **Economic benefits:** Mangrove forests provide valuable resources to coastal communities in the form of timber, honey, and other non-timber forest products. Restoring mangroves can also create income-generating opportunities through tourism and eco-tourism activities.
5. **Improved water quality:** Mangroves absorb and filter pollutants from water, helping to improve water quality. By restoring mangroves, we can help improve the quality of both marine and freshwater ecosystems.
6. **Educational and cultural value:** Mangroves are an integral part of many coastal cultures and are often considered sacred places. Restoring mangroves can help preserve cultural heritage and provide educational opportunities to communities.

In conclusion, mangrove restoration is a crucial practice that provides a wide range of benefits to coastal communities. By understanding the value of these forests and investing in their restoration, we can help preserve these ecosystems for future generations.

- **Livestock Farming and Adaptation Strategies**

Livestock farming has naturally evolved to become a major traditional agricultural livelihood practice in coastal communities. Communities in the Niger Delta for instance, keep livestock such as goats, sheep, birds, pig etc. for subsistence purpose. Presently, the negative impact of climate change on fisheries and crop farming, which are the main occupation of the people has forced them to take some adaptation measures that are described below.

- **General Adaptation Strategies of Livestock Farming**

<p>Remarks</p>	<p>Diversification, intensification and or integration of livestock and crop production. People combine livestock and farming for commercial purpose, livestock waste is used as organic manures for crop farming, while grasses and leaves from harvested crops are also used to feed herbivorous animals such as goats, sheep and cows.</p>
<p>These adaptations strategies can be adapted according to the peculiar situation of communities</p>	<p>Similarly, there is also the introduction of mixed livestock farming systems.</p> <p>Cross breeding of local and foreign livestock breeds that will then adapt to the harsh conditions of the local environment and also survive on available local feeds. Cross breeding also helps foreign breeds which grow faster and bigger become genetically resistant and tolerant to temperature alterations, diseases and other local factors that foreign breeds cannot tolerate.</p>

• Selected Livestock Farming and Adaptation Strategies

Adaptation Strategy	Adaptation Method	Adaptation Benefits
<p>Cattle Rearing (Hereford breed)</p>	<ul style="list-style-type: none"> • Training on ranching maintenance, care and treatment of cows • Procure, hire or obtain land • Prepare land • Build ranch with local materials, wood, bamboo, Indian bamboo etc. • Provide shade 	<ul style="list-style-type: none"> • The Hereford breed of cattle is resilient and has been the breed owned by coastal communities. • It is considered more valuable than other species of cows. • Presently, individuals own cows in the community to supplement supply of fish due to the poor fish catch. • These cows are allowed to wonder about and have caused conflict between the owners and farmers and - most people in the community are aggrieved about the cow dumps scattered indiscriminately in the community. Thus, ranching will address such conflicts • There is available technology that utilizes locally sourced materials to use cow dumps for biogas and organic manures for farmers.
<p>Goat Farming (West African Dwarf Goat/Sahel Brown)/sheep/Ram Farming</p>	<ul style="list-style-type: none"> • The West African dwarf goat among other species is the most resilient and can survive optimally in intense climatic conditions of coastal communities • There are about 4 systems of goat farming: intensive system or zero grazing; (goats are confined and provided with feeds) tethering (goats are tethered during the day to feed on grasses and returned back to the pen at night) semi-intensive (goats are restricted at night and certain times of the day but allowed to graze at a certain time of the day under herdsman). The extensive system (goats are allowed to browse and graze large areas of land especially in arid regions) • The requirements are, building of a goat pen in the case of the first three systems of goat farming. Note, ventilation is important but position pen to prevent direct sun heat inside the pen. Elevated ground or stilted houses can be adopted depending on the climatic condition of the area • Obtain training on goat farming • Stock appropriate specie of goats • Care, feeding and general management of goats • Monitoring and recording of performance 	<ul style="list-style-type: none"> • The African dwarf goat have strong climatic adaptation ability • Goat feeds can be made from bio-domestic waste and grasses • Goats have fast reproductive rate such as early maturing, short kidding interval, quick returns on investments, and quick building up of flock. • Goats can be selected based on the environment for heat or cold tolerant species for cross breeding • Goats can feed anytime and can rest during intense rain or sun • Goats can be reared along with cultivation of crops. The goat waste can be used as manures for crop farming • Goat feeds are easy to formulate and produce. • Grasses can be stored at no cost for goat feeding • Farmers who require goat waste can bring edible grasses in exchange for the waste.

Adaptation Strategy	Adaptation Method	Adaptation Benefits
<p>Pig Farming</p>	<ul style="list-style-type: none"> • Training on pig farming, management and marketing • Select appropriate land area swampy areas in coastal communities are very good for pig farming as pigs love water and mud. Thus, pig farms should be located in areas that allow water to flow in and out according to tidal movement. • Construct pig pens within a perimeter that is fenced with either sturdy wires or local materials • Obtain productive pig breed such as the Hampshire, Landrace, Duroc, Yorkshire, and their crosses. They can be crossed with local breeds. These breeds are disease-resistant and climate resilient • Ensure feeding and breeding processes are effective • Supply to grocery stores and in the local market. Pig businesses are very lucrative and have the potential of generating very high income when managed effectively. 	<ul style="list-style-type: none"> • Pig Farming is a high priority alternative source of livelihood for farmers • Pig farming has the of increased income and food security in coastal communities. • Coastal communities have the advantage of climate change adaptation challenges of pig farmers in arid regions. Coastal communities provide a good environment for pig farming. • The waste from pigs can be transformed and used as organic manures for crop farming. • Pigs can be fed with local food waste. However, it is also very easy to formulate good feeds for pigs from local foods • Pig reproduction is very high when managed effectively. Pigs can litter an average of about 10 piglets in every 4 months' circle • Climate change adaptation challenges of pigs in arid regions are actually • Pigs are generally consumed by majority of the population in the Niger Delta. However, pig farming is not popular and effectively practiced in the region. Therefore, introducing pig farming in the region will be a high incentive for alternative livelihood, income generation and food security

• Odour-Free Pig Farming

Transforming pig farms to be odorless requires a combination of proper management practices and technological measures. Here is a step-by-step process to achieve an odor-free piggery:

Step 1: Assess the Current Odor Situation

- Conduct a comprehensive assessment of the piggery farm to identify the sources and intensity of odours.
- Evaluate the ventilation system, waste management practices, and overall farm layout contributing to odour issues.
- Consider engaging experts or consultants specializing in pig farm odour management for an in-depth analysis.

Step 2: Optimize Ventilation System

- Ensure proper ventilation throughout the piggery to remove and disperse odorous gases.
- Inspect and clean ventilation fans and ducts regularly to ensure optimal airflow.
- Consider installing or upgrading ventilation systems to improve air quality and minimize stagnant air pockets.

Step 3: Implement Effective Waste Management Practices

- Develop and enforce a comprehensive waste management plan for the piggery.
- Properly collect and remove manure and other waste materials from pens and storage areas.
- Implement regular cleaning schedules and consider using additives or treatments to neutralize odours in waste storage areas.

Step 4: Utilize Anaerobic Digesters or Biogas Systems

- Consider implementing anaerobic digesters or biogas systems to efficiently process pig manure.
- These systems break down organic matter and capture methane gas, reducing odours and producing renewable energy.
- Work with experts to design and install a suitable anaerobic digester or biogas system for the pig farm.

Step 5: Implement Odour Control Technologies

- Explore the use of advanced odour control technologies such as biofilters, scrubbers, or activated carbon systems.
- These technologies help filter and neutralize odorous compounds before they are released into the atmosphere.
- Consult with experts in odour control to determine the best technology that suits the specific needs of the piggery.

Step 6: Optimize Animal Housing Design

- Review the design and layout of pig housing to minimize odour-related issues.
- Consider separating feeding and resting areas to reduce manure accumulation and related odours.
- Evaluate flooring materials and drainage systems to facilitate proper waste management and minimize odours.

Step 7: Implement Best Management Practices (BMPs)

- Adopt industry-recommended Best Management Practices (BMPs) for odor control in pig farms.
- Implement measures such as manure composting, cover crops, or vegetative buffers to reduce odors.
- Train and educate farm staff on proper management practices and ensure their consistent implementation.

Step 8: Continuous Monitoring and Maintenance

- Establish a regular monitoring and maintenance program to assess odour levels and address emerging issues promptly.
- Regularly inspect ventilation systems, waste management facilities, and other components critical to odour control.
- Implement preventive maintenance practices to ensure the long-term effectiveness of odour control measures.

Step 9: Community Engagement and Communication

- Engage with neighbouring communities and stakeholders to address any concerns related to pig farm odours.
- Maintain open lines of communication, provide updates on odour control efforts, and address community feedback or complaints.
- Consider implementing additional measures such as landscaping, buffer zones, or vegetative barriers to minimize the perceived impact of odours on surrounding areas.
- It is essential to adapt these steps to the specific conditions and requirements of the pig farm. Where necessary seek guidance from experts in odour control and maintain a commitment to continuous improvement for long-term results.

• Poultry Farming

Poultry farming is a very lucrative business in Nigeria. The demand for chicken and eggs is very high. To achieve success in poultry farm, a lot of work is required. It is better to start small and grow big. Going into poultry farming with practical training is critical to the success of poultry farming. The impact of climate change in coastal communities on poultry farming has caused many huge losses as a result most poultry farmers have abandoned the business. The supply of chicken in communities have become very low and cost intensive. Therefore, the adaptation strategies below are conceived to address some of the challenges of poultry farming.



Poultry built on Stilt in Agbakabiriyai Nembe



Poultry built on Stilt

Adaptation Strategy	Adaptation Method	Purpose of Adaptation
<p>Poultry and Duck Farming</p>	<ul style="list-style-type: none"> • Do market analysis • Learn the skills of poultry farming • Decide on the size and type of birds • Build your poultry either the Deep Litter System or the Battery Cage depending on the available resources and ability to manage the poultry effectively • The duck fowl farming requires housing within a fenced area that has collection of water • Either of the two housing system can be built on stilt in flood prone areas • Procure inputs and feeds • Set and implement poultry management policies • Join poultry farmers association 	<ul style="list-style-type: none"> • The temperature of the poultry can be regulated and therefore, the unpredictable weather situation can be controlled. • There are different species of native fowls such as the Rooter hen, the guinea fowl, duck fowls etc. These breeds are very resilient to the coastal terrain. However, their growth is slow and will take longer time for the fowl to reach maturity • The ducks and native fowls can survive under intense flood and rainy seasons. • The conventional agriculturally enhanced fowls are not resilient to weather conditions and can die massively in a very short period • The native fowls is very tasty and preferred to the agricultural fowls • Native fowls are not reared for business purpose in communities except for household use. Thus, training on native fowl poultry business will open new alternative sources of employment, food security and income generation • The native fowls can eat industrial and domestic feeds from waste. Unlike the Agricultural fowls that might have health issues if fed with domestic feeds from waste. • Mixed species of native and agricultural fowls for cross breeding will also result to resilient breeds.

• Steps in Odourless Poultry Farming

Step 1: Assess the Current Odour Situation

- Conduct a thorough assessment of the poultry farm to identify the sources and intensity of odour.
- Evaluate the ventilation system, waste management practices, and overall farm layout that may contribute to odour issues.

-Consider engaging experts or consultants specializing in poultry farm odour management for a comprehensive analysis.

Step 2: Improve Ventilation System

- Ensure proper and adequate ventilation throughout the poultry farm to remove and disperse odorous gases.
- Install or upgrade ventilation systems to provide sufficient airflow and minimize stagnant air pockets.
- Consider using exhaust fans, air scrubbers, or negative pressure systems to effectively remove and filter odorous air.

Step 3: Implement Effective Waste Management Practices

- Develop and enforce a strict waste management plan for the poultry farm.
- Regularly clean and remove manure, litter, and other organic waste materials from the barns or coops.
- Implement proper storage and disposal methods for waste materials, ensuring they are kept away from poultry housing areas.

Step 4: Use Odour Control Additives or Treatments

- Explore the use of odour control additives or treatments designed specifically for poultry farms.
- These products can be added to the litter, manure, or waste storage areas to neutralize or minimize odours.
- Use these additives according to the recommended application rates and guidelines provided by the manufacturer.

Step 5: Optimize Biosecurity Measures

- Implement robust biosecurity measures to minimize the risk of disease and infections in the poultry farm.
- Proper biosecurity practices can help reduce any potential odour-causing agents associated with health issues or decomposition.
- Regularly inspect and maintain poultry housing and equipment to prevent any leaks, spills, or contamination.

Step 6: Implement Best Management Practices (BMPs)

- Adopt industry-recommended Best Management Practices (BMPs) for odour control in poultry farms.
- These may include measures such as proper manure composting, utilizing cover crops, or implementing biofilters.
- Training and educating farm staff about these practices and ensuring their consistent implementation is crucial.

Step 7: Continuous Monitoring and Maintenance

- Establish a regular monitoring and maintenance program to assess odour levels and address any emerging issues promptly.
- Regularly inspect the ventilation system, waste management facilities, and other components critical to odour control.
- Implement preventive maintenance practices to ensure the long-term effectiveness of odour control measures.

Step 8: Community Engagement and Communication

- Engage with neighbouring communities and stakeholders to address any concerns related to poultry farm odours.
- Maintain open lines of communication, provide updates on odour control efforts, and address any community feedback or complaints.
- Consider implementing additional measures such as landscaping, buffer zones, or vegetative barriers to minimize the perceived impact of odours on surrounding areas.

Remember that each poultry farm is unique and the effectiveness of odour control measures may vary. Tailor the approach based on the specific conditions and requirements of the farm and seek guidance from experts when needed.

• Snail Farming

Among the species of snails; *Achantina Fulica*, *Achantina* and the *Achantina Marginate*, the *Achantina Marginate* is the giant one weighing between 120 and 250gms and can grow up to 321mm. Most snail farmers do not understand the difference; this is important for income generation. Snail breeding can be done in coastal communities. It requires local materials and biodegradable domestic waste for feeding, much less than goats and pigs that also requires bio-waste. The snail shell is calcium and should be ground and used as ingredients for animal, poultry, fish and snail feeds. Both outdoor and indoor snail breeding is good. However, outdoor snail breeding is more environmentally friendly.

There are many ways of rearing snails. The most common places people keep snails in Nigeria are: In a large room like a garage or in a plastic or wooden spaces in a balcony, in a greenhouse and outdoor areas such as crop farms, gardens or specially prepared outdoor places in a vegetative environment.



Different types of snail farms

Adaptation Strategy	Adaptation Method	Purpose of Adaptation
<p>Honey Bee Farming: This is the process of beekeeping to collect honey or other products such as propolis, beeswax, royal jelly etc from the bee.</p>	<ul style="list-style-type: none"> • Obtain basic training on Bee Farming • Develop a simple business plan • Identify suitable location that will attract bees • Procure inputs such as beehives, hats, bee suits, smokers, buckets, boots, wheelbarrows, basins, machetes, etc. A small scale mechanized bee farming will procure, honey extractor machines, packaging and sealing machines etc. • Prepare and locate beehives in designated areas with numbering • Introduce honey bees to the hives • Study the performance of the bees • Harvest honey combs and other essentials for refining, packaging and sales 	<ul style="list-style-type: none"> • Honey beekeeping does not need daily care like livestock or crop farming • Bee Farming allows farmers to undertake other livelihood activities like crop farming • Bee hives can be constructed from local materials • The tropical forest in coastal communities provides good vegetation for beekeeping. • Honey bee farming has a huge potential for income generation. Honey is in high demand. • Honey bees pollinate a high proportion of crops. Thus, crop farmers who undertake honey bee farming around their crop farms are likely going to have high crop or vegetable yields. Advisably crop farmers in coastal communities should engage in mixed farming (Crop and Honey Bee Farming) for high crop yield and an additional stream of income • Bee keepers contribute directly to food security as a result of bee pollination. According to bee experts at the Food and Agriculture Organization (FAO) of the United Nations, a third of the world's production depends on bees.

INFRASTRUCTURAL ADAPTATION STRATEGIES

• Waste Management

According to the West African Coastal Area Management Program (WACA) Nigeria's coastal and marine area lies on the Atlantic Ocean and borders the Gulf of Guinea. It stretches for approximately 853km and includes nine states out of the thirty-six states of the Federation, namely; Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Lagos, Ogun, Ondo and Rivers (GoN, 2010). The coastal population accounts for approximately 19% of the national population, which was recorded in the national census of 2006 as 140,431,790. The rate of urbanization is 4.66% with high population densities and high population growth occurring along the Niger Delta and Lagos (USAID, 2014). Nationally, 69% of the population lives below the poverty line, with 38.7% being recorded as extremely poor (GoN, Nigeria Poverty Profile, 2010). Based on the foregoing, coastal communities account for a massive waste. Particularly, non biodegradable waste such as plastics and cellophane. Plastics, cellophane, fibres and other waste products dumped into the river have contributed to the sea level rise and temperature. Thus, waste management is a critical issue that should be managed as part of the adaptation strategies for climate change in coastal communities. Initiating waste-to-wealth programs in communities to recycle plastics, cellophane and other waste will create employment opportunities. Waste management is essential for a sustainable and healthy environment. It is also a crucial step in adapting to the effects of climate change. As a strategy for climate change adaptation, waste management focuses on reducing the environmental impact of solid and hazardous waste while also minimizing emissions of greenhouse gases that contribute to global warming. The following are some of how waste management can serve as a climate change adaptation strategy:

- 1.Reduce greenhouse gas emissions: Waste decomposition is a significant source of greenhouse gases such as methane. Proper waste management practices can help reduce these emissions, either through composting organic waste or capturing methane from landfill sites and using it as a source of energy.
- 2.Reduce waste generation: Waste reduction strategies, such as recycling and composting, reduce the amount of waste that ends up in landfills. This, in turn, reduces greenhouse gas emissions associated with the production and transportation of new products.
- 3.Promote resource conservation: Waste management practices that promote the reuse and recycling of materials can help conserve natural resources and reduce the carbon footprint associated with the extraction and processing of raw materials.
- 4.Protect public health and the environment: The proper disposal of hazardous waste can reduce the risk of contamination of soil and groundwater. This, in turn, prevents the release of toxic substances into the environment that can affect local ecosystems and human health.
- 5.Raise public awareness: Waste management initiatives can raise public awareness and education programs to encourage individuals and communities to take steps to reduce waste generation and promote sustainable waste management practices. Awareness of waste management benefits can engender community action on waste management which can help to reduce the risk of flooding and other climate-related disasters by ensuring that waste is disposed of properly and not left to accumulate in waterways. Finally, waste management can help to promote sustainable development by creating jobs and supporting local economies.

In conclusion, waste management can serve as an essential climate change adaptation strategy. By managing waste properly, reducing greenhouse gas emissions, conserving resources, and promoting public awareness, it is possible to reduce the environmental impacts of waste and mitigate the effects of climate change.

Adaptation Strategy	Adaptation Method	Adaptation Benefits
<p>Establish a centralized waste dump sites sorting</p>	<ul style="list-style-type: none"> • CSNs facilitate community centralized waste dump sites for sorting • CSNs engage interested persons in waste sorting • Procurement and Installation of plastic shredders, and simple metal compactors • Train and engage operators • CSNs to initiate incentives for household sorting of waste and deposition at waste centres • Local fabrication of special boats for waste transportation • CSN sensitization of communities on the importance of waste management and the need for Waste Reuse, Reduce and Recycle. 	<ul style="list-style-type: none"> • Waste can easily be sorted for financial benefits • Environmental pollution by waste will be reduce • Contamination. Infections and spread of diseases will reduce (health and environmental benefits)
<p>Waste Conversion to Bio-Gas</p>	<ul style="list-style-type: none"> • The use of available local technology to convert biodegradable domestic waste to bio-gas should be adopted • Interested community stakeholders should be trained on the technical skills required. • CSNs can initiate Incentives for community completion on waste management strategies 	<ul style="list-style-type: none"> • Sustainable energy • Important alternative for fossil fuel • Eco-friendly energy • Use of local infrastructure • Income generation

The process of waste conversion to biogas involves several steps. Here are some of the steps in converting waste to biogas:

1. Collection and segregation of waste: Waste is collected from households, industries, and commercial areas and is segregated according to their type. This step ensures that the organic waste is separated from the inorganic and hazardous waste.
2. Shredding and pre-processing: The organic waste is shredded, and any large-sized waste is broken down into smaller pieces for efficient digestion. The waste is then pre-processed to remove any contaminants such as plastics, metals, and glass.
3. Anaerobic digestion: The pre-processed waste is fed into an anaerobic digester where it is broken down by microorganisms in the absence of oxygen. This process forms bio-gas, mainly composed of methane and carbon dioxide.
4. Biogas purification: The bio-gas produced is then purified by removing impurities such as sulfur, water, and carbon dioxide. The purified bio-gas is then compressed and stored in gas cylinders for transportation and use.
5. Generation of electricity or heat: The bio-gas is either burned to generate electricity or used as fuel for heating furnaces, boilers, and other industrial processes.
6. Use of bio-fertilizer: The solid waste leftover after the anaerobic digestion process is rich in nutrients and is used as bio-fertilizer in agriculture.

In conclusion, the conversion of waste to bio-gas has significant environmental benefits as it reduces greenhouse gas emissions, promotes renewable energy production, and reduces waste disposal in landfills. The process also produces organic fertilizer that can replace chemical fertilizer in agriculture.

Adaptation Strategy	Adaptation Method	Adaptation Benefits
<p>Conversion of Waste to Organic Manure</p>	<ul style="list-style-type: none"> • Biodegradable waste can be converted to organic manure and fertilizers which can be used by farmers • Seminars and workshops is required to change the mind-set of community members in waste to wealth programmes 	<ul style="list-style-type: none"> • Sustainable source of manure for farmers • Increase in agricultural yield, income generation and food security • Attract youth to farming activity

Converting waste to organic manure is a sustainable practice that can reduce waste accumulation in landfills and contribute to improving soil health and fertility. Here are some steps involved in the process:

1. **Collecting waste:** The first step in converting waste to organic manure is collecting waste from sources such as households, food processing companies, agriculture, and sewage treatment plants. The collected waste should be sorted to separate organic and inorganic waste.
2. **Composting:** The organic waste is then taken to a composting facility, where it is converted to compost through decomposition. Composting involves creating a pile of organic waste mixed with other materials like leaves, sawdust, or grass clippings, which provide carbon and nitrogen for the microorganisms in the pile to break down the organic matter. The pile is then regularly turned to ensure proper aeration and moisture levels.
3. **Curing the compost:** Once the decomposition process is complete, the compost is left to cure for several weeks to allow for the breakdown of any remaining organic matter. During the curing process, microorganisms continue to work on the compost, improving its nutrient content.
4. **Testing the compost:** The final step in the process is to test the compost to ensure it meets the required standards for use as organic manure. Tests are typically done for pH levels, nutrient content, and potential contaminants.
5. **Application of compost:** The cured compost can now be used as organic manure in agricultural practices, gardening, or landscaping. The application of compost helps to improve soil structure and fertility, enhance water retention, and suppress plant diseases.

In conclusion, converting waste to organic manure is a sustainable practice that can contribute to reducing waste accumulation while providing an environmentally friendly alternative to conventional chemical fertilizers. The process requires proper waste management practices and regular testing to ensure optimal quality of the resulting compost.

- **Local Energy Strategies**

Local energy strategies refer to plans and actions aimed at promoting sustainable and efficient energy use within a particular geographic area. In this case, coastal communities of the Niger Delta of Nigeria. Below are some of the steps involved in developing and implementing local energy strategies:

1. **Assess local energy needs:** The first step in developing a local energy strategy is to understand the energy needs of the community, including current and future energy demand and sources of energy. This information is gathered through a community energy audit, which analyses energy consumption patterns and identifies areas of potential energy savings.
2. **Set goals and targets:** Based on the results of the community energy audit, local energy targets and goals are set, which guide the development of strategies and action plans. These goals and targets may include reducing energy consumption, increasing the use of renewable energy sources, and improving energy efficiency.
3. **Develop strategies and action plans:** A range of strategies and actions is developed to achieve the energy targets and goals. Examples of strategies and actions include promoting energy-efficient buildings, encouraging the use of clean and renewable energy sources, and developing public transport infrastructure.
4. **Stakeholder engagement:** Engagement of local stakeholders is critical for the development and implementation of local energy strategies. Stakeholders may include community groups, business leaders, government officials, and energy experts. Regular consultation and engagement with stakeholders can help to build support for the strategies and actions and ensure they are implemented effectively.
5. **Implementation:** The strategies and actions developed in step three are implemented, with clear timelines, responsibilities, and performance indicators. Monitoring and evaluation are carried out to ensure progress towards the energy targets and goals.
6. **Review and update:** Local energy strategies are reviewed and updated regularly to ensure they remain relevant and effective. This includes assessing progress towards energy targets and goals, identifying emerging technologies and opportunities, and responding to changing community needs.

In conclusion, developing and implementing local energy strategies requires collaboration, innovation, and long-term planning to achieve sustainable and efficient energy use within a specific geographic area.

<p>Locally made energy stoves</p>	<ul style="list-style-type: none"> • Train interested persons on how to fabricate energy efficient cooking stoves • Use a good flat material, preferably iron on a flat land area to provide a level base should be identified • Determine the size of the energy efficient stove that is required. • Fabricate a panel in a circle shape and then fill the circle with clay to the base of the flat platform • Build up the walls of the using clay until it is about 15-20 cm high, leaving the middle of the circle and the base of the panel open to allow charcoal or pieces of wood to be put in for fire. • Construct a pot stand on the panel after filling the clay to allow for balancing of cooking pots and to also help in lifting the stove from place to place. 	<ul style="list-style-type: none"> • Energy efficient stoves reduces the use of daily kilograms of fire. • It reduces illnesses as a result of high inhalation of carbon monoxide (Smoke from use of fire) • Massive felling of trees and cutting of mangrove for fire will also reduce • Youths who are skilled in fabricating energy efficient stoves are likely to earn their living from it. • Reduced use of fire for furl can reduce tension between two tribes or opposing group of persons over forest resources.
<p>Use of Nypa Palm Seed for Domestic Fire</p>	<ul style="list-style-type: none"> • Nypa palm seed can be used for domestic fire with either the energy efficient stoves or the traditional fire making system for fish preservation (Fish drying). The seeds when used for fire, produce high velocity of fire • Harvest matured nypa palm seeds and dry in the sun or platforms above fire systems for fish drying • Use dried Nypa palm seed for fire. 	<ul style="list-style-type: none"> • Increased use of Nypa palm seed for fire will reduce the spread and invasion mangrove trees by Nypa Palm • It will reduce the cutting of mangrove trees for fire • It will enhance Mangrove restoration • It will also restore breeding grounds of fishes and other aquatic lives in coastal communities of West Africa.

- **Health Adaptation Strategy**

Rise in temperature, heatwaves, storms, heavy rainfalls, rise in sea level, floods, the disruption of the ecosystem and particularly, water and food systems due to extreme weather conditions in coastal communities has caused severe health impacts leading to acute illness and death. However, health issues as a result of climate change impacts vary from one community to the other. As climate change impacts continue to worsen, the health risks posed to coastal communities are rising. The increase in floods, storms, and other disasters can lead to injuries, illness, and poor mental health. The following are some examples of healthcare implementation strategies that can be used as climate change adaptation strategies in coastal communities:

1. **Health Audit:** The Community Stakeholders Network in collaboration with Health Centre's and other health service providers in the area to conduct a health audit. Anticipated climate change impacts and an assessment of vulnerabilities should be part of the health audit programme. The population and scope of climate change impacts as well as associated potential health impacts and the vulnerabilities of communities to these health impacts should be examined.
2. **Health Care Burden and Intervention Strategy Development:** The health audit will provide the required data to analyze likely health burden on available health care facilities if any and recommend measures and adaptation strategies to be taken. This will also help in Identifying the most suitable health intervention plan or scheme for the identified health impacts of greatest concern.
3. **Building resilient healthcare facilities:** Coastal communities need healthcare facilities that can withstand climate extremes and natural disasters. The hospitals, clinics, and other healthcare facilities should be designed to avoid disruption during extreme weather conditions like hurricanes or floods.
4. **Disaster preparedness:** Healthcare systems (hospitals, emergency services, and public health agencies) should develop preparedness plans tailored to the specific climate hazards that pose a threat to the community.
5. **Health outreach:** Healthcare providers can play a vital role in informing coastal communities about the risks of climate change and how to protect themselves and their families. Public awareness, education, and outreach programs can educate residents about the connection between climate change impacts, health risks, and the importance of taking preventative measures.
6. **Mental health support:** Climate change-related disasters such as floods and hurricanes can result in trauma and prolonged anxiety, causing mental health challenges. Healthcare providers and community groups need to provide mental health support services to help cope with the psychological impact of climate-related changes.
7. **Disease surveillance and control:** Climate change poses increased risks of outbreaks of diseases in coastal communities. Disease surveillance systems can be implemented and put in place to prevent and control any outbreaks of diseases in coastal communities that can cause illnesses like diarrhea or other water-borne illnesses.

A comprehensive climate impact health intervention and adaptation plan should be carried out and updated regularly for effective health care implementation. Health care implementation can serve as an important climate change adaptation strategy in a number of ways. Some of these include:

1. Ensuring access to health care services: Climate change can increase the frequency and severity of extreme weather events such as floods, hurricanes, and tornadoes, which can have a significant impact on people's health. Providing access to health care services, including emergency medical care, can help mitigate the negative health impacts of such events.
2. Developing public health programs: Climate change can increase the spread of infectious diseases, including vector-borne diseases such as malaria and dengue fever. To prevent or control the spread of these diseases, public health programs can be implemented that include disease surveillance, vector control, and vaccination campaigns.
3. Strengthening health infrastructure: Climate change can cause damage to health care infrastructure, including hospitals, clinics, and other facilities. Strengthening these facilities to withstand extreme weather events can ensure that health care services are available when they are needed most.
4. Promoting healthy lifestyle and behaviour changes: Climate change can change the availability and quality of food and water, which can have a direct impact on people's health. Promoting healthy lifestyle and behaviour changes, such as consuming a healthy diet, engaging in physical activity, and reducing exposure to environmental pollutants, can help people adapt to these changes.

Overall, health care implementation can play a crucial role in climate change adaptation by reducing the negative health impacts of climate change and helping people adapt to the changing environmental conditions.

- **Housing Strategies**

Climate change has made most community dwellers become vulnerable and homeless due to the changing climatic conditions that has resulted in heavy storms, increase in horizontal rainfall, flood and erosion. Most houses are built with thatched roofs and walls made from clay. Coastal communities are particularly vulnerable to the impacts of climate change, including flooding, sea-level rise, and intense storms. Housing implementation strategies can help address the challenges posed by these impacts and provide solutions for climate change adaptation in coastal communities. The following are some examples of housing implementation strategies as climate change adaptation strategies in coastal communities:

1. Elevating buildings: Raising houses and critical infrastructure above the flood level can reduce the risk of damage from flooding. In some areas, structures are already designed with the first floor as a parking area that can be elevated during flooding events.
2. Building seawalls: A seawall can help to protect coastal communities by reducing the impact of waves and storm surges. Seawalls can be designed to protect properties and public infrastructure, reduce erosion and protect mangroves, wetlands, and other natural habitats.
3. Green infrastructure: Using natural or green infrastructure, such as wetlands and dunes, can reduce the impact of flooding and storm surges and improve water and air quality while absorbing carbon emissions. Additionally, vegetated roofs and porous pavements can reduce the amount of runoff, reduce heat islands and provide added amenity spaces.
4. Relocation: Coastal communities facing the worst impacts of climate change, such as rising sea levels and increasingly severe storms, may need to relocate or adapt to new living conditions. This can involve incorporating the principles of resilient and sustainable design in their new communities.
5. Appropriately sized and designed homes: Houses in coastal areas must meet specific designs that consider the hazards associated with their location, such as hurricane wind and flooding, and building codes that require structures built before construction.
6. Retro-fitting Buildings to Withstand Extreme Weather Events: Climate change is expected to increase the frequency and severity of extreme weather events such as storms, floods, and heatwaves. Retrofitting buildings to withstand these events can help protect residents from harm and reduce property damage.
7. Increasing Energy Efficiency: Buildings are responsible for a significant amount of greenhouse gas emissions worldwide. Increasing energy efficiency in housing can reduce these emissions and help mitigate the negative impacts of climate change.
8. Encouraging the use of Renewable Energy: Switching to renewable energy sources such as solar panels or wind turbines can help reduce greenhouse gas emissions and build resilience to power outages or disruptions caused by extreme weather events.
9. Designing Tree Planting: Communities should be planned for tree planting to shield houses from being destroyed by storms. Tree planting should be planned in ways that it does not destroy houses when it breaks. Trees in and around buildings can help reduce heat and provide natural habitats for beneficial insects and other wildlife.
10. Promoting Sustainable Building Materials: Many traditional building materials require significant energy to produce and transport. Using sustainable materials such as recycled content, locally sourced wood, or natural insulation can help reduce the carbon footprint of new construction or retrofitting existing buildings. Local houses can also be built with the use of Nypa Palm in place of Raffia palm leaves for thatches. This will help reduce the invasion of nypa palms. Using cement to form concrete for the groundwork of houses to withstand flood and erosion should be an important consideration in construction of all forms of houses in coastal communities. Cement can also be used to plaster mud houses to shield it from being destroyed by horizontal rainfalls.

Overall, housing implementation can play a critical role in adapting to climate change by reducing the carbon footprint of buildings, making them more resilient to extreme weather events, and taking actions to reduce climate change impacts.

- **Transportation Strategies**

Transportation systems are a vital part of any coastal community's infrastructure, but they are also vulnerable to the impacts of climate change such as intense rainfall, storm, flood, erosion etc. This has affected the movement of vehicles, goods and services to and from communities to market centers and cities. As a result, there is a general increase in cost of transportation, goods and services in the communities. Therefore, transportation system implementation strategies can help coastal communities adapt to the adverse effects of climate change. Here are some examples of transportation system implementation as climate change adaptation strategies in coastal communities:

1. **Designing resilient transportation infrastructure:** Coastal communities must ensure that their roads, bridges, and other transportation facilities are resilient to climate change. For instance, transportation infrastructure must be built with materials that can withstand extreme weather conditions, such as stronger and thicker bridges, elevated roads, and reinforced piers.
2. **Regional transportation planning:** Transportation systems in coastal communities must be planned more regionally to enhance connectivity and reduce the risk of isolation from increasing sea levels and severe weather. This plan should incorporate multiple modes of transportation, making use of boats, buses, bikes, sidewalks, and ferries, accordingly.
3. **Encourage sustainable modes of transport:** Increasing the adoption of climate sensitive transport systems such as cars and boats. Biking and walking should be encouraged to minimize greenhouse gas emissions, improve public health, reduce traffic congestion, and overall increases the livability of coastal communities. Road networks should be planned in line with climate sensitive approaches. Drainages, culverts and bridges should be introduced to road construction in coastal communities to allow for free flow of water during heavy rainfalls and other water overflows. Planting of trees by road sides to prevent the soil from caving in and form gullies that will damage roads.
4. **Promote disaster response planning:** Coastal communities should have disaster response plans in place to address transportation-related challenges during and after extreme weather events. This would include established routes, vehicles and personnel that can rapidly assist in recovery efforts following coastal storms that block or damage transportation routes. A quick response team with communication gadget for swift response to rescue boat mishaps during sudden weather changes such as heavy storm and rain fall should be established.

Encouraging alternative transportation options: Encouraging the use of transportation options, such as water taxis, to reduce the dependence on roadways and create more efficient transport routes between coastal regions. Communities should work towards building local transportation boats that are covered to convey goods and services.

In conclusion, the implementation of resilient and sustainable transportation systems can play a crucial role in the adaptation of coastal communities to climate change impacts. These adaptations should include making strategic infrastructure investments, adding multiple modes of transport, fostering behaviors to reduce ecological impacts, and promoting planning approaches that create more livable communities.

- **Water Adaptation Strategies**

Climate change has made it difficult for coastal communities to have potable drinking water as their water sources have become mixed with salt water, making it very saline for drinking. Thus, the water quality in most coastal communities is very poor and this has caused health challenges and have disrupted the ecosystem. Water system implementation can be particularly important as a climate change adaptation strategy in coastal communities, where sea level rise and increased storm surge can threaten water quality, infrastructure, and access to potable water. Some examples of water system implementation strategies that can be used in coastal communities include:

1. **Desalination plants:** Desalination plants can be used to remove salt and other contaminants from seawater, providing a reliable source of potable water even as sea levels rise and saltwater intrusion increases.
2. **Flood control infrastructure:** Flood control infrastructure such as seawalls, raised roads, and storm water drainage systems can help protect coastal communities from flooding caused by sea level rise and increased storm surge.
3. **Managed retreat:** Managed retreat involves moving people and infrastructure away from areas that are at high risk of flooding or other climate-related hazards. This can be a long-term adaptation strategy for coastal communities facing severe sea level rise.
4. **Shoreline restoration:** Restoring natural coastal features such as mangroves, salt marshes, and sand dunes can help protect shorelines from erosion and flooding while improving water quality and enhancing biodiversity.
5. **Storm water management:** Effective storm water management strategies such as green infrastructure and constructed wetlands can help capture and filter storm water runoff, reducing the risk of flooding and improving water quality in coastal areas.
6. **Water Conservation System:** Construction of a simple community water reticulation system to enhance water conservation and improve storage
7. **Capacity building:** Training of communities on simple water purification system using local materials and boiling of water for drinking

Overall, water system implementation can play a critical role in helping coastal communities adapt to the impacts of climate change by providing a reliable source of potable water, protecting infrastructure from flooding and erosion, and improving overall water quality and stormwater management.

SOME GLOBAL CLIMATE CHANGE ADAPTATION PRACTICES

There are many best practices in climate change adaptation strategies being implemented globally. Some of the most effective ones are as follows:

Ecosystem-based adaptation: This involves the conservation, management, and restoration of ecosystems and their functions to help communities adapt to climate change impacts, such as flooding and drought.

Infrastructure adaptation: This includes the use of engineered solutions, such as sea walls and flood barriers, to protect communities from extreme weather events.

Community-based adaptation: This focuses on empowering local communities to identify and implement adaptation measures that are appropriate, effective, and sustainable in their context.

Early warning systems: Early warning systems, such as weather forecasting and flood alerts, can help communities prepare and respond to extreme weather events.

Disaster risk reduction: Disaster risk reduction measures, such as land-use planning and building codes, can help communities reduce their vulnerability to natural hazards and adapt to the impacts of climate change.

Climate-smart agriculture: This involves sustainable farming practices, such as conservation agriculture and agroforestry, that reduce greenhouse gas emissions and increase the resilience of crops and livestock to climate variability.

Water management: Water management practices, such as rainwater harvesting and wastewater reuse, can help communities adapt to the impacts of climate change on water availability.

These best practices are not mutually exclusive and can be combined to create a comprehensive climate change adaptation strategy. The most effective adaptation strategies are those that are tailored to the local context and involve active community engagement and participation.

GLOBAL BEST PRACTICES ON CLIMATE CHANGE ADAPTATION IN COASTAL COMMUNITIES

Coastal communities are particularly vulnerable to the impacts of climate change, such as rising sea levels and more frequent and severe storms. Therefore, adapting to climate change in coastal communities requires special attention to their unique challenges and vulnerabilities. Some of the best practices in climate change adaptation strategies in coastal communities are:

1. **Shoreline protection:** Protecting coastal communities from storms and sea level rise by building seawalls, revetments, breakwaters, and beach nourishment.
2. **Managed retreat:** Relocating or abandoning development in vulnerable areas, such as low-lying coastal zones, to reduce exposure to sea level rise and storm surges.
3. **Natural infrastructure:** Using natural systems, such as wetlands and mangroves, to provide protection from storms and erosion while providing other ecosystem services.
4. **Coastal land use planning:** Avoiding development in vulnerable areas, such as flood zones and erosion-prone areas, and promoting smart growth principles.
5. **Early-warning systems:** Providing early warning systems for storms and sea level rise to help communities prepare and protect themselves.
6. **Building codes and standards:** Ensuring that coastal buildings and infrastructure are designed and built to withstand storm surges and sea level rise.
7. **Community engagement and participation:** Promoting community-based adaptation through engagement and participation in planning and decision-making processes.

These best practices can be used in combination to create a comprehensive climate change adaptation strategy for coastal communities that is tailored to their specific circumstances. The most effective adaptation strategies involve a collaborative approach that takes into account the unique needs and perspectives of coastal communities and other stakeholders.

FINDINGS ON COMMUNITY BASED ADAPTATION STRATEGIES

Climate Change Issue	Current Adaptation/Mitigation Strategy	Adaptation Benefits	Remarks
<p>Heavy wind and Rainstorm de-roofing of houses</p>	<p>Reinforcement of roof on lintel with a strong concrete</p>	<ul style="list-style-type: none"> • Planting of mangrove forest • Planting of economic trees on streets, waterfront and premises of houses in the community. • Community Ogbono tree plantation in a designated area agreed by the community. • Palm plantation for palm oil to enhance palm oil business value chain • Fresh water and Mangrove Forest Protection and Restoration byelaws. This will also curb the high rate of afforestation, particularly mangrove cutting for construction activities 	<ul style="list-style-type: none"> • Community members will be interested in planting economic trees for income generation • Ogbono tree is a hard wood with high economic value, it is a specie of mango that is eaten and the seed used for soup and very expensive in the market. Note: University of Port Harcourt sells economic tree seedlings including ogbono seedlings. • The CSN can establish a mangrove nursery and planting center and introduce strategies such as planting on birthdays, burials, weddings, etc. to encourage afforestation generally. • Community members believe that “mangrove forest regenerates without human intervention, it is a God given source of energy. It will never finish” It is therefore, important to back up mangrove protection and restoration
<p>Poor waste management: Much of the plastic and cellophane ends up in the sea which is dangerous to the biodiversity and contributes to ocean warming and sea level rise. Aquatic creatures also get entangled, some swallow particles of cellophane and plastic and die.</p>	<p>There is no collectively agreed waste management practice. Waste gathering, burning and disposal in water bodies are the most practiced waste management systems in communities. However, there is a new dimension to waste management as there are valuable waste buyers in the community. Plastics, metals and bottles are the mostly frequently procured or exchanged with other valuable materials such as buckets, plates etc.</p>	<ul style="list-style-type: none"> • Community waste collection Centre with plastic shredding machines • CSNs to sensitize and provide waste centres for segregation at community level. Solid and plastic waste sorted and shredded will be sold in kilos to recycling companies. This will generate revenue and create jobs for people. • Local Organic Manure Production Centre to transform biodegradable waste to organic manures for farmers. 	<ul style="list-style-type: none"> • CSNs will either establish such centres or encourage private sector investors who are interested in waste recycling business to invest.

Climate Change Issue	Current Adaptation/Mitigation Strategy	Adaptation Benefits	Remarks
<p>Low fish catch resulting in low sources of protein in the community and depletion of sea foods</p>	<ul style="list-style-type: none"> • Breeding of livestock, fish farming, poultry and piggery) (Goat, cow. Particularly the Herford cow breed is preferred by the community) • Multiple fishing methods with different types of fishing net 	<ul style="list-style-type: none"> • Community to designate areas for Ranching of cow. The Herford breed. Farmers can use cow dung as manures and provision of domestic energy source. (Cooking Gas) • Cluster fish farming in the mangrove using salt water species of catfish and tilapia as well as other species as pilot to study performance. • Technical training on livestock, poultry and fish farming: <ul style="list-style-type: none"> - Goat (Mixed breed) - Poultry - Snail farming - Bee farming - Pig farming etc. • Mangrove conservation policies should be developed and enforced to allow breeding of sea foods such as oyster, periwinkles, shrimps, prawns etc. 	<ul style="list-style-type: none"> • Establish fishermen network across coastal communities in the Niger Delta • Advocate to government to initiate/approve community bye laws on fishing practices
<p>Rise in sea level, sea surge, erosion and flooding</p>	<ul style="list-style-type: none"> • Local embankment with the use of chicoco mud and tree trunks. • Use of stone and sand in bags to block water channels flowing into the community • Construction of local houses on stilt • Sand and mud filling of low land areas in the community 	<ul style="list-style-type: none"> • Modern embankment used to protect oil company shoreline facilities in the communities should be extended to cover community shorelines. • Excavation of sand at coastal community shorelines by community and oil company contractors should be checked and controlled. • Dredging, management and conservation of wetlands and establishment of vegetated barriers along rivers and streams to reduce flooding, overflow of sea water and erosion 	<ul style="list-style-type: none"> • Training on flood management and control is very important for the CSNs • Monitoring of sea level, sea surge, erosion and flooding.

Climate Change Issue	Current Adaptation/Mitigation Strategy	Adaptation Benefits	Remarks
<p>Poor crop yield Changing climate conditions pose a major challenge to agriculture through increased rates of crop failure, reduced livestock productivity, and altered pressures from pests, weeds, and diseases. Rural communities are particularly vulnerable to these changes.</p>	<ul style="list-style-type: none"> • Application of inorganic fertilizers. • Bush fallowing methods have been re-introduced • Use of laboratory modified seeds/seedlings • Mixed cropping of short and long-term crops. Crops mostly farmed in communities include: plantain, banana, cassava, the different yam species, maize, vegetables, potatoes, pepper, okra, • Multiple livelihood practices by some households 	<ul style="list-style-type: none"> • Application of organic manures that can be produced in the community by CSNs • Cluster/cooperative farming models should be adopted to attract local and international agricultural facilities to farmers in training opportunities, grants/loans etc. • Short/long term crops that are climate resistant should be encouraged. • Mixed economic tree planting for commercial purpose such as oil palm, citrus, coconuts, etc. • Crops that do well in the Sahel region with little water should be tried in the south for commercial purpose such as carrots, ginger, tomatoes, etc. • Rice farming should be introduced as it has been found to do well in freshwater and mangrove forest areas. 	<ul style="list-style-type: none"> • Due to poor application and uncontrolled use of fertilizers, Training of CSNs on application and control of organic and inorganic fertilizers or manures will be an important consideration. • Extensive training on climate change and agriculture, small/medium/large scale farming is recommended. • A study of crops that can yield well in coastal communities should be conducted rather than depending on only crops farmed by communities. • All kinds of farming (crop, fish, livestock, poultry, snail, etc.) have technicalities which are not adhered to by local farmers. Thus, training on selected areas of farming is very crucial to climate change intervention process. Emphasis should be on climate change, conflict and agriculture, climate change adaptation in agriculture for sustainable livelihood.
<p>Invasion of mangrove forest by Nypa Palm</p>	<ul style="list-style-type: none"> • No deliberate local community adaptation process. However, nypa palms are used for the construction of local thatch houses, particularly roofing of such houses. 	<ul style="list-style-type: none"> • Excavation of nypa palms and planting of mangrove in such areas particularly along community shorelines overtaken by nypa palms. • Use of nypa palm seeds for domestic source of energy for fishing drying etc. This will reduce use of mangrove and fresh water forest wood for energy. 	<ul style="list-style-type: none"> • Economic uses of nypa palm should be investigated.

Climate Change Issue	Current Adaptation/Mitigation Strategy	Adaptation Benefits	Remarks
Loss of direction in the sea	<ul style="list-style-type: none"> Restoration of light houses in Akassa, Ogulagha and Bonny 	<ul style="list-style-type: none"> Use of simple navigational equipment's (compass) by fisher folk 	<ul style="list-style-type: none"> There are existing light houses in Akassa, Bonny and Ogulagha, which can be restored and powered with solar energy.
Climate change related Health Issues	<p>No deliberate local community adaptation process for prevention and adaptation. Generally, communities do not also have good health facilities and systems. They rely mostly on patent medicine stores and alternative medicines.</p>	<ul style="list-style-type: none"> Provision of modern health facilities Reduce or stop gas flaring in the Niger Delta Reduce vehicle emissions by encouraging less vehicle usage by government and other private sector organizations. Transform rural communities to semi-urban areas to reduce migration and ultimately reduce use of vehicles and emissions 	<ul style="list-style-type: none"> Global warming has contributed to the poor air quality in the Niger Delta which has aggravated lung diseases and premature death People are said to be mostly at risk from ozone exposure, people suffering from asthma, children, older adults, and those who are active outside, especially outdoor workers come down with health conditions such as diabetes, skin diseases, cough, etc. which are of higher risk of ozone-related health effects. Sensitization and other protective measures should be considered.
Thunder and Thunder Lightning Belt (Finima in Bonny LGA)	<ul style="list-style-type: none"> Use of thunder arrestors in strategic community locations and houses Use of wooden materials 		
Culture and Traditional decadence. Climate change adaptation has affected cultural practices of the communities. For instance, sacred forest where people are not allowed to cultivate are now being cultivated and exploited for livelihood, creating conflict between traditional extremists and progressives	<p>No local community adaptation strategy</p>	<ul style="list-style-type: none"> Identify and protect cultural practices that have the potential of reducing climate change impact CSNs to engage communities to leverage on local knowledge and experience. Community story telling on cultural practices that will reduce climate change impact. 	

Climate Change Issue	Current Adaptation/Mitigation Strategy	Adaptation Benefits	Remarks
Increase in temperature and heat wave	<ul style="list-style-type: none"> • Use of hand and electrical fans/Air conditioners • Bathing many times round the day • Opening of doors and windows day and night 	<ul style="list-style-type: none"> • Planting of trees and increased vegetation in the community to help absorb heat • Use of cooling roof materials for roofing • Use of local heat resilient materials for building 	
Lack of potable water. Communities lack clean drinking water worsened by climate change impact	<ul style="list-style-type: none"> • Construction of self-help mono pumps • Streams, ponds, wells, etc. as main sources of water for drinking. • Local filtration of water with mud • Boiling and sedimentation of water for drinking 		
Poor energy supply	<ul style="list-style-type: none"> • Use of local lanterns • Use of local fireworks • Use of energy generating sets popularly called generators 	<ul style="list-style-type: none"> • Construction of wind mills in community • Utilization of solar panels • Conversion of domestic/animal waste such as cow dung • Connection to the national electric grid • Use of gas turbines constructed by oil companies in communities 	
Fishing boat engine theft by Pirates	<ul style="list-style-type: none"> • Cluster fishing • Use of old engine cover to make the engines unattractive • Fishing within close range from the community • Fishing close to security locations in the sea. (It was reported that this has caused conflict as security personnel would not allow fisherfolk close to their platforms) 	<ul style="list-style-type: none"> • Installation of tracker in the engines of fisherfolks 	

SUMMARY OF ISSUES, COMMENTS, SUGGESTIONS, AND ADAPTATION STRATEGIES

Communities are facing changing climatic conditions that continuously affect their context and relationships. This section of the report therefore presents a summary of findings and observation on how climate change is affecting community behaviour, livelihoods and services.

- Lack of fish due to low catch has made some person's practice breeding of the Herford specie of cow and other livestock.
- Community imposed an indefinite curfew from 11pm to dawn due to increase in crime: Increasing violence against women.
- Some livelihoods in the community were perceived to be exclusively for men and others for women. But currently, both men and women engage in all forms of livelihoods. Eg. bricklaying, digging of foundations for construction of houses etc.
- Increasing child labour in communities.
- Increasing rape of women farmers by herders.
- Widows are entitled to farm lands but are now denied land by family members when their husbands die, due to land loss and low fertile lands as a result of climate change
- Cassava gestation period used to be 9 to 12 months for high yield but farmers now resort to a 6 months' gestation period using high breed cassava stem that is comparatively lower quality and production.
- Increase in the consumption of reptiles (Snake, frog, etc.) and other animals which were previously considered as taboos or prohibitions for consumption.
- Increase in divorce due to migration and livelihood loss.
- Increased community security groups due to increase in crime and conflicts associated to climate change challenges. Most times, the members of such security groups are recruited from criminal gangs or groups alike.
- Fishermen associations are being set up to protect fishing activities in communities.
- Communities are having increasing conflicts due to infiltration of non-natives taking over fishing activities in some coastal communities.
- Native doctors and other forms of ancestral worship is regaining prominence due to divination activities believed to enhance agricultural production; farming and fishing in particular.
- Piracy, sea robbery and other forms of maritime crimes are considered normal alternative livelihood strategies by some persons in the community, as such communities prefer to punish such criminals when they are caught and let them free.

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