Preparing Smallholder Farm Families to Adapt to Climate Change:
Project Guide 3: Managing Water Resources
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1. Introduction

In Liberia and everywhere in the world, water is paramount natural resources to humans, animals and plants including every other living creature. This all important element to life is scarce in supply and availability. The existence of all living organisms highly depends on water for survival; maintain good health and other reproductive activities or multiplication processes. Agriculture and agricultural production require a huge amount of water resources to increase growth, development and production in general. Plants and crops however require considerable amount of water to carry out all photosynthetic, metabolic and transpiration activities.

2. Aim of the Project

- Enable smallholders' farm families live , cope and co-exist with climate change variabilities and events

3. Objectives of the project

a. General objective

To empower smallholder farm families to cope and live with climate change events and variability through the use of simple and basic agricultural mechanisms such as soil conservation, mixed or multiple cropping, water conservation and so on.

b. Specific objectives

- To enhance farmers coping strategy and maintain sustainable agricultural production.
- To increase smallholder farm families productivity
- To enhance smallholder farm families performance in production agriculture in order to achieve relative food security
- To expand agricultural production through soil conservation and multiple cropping methods
- To increase water management and conservation methods among small holder farm families.
- To increase sustainable water used among smallholder farm families.
- To expand the socio-economic based of smallholder farm families

4. Definition of water

Water is a liquid substance use to dissolve other soluble substances such as plants food in the soil and make them available to plants and crops for their wellbeing , reproduction, metabolic and transpiration activities.

5. **Functions or Uses of water**

- It is good for plant growth and development.
- It is use in plant food production
- It is use to dissolve plant food in the soil
- It is use to care for plant health
- It is used to transport plant food from the soil via the roots upward to the leaf apex.

6. **Importance of water to farmers and agriculture**
    - Provides plant growth and development.
    - Promotes plant metabolic and transpiration activities
    - Participates in plant food production and Manu faction
    - Allows plants and crops survival
    - Makes plant food in the soil available to plants
7. **Managing Water Resources**

Management in this concept is the sustainable use of water through strategic water management mechanism in order to achieve the intended purposes, like for example in agriculture, water is used for seed germination, plant growth and development , care and maintaining plant health and many more .

8. **How water resource is managed in agriculture to adapt to Climate Change ?**

There are several ways water can be managed by smallholder farm families, and the following methods are suggested to be considered :

- **Sustainable water Management**
  In most semi-arid and arid areas are exposed to serious climate change impacts , therefore suffer huge decrease in water resource due to climate change . Traditional water management techniques such as construction of indigenous system to harvest rainwater for animal rearing and crop production . For example roof catchment system , small dam and rock cistern
- **Construction of small dams or reservoirs**
  Dams can be constructed on farms for dry land farming and vegetable production including animal rearing . These reservoirs or dams can be used to supply water during long period of dry season and possibly drought period
- **On farm water preservation systems and small low cost irrigation systems such as drip and treadle pump and hydroponics**
  These are done in water logged areas particularly in lowland or swamps .All engineering structures such as bunds , canals , peripheral outer canals , outlet and inlets are constructed to make water available throughout the year during climate change devastation.
- **On farm construction of bole holes**
  Construction of bole holes on dry lands can serve livestock and crops farmers during climate change variability and events . In the long dry period in Liberia most vegetable crops growers and animal farmers depend on this type of irrigation

Conclusion

In conclusion sustainable water resource used and management can considerably increase the coping capacity and ability of smallholder farm families.

References

1. Arms Karen, 2000 , Environmental Science , 41-12
2. FAO. 2007, An International Journal of Forest and Forestry Industries, Unasylva, Vol. 58, 2007/4, 229, 34-35.
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Adaptation under the new normal of climate change
The future of agriculture extension and advisory services.

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1. Introduction

Agriculture extension and advisory services adaptation to climate change variability and events is a significant practical issues and challenges the whole world is seriously facing . if food security is to be achieved , anthropogenic impact for example are to be controlled and reduced with serious national policy formulation . There should also be formulation of national policy protecting sustainable land use and management in every country , if the future of agriculture extension and advisory services continues to be better in the advent of climate change impacts.

Agriculture and farming activities are carried out in the environment which is not protected and can hardly be protected without strong environmental policies formulated by law makers in place . For example the rise in average global temperature , discernable change have been observed in day and night including seasonal temperature, in the frequency , duration and intensities of heat waves, drought and floods , wind and storm pattern and so on in Liberia in the recent years . These suffered farmers effective production agenda and consequently reduce production output across the country. Unfortunately , the advent of pests and deadly Ebola disease added more injuring to the problems.

2. Definition of agricultural extension and advisory services

This is concern primarily with the improvement of agriculture , using conventional teaching methods .

3. Aims of Extension and advisory services

To assist people gain livelihood, improve their physical and psychological level of living of rural families and fostering rural welfare.

4. Objectives

a. General objectives

To improve agricultural production methods and livelihood of people through conventional teaching methods .

b. Specific objectives

- To disseminate knowledge to rural people in order to improve on agricultural production for better standard of living and livelihood.
- To increase per capita income , quality of life and general welfare of people.
- Provide education for people engaged in farming and agriculture activities.
- Provide improve technologies to solve some of the problems in farming and agricultural activities

5. Current Extension and advisory services delivery systems

a. Ministry of Agriculture (MOA)

The ministry of Agriculture (MOA) has an established extension department , headed by a Deputy Minister , this Deputy minister is directly supervised by the Minister of Agriculture. The ministry has County Agricultural Coordinators (COC), who are directly supervised by the Deputy minister in charge of Extension and advisory services. These COCs are based in the various counties of assignment. The COCs are supervising District Extension Officers , these are directly in touch with the farmers . The functions of these Officers are categorically similar in application however , there are few distinctions in few duties performed by them.

b. Central for Agriculture Research (CARI)

This national research institute has an established extension department headed by a well-qualified Extension expert, who is directly supervised by the Director in charged of CARI. The head of this department is assisted by the Assistance Extension Officer, this Officer supervises several Extension Agents or Officers . These Officers directly deal with the farmers.

c. International Non governmental Organizations

All agricultural oriented Non governmental Organization partners in agricultural development in Liberia have Extension Officers who coordinate all extension activities in the various Organizations in the Country.

d. Private Individual Agricultural Enterprises

These individual private enterprises hired their own Extension Officers , who coordinate all extension and advisory services in their various of operations among their farmers.

6. Gaps, Problems and Constraints in agriculture extension and advisory services

There are many gaps , problems and constraints in agriculture extension and advisory services before and after the civil war in Liberia, most of these challenges are serious in post war Liberia .

a. **One of the gaps is limited Extension Agents or Officers**

Agriculture is a field work with long distances cover by farmers to cultivate their lands for farming activities , apparently giving more tasks to extension workers to cover long distances to disseminate the new methods and technologies to farmers, as well as training and giving some pieces of advice to them.

b. Another gap is limitation of the few Extension Officers to be empowered

Agriculture extension and advisory services requires a lot of new f innovations and technologies, these require Extension Officers to be more knowledgeable and skillful in delivery extension and advisory service .

c. There is a gap in research

Research is the pivot and nucleus of development in all countries in the world. Through ardent research new innovations and development can be discovered and disseminate for possible administration and implementation , but there are high degree of gap in research

7. The problem and constraint in the Agriculture extension and advisory services are as followed :

d. Lack of logistics

Agriculture extension and advisory services require logistic support to enable the Officers or Agents to effectively carry out their primary functions and achieve their essential goals. . Moreover, with good logistic support from the government as the primary source through the Ministry of Agriculture will better improve agriculture extension and advisory services .Apparently the agriculture extension and advisory service s with the country is lack of basic logistics such as mobility

e. Poor road network and transportation

Good road network and transport system can alleviate agriculture extension and delivery services , but currently post war and deadly Ebola disease country is seriously affected by poor road network and transportation across the country.

f. Poor seeds and planting materials

Most farmers do not have access to quality seeds and other planting materials , this is as a result of long distance location of farm sites and farmers . Most of these places are nt accessible by even motor bike , no road s and bridges.

g. Language barrier and cultural experience by some extension workers

An effective agricultural extension and advisory services require Agents that are familiar with the language and culture of the farmers and the communities he/she is assigned . Because there are few Extension Officers working with the ministry and International Organizations around the country , there is no option to these entities but to send Agents that not familiar to areas unknown to them.

h. Attitude of Extension Agents

Most Agriculture Extension Officers completely lack the right attitude and aptitude in the administration and implementation of their duties. Some however can try to live to the expectation of the farmers but high per cent of them live below the expectation . It interesting to know that Extension Agents used the tools, equipment and other inputs for their own personal use.

8. Climate change Impact on Agriculture Extension and advisory Services

Climate change phenomenon is relatively new to Farmers, even though, they have been seriously affected by this natural device for a long period of time. With all the concerted efforts made by the government and her partners in agriculture development, the negative situation created by climate change is still going on a baited .The following are some of the climate change impact on the Agriculture Extension and advisory services in the country:

- **Insect-pests and disease outbreak**

  2007 and 2014 , there was an outbreak of insect-pests in Liberia . The former was very serious so much that international bodies were called upon by the Liberian government to assist the country to eradicate them. It was however believed that those insect –pests outbreak were motivated by climate change

- **Long period of dry and rainy seasons.**

  There are two major seasons experience and prevailing in the country , these are rainy and dry seasons. Each of these two period has twelve months calendar within year. If there is more than six months observation and experience in either rainy or dry seasons , than climate change impact is manifesting on serious term. These has been the experience in Liberia for a long period apparently confusing the farmers about the farming calendar . With long period of rainy season , plant flowering have been affected and more plants are aborted before sun light shines.

- **Irregular rainfall pattern**

  This event has created serious flooding in the country , when heavy rainfalls , this will result to the destruction of livestock and crops in the fields . Besides flooding more crops can be eroded and destroyed .

- **Heat rash and other farmers' health problems**

  With average global temperature , discernable change have been observed in day and night including seasonal temperature, in the frequency , duration and intensities of heat waves have been creating serious health challenges for farmers and their livestock in general.

- **Difficulties in seed germination**

  Seeds are living embryo which require water as an essential factor to activate and stimulate the emergence of radicle and later plumule. If the soil water is completely dried , there is a great tendency the embryo will die back in the soil.

9. The future of Agriculture Extension and advisory Services and methods of securing it potentials.

With the current prevailing climate change impact , if serious action are not taken t o control and reduce the trend of impact, The future of agriculture extension and advisory service is seriously in jeopardy and doomed for good. However, the government and her partners in development have been taken board steps to mitigate resilience in agriculture .To ascertain this , the government with her partners have supported several research in climate change , Farmers have been assisted to cope and live with the climate change variability events. The

following are essential factors to savage the future of Agriculture extension and advisory services .

- **Sustainable water Management**
  In most semi-arid and arid areas are exposed to serious climate change impacts , therefore suffer huge decrease in water resource due to climate change . Traditional water management techniques such as construction of indigenous system to harvest rainwater for animal rearing and crop production . For example roof catchment system , small dam and rock cistern
- **Construction of small dams or reservoirs.**
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- **On farm construction of bole holes.**
  Construction of bole holes on dry lands can serve livestock and crops farmers during climate change variability and events . In the long dry period in Liberia most vegetable crops growers and animal farmers depend on this type of irrigation
- **Soil conservation**
  Soil is the home of plants and micro-organisms , it contains water or moisture content to help dissolve soil elements and make them available to plants roots for absorption and upward transportation . Moreover soil l water helps in the germination, growth and development of seeds and plants. Therefore irrigation and construction of bunds and other engineering structures to conserve soil water.
- **Encourage farmers to cultivate lowland**
  Most lowland can retain water throughout the year , those lowland require to be identified and developed for groups of farmers , farmers associations and farmers that owned such lowland can be help by developing their lowland .
- **Crop biodiversity**
  Farmers should be encouraged to adapt to multiple crop cultivation to overcome crop failure and other inevitable field invaders and climate change impact variability. Crop biodiversity can positively impact food security and availability.
- **Sustainable land used and Management**
  This focuses at the policy formulation regarding land use and management. In Liberia , the manner of approach in land use is extremely regrettable , interestingly arable lands for agriculture are used for mining purposes, high level of deforestation, too much slash and

burning , charcoal production and so on . The policy makers require to formulate excellent sustainable land use policy to reduce anthropogenic impact on the environment

Conclusion

In conclusion Climate change impact can be lived and cope with by farmers if only the above mitigation resilience approaches are gradually adapted and adhered to , to secure the future of agriculture extension and advisory services..

References

4. Arms Karen, 2000 , Environmental Science , 41-12
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