PRESENTATION ON THE SOIL RESOURCES OF THE REPUBLIC OF THE GAMBIA AT A WORKSHOP ON “AGRICULTURAL SYSTEMS AT RISK; PRIORITY ACTION TOWARDS CLIMATE CHANGE ADAPTATION AND LAUNCH OF THE GLOBAL SOIL PARTNERSHIP IN WEST AFRICA.”

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• **INTRODUCTION**

• The Republic of The Gambia is located on the west coast of Africa between $13.790^0$ and $16.820^0$ west and within latitude $130^0$ North. The country is bordered in the north, east and south by Senegal and in the west by the Atlantic Ocean. The country’s main drainage is the River Gambia which gets its source from the Fouta Jallon highlands and runs through the entire length of the country. The country covers a land area of 11,300 km$^2$ with a population of 1.6 million inhabitants and a relatively annual growth rate of 2.6% (SOE, 2010)
• The climate of the country is a typical sudan-sahelian type with a short rainy season from mid June to early October and long dry season from October to June. The country is regularly affected by the northly harmattan wind during the dry season. Average temperature ranges from $18^0c$ to $30^0c$ during the dry season and from $23^0c$ to $33^0c$ during the rainy season. The relative humidity during the dry season is about 68% along the coast and 41% inland, while during the rainy season it is above 77% throughout the country. Average annual rainfall is in the region of 1000mm though it ranges from 850mm to 1500mm depending on the agro-ecological zone. Agricultural production is highly dependent on rainfall, whose distribution has been erratic and inadequate over the past thirty years.
• **SOILS OF THE GAMBIA AND THEIR AGRICULTURAL USES**

• Most of the land surface of The Gambia is formed from sandstone laid down during the late Tertiary period. The deposit “Continental Terminal” is a highly weathered detritical sediment made up of clayey sandstone with intercalated discontinuous quartz gravel, sand and clay. A localized occurrence of calcareous sandstone occurs near Walli-kunda in the Central River Region approximately 300km from the capital, Banjul.
It is believed that this sediment has been subjected to several phases of transport and subsequent deposition by fluviatile and Aeolian agents. Its composition is dominated by quartz and clay, with a small percentage of other resistant minerals. The nature of these sediments indicates that they originate from the erosion of ferralistic soils on granite gneiss complex and associated with paleozoic sediments of east of The Gambia.

Within the present and sub recent floodplain of the River Gambia and its tributaries, there is a complex pattern of alluvial deposits, including former terrace levels and several fluvial-marine deposits.
• In the east of the country, elevated levees border much of the present river course and the edges of its previous courses. These levees become progressively lower and less well defined to the west disappearing almost completely in the brackish water zone of the river. Soils in the Lower River valley up to eastern limit of salt water flow are either affected by salinity or are under the influence of the potential acid sulfate condition. Soils outside the real delta and its tidal influence can only be used for rice cultivation during the rainy season when the fresh water flush pushes down the salinity level in the river waters and in the soil profile.
• **DIAGNOSTIC SOIL PROPERTIES.**

• The soils of The Gambia can be subdivided into two main groups namely:
• **Alluvial soil.**
• These are soils developed on alluvial material deposit by River Gambia and its tributaries, and often affected by temporal or permanent wet conditions. Alluvial soils cover approximately thirty percent of the Gambia, but the related extension drops gradually from west to east. Most of the alluvial soils are hydromorphic and fine textured usually comprising more than 80% silt plus clay throughout. Less hydromorphic and somewhat coarser textured soils occur on the high lying levees in the east of the Gambia, and sandy layers have been found in most recent fluvial sediments. The alluvial soils can be broadly subdivided into those which are-or have been subjected to inundation by saline water, and those east of about 15°W which show no evidence of saline condition. The saline affected soils are covered by mangrove vegetation or, where accretion has raised the soil level above the limit of tidal flooding barren flats.
1. **Tendaco**: Rice is grown under a bush fallow system in upland depressions with light soils along the Atlantic coast south of Banjul.
• **2. Wulombango:** These are rice fields that are found on fine textured sandy loams in broad, shallow, gentle sloping valleys perpendicular to the river throughout the country.
• 3. **Bantafaro:** Bantafaro rice fields found on mixed hydromorphic soils usually ripe clays on the edges of the flood plain above the high tide mark and are fed by rainfall, run-off and seepage.
4. Back swamp:

This rice ecology is found upstream in Central River Region on heavy clays in broad inland sloughs between the river levee and the plateau. They are seasonally flooded by rain and run off and are outside tidal influence.
• 5. Freshwater Tidal swamps:

These rice fields are found on fine textured heavy clays along the upper Central River Region.
6. Seasonally saline tidal swamps:

These fields are located in on the fringes of mangroves in the Lower Central River where actual and potential acid sulphate soils are found.
• (2). Continental Terminal Soils.

These are located on the uplands formed in the weathering products of the underlying Continental Terminal acid complex.

• Soils developed on the Continental Terminal are well drained and have a low chemical fertility, Cation Exchange capacity (CEC) of clay is approximately 6 meq/100g. Organic carbon is generally not more than 0.3-0.4% in the surface horizon. The CEC of the soils lies in the range of 1.5 – 5.5 meq/100g. Base saturation is usually fairly high, often between 40 and 100% in which calcium generally predominates, though the level of magnesium may exceed that of calcium on exchange complex in some subsoil horizons. Available phosphorus is extremely low, usually 3-6 ppm.
The soils on the continental Terminal are poorly structured and hard to very hard consistency when dry. Bulk density of most soil horizons is high, in the range of 1.65-1.85g/cm\(^3\) a level normally associated with severely impeded root growth. With the exception of the shallowest soils, all profiles show a textural gradient from a coarser textured surface horizons to finer textured surface horizons within 2m of depth. Surface horizons are usually sand and loamy sands, less commonly sandy loams, and subsoil horizons are most frequently sandy clays, though a range from loamy sands to clays may occur.
Cont.

- Soils of the plateau differ in two aspects from the colluvial and interfluves soils. First the surface horizons of plateau soils are usually finer textured than those of the colluvial soils or locations where plateau soils have coarser surface on top finer texture. The uplands soils are predominantly used for groundnut and coarse grain production. The severe impacts of climate change is felt in no small measure in the utilization of upland soil. Short duration rains coupled with poor water retention capacity and low inherent fertility has drastically reduced the productivity of these soils.
• CLIMATE CHANGE IMPACT ON AGRICULTURAL LAND OF THE GAMBIA

• The total agricultural land area of The Gambia is estimated at 1,036,534 Ha of various degrees of suitability for agricultural use. Only 558,000 Ha are considered suitable for agricultural production.

• The adverse impacts of climate change on the agricultural lands are evident in the Gambia as in all sub-Saharan West African countries. The Gambia is faced with serious environmental problems. The natural resource base upon which the production of food and cash crop depend is being rapidly depleted by the successive years of drought during the last twenty decades exacerbated by the unguided exploitation for commercial gains. Thus, the impoverishment of soil fertility through poor farming practices coupled with long period of successive drought has resulted in a decline in agricultural production. Productivity of agricultural crops especially groundnut which predominates the upland soils has been constrained. Increased salinization and acidification of the swamps and the lowland ecologies have severely reduced the available land for rice production.
- **MITIGATIONS OF CLIMATE CHANGE IMPACT ON AGRICULTURAL LAND (SOILS) OF THE GAMBIA.**

- The Government of The Gambia is cognizant of the adverse effects of climate change on the natural resource base of the country and on the agricultural soils in particular. The Gambia has enacted many laws focused on natural resources to achieve sustainability goals. Several pieces of legislations have been enacted to provide for the conservation and sustainable use of natural resources. These include the National Environment Act (NEMA) 1994, Wildlife Conservation act 1977, Forestry Act, 1977, the Forestry regulation 1995 and the land use Regulation 1995. If effectively enforced, these pieces of legislation would to a greater extent dictate the way and manner the country’s natural resources and soils in particular would be utilized.
Institutions are established for the implementation of the Natural Resources Policy. The key among them is the establishment of Soil and Water Management Unit (SWMU) under the Department of Agriculture in the 1970s.

SWMU is in charge of developing policies on the soil and water management, land capacity zoning, upland conservation and development of small scale water control schemes in the lowlands. It has been involved in developing and reclaiming Bantafaro and Wulambango rice lands by means of simple water retention and anti salt intrusion earthen dykes (dual purpose) and bunds for erosion control on the upland. The unit has five technical sections namely.
• 1. Engineering section responsible for the design and implementation of structures for water retention and prevention of saline intrusion.
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2. Soil survey and land evaluation section.

This section is responsible of soil surveys and mapping of soil types and evaluate them for their suitability for different uses. The section can also provide information on the agro-ecological zones of the country.
3. **Agronomy Section.**

The agronomy section is responsible for agronomic follow-up on SWMU implemented small scale schemes for water retention and also assists in screening of lowland rice varieties and conduct on farm adaptive trials. In addition, it handles the agro forestry and range management aspects.
• 4. Monitoring and Evaluation Section.
The monitoring and evaluation section is responsible for documenting achievements by means of computerized data base.
• 5. Cartographic Section.

• This section is responsible for producing soils and topographic maps for land use and engineering planning.
The government of the Gambia in collaboration with international organizations such as FAO and funds from banks such as IFAD, AFDB and IDB implemented and or development programmes to alleviate food insecurity through better use of the available natural resources. Among these are the recently concluded Lowland Agriculture Development programme (LADEP) and the ongoing participatory Integrated Watershed Management Programme (PIWAMP) both jointly funded by GOTG, IFAD and AFDB. The PIWAMP is a follow-up project after the successful completion of LADEP. Both programmes focused on rice land development through construction of SWMU’s low cost anti saline intrusion and water retention dykes and building of cause ways and foot bridges.
The later (PIWAMP) as a result of lessons learnt from LADEP incorporated upland conservation measure as a prerequisite in all their interventions sites thus an integrated approach in watershed management. The Islamic Bank funded Gambia Agricultural Lowland Development Project concluded in December 2012 and was also focused on the improvement of lowlands by building anti salt intrusion and water retention dykes. Other soil amendment measures such as use of agricultural (from burnt oyster shell) lime and phosphogypsum are encouraged. Erosion control measure in form of planting vetiver grass contour bunds and gully plugs are used.
Conclusion

• To conclude, I wish to emphasize that the sufficient land resource which when wisely and properly utilized can feed its growing population. The indiscriminate land use practices is a hindrance to our sustainable land use as envisaged in our land improvement endeavors. Therefore, it is indeed a felt need of The Gambia’s agricultural sector to have all pieces of land assessed for their sustainability for various utilities.
Currently no accurate figure exists to show the total available land for agricultural use and the extent of damage due to climate change and other phenomena. With accurate data emanating from detailed resource surveys especially soils and evaluating them for their actual and potential uses would promote sustainable management of Gambia ‘s soil resources.
THANK YOU