

## UNISDR Scientific and Technical Advisory Group Case Studies - 2014 Using Agricultural Management Practices to Restore Lands Affected by Salinization Process under Changing Climate Conditions: Impact on Food Security in the Senegal River Valley

### The Problem

In Senegal, a Sub Saharan developing country, where agriculture is the dominant economic sector involving over 65% of the population, land degradation due to salinization processes is present in most of the 6 agro-ecological zones (Figure 1). Salinization is a process that leads to an excessive increase of water-soluble salts in the soil to the extent that soil fertility is severely affected. It has become a major environmental issue and a cause of food insecurity because of the 3 million ha of arable land that this country has, 1/3 is salt-affected (Sadio, 1991). Senegal, with 14 million people, is a net food importer, particularly for rice, which represents almost 75% of cereal imports. Therefore, food insecurity is likely to increase with climate change unless early warning systems and development programs are used more effectively. In addition, the 2008 food crisis that resulted in the rise of food prices has plunged Senegal in a very difficult situation both for the government and the population. Given the strong dependence of the country on rice imports, it was urgent for the government to support any research and development program to increase food production. The objectives of this study were to determine: how lands respond to management practices; their resilience to salinization processes under climate change; and impacts on food security.



Photo 1: Soil degradation due to salinization

### The Science

This study relates the dynamics of the salinization process with climate change and different management practices to remediate saline soils for better cropping. To restore degraded soils, several management practices were compared to determine the most efficient one that can be readily adopted by farmers.

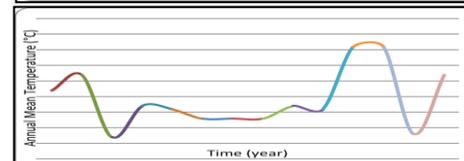
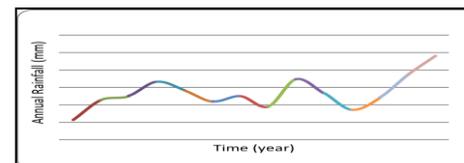
They consisted of 1) abandoning lands with no watering and no cropping; 2) leaching followed by rice cropping; 3) leaching followed by continuous rice cropping; 4) leaching followed by crop rotation with rice,



Figure 1. The Senegal River valley along the region of Saint-

sugarcane, and fallow; and 5) leaching followed by continuous rice cropping over years. Leaching, a process of watering the plots to wash the soil from the salt was monitored using piezometers. All treatments were chosen base on the amount of water required to leach the soil.

The more water is used, the more effective the desalinization process. In addition, climatic data was collected from a weather station from which it is shown contrasting rainfall patterns in the range of 200 to 400 mm of 2–3 months and a dry season of 9–10 months. During the same period, mean annual temperatures were above 25°C (Figures 2 and 3). Data analysis revealed that temperatures were higher than usual with maximum temperatures above 34°C.



Figures 2 and 3: Changes in mean annual rainfall and annual mean temperature over time (CSS Weather Station 2011).



Photo 2: A rice field at maturity under management practices

Leaching combined with cropping systems showed a gradual but significant decrease in soil salinity content (Figure 4). A comparison of these results with those from previous studies showed a noticeable decrease in the level of salinity (Boivin et al., 1998; Hoffman, 1980). The desalinization can be improved as long as the immersion continues with enough drainage water (Hoffman 1980). Data have shown that with rice cultivation over years and a good drainage system, desalinization of the land can be achieved effectively.

### The Application to Policy and Practice

Since independence in 1960, rice consumption in Senegal has grown almost ten-fold, currently standing at around 1 million tonnes (Bruntrup et al, 2006). Facing such major challenge, a vast program of rice production, using effective management practices was developed, not only in the river valley but also in all areas suited for rice production in the country but affected by salinization processes.

### Did it make a Difference?

The desalinization techniques that were employed in this region have showed convincing results for restoring degraded soils (Photo 2). The mean grain yield for rice has been increased 3 times in most rice fields (3–8,5 t/ha). In collaboration with some international development agencies, 50% increase in rice production were recorded as follows: 15% increase in the production of paddy per hectare in the pilot sites, 20% increase in the income of rice farmers of the pilot sites, and 15% increase in the production of paddy in the pilot sites in restored and suitable areas along the river valley. This allowed for better crop production and hence improved food security. Globally, desalinization through rice cultivation presents an effective way to reduce the risk of food insecurity.

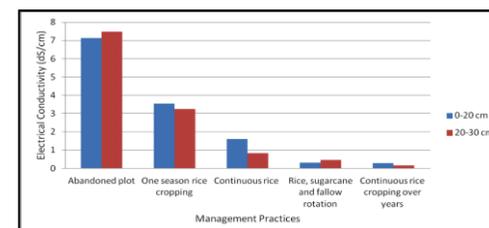


Figure 4: Changes in electrical conductivity between management practices.

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