Political Economy Modelling of Common Property Management to Combat Desertification: On Mandatory Tree Planting to Cure Soils from Salinity

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Abstract:

Many farming areas in the arid tropics and subtropics are characterised by increasing salinity. These areas include land farmed with traditional methods, poorly managed rain fed land under semi-arid conditions, and modern, extensively or intensively used irrigated land typical for commercially overexploited regions. Intensification of agriculture due to population pressure and increased economic incentives due to land development have contributed to salinity in many desert prone areas. Today salinity threatens extensive tracks of land in arid and semi-arid regions thus becoming a serious problem that basically leads to further desertification. Surface and ground water systems as well as deeper aquifers are often heavily polluted with salt. Salt accumulation is a largely uncontrolled externality of plant production practices inappropriate under certain soil conditions and poor common property management. High salt contents reduce productivity as a common-pool externality. In particular small-holders with low technological levels, short-term needs for agricultural products, and capital constraints have the tendency to over-exploit water. Additionally, the potential of soils to recuperate from salinity declines over time. Due to the immanent common property problem of water and soil, soil protection has high transaction costs and non-point-pollution is common. Because of high salinity, short-term resistance of plants to water stress and the long-term use of the soil are negatively effected. Concerning causes of pollution, overuse of water, subject to high evaporation and without amelioration methods, is regarded as the main cause for the continuation of problems.

Environmental regulations for water use and farm practices, such as limitations in water dosage, specific plant rotations etc., are normally not in the direct interest of small-holders, since they reduce current income and are difficult to monitor. Also, benefits often have to be shared. However, for the regeneration of soils, by methods such as fallow, tree planting maybe an alternative. In particular, tree planting to extract salt and to minimise shocks due to droughts, has recently gained interest in public management as a low cost solution. But tree cover also reduces cropping area and implies long-run considerations on sustainability instead of short-run exploitation. Though tree planting in a community fallow scheme is a viable option (even for purification of degraded soils), voluntary willingness to participate is often nearly nil due to 'tragedy of the commons' problems. In the dynamic context of salinity, resulting from multiple polluters and accumulated, damage on soils depends on stocks and flows of pollutants. The paper presents a model that accounts for salinity in the short and long-run. It explores different levels of mandatory tree planting against salinization by farmers. As a dynamic model, it is designed to control farm activities and reduce salinity in a community to combat desertification.

The paper applies a dynamic control frame, in which a manager optimises the use of the common property (fallow) in seeking to achieve an agreed level of minimal salinity. On behalf of the community he decides within a political economy setting on tree cover on farms. The model depicts the bargaining process for establishing a community objective function that includes the manager's objective function. He is a partial manager, not a benevolent dictator. But, he has statutory power to regulate tree planting. Farmers can harvest organic matter from trees grown on fallow and benefit from sales. Benefits are derived from a better soil quality that uniformly benefits members. Concerning institutions, the approach investigates the tragedy of the commons and statutory regulations. Financial innovations for compensation are also included.

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20