Farming Systems Approaches for Soil and Water Conservation in Semiarid Areas

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Abstract: Soil and water conservation measures under taken in watershed development programmes are normally not very successful for various reasons. With complete lack of stakeholder participation in the planning and execution of integrated watershed development programmes even technically sound programmes often fail to give desirable results.

Stake holder participation in watershed programmes is often limited either to contribution of cash or labour to the works planned by the implementation agency. While this is important, what needs to be understood is the deeper ties that farmers have with their land and the intricacies involved in complex production systems that have evolved over a long period of time. With cropping intensification and market driven agricultural initiatives, these complex production systems are giving way to mono cropping and narrow production base, which makes farmers highly vulnerable to any fluctuations in the situation.

Creating enabling environment where in farmers are tied to their land for most part of the year in semiarid conditions can be a challenging task. With very little scope for achieving desirable extent of irrigation, only alternative left for addressing the needs of majority of semi arid farmers is to develop approaches and technologies which enable farmers to earn their livelihoods through out the year in their own lands.

The farming systems approaches adopted successfully in planning and implementation of micro watersheds has given enough insights to address the watershed development programmes from an entirely different perspective. Establishing adequate vegetation and preventing soil erosion through promotion of tree based farming systems in the catchment area is a pre condition for ensuring the health of the watersheds. In addition to providing the most needed fodder and fuel wood to the families, the trees established also provide the most needed economic security to the poor farmers. Without creating adequate assets and production potential to the individual farmers, any amount of investments in community assets alone will not help.

Constructing decentralized water harvesting structures ensures minimum silt movement from the upper catchment area thereby ensuring retention of soil fertility and long-term viability of the water harvesting structures.

The water percolated in the ponds all across the watersheds help to increase the subsoil moisture situation there by helping preventing wilting of crops during long dry spells. This also helps to recharge the ground water table.

Keywords: decentralized water-harvesting systems, equity-issues, farming-systems, tree based farming, soil conservation and arresting silt movement

1 Introduction

Some of the issues that are required to be addressed for promotion of farming systems approaches for efficient soil and water conservation and fertility management at the watershed level are described below.

2 Issues involved in catchment area treatment

Effective catchment area treatment for preventing further siltation of water harvesting structures is essential. Establishing adequate vegetation and grass cover for preventing soil erosion through promotion of tree based farming systems in the catchment area (See Case Study - 1) is a pre condition for ensuring the health of the watersheds. Establishment of live hedges as wind breaks in the field boundaries is essential for ensuring adequate protection. Adequate attention is to be given for promoting agro-biodiversity in the catchment for environmental sustainability. Constructing decentralized water harvesting structures - A series of dug out farm ponds in the catchment at the rate of 1 pond for every 1 or 2 hectares depending on slope and other run off characteristics of the area. (See box below). This system ensures minimum silt movement from the upper catchment area thereby ensuring retention of soil fertility and long term viability of the water harvesting structures.

2.1 Farm ponds- an important intervention for promoting farming systems approaches in watersheds

- Formation of trench cum bund across the slope. The trench cum bund formed helps to retain silt and water in-situ.
- The trench cum bund formed is used for plantation of mixed species of forestry trees numbering up to 1,000 per ha.
- The fields are planted with dryland fruit species such as Tamarind, Cashew and Mango.
- For every two ha of catchment one farm pond measuring 25″ ×25″ ×10″ is excavated.
- Series of farm ponds are located on contour lines.
- These ponds are located in such a way that the field “trench cum bunds” act as conducting channels for excess water from each pond to be conducted to the next pond in the same contour.
- Once a pond is filled with rainwater the excess water flows to the next pond through the conducting channels. The last pond in the chain discharges to a check dam in the drainage line. In a line normally there can be 5 to 15 ponds.
- If the water is allowed to flow vertically down, because of the velocity gained, the gushing water carries away maximum silt down the valley. Hence the ponds are not connected vertically.
- The ponds are not lined with any impervious material. Instead the ponds are regularly desilted for encouraging maximum percolation.
- The horizontal connection of ponds helps to retain water for maximum time in the upper reaches of the watershed
- The water seeping in to the soil helps to maintain good moisture regimen in the soil, which feeds the crops, and other vegetation in the watershed for longer periods even after the rainy season is over.
- The area is characterised by coconut plantations in the valleys. The effect of percolation of substantial quantity of water in the upper reaches of the watershed results in very good moisture regimen in the valleys due to seepage and subsoil flow. Hence the need for irrigating the coconut orchards is reduced.
- The farmers are already reporting longer duration of flow of water in the drainage line even after the rains have subsided.

2.2 Equity issues

There is a great need for creating water harvesting structures and vegetation in the catchment so that people in the catchment can take care of catchment management preventing further siltation of water harvesting structures in the drainage line. The investments that go into the catchment should be of some direct benefit to the people in the catchment. The ponds created at the decentralized locations will also help recharging ground water level. This helps to take up irrigated crops with open wells and borewells. The vegetative cover created also adds to the economic benefits for the poor people in the catchment. Failing this, large investments made for construction and maintenance of water harvesting structures will

benefit only people in the command area and hence there will be very little stakes for people in the catchment area for protecting the catchment.

2.3 Soil fertility and production related issues

Over a period of time farming systems have evolved in semi arid tropics to suit the particular requirement for maintaining soil fertility and production related issues. Any watershed development programmes addressing soil and water conservation issues should essentially take into consideration these farming systems issues in order to have lasting effect. The farm nutrient flow studies indicate how important these factors are in maintaining the wealth of watersheds. The structures constructed in watersheds alone cannot provide the required protection to the watershed, as the involvement of farmer on day to day basis is more critical to ensure protection of watersheds. This can be achieved only by integrating other farm enterprises into the farming systems in order to enable the farmers stay back on their lands through out the year. The soil and water conservation measures should also essentially promote a vegetative cover on the agricultural lands, provide fodder and fuel, shade and shelter, wind break effect through vegetative barriers, accommodate livestock etc., in order to provide sustainable livelihoods to the farmers.

Two example of the complex farming system with nutrient flow patterns is indicated below (Fig 1 and Fig 2). This complexity is what makes it more sustainable. The complexity is also dictated by the plurality of the livelihood options exercised by the farming community. This plurality is also a coping mechanism evolved over a period of time to adjust to the uncertain cropping in semiarid tropics. It is to be appreciated that any attempt to simplify the farming systems with a tendency towards mono cropping will have adverse effect on the farm nutrient balance making the farming operations unsustainable over a long run. It is also to be noted that in any given region the farms are not be identical interms of the complex interrelationships between various farming enterprises that are established and sustained over a period of time.

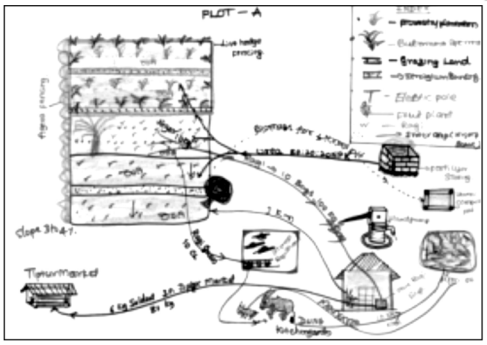

Fig. 1

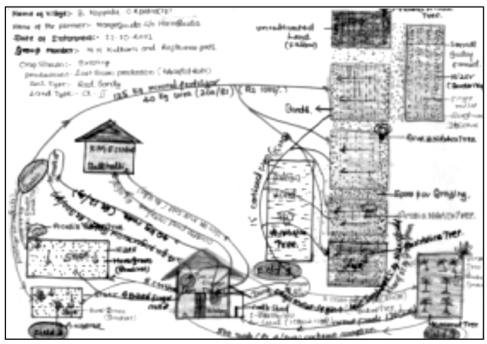

Fig. 2

2.4 Livelihood issues

The livelihood options exercised by the village community are intricately linked to the evolution of the farming systems in any given region. This fact also has a bearing on the soil conservation and fertility management options exercised by the farmers.

Perhaps the most important characteristics of semi-arid farming systems are the objectives or motivations of farming families. These include food security, insurance against risk, and profit maximization . Other studies and field experiences have also shown that household food security is a major concern of farmers when deciding on their cropping pattern. Most farmers grow all the food they need. However, even small farmers (1 ha to 3 ha) grow *some* cash crops, and often purchase some of their food grains from the market or through the Public Distribution System (PDS).

Important risk spreading measures include farm diversification. Farmers tend to accumulate savings in the form of trees grown in the farmstead, backyard poultry, small and large ruminants etc. These farm

enterprises are also complimentary to each other and provide very stable and diverse livelihood options to the farmers. Any measures taken up at the farmers level for soil and water conservation must essentially address these intricate farm diversity aspects failing which farmers may not be in a position address the requirements for optimum soil conservation measures.

Households are constantly adapting their livelihood strategies in response to assets available to them, and external pressures and incentives, such as price fluctuations, subsidies, etc. Many examples of such adaptations could be observed in Semi arid tropics which inturn will have an impact on the farm productivity:

- Farmers selling livestock in response to changes in family composition (children leaving for off-farm employment, high wage rates for herders, and shortage of grazing lands.
- Farmers increasing the area under cash crops, because food grains are available through the PDS (Public Distribution System).
- Farmers leaving their land fallow because of low local prices for food grain as a result of the availability of PDS rice and wheat (e.g. in Medak district of Andhra Pradesh)**.**
- Landless people making a living from selling FYM and vermi-compost, in response to the increasing demand for organic matter.

This issue has a direct bearing on the way farmers respond to the soil conservation requirements in the watersheds. The interventions should essentially help in augmenting the coping mechanism of the farmers.

3 Issues related to crop choices

Rainfall in southern India typically occurs in two peaks, first peak in June - July and the second peak in September – October. The cropping systems were evolved by the farming communities to utilize the moisture available through out the rainy season. Hence the choices that were available to farmers many times ran into dozens. Very few crops were cultivated as single crops. Most of the farmers practiced mixed crops with options for several cereals crops, several pulse crops and fodder crops. These crops in addition to suit the uncertain rains also were evolved to provide the most needed nutrition both to humans and animals.

The policy driven changes towards monoculture operations, even in scientifically managed watersheds, has led to very unsustainable options. Though these changes directed by policy help to a great extent to meet the national level requirement in terms of food grain production, often they may not be in the long term interest of the farmers. Most of the technologies promoted by the watershed development programmes do not seem to be very sensitive to the issues of farming systems and interdependence of various farming enterprises.

The dynamics associated with changing crop choices and impacts are complex. People often prefer wider choice of food stuffs in their nutrition. It is noticed in several villages that families utilised 20 to 30 different plants from a field of only 1 to 2 acres, including a number of uncultivated foods.