A Case Study

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Intervention of forestry and horticulture in watershed management under different climatic conditions

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Abstract : The humps, slopes and gully bottom planting of *Acacia nilotica* and *Dendrocalamus strictus* intercepted rain water, reduced the impact of falling rain drops and alimented the ground water table. Similarly, planting of *Citrus* spp. and *Zizyphus mauritiana* and *Psidium guajava* in ravinous area protected the degraded land of watershed and provided fuel from the annual pruning. The plantation of *Acacia niotica* and *Dendrocalamus strictus* under farm forestry provided the wood for domestic purpose. The pods of *Acacia nilotica* are being used as nutritive feed to the browses. Pearl millet in association of clusterbeans and cowpea planted in the interspaces of *Mangifera indica* gave 3000 kg/ha mango fruits and 360-370 q/ha green fodder. The grasses grown between the rows of *Mangifera indica* and *Madhuca latifolia* harvested by 175 - 225 q/ha at green stage. The fruits yield by 3000 kg/ha and 3500 kg/ha were also reaped from *Madhuca latifolia* and *Mangifera indica,* respectively. *Zizyphus mauritiana, Acacia nilotica, Prosopis juliflora, Ficus bengalenasis, Ficus glomerata* and *Ficus lacor* planted on banks of gullies for their establishment. These plantations established the gullies and green leaves and fruits of these trees are also being used as green fodder during summer season or drought period. *Acacia nilotica* planted in conjunction with grasses for rearing of domesticated farm animals under silvi-pastoral system paid good dividends to the farm families of watershed.

Key words : Humps, Gully bottom, Intercepted, Rain drops, Pruning, Browse

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Forestry and horticulture are closely linked for watershed management along with environmental amelioration and socio-economic upliftment, the later resulting in considerable improvement of the quality of life in villages. The forestry and horticultural systems generate several positive environmental impacts in watershed areas like improvement in hydrological balance and production of water from rain water harvesting, improvement in physical properties of degraded soils, alimentation of ground water, reduction of surface runoff water and sedimentation of reservoirs, recycling of carbon, creation of favourable micro-climatic condition conducive to higher food production, increase rainfall through transpiration and maintaining balance in oxygen, carbon dioxide, atmospheric temperature and relative humidity. The grain crops like cereals, pulses and oilseeds grown by farmers under fragile condition are just enough to meet their family requirements but the products of fruit trees give cash to them. Some fruit leaves e.g. *Ber* contain good percentage of crude protein, which proves beneficial for the browses. Apart from leaves the fruit trees also yield wood from the annual pruning, which can be sued as fuel wood. Fruit trees provide employment to the farmers and their family members during off season also. Likewise, the forest trees maximized the per unit production of fodder, fuel, wood and other forest products. In addition to this, the forest trees also optimize the productivity of biological and physical resources *viz.,* land, labour, live stock, soil moisture, solar radiation and the like. The forest trees also preclude the soil erosion, conserve the soil moisture, increase the soil fertility, help in eco- friendly farming and maintain the ecological balance.

It has been estimated that the forest bushes /shrubs and small horticultural trees take CO_2 @ 3 M.T./ha from the environment and release O_2 @ 1 M.T./ha. Similarly, standing trees catch to dust @ 70 M.T./ha on their foliage and clean the environment, reduce the temperature and

finally make the favourable climate.

In Bundelkhand tract of U.P., arable farming has dominated dry land agriculture, so far. It is only recently that alternate land use system *viz.,* agro forestry, conservation forestry, browse forestry, forage forestry, farm forestry, agri- silviculture, silvi-pastoral system, agri-silvipastoral system, agri-horticulture, silvi-horticulture and agri-silvi-horticulture systems are receiving attention in dry land agriculture. This is because of these systems give stability to the resource poor, small and marginal dry land farmers. With a view to accord the benefits from the fragile forestry and horticulture in agricultural dominated ravinous watershed Rendhar, Bundelkhand, the different systems of agro-forestry have been deployed and these systems are giving good dividends and farmers harvesting the fruits of generated technologies.

The operational area of 747.83 ha watershed is situated in Rendhar village at Jalaun district of Bundelkhand (U.P.). The height above mean sea level is 149 meter. The site of watershed typically represents soil, climate and socio- economic condition of Bundelkhand region. The mean annual rainfall of watershed is 880 mm. The soils of watershed are developed over alluvium and occur on nearly levelled to undulating old flood plains. The watershed soil belongs to class III and IV of land capability class. For protection and productive utilization of degraded land the different systems of agro forestry *i.e.,* conservation forestry system, conservation horticulture system, farm forestry system, forage - horticulture system, horti-pastoral system, browse forestry system, extension forestry system and silvi-pastoral system were followed on non- agricultural dominated site of model watershed during 1989-90 -1990-91. The scientific studies on impact of these systems were carried out after 15 years of the termination of the project during 2005-06 through detailed survey because Water Resource Development Committee was constituted at the time of watershed activities implementation for maintaining aforesaid systems as well as community assets.

The results obtained from the present investigation as well as relevant discussion have been summarised under following heads:

Conservation forestry system :

Under this programme the *Acacia nilotica* and *Dendrocalamus strictus* were planted on humps, slopes and gully bottoms of ravinous land for preventing soil erosion and runoff and productive utilization of land. These perennial forest plants had intercepted rainwater, reduced the impact of falling rain drops on the soil and alimented the ground water table. For afforesting in ravinous area of watershed, *Dendrocalamus strictus* was found most promising.

Conservation horticulture system :

On class IV land *Citrus* spp. and in ravines, *Zizyphus mauritiana, Psidium guajava* etc. were planted under conservation horticulture programme. These fruit trees thrived well and protected the degraded land of watershed. These trees are giving good quantity of fruits. The farmers of watershed area are also using the wood as a fuel from the annual pruning of these trees.

Farm forestry system :

Under this system, the *Acacia niotica* and *Dendrocalamus strictus* were planted around the fields on the mends at recommended spacings. These forest trees thrived well and no adverse effect was seen on crops upto 5-6 years of the plantation. The pods of *Acacia nilotica* raised under this system are being used as nutritive feed to the browsing animals.

Forage-horticulture system :

Pearl millet in association of cluster bean and cowpea was planted as a green fodder between the *Mangifera indica* rows and this system of agro-forestry gave about 3000 kg/ha mango fruits to the farm families and 360-370q/ha green fodder to the animals.

Horti-postoral system :

The grasses were grown between the rows of *Mangifera indica and Madhuca latifolia* during rainy season, this system had also given 3000 kg/ha fruits of *Madhuca latifolia* and 3500 kg/ha fruits of *Mangifera indica* and 175-225 q/ha green grasses in association of both the horticultural tree.

Browse-forestry system :

Under this system, the horticultural tree *Zizyphus mauritiana* and forest trees *Acacia nilotica* and *Prosopis juliflora* were planted on *nala* banks and road sides. The green leaves and fruits of these trees are being used as a green fodder for browses. The *Ficus bengalenasis, Ficus glomerata and Ficus lacor,* which were planted on road sides and around the garden in the operational area, have been managed with watershed technology and now its green leaves and fruits are also being used as a green fodder for browses during summer season or drought period.

Extension -forestry system :

The selected area of dry land watershed was treated

with different soil and water conservation measures. After the treatment of operational area the forest trees like *Acacia nilotica, Cassis siamea, Eucalyptus* spp, *Azadirachta indica* etc. were planted on community assests *viz., nala* bunds, water storage structures and *nala* banks for meeting the general requirements of watershed families. At present these forest plants are giving wood material for domestic purpose of farm house hold.

Silvi-pastoral system :

After the implementation of watershed technology in the operational area, the rearing of milch animals had been started by the watershed families. For meeting the need of fodder, these systems were introduced. In this system the *Acacia nilotica* was grown as a forest tree on the limited land for wood production and local grasses raised in the vacant space left between trees for rearing of domesticated farm animals. The *Acacia nilotica* is providing the wood for domestic use through pruning, while grasses grown in the interspaces of forest trees also graze by animals.

These systems, have been found depended able for utilization of degraded land of watershed, so far because trees tolerated extreme soil and climatic conditions, whereas grasses provided good land cover. These results confirm the findings of Singh (1997) and Singh (2003).

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