Case Study

Environmental Accounting for Forest Area: A Case study of Pavagadh

Our environment is like a bank which is filled with limited amounts of renewable and non-renewable natural assets or capital. This has been stated by **Grey et.al. (1995).** Through bank operations, the capital generates interests. Similarly environmentally sustainable society protects the renewable capital, lives-off the interest, and uses the non-renewable capital wisely. In this way massive debt is avoided and the ecosystems are kept running. This verdict is also applied to sustainable management of environmental resources which is a complex and difficult task. This is due to the uncertainty, complexity of environment and economic loss inherent in natural ecosystems and processes. Today the managers have started giving attention to economic development and conservation of the resource under use. They have understood the importance and essentiality of cost involved in restoration of any resources, which if not done the cost may hamper the future development. On the similar footstep during this research work an attempt was made to follow the framework designed by Natural Resources Accounting System (NRAS). To highlight the importance of valuing or accounting the environmental services in the form of cost benefit analysis relation to the Edaphic i.e. the soil factor.

This framework helped out to estimate the change in this value if a conservation action or a destructive action is undertaken, how this change affects different stakeholders that is, who are the benefited and who are the losers, and therefore help in decision making. This also can help in calculating the actual costs and benefits for taking up such an activity or even for the valuation/ compensation for the damage in case of a change in the land use. In addition to all this it also includes valuing the environmental services that the plot of regenerated land provides. It is obvious that regeneration helps in various aspects like control of soil erosion, improvement in soil fertility, soil formation, improved biodiversity etc. thereby, helping in regulating the

microclimate. In the present valuation study the valuation of changes in soil fertility using the replacement cost and substitute cost method has brought out the significance of the restoration activities carried out in different plots of pavagadh forest area.

This was done firstly, by determining fertility status of forest soil, and secondly, by calculating accurate amount of economic loss or economic benefit due to changes in soil fertility status. The soil samples were collected from the 12 different plots including preserved plots of this forest area.

Valuation of the plots: The valuation studies have been carried out for one of the parameter – change in soil fertility. The replacement cost technique was used to estimate the cost of nutrients in the selected sites where economic valuation of benefit from the surplus amount of nutrients or losses from the low nutrients or losses from the low nutrients was accomplished indirectly by looking cost forest department had to pay to retain soil fertility.

It is common knowledge that as the vegetation improves, there is an improvement in the quality of soil because of the decayed organic matter (humus), but it is difficult to value the improvement normally. The fertility of the soil is measured based on the nitrogen, phosphorous and potassium (NPK) content, electrical conductivity and the pH value of the soil and any change in the soil fertility status of different sites is calculated based on the replacement value method of NPK. Thus economic valuation was assessed on the basis of replacing nutrients which are in less amount that is saved where nutrients are retained in the soil. The amount of nitrogen(N), Phosphorous(P) and Potassium(K) lost from the soil or retained in the soil during the years 1997 – 2009 was calculated for accounting of these nutrients. The results showed the variation in the nutrient status and the soil quality gradually changed as per the increase or

decrease in nutrients. Out of the total 12 plots, soil of five plots showed a change from normal to acidic condition in the pH, while Electrical conductivity (EC) did not get changed from the year 1997 to 2009. Based on the status of the Nitrogen, Phosphorous and potash in 1997 and 2009 the replacement cost/accounting was carried out for each of these nutrients. Status of nitrogen content for the year 1997 showed that in these plots, it was below the optimum level; whereas 2009 result showed that it increased and attained the medium to high amount in few plots. These plots contained surplus amount of nitrogen and therefore, there was no need to add the fertilizer to maintain the optimum level of nitrogen in the soil. In this way, these plots had benefitted. On the other hand, rest of the plot contain nitrogen below the optimum level and hence these plots require additional amount of nitrogen to maintain the optimum level. In this way they showed a loss in terms of rupees to add fertilizer. Overall, accounting for Nitrogen showed that addition of nitrogen fertilizer of Rs. 512.067 per hectare is required for retaining optimum fertility of the soil in context of Nitrogen. Moreover addition of Organic matter of Rs. 31539.9 per hectare is also required which can be saved by proper collection and conservation of internal organic matter. Accounting carried out for nutrients like Potassium and Phosphorous showed profits in both the cases. The increase in these contents over a period of time has saved an amount of Rs. 3104.494 and Rs. 6721.468 per hectare in case of Phosphorous and Potassium respectively. Replacement cost of N, P, K and OM is depicted in the **Figure 13**. The figure brings out that Malwar P.P. Plot (outside) has the highest, whereas Semialata plot (inside) without lac has the lowest amount of replacement cost. This has proved that the restoration and conservation efforts by the Forest Department had generated positive results.

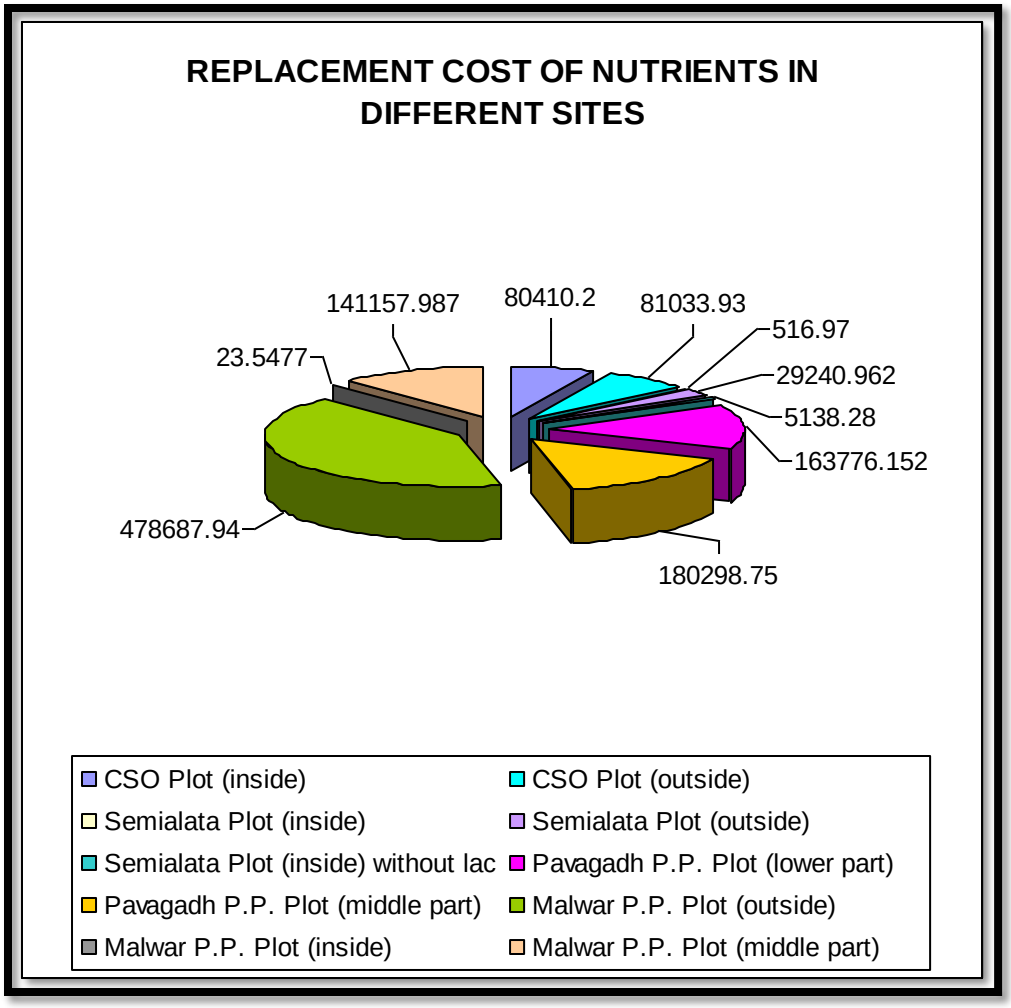

Figure: 13 Replacement cost of nutrients in different sites

Accounting for these nutrients for year 1997 and 2009 were also carried out considering the rate of particular fertilizer in year 1997 and 2009. In this analysis rate of urea, Super phosphate and Murates of Potash for both the years were taken into consideration for replacement of Nitrogen, Phosphorous and Potassium respectively during the calculation. The accounting of Nitrogen as per the rates of the fertilizers in the year 1997 and 2009 showed that whichever values are considered, in both the cases an input of fertilizers costing more than thousand rupees for one hectare is required.

The accounting of Phosphorous indicated that there is a benefit of Rs. 632.716 and Rs. 1007.254 in 1997 considering the price of 1997 and 2009 respectively; whereas profit of Rs. 2582.775 and Rs. 4111.778 in 2009 as per cost of fertilizer in 1997 and 2009 respectively. In overall, for phosphates the amount had been saved over a period of time.

Accounting for the potassium had also brought out the fact that there was a benefit considering the rates of both the years. It was clearly shown that most of the preserved plots inside has higher values when compared to the outside areas indicating the good quality attempts carried out by the forest department for the restoration of these forest plots.

In this study the entire non-spatial or the attribute data in the form of physiochemical properties was integrated with the specific ground location using the advanced tool like Geographic Information System (GIS). Using this tool, the economic gains and losses were integrated with these locations, which were represented by the maps which can be regularly updated as they are stored in the digital format and the year wise changes or the monitoring done for these two variables can be obtained.

Environmental accounting is comprised of many environmentally – conscious business activities and it encompasses a huge amount of data and also a complex analysis. In such case the use of the new tool like GIS can help the organizations in updating and analyzing their data timely and accurately. Thus a pioneer attempt had been made in this work to utilize this technique and highlight its potential.