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Variability of Biodiversity in Drought Prone Area

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ABSTRACT *Biodiversity and livelihoods are closely interlinked with each other. In drought prone area there is a continuous threat from local environment to livelihoods. A study was conducted in four villages located in drought prone areaindicates that watershed development programme has a positive impact on livelihoods resources (CDI= 0.57 to 0.87) indicating that there is diversification in cropping pattern which helps to strengthen the livelihood resources. The traditional agriculture has been shifted towords madern method of cultivation and use of high yielding verity of seeds.*

Introduction

Biodiversity is often defined as the variety of all forms of life, from genes to species (Gaston 19960). It is part of our natural capital (Perrings et. al., 2006). Moreover, biodiversity offers scientific, cultural, aesthetic and recreational services, which increase the quality of life of the society (Altieri, 1999). Biodiversity is a powerful tool for assessing sustainability in ecosystems at the level of genetic, species and ecosystem diversity (Biala et.al.2003). **P**eople and their environment are interdependent and have a great significance for survival (Iyer 2003, FAO 1993). Any change in the surrounding environment directly affects the people living therein. Kerr (2002), and Vishnudas (2007) have stated that a degraded environment results in a degraded quality of life of the people. To assess the challenges of ecosystem and biodiversity a study was conducted in four villages located in drought prone areas where watershed development projects were implemented. Therefore, the objective of study was to assess the impact of watershed development programme on biodiversity.

Methodology:

Four villages of Pune district of Maharashtra state were selected. These villages falls under Drought Prone Area Development Programme (DPAP). Interview schedule was used for data collection from respondents i.e. farmers. It was observed that the educational and economic condition were very low. Agriculture is the main occupation of most of the villagers. Hence, watershed development programme has vital significance for the villagers. The villages Morachi Chincholi and Shahashtabad are located in Sub Watershed No. BM 26 having an area of 32043 ha. The village Pabal is located in Sub Watershed No. BM 18 having an area of 21881 ha., the village Kendur is located in Sub Watershed No. BM 19 having an area of 22479 ha. and Kendur is in Mini Watershed No. BM 19- 4/7.

Groundwater Table:

The ground water table varies from 6 to 15 meters. In order to study the trend of groundwater table, three observation wells were stuided. The rise in groundwater during monsoon is mainly due to rainfall. The recharge due to rainfall is calculated as:

$R = A \times Sy \times (h1 - h2)$

Where,

R = Recharge
A = Area under evaluation
Sy = Specific yield of the aquifer
h1 = Water level measured immediately after monsoon
h2 = Water level recorded before monsoon

Agricultural diversity: Agricultural biodiversity positively influences socio-economic stability and reduces the effects of severe changes in consumer demand. Genetic diversity within species forms a reservoir of genes available for genetic improvement. The choice of local species, varieties and breeds, especially those which are on decline, prevents their extinction and genetic erosion (Maljean and Peeters, 2001). At the landscape level, crop and temporary grassland diversity adds to habitat variability and heterogeneity and increases the ecotone effect, thereby supporting the existence of beneficial fauna. Simple and easily obtainable indicators of planned diversity at the field, farm and landscape level include the number of varieties and species of crops, and livestock breeds.

The type of crops cultivated in study area are jawar, bajara, moong, wheat, groundnut etc. It has been observed that the villagers are now turning towards hybrid varieties of crops as they need less water and give more produce in a shorter time. Majority of the farmers go for inter-cropping and the crop selection is done in such a way that one of the crops helps increase (or retain) the soil fertility because of the legumes attached to its root system. In order to visualize the short term impact of watershed development, the researcher has studied the crop diversification and livestock number. The watershed helps farmers in diversifying and intensifying their agricultural activity in a manner that enables them to augment their income and employment.

Expansion of area under cultivation: The changes in crop, made possible by the implementation of watershed project and WDP project has brought about substantial changes in the Kharif, Rabi, and summer crop patterns. It is also observed that there is increase in the land under cultivation during Kharif season. In Chincholi, 150% increase in jawar and bajara, 64% increase in the land under onion cultivation -which is a cash crop and 75% increase in land used for growing vegetables. Similarly in Shashtabad there is 80%. increase in land under onion cultivation and 300% under vegetable cultivation. There is also 7% change in bajara and moong cultivation. In Pabal and Kendur there is only 9% and 4% positive change in land cultivating bajara. But groundnut cultivation of shows a negative change of -11%. The land under cultivation of toor dal has decreased in Pabal by 29% (-29%) but Kendur shows a positive change of 78%. Chincholi there is a positive change in the area under cultivation: wheat (150%), Onion (58%), vegetables (210%) and others (27%). In Shashtabad also there is a similar positive change of wheat (67%), Onion (50%), and vegetables (60%). In both the villages no decrease has been recorded in the cultivation of any type of crop. In fact, there was a positive change even in the year 2003, when there was scanty rainfall. The watershed development programme has thus shown a positive impact in NGO villages. In Pabal the positive change could be seen only for jawar (4%) and wheat (10%) but for harbara (-20%) and other crops (-11%) there was a decrease (a negative change). In Kendur except for jawar (-25%) which shows a negative trend the other crops viz., harbara (47%) and onion (309%) show substantial increase. From the positive change

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in cash crops one can predict that the economic condition of the farmers must also have improved in the study area.

Crop Diversification Index (CDI) : Crop diversification is the significant presence of a variety of crops in a production space i.e. distribution of crops over the acreage. The pace of diversification and its resultant economic gain depend on the economic, social, ecological, environment and other related factors. The dynamics of crop diversification thus depends on the allocation of resources for production of different crops over time and space. A diversified crop profile would mean a large number of crops, in significant shares, in the overall acreage. However, the land is an inelastic factor of production. Therefore, crop diversification becomes a distinct, though integrated, organ of overall agricultural diversification, because of its feature of allocation of inelastic factors of production amongst competing crop choices (Mehta, 2005). CDI is used as an effective strategy for achieving food & nutrition security, income growth, poverty alleviation, employment generation, judicious use of land and water resources, sustainable agricultural development, and environmental improvement (Mehta, 2005 as cited in Singh 2001). Crop Diversification Index can be calculated using the formula:

$$CDI = \sum_{i=1}^{n} Pi \text{ Log } (1/Pi)$$

Where

Pi = Proportion of area sown under ith crop in comparison to total cropped area

N = Total number of crops in the watershed.

CDI = Crop Diversification Index is based on Simpson Index of Diversity:

$(1 - \Sigma P_i^2)$ where, Pi is the proportionate area of ith crop activity or enterprise or value in the gross cropped area or total value of output.

The index scale is in the range of 0 to 1 with the degree of crop diversification in the respective geographical domain. Higher value of CDI is a measure of better diversification (Girish, 2004). With increasing diversification, the CDI also increases. It is bounded by "0" i.e. complete specialization and "log N" i.e. perfect diversification. For the present study the classification is based on crop diversity, using CDI, which is a measure of the extent of diversification, having logarithmic character. The total number of crops grown in the study area was 14 and the demarcation line came out to be:

Maximum value of Index = log N

= ½ (log 14)

= 1.14613/2 = 0.5730

Hence,
More diversified farms have a CDI of more than 0.5730 Less diversified farms have a CDI of less than 0.5730.

Table 9. Change in Crop Diversification Index of Study Area

Crop	Chincholi	Shashtabad	Pabal	Kendur
Bajara			-0.01	0
Groundnut			-0.01	-0.02
Toor			-0.01	0.01
Bajara+Moong		0.02		
Jawar+ Bajara	0.02	0		
Onion	0	0.01		
Moong & Gram	-0.04	0		
Vegetables	0	0.05		
Jawar			0	-0.03
Wheat	0.01	0	0	0.01
Harbara			-0.01	0
Onion	0	0		0.06
Vegetables	0.03	0.01		

Diversification of agriculture is considered essential to get complementary and supplementary advantages of relationships and to reap maximum returns. In addition, it is also required to maximize resource use, and efficient multi-dimensional use of limited land, time, use of output of one crop as an input to others, and intensive use of family labour to maximize profit. Analysis of the data showed that the value of all the four villages was above 0.57 except Shashtabad (CDI = 0.57) which means the village was only moderately diversified before the implementation WDP. Chincholi had more diverse farms (CDI= 0.83), followed by Kendur (CDI = 0.74), Pabal (CDI = 0.60) and then Shashtabd (CDI = 0.57). However, after the implementation of WDP, the situation in Chincholi remained the same, i.e. the CDI= 0.83, while the value of Shashtabad which was 0.57 increased to 0.66 an increase of about 0.09 which is due to better irrigation facility. The situation in Gov villages was found to be good with the CDI of Kendur increasing by 0.07, after the implementation of WDP. A negative change. (– 0.03) was found in the case of Pabal showing that the crop diversity has decreased. This may be due to the increasing urbanization and acquisition of land for SEZ.

Conclusion: It can be concluded that watershed development programme has a positive impact on the environment, ecosystem and biodiversity of the study area. The current land use pattern shows a shift towards crops that require less water, but are more profitable. Under such a situation, provision of irrigation would not lead to a reverse shift towards water-hungry crops. As can be predicted from the hydrographs, the ground water level is also increasing in both NGO and Gov villages. Due to the availability of ground water the number of dug wells and bore wells has also increased. Cultivation of a variety of crops, especially cash crops like onion have increased. From this it can be concluded that the economic condition of the respondents has also improved.

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