

**PARTICIPATORY WATERSHED DEVELOPMENT:
IMPACTING UNDERNUTRITION IN RURAL INDIA**

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Marcella D'Souza

Takemi Fellow, Department of Population and International Health, Harvard School of Public Health and Director, Watershed Organization Trust (WOTR)

Address: Paryavaran, Market Yard Road, Ahmednagar 414 001, India.

Phone: +91 (241) 356188/322011

Fax: +91 (241) 341134

Email address: wotr@vsnl.com
mdsouza@hsph.harvard.edu

Abstract

Undernutrition and malnutrition in children in developing countries is closely linked to environmental degradation, repeated droughts and poverty. Watershed development is being currently undertaken extensively in India to drought-proof degraded lands and alleviate poverty. This paper studies the impact of watershed development on the nutritional status (weight-for-age) of children of the 0-5 years age group and the factors at both household and village level that influence the change. The focus of this study is the Indo-German Watershed Development Programme, Maharashtra. Of the 129 projects under implementation, 27 project villages, grouped according to stage in project implementation and 727 households with 1532 children of 0-60 months, form the study group. While land productivity as measured by crop production is greatly enhanced (505 percent) and households owning cross-bred milch cows also increase (41.2 percent) as compared to the pre-WSD situation in Group III villages, it is noted that there is a mere 6.8 percent increase in the children who are of normal weight as compared to the Group I villages (near Pre-WSD situation). Group V comprising of 3 villages was studied. Otherwise comparable with the Group III of this study (stage in project implementation and enhanced land productivity) these villages did not have the individual household "Survey 2000" conducted, besides, the local women's organizations of these 3 villages were involved in their daycare center. The study showed that 89 percent of children of Group V villages are of normal weight-for-age, a 40 percent improvement over Group I villages and 33 percent improvement over Group III villages.

This study reveals that when environmental regeneration efforts actively involve women in the management of the village daycare center, enhanced land productivity will result in improved nutritional status of children.

Key words: Watershed development,
Nutritional status of children,
Women's involvement,
Indo-German Watershed Development Programme,
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1. Introduction

Among the many causes of under-nutrition and malnutrition in children in developing countries, low land productivity and poverty are most frequently encountered. While India has been at the forefront of the green revolution and agriculture contributes to nearly one-fourth of the GDP (Reserve Bank of India, 1999), India also has 175 million hectares of degraded areas and wastelands of which 92.7 million hectares is reclaimable (Mohan Daria Committee Report). Besides, India has a long history of severe droughts (World Bank Sept. 2000) and has 40 percent of its inhabitants that live below the international poverty line (defined as US \$1 a day). Hence, it is not surprising to note that in the recently conducted National Family Health Survey of 1998-1999, data for Rural India and Rural Maharashtra reveals a mere 53 percent and 51.4 percent respectively, of children that are of normal weight-for-age for the 0-36 months age group.

In recent years, watershed development (WSD) is being undertaken extensively by both national and external donors, as a means of addressing land degradation, drought and poverty. Participatory watershed development projects focus on regeneration of the catchment basin of a stream or river system. Treatments comprise of developing forests, pasturelands, raising soil conservation measures and building water-harvesting structures (gully plugs, check dams) along watercourses. It also includes developing appropriate land use and economic strategies that meet both conservation and production needs. Such an initiative requires approximately 4-6 years for treatment of a micro watershed (approximately 10 sq. kms). This demands an intensive involvement of the organized village community and the facilitating NGO (if any) with little time left for other developmental activities, however important.

Since under-nutrition is closely associated with degraded lands, it is generally assumed that environmental regeneration and enhanced land productivity should improve the nutritional status of the local inhabitants. Although the project under study did not explicitly address nutritional issues, this paper observes the impact of WSD on the nutritional status of children and the determinants of positive change. The purpose is also to identify the minimum intervention/s required that would enhance positive outcomes without burdening the implementers. The age group (0-60 months) is selected as an indicator of nutritional impacts since little children are the most vulnerable sector of a population and can be compared to international standards. In this study the weight-for-age criteria is used since it has been adopted by the state managed "anganwadi" (child care and supplementary feeding of the Integrated Child Development Scheme) program.

2. Description of the Research

2.1 Background of the Area, Project Villages and Population under Study

This study is based on data obtained from projects of one such environmental regeneration intervention, "The Indo-German Watershed Development Programme,

Maharashtra, India¹ that implements 129 projects (as of March 2001), involving 171 villages, in 77 blocks of 22 districts of Maharashtra. A total of approximately 180,000 people live in these villages. The treatment of 135,812 hectares (1358 sq. kms.) has either been completed or is in progress. Of the 129 projects, approximately 65 percent of projects fall under the Agro-economic Zone 3 villages characterized by arid, semi-arid, sub-humid low rainfall areas, having low land productivity and a high incidence of poverty. About 30 percent of projects fall under Agro-economic Zone 2 characterized by high rainfall, low productivity, low levels of irrigation and high incidence of poverty. The literacy levels are lowest for Zone 2 as compared to the other 3 zones (Ghosh, S.P.1995). The remaining projects fall under the heavy rainfall, high productivity Zone 1 of the coastal districts.

- a. Geographic location: Of the 27 villages selected, 22 are in Agro-economic Zone 3 and fall in the rain-shadow belt of the state (250 – 450mm annual rainfall). The 3 villages of Group V also fall under Zone 3. The other 5 villages of Agro-economic Zone 2 have a heavier rainfall (800 – 1200mm. pa.). (b) Of the 27 villages, 7 have over 75 percent of households of predominantly socially disadvantaged communities (scheduled tribes [ST], other backward classes [OBC] as stated in the Constitution of India article 341 & 342). The 20 other villages have mixed populations - nomadic tribes, ST, OBC and schedule castes - together with other caste communities. (c) Projects villages are grouped according to the current stage in project implementation. Group I villages have not yet entered or are in early stages of implementation. Group II villages are in mid-project implementation. Group III villages have been completed between 2000 to May 2001. Group IV villages are 2-6 years post project implementation. The Group V villages are comparable to Group III, but these households were not included in socio-economic Survey 2000, but have the local women's organization specially involved in the children's day care centre (anganwadi). Table 1 gives the summary of the of the study sample. (d) Households that have children of 0-60 months form the sample study. This category is representative of the entire village as it includes all socio-cultural communities and classes of the population.

2.2 Data Collection and Sources

Data sources comprised of the following (a) Socio-economic "Survey 2000" conducted for households of Groups I-IV. (b) Baseline household data of the "Pre-WSD Survey" of Groups II-IV villages (source: respective projects). (c) General data for the village obtained from the records and annual reports of the individual projects (source WOTR: project data and reports). (d) Focus - Group Interviews conducted with the 3 villages of Group V. (e) The Nutritional status "weight-for-age" check of children conducted between December 2000 and February 2001.

¹ In this article, the IGWDP comprises of two sub-programs 1) a major bilateral one, funded by official German Development Cooperation and 2) a smaller NGO [Misereor] funded sub-program (24 projects covering 13,411 ha.). The guidelines followed are similar for both.

Overall it was found that 62.5 percent of the children of the study villages were included in this study.

2.3 Methodology

A comparison is made between the Pre-WSD year and Year 2000 for the individual households and between the different groups (according to phase in project implementation) in year 2000. Since the objective of this paper is to study the impact of WSD on the weight-for-age status of children, the findings of the household data from Survey 2000 with regard to (1) the normally expected outcomes of WSD (enhanced land productivity: crop production and livestock) and (2) the food consumption pattern (number of meals/day and milk by the children) are analyzed in terms of (3) its reflection on the weight-for-age of the children.

Factors that impact the Nutritional Status namely (a) those that affect the village as a whole: percent of socially disadvantaged communities, women's organization and involvement in WSD, the existence of a government managed day-care center and women's involvement in the day-care center. This data was tested using the Spearman Correlation Coefficients. (b) Those that affect the individual households: households that have breakfast regularly, households that own cross-bred milch cows, children of 0-60 months who drink cow's milk regularly and households that have no adult woman who has entered primary school was analyzed using the Chi Square Test for Independence.

For this analysis, households are grouped according to the weight of the child. It is found that an approximate 43 percent of households in the study group have more than one child between 0-60 months. It is not uncommon to find that in such households, children may fall under different nutritional grades. Hence for the purpose of this study: if all children in a household weigh normal, then that household is grouped under the category "children of normal weight". But if a household has one or more children who weigh normal, but the third is below weight-for-age, that household is grouped according to the child who weighs "below normal weight-for-age".

3. Research Findings and Discussion

The findings are discussed in 2 parts: (1) The relationship between land productivity and the weight-for-age nutritional status of the children and (2) the factors pertaining to individual households and the village that influence the nutritional status.

3.1a Land Productivity, Food intake by children and the weight-for-age Z Score.

Land Productivity is analyzed under 2 heads: Crop Production and Livestock.

In Table 2 we have a comparison between the crop production of the Pre-WSD period and year 2000 for the Groups II and III villages. While there may be 1 to 3 crops taken a year depending on irrigation facilities, the average production

(quintals per hectare) of each crop was calculated for the total hectares under cultivation in the respective year. It is observed that there is an increase of 7.7 quintals/hectare (150 percent) in the Group II villages (average 3 years in project) and 13.7 q/ha (505 percent) for the Group III villages (average 5.8 years in WSD). In the Group II villages the land of all the households interviewed may not have been treated, but treatment has been almost complete in the Group III villages.

Rainfall has a major influence on land productivity. In Group III villages, the rainfall is on the lower side, ranging from 378mm to 994mm (10 year annual average). But in the year 2000, the overall average rainfall for Group III villages was less by 147mm, with only 2 of the 7 villages receiving more than their average. In the per-WSD year, the overall average for all villages was less by 62mm, with 4 villages receiving more than their respective 10 years average. Despite a relatively poor rainfall, crop production actually increased. This could be attributed to the drought mitigating, moisture retention impact of WSD.

Besides millets (sorghum) which is the staple food in this region, the production of cereals (wheat) is on the increase. In the group II villages, the production of wheat has increased by 0.93 q/ha (206.9 percent) and pulses by 1.29 q/ha (352.9 percent) over their Pre-WSD record. Vegetable crops have dramatically increased (11.38 q/ha) in the Group III villages over their Pre-WSD output, showing that besides an increase in quintals per hectare, there is also a change in the cropping pattern.

As watershed development advances, the otherwise barren degraded lands now produce grasses and fodder for livestock. Watershed development requires either a ban on free grazing, or controlled grazing as a soil conservation measure which results in the added benefit of fodder production. This availability of fodder has permitted more households to own cross-bred cows. In **Figure 1** one notes that as cross-bred cows increase with the advancing years in WSD. There is a decrease in other livestock, especially of indigenous cows. In Survey 2000, only 10.7 percent of Group I households own cross bred cows, while it is 50 percent for the Group IV households.

3.1b The relationship between Land Productivity and Food Intake

It is generally assumed that with an increase in crop and milk production there should be an increase in food intake. Households in rural Maharashtra customarily have their first meal at about 10 am (before going out to the fields) and the second meal at about 6 pm (on returning from the fields). Breakfast is not a custom. The data collected does not specifically indicate whether children are also given breakfast. In **Figure 2** it is observed in Group I villages that 35 percent households have breakfast and this increases to 74 percent in Group IV villages.

With regard to children who drink cow's milk: in Figure 2 it is also observed that the number of children who drink cow's milk increases from 35.2 percent of the Group I households to 57 percent of Group II households, then steadily declines to 25.6 percent for the Group IV households (10 percent lower than Group I). This is

despite the fact that the number of households owning cross-bred milch cows in Group IV is 39 percent higher than that of Group I. From information obtained from these villages, one notes that as the project advances in WSD, the number of cross-bred cows increase with an increase in milk production. A dairy cooperative is soon established in the village and more households sell all the milk.

3.1c The reflection of land productivity on the nutritional status of the children

In **Figure 2** the weight-for-age Z score of the children of Groups I – IV is observed in relation to the meals and milk intake by the children. The percent of children that are of normal weight (48.4 percent) in Group I households is lower than that of rural Maharashtra (51.4 percent) as reported in the National Family Health Survey 1998-99. The data also reveals that the percent of children that are of normal weight in Groups III and IV (advanced in WSD) is just 6.8 percent and 13.3 percent better than Group I. The results observed in Figures 2 suggest that the enhanced land productivity of WSD translated into only a small improvement on the nutritional status of children.

3.2a Factors at Individual Household Level that impact nutritional status are observed in

Table 3.

- i. The high proportion of households in all 5 groups that have no adult women who have entered primary school has a negative impact (p value < 0.05) on the Group I villages only; whereas for groups II-IV, it does not seem to negatively influence the nutritional status of the children (p value > 0.5). (b) Even in households owning cross-bred cows and (c) households where children drink cow's milk there does not appear to be an impact on the nutritional status. The p value is > 0.05 for all groups for both (b) and (c).

With the improving land productivity and the ban on free grazing, marginalized wastelands become a good source of fodder (WOTR – Annual Reports of projects). Individuals and women's groups now link to Micro-Finance Institutions and increasing number of households own cross-bred, milch cows (WOTR. Dec 2000). In the rain-shadow belt of Ahmednagar district, milk production shoots up by the 4th - 5th year in project period to over 400 liters per day and by the 6th - 7th year to over 900 litres per day per village on an average. Dairy cooperatives are approached to service the villages and milk intake by children simultaneously decreases.

- ii. As WSD advances, it is also noted that there is an increase in the number of households that now have breakfast. It appears that in households that have breakfast (the 3rd meal) there is a positive impact on the nutritional status of children of groups II and III (p value < 0.005). While enhanced crop production appears directly related to the increase in food intake, the increase in income from the sale of milk may also contribute towards it.

Data show that households regularly consume sorghum and wheat products with vegetables. Pulses are the only mentioned source of proteins consumed regularly by less than 40 percent of households and only once a day.

- 3.2b** Factors that affect the village as a whole are observed in **Table 4**. One notes that (a) villages having a high percent of households that belong to the socially disadvantaged communities (ST, SC, OBC, and nomadic communities) have a high proportion of undernourished children (p value = 0.0001). These villages are usually remote, have poor transport facilities and have been less exposed to developmental processes as compared to villages of mixed populations. (b) Another factor studied is the presence of a state initiated and managed day care center for children (anganwadi) that provides supplementary food for children and child health care information for mothers. Of the projects under study, 18 of the 27 have an “anganwadi”. The other villages have a pre-school (balwadi) program only. Analysis reveals that the presence of an “anganwadi” does not have the intended impact on the nutritional status of the children (p value=0.15). (c) The general organization and involvement of women in the watershed also does not have a significant impact (p value = 0.8).
3. As mentioned earlier, villages of Group V, except for not being included in Survey 2000, are comparable with Groups III and IV in terms of years in project period and location within the rain-shadow districts. The other difference between these 3 villages and the rest of the study group is that the women’s organizations of these villages are especially involved in the daycare center. Results seen in the weight-for-age status indicates that Group V villages are 40.4 percent higher than Group I villages and 21 percent higher than Group IV villages.

The Focus-group interviews revealed the women’s keen interest in the same. Initially this was not the priority of the women but was encouraged and fostered by the facilitating NGOs. In some villages (Ladgaon), in the first 6 months, each household contributed Rs5/- per month per child to pay the “anganwadi” worker. The day-care center was later linked to the government Integrated Child Development Scheme. In all 3 villages, the Joint Women’s Committee (representative of all women’s self-help groups) is involved in its functioning. Women are aware of the weight check-up conducted regularly by the anganwadi worker. Women are interested in the ‘anganwadi’ centre as children are taken care of while they work. Children learn to socialize and are prepared for school. The weight-for-age check for these 3 villages revealed that 85 percent (1 village) and 90 percent (2 villages) of the children weigh normal. From this one may infer that together with the enhancement of land productivity and income – the direct outcomes of watershed development – women’s involvement in the day care centre will greatly improve the nutritional status of children.

Learnings and Conclusion

Participatory watershed development has a potential for improving the nutritional status of people in environmentally degraded regions. Enhanced land productivity despite the lower than normal rainfall, even in rain-shadow regions, can help withstand the effects of drought. But, the increase in crop production and income should not be understood as being automatically reflected into improved nutrition of the children. In fact, even the existing government project - the 'anganwadi' - now accepted by the households in the village, does not always have the intended impact of improved weight-for-age of the children. The mobilization of the village and especially of women provides the catalyst and atmosphere of learning that facilitates the spread of information to the whole village. This is true even when the percent of women who have entered primary school is very low. In environmental regeneration projects, when villagers and especially women are mobilized, their participation and involvement sought in the day-care center and information on nutrition and child care given to them, can long lasting nutritional impacts be obtained. Since enhanced land productivity also creates opportunities for changes in cropping patterns, facilitating NGOs would do well to promote nutritionally useful crops that would benefit the villagers first.

Since women's active participation is now sought in all environmental regeneration projects, policy makers and project planners should specifically promote women's involvement in the management of day care center and the improvement of the nutritional status of their children. This will dramatically improve the nutritional status of the children and the local inhabitants in otherwise poor and degraded regions of the world.

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