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The Role of Farm Ponds in Agricultural Development: A Case Study of Nivadunge Village in Pathardi Tehsil of Ahmednagar District (M.S.)

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Abstract Farm ponds have been built all over the world to encourage agricultural expansion. Natural-based solutions are increasingly being recognized as a viable option for addressing water-related issues. This is the first study to look at how ponds influence the adoption of water-saving irrigation practices. Sustainable rural development and the management of other small, scattered wetlands can benefit from the conservation advice and analytical methodology. The current study examines agricultural improvement in Nivadunge village using farm ponds. The evolution of agriculture was tracked using a variable parametric method. This village is situated in a drought-prone region. The depth of black cotton and red soil is shallower than that of other soils. There are gravel and sandy soil types, and they store water to a lower extent. This type of research can help villages grow their agriculture in a holistic way.

Keywords: *IPCC, multi-faceted, agricultural development, farm ponds, cash crops etc*

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1. Introduction

The issues of Indian agriculture cannot be overlooked as more than 62% population is directly dependent on it [1]. Therefore, it is essential to understand the issues associated with farming activities and to provide specific suggestions. Both of these aspects have been studied by several geographers like [2,3] etc.

Ahmednagar district is known as the drought-prone region in Maharashtra (FFC 1973). Most importantly, rainfall is less than half of the potential evaporation [4] that has resulted in crop failure once in three years according to the data provided by the IMD. There are various schemes to secure agriculture and to reduce [5] the frequency of crop failure in such regions. A farm pond is considered quite useful for conjunctive use of stored water in the event of a long dry [6] spell. The severity of droughts has its long-term impact [7] as it does not allow the capital formation and hence farmers become vulnerable communities, financially as well as socio-politically [8] What is the way out? It is possible to hold the runoff water through the Farm pond by stopping it, storing it, and using it for safe irrigation [9] when needed. Which can be used conjunctively in the event of failure or late arrival of monsoon? [10] "Farm pond is an artificial dug-out structure with definite shape and size for collecting and storing surface runoff water for secure irrigation whenever needed" [11] Agricultural development in any region is a multi-faceted [12] process. Irrigation plays a vital role [13] in Agriculture.

The fundamental goal of this research is to comprehend agricultural development through farm ponds and their impact on the socio-economic development of farm pond owners. This type of research is critical for agricultural planning at the village level in order to achieve holistic growth. The major goal is to collect surplus run-off water through dug-out farm ponds built under the program for protective and life-saving irrigation during crucial crop stages [14] in order to increase agricultural yield and income for resource-poor dryland farmers.

2. Study Area

Nivadunge village is in the Pathardi tehsil of Maharashtra's Ahmednagar district (Figure 1). It is approximately 9 kilometers west of Pathardi, the tehsil town, and approximately 65 kilometers east of the district town. The village is located at the intersection of $19^0$15'33"N latitude and $75^0$05'35" E longitude. The average elevation is approximately 552 meters above mean sea level. The village has a total land area of 2282.25 ha.

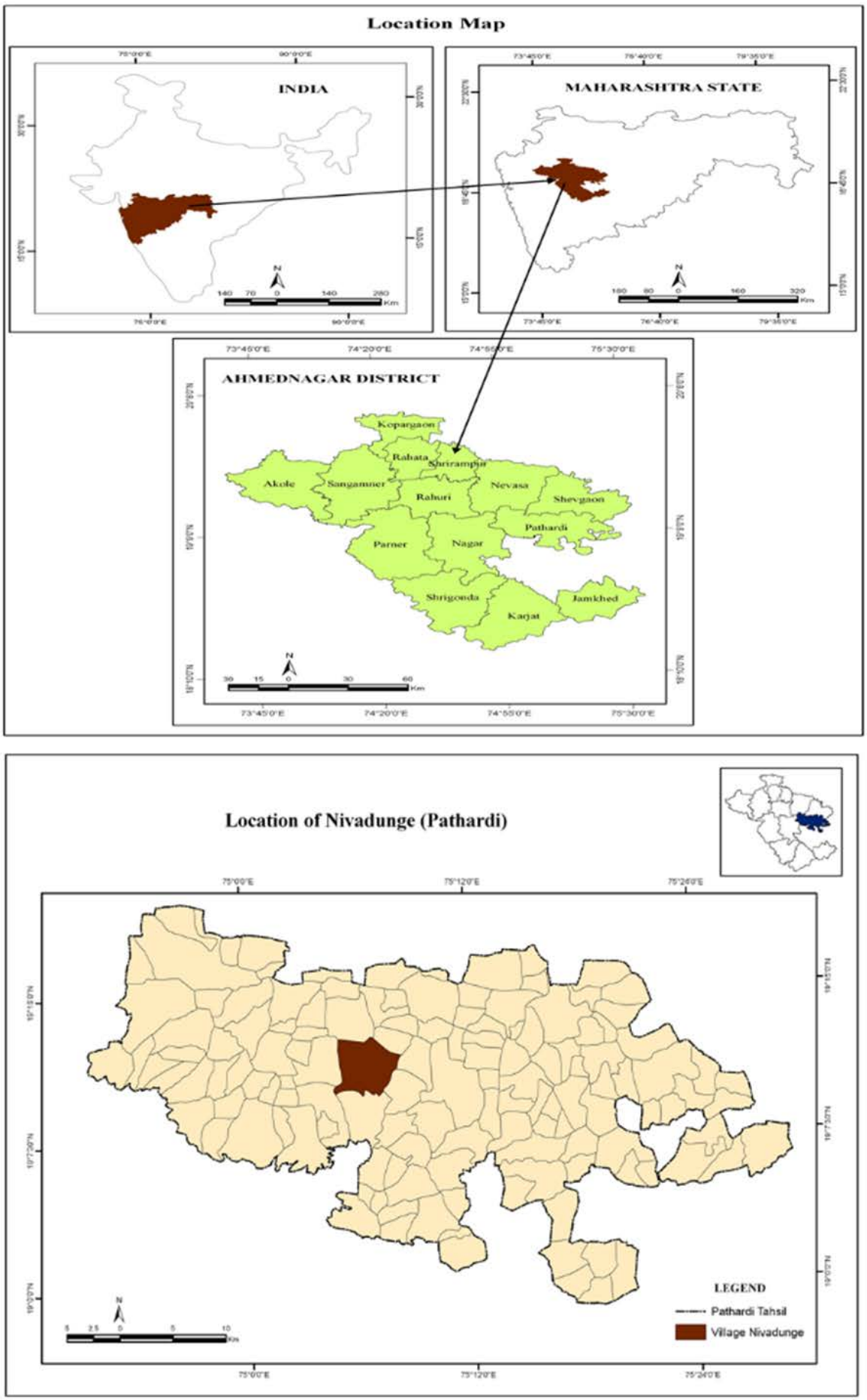

Figure 1. Location map of Study area

3. Database and Methodology

Data for this study was gathered from both primary and secondary sources. A village survey is conducted, and data is gathered through standardized questionnaires. For the purpose of selecting farmers in the chosen hamlet, a suitable sample procedure was used. A minimum of 50% (54 farmers) of the total farm pond holder farmers in the community have been selected for data collection. Related to agriculture and infrastructure twelve agricultural development parameters [15] have been estimated for two scenarios, namely before and after the construction of a farm pond, and the difference between them has been determined. With the use of appropriate statistical tools, the acquired data from the field and offices was assembled, analyzed, and summarized. Changes in parameter values have been calculated, and analysis has been conducted.

4. Results and Discussion

4.1. Area and Land Use

The acreage and land use of Nivadunge village is depicted in the pie graphic (Figure 2). The village's total geographical area (TGA) is 2282.25ha. The village's NSA is approximately 81.86 %. The field observations that led to this large amount of NSA are as follows: first, the Nivadunge village is located in the Deccan trap, which has a modest slope [16]. As a result, the amount of land available for farming has increased. Second, the farmers of this hamlet have used techniques like CCT and levelling to convert the majority of their wasteland into cultivable land [17]. The majority of the land is used for horticulture crops such as pomegranate, orange, and other citrus fruits.

4.2. Available Amenities for Agriculture

The (Table 1) depicts the various agricultural amenities accessible in the Nivadunge village.

Four milk collection centers are available in this village which collects milk from farmers and sends it to Tisgaon and Pathardi cooperative dairy plants. For irrigation purposes, the village has 720 wells and bore wells. A total number of 108 farm ponds have been constructed in this village by farmers. This village has 92 tractors for agricultural allied activities. In this hamlet, there are four milk collection facilities that gather milk from farmers and deliver it to the Tisgaon and Pathardi cooperative dairy plants. The community contains 720 wells and bore wells for irrigation needs. Farmers in this village have built a total of 108 agricultural ponds. For agriculture and related tasks, this community possesses 92 tractors.

4.3. Agricultural Progress of Farmers with a Farm Pond

The second portion of the case study focuses on the agricultural growth of farm-pond holding farmers in Nivadunge village. How effective are farm ponds for generating protective irrigation areas? Is there a way to repurpose farm pond water for something else? As a result, data is gathered through surveys and discussions with farmers.

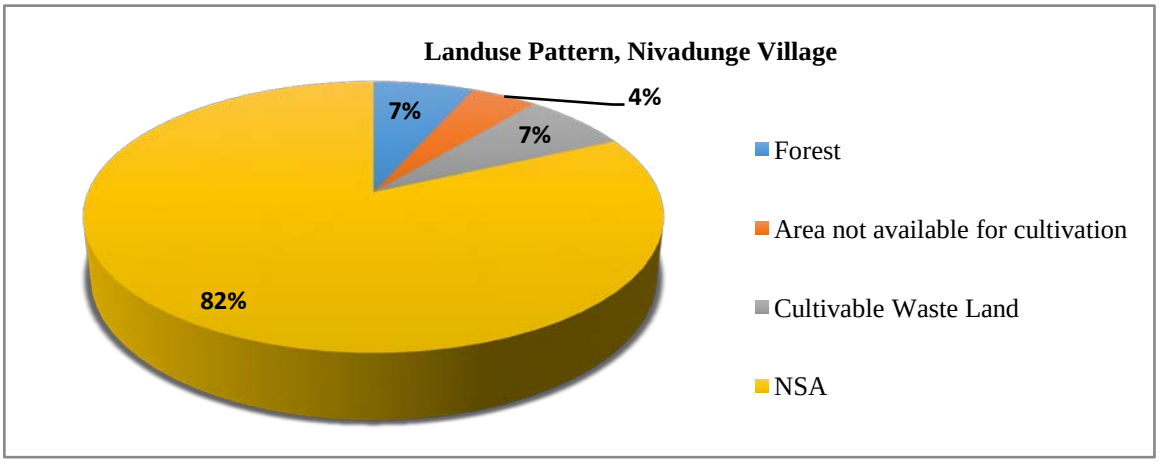

Figure 2. Landuse Pattern of *Nivadunge* village

Table 1. Available Amenities

Available Amenities	Agricultural Markets	Banks and Society	Milk Dairy	Well and Bore well	Tractors	Farm ponds
Number	2	2+1	4	720	92	108

(Source: Based on Talathi office record 2017-18).

Table 2. Use of Farm-Pond Water Resource

Total Number of Sample Farm-ponds	Water storage capacity (TCM)	Area under protective Irrigation in ha.	Use of Farm-pond by Farmer		
			Crops	Drinking purpose	Fish culture
54	422.30	79.23	54	36	54

(Source: Computed by researcher based on field work).

Irrigation has protective 79.23% of the land due to the farmers of Nivdunge village's use of farm ponds, the majority of which are used for agriculture and fish farming, resulting in a rise in agricultural revenue.

4.4. Agricultural Development Variables

The Table 3 shows the twelve agricultural development indicators of farmers with farm ponds in Nivadunge village.

Table 3. Agricultural Development Variables

Sr. No.	Agricultural Development Variables	Before FP	After FP	change
1	% of NSA to TGA	69.00	88.26	+19.26
2	Cropping intensity	122.61	152.95	+30.34
3	Irrigation intensity	98.84	153.43	+54.59
4	A number of farm ponds per 100 ha. of NSA	N.A.	51	51
5	% of irrigated area by farm-ponds to NIA	N.A.	79.95	79.95
6	% of the area under horticultural crops to NSA	26.03	84.33	+58.30
7	% of the area under micro irrigation to NSA	32.5	70.17	+37.67
8	Use of fertilizers in tons per 100 ha. of NSA	28.5	65.6	+37.10
9	The number of electric pumps per 100 ha. of NSA	89	135	+46
10	The number of tractors per 100 ha. of NSA	9	32	+23
11	The number of sprayers per 100 ha. of NSA	35	82	+47
12	Average annual income per farmer in rupees	88,000	7,84,000	+6,96,000

(Source: Computed by researcher based on field work).

Before the construction of the farm-pond, the percentage of NSA to TGA was 69 %, but it is now 88.26 %. It indicates that the NSA has increased by 19.26 %. This is a crucial aspect to consider while studying the agricultural development of farm-pond owners. Cropping intensity refers to the usage of agricultural land on multiple occasions during the course of a cropping year. The village's gross cropped area was 112.60 ha. Before the pond was built, but it increased to 186.55 ha. After the pond was built. Cropping intensity has changed by 30.34 % in volume. Before and after the farm-pond construction, the irrigation intensity was 98.84% and 153.43 %, respectively. The intensity of irrigation has increased by 54.59 %. Farm-pond density in Nivadunge is 51 farm-ponds per 100 ha. of NSA built during the study period. The sample farm-pond holding farmers' percentage of irrigated land by farm-pond is 79.95 %.

A farmer's economic development is mostly dependent on cash crops and fruit harvests. Before the building of the farm-pond, the Percentage of the area under horticulture crops to NSA was 26.03 %, but after the construction of the farm-pond, it grew to 84.33 %. It indicates that the amount of land planted with horticulture crops has increased by 58.3 %. The micro-irrigation approach has been proved to be successful in using water and increasing productivity. Before the farm-pond, the area under micro-irrigation to NSA was 32.5 %, but after the farm-pond, it climbed to 70.17 %. The percentage of area under micro-irrigation has increased by 37.67 % from NSA.

Fertilizers are important for crop productivity because they replenish soil fertility. The number of tonnes of fertilizer utilized per 100 acres of NSA was 28.5 before the farm-pond building and 65.60 tonnes after. The pumping set is used to extract subsurface water [18], and lift it to a farm pond for irrigation. The farm-pond having farmers have 89 pumps before and 135 pumps after the construction of farm-pond per 100 ha. of NSA. Tractors help to increase cropping intensity by enabling the farmer to save time and utilizing that time to grow an extra new crop. The number of tractors per 100 ha. of NSA was 9 before and 32 after the farm-pond. Before the farm-pond construction, there were 35 sprayers per 100 hectares of NSA of farmers who had a farm-pond, whereas there were 82 after the farm-pond construction. Before the construction of the farm-pond, the average annual income of farm-pond owning farmers in Nivadunge village was 88,000 rupees, and after the construction of the farm-pond, that is 7,84,000 rupees. The increased cultivated area in fruit and cash crops is the main factor for an increase in average annual revenue. The pomegranate crop is another important crop in this village.

5. Conclusion

Farm ponds can help ease water constraints caused by various factors, including climate change [19]. This approach has the potential to increase the amount of water available for supplemental irrigation [20] while also increasing planted area and productivity, resulting in increased net crop yields [21]. In climate change scenarios, a farm pond responds to increased drought frequency, particularly mid-season, and final dryness. Therefore, the legislation supports one pond per 2.0 ha of farmland, either on a farm-by-farm basis or as a community-shared resource. The challenges of putting farm pond technology into application on a large scale are also explored.

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