Rural Development in the Drought Prone Areas of South Deccan Plateau in India

Kenzo Fujiwara* and Shuichi Nakayama**

The rural development in the drought prone areas must be one of the central global issues from the viewpoint of a stable expansion of human habitat. The purpose of this study is to point out the problems of rural development in the drought prone areas of South India through a field survey.

An intensive field survey was conducted in the two villages of Yeradona and Bidarakere. The development of Yeradona is progressing through large scale irrigation. Bidarakere, on the other hand, is developing under the Integrated Rural Development Program, particularly contour bunding and bore-well construction.

The study found that both villages were enjoying a certain degree of improved agricultural productivity and standard of living. However, some problems of the development process can be seen in the studied villages. The major problem in Yeradona is the disruption of the ecological balance of the agricultural lands caused by the supply of an excessive amount of water to these from the irrigation channels. In Bidarakere, because of the bad maintenance of the contour bunding, and the resulting gully erosion, the fields are gradually becoming unstable. In addition, the construction of bore-wells is reaching its limit in relation to the water resources available.

It may be said that India is passing through a critical stage in her rural development through the present development programs in the drought prone areas. More consideration on the methods of development is required to reduce the degree of disruption of the ecological balance and to avoid the social tension among villages caused by the high expectation both of the authorities and the farmers for rapid economic growth.

I. Introduction

The study of rural development in India seems to have reached a new stage of high tide in the recent years. One of the major reasons for this is that the government has laid emphasis on the development of the weaker sections[1] of the society in its Fourth Five Year Plan initiated in 1969. The majority of the weaker sections of people live in the rural areas of India. Thus the development of her national economy will never be realized unless the economic standards of the weaker sections in rural areas is effectively improved by government planning.

The government of India emphasizes rural development. This can be clearly understood in the formation of the Ministry of Rural Reconstruction in 1978 and its re-formation as the Ministry of Rural Development in 1981. This re-formation has brought about the implementation of the “Integrated Rural Development Program” which has constituted the basic development planning of rural India since 1978.

Under such circumstances, some of the research works by scholars such as Franda (1979), Mishra (1982), and Sussman (1982) have presented some interesting results on rural development in India. However, the authors have felt that those studies could not satisfactorily highlight the core strategy to solve the basic difficulties for further development. It may safely be said that the major shortcoming of such studies on rural development is lack of deeper consideration of the physical environment of rural India. Any planning

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strategy should be based on a comprehensive study of the physical factors characterizing a particular planning area.

II. Objectives of the study

1. Objectives

Studies of settlement structure, settlement pattern, and land use have been the traditional field for the geographical study of rural areas in India for a long time. The objectives of this study are, firstly, to understand the characteristic features of the physical environment of rural areas and, secondly, to discuss how a particular physical environment affects the development programs in the areas of the South Deccan plateau prone to drought and the problems arising thereof. The significance of undertaking a study of rural development in the drought prone areas is that such areas of environmental frontiers exist not only in India but also in other parts of the world. If a new strategy of development for drought prone areas could be found, it would certainly contribute to the enlargement of the possibility of improving the low level of socio-economic conditions in rural areas of other parts of the world as well.

2. Data and research methodology

The discussion of this paper is chiefly based on firsthand data and information collected through a field survey in the State of Karnataka in 1980. The authors take the view that the field survey is one of the most basic methods of geographical study. The land surveying and the “door to door” interviewing method are the two major techniques used for this study. In addition, secondary source of information is also obtained from government offices and used in conjunction with the field survey in order to support the firsthand information.

III. The study areas

1. The regions

The State of Karnataka is generally divided into three major physiographic regions, the West Coast, the Malnad, and the Maidan as shown in Figure 1. It is the Maidan that is covered largely by the drought prone areas. The Maidan is further divided into two sub-regions, the North Maidan and the South Maidan.

The North Maidan is a plateau rising to about 625 m above sea level. Climatically, the region is dry with hot summer, warm winter, and rather undependable rain. The mean temperatures vary between 22°C and 25°C in January and 28°C and 33°C in May. The annual rainfall varies from 400 mm in the north to 900 mm in the north-west. The whole area specialized in dry farming except in areas where new irrigation facilities have now been made available. Jowar (Great millet: Sorghum vulgare Pers.) and cotton are the main crops of the region. The region is covered mainly by black soil and is a mineral-rich region of the State.

The South Maidan forms the core of the State in that it consists of the original nine districts of the erstwhile princely State of Mysore. It is the region where a number of pioneering efforts in irrigation, electrification, industrialization, and education have been made. In contrast to black soil of the North Maidan, this region is composed of red soil which is less fertile. The northern part of this region is more mountainous than the southern part, reaching to heights of 690 m. The western and the southern parts are relatively higher, at places reaching 1,800 m above sea level, but in general ranges from 800 to 900 m. The annual rainfall varies from 300 to 600 mm. Only some of the higher parts in the west and south receive more than 750 mm of rainfall. The mean temperatures for January vary from 15°C to 21°C and those for July from 29°C to 32°C. Ragi (Finger millet: Eleusine coracana Gaertn) is the main crop. It requires less water than rice but more than jowar. Groundnut is another dry crop grown in the region. Sugarcane and rice are the main wet crops. Wherever irrigation facilities are available, especially in the low-lying lands, garden crops like coconut and arecanut are also quite common.

The distinguishing feature of the drought prone areas is low precipitation and uncertainty of rainfall. Fukuoka (1982) reported that the region suffered from drought every four to six
years in the twenty year period between 1960 and 1980. Indeed, the region was affected by drought in 1965, 1972 and 1976. The people of the area have always been menaced by drought, as a result they have become accustomed to the difficulties associated with drought. In years of drought they continue the production of their crops with the aid of improved irrigation facilities and dry farming methods.

2. The villages under study

The villages under study were selected from the drought prone area, or in other words, the semi-arid area of the State of Karnataka. The first village, Yaradona in Raichur district, is located about 450 km north of Bangalore (Figure 1). Yeradona is a part of the command area of the multi-purpose Tungabhadra Project which commenced in 1953. The village has been experiencing a great change in various aspects since the introduction of irrigation canals in 1957. The most significant change has occurred in the agricultural systems from dry farming to wet farming by emphasizing rice cultivation. The rapid growth of agricultural production has brought about an immigration of many agricultural laborers which has resulted in a tremendous growth of population in the village studied. The population of the village has increased about 3.9 times in the last 30 years (from 1,228 in 1951 to 4,783 in 1981). Thus the traditional community structure of the village encountered difficulties both by the change of living conditions and by the reform of the agricultural systems.

The second village, Bidarakere in Chitradurga district, is located about 300 km northwest of Bangalore (Figure 1). The agriculture of the village relies mainly on the traditional dry farming. Ragi, jowar, navane (Italian millet: Setaria italica Beauv.), and paddy are cultivated as food crops, and cotton and onion as commercial crops. It is said that cotton was first introduced to this village in the beginning of 1920s and onion in 1949. Several development schemes under the Drought Prone Areas Program have been in full progress since 1970. The population of the village was 1,911 in 1951 and 2,903 in 1981. However, it is also noteworthy that the birth rate has been gradually decreasing since 1961.

IV. Types of development programs

The development strategy for the drought prone areas is varied as seen in the report of the Working Group of the Planning Commission on Integrated Rural Development. The Drought Prone Areas Program (DPAP) has the following objectives: (i) development and management of irrigation; (ii) soil and water conservation and afforestation; (iii) restructuring of the cropping pattern and pasture development; (iv) changes in agronomic practice; (v) livestock development; and (vi) encouragement of small and marginal farmers and agricultural laborers (Ministry of Rural Development, 1982). It is clear from these objectives that the development of irrigation and soil conservation are the key strategies for the drought prone areas. In this study the major points of discussion are devoted to irrigation and soil conservation.

The major modes of irrigation in India are canals, tubewells, traditional wells, and tanks. Table 1 shows the change in the area irrigated
by these modes in India since 1950-51. It clearly demonstrates the rapid growth of the area irrigated by government canals and tube-wells since independence. This is because the government has emphasized on these two types of irrigation systems in the development planning of rural areas.

The rural development schemes centering on various irrigation projects can be seen in the semi-arid areas of the State of Karnataka. One example is the Tungabhadra Project. It presents a typical type of multi-purpose large scale canal irrigation project initiated just after independence. The other is the “Drought Prone Areas Program” (in operation since 1970) which is a kind of integrated rural development scheme. The effects of the two different schemes on rural development may be understood from the results of the field survey carried out in the studied villages in each of those particular planning areas.

1. Two types of rural development

Two types of rural development schemes in the drought prone areas are hypothetically presented in the present study. The first is the effect of a canal irrigation project. The impact of this on the socio-economic structure of a planned area will be immense. In this case, the traditional rural systems change rapidly into a modernized system. Over a longer period, it could be expected that the socio-economic standards of a particular village will increase immensely. The second, that is, the integrated development program centering on minor irrigation, when applied to a planned region, shows a good response. In this case the socio-economic structure of a particular village gradually improves and the population attains a higher standard of living over a period of time.

2. Development through canal irrigation

One of the most effective ways to develop agriculture as well as the farming system in the drought prone areas is the construction of a canal irrigation system on a large scale. The Tungabhadra Project (TBP) is one of the most important projects constructed in South India since independence. The original plan of 1860, according to the Command Area Development Authority of Tungabhadra Project (1976), was the inspiration of Sir Arthur Cotton who was known as “the irrigation wizard of the South”. Since then, several plans have been presented to the government by various commissions. One of the difficulties encountered in implementing the plans in those days was that the Tungabhadra River was so long and big that the neighboring state governments of Mysore, Madras and Hyderabad could not come to a mutually satisfactory agreement concerning the distribution of water among them. The inter-state agreements were finally made in 1944, and the project was officially commenced on February 28, 1945 as a joint venture of the Governments of Madras and Hyderabad.

The construction of the dam at Mallapuram near Hospet and excavation of a part of the canal system were completed in the first half of 1953 and water was first made available for irrigation on July 1, 1953. The dam constructed at Mallapuram is 2,450 m long and 49 m high above the lowest bed level of the river and has a storage capacity of 130.7 T.M. cft (3,701.0 M.cu.m.). It corresponds to 28.6% of the annual discharge flowing into the dam in a year. The reservoir has a catchment area of 27,972 km² and a water spread area of 378 km².

Table 1. Area irrigated by modes of irrigation (thousand hectares).

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</thead>
<tbody>
<tr>
<td>Government canals</td>
<td>7,158</td>
<td>8,025</td>
<td>9,170</td>
<td>9,859</td>
<td>12,196</td>
<td>12,904</td>
<td>12,931</td>
</tr>
<tr>
<td>Private canals</td>
<td>1,137</td>
<td>1,360</td>
<td>1,200</td>
<td>1,099</td>
<td>869</td>
<td>863</td>
<td>851</td>
</tr>
<tr>
<td>Tanks</td>
<td>3,613</td>
<td>4,423</td>
<td>4,561</td>
<td>4,258</td>
<td>3,900</td>
<td>3,982</td>
<td>3,898</td>
</tr>
<tr>
<td>Tube-wells</td>
<td>5,978</td>
<td>6,739</td>
<td>7,290</td>
<td>8,653</td>
<td>7,679</td>
<td>7,520</td>
<td>7,440</td>
</tr>
<tr>
<td>Other wells</td>
<td>2,967</td>
<td>2,211</td>
<td>2,440</td>
<td>2,475</td>
<td>2,298</td>
<td>2,379</td>
<td>2,279</td>
</tr>
<tr>
<td>Other sources</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Total net irrigated area</td>
<td>20,853</td>
<td>22,758</td>
<td>24,661</td>
<td>26,344</td>
<td>32,546</td>
<td>34,491</td>
<td>34,799</td>
</tr>
</tbody>
</table>

The command area is fed by three canals, namely, the Left Bank Canal in Raichur district, the High Level Canal and the Low Level Canal in Bellary district. The total irrigable area (Ayacut) under TBP is 1,274,060 acres, of which 873,427 acres lie in the State of Karnataka and 400,633 acres in the State of Andhra Pradesh.

The Left Bank Canal (LBC) which irrigates the studied village, Yeradona, is 227 km long and irrigates 580,000 acres of areas solely in Raichur district.

One of the features of the Project is the localization of cropping in the command areas. The main objective of localization is the utilization of water to its maximum capacity with a reasonable cropping pattern, viz., extension of the block system for irrigation and reduction of the intensity of the water flow. The localization of cropping was carried out under the conditions that (i) each village had its share of irrigation, (ii) wet and dry blocks were arranged roughly in the proportion of 1:3, (iii) continuous patches of fertile land were chosen for wet block, and (iv) wet blocks were not localized near a settlement so as to safeguard the villagers' health against malaria. Heavy irrigation is usually avoided within 800 m of human habitation, but such land, if localized, can be reserved for light irrigation only.

The basic allocation of localized areas in the command area of the Left Bank Canal is illustrated in Table 2 and the basic irrigation calendar is presented in Figure 2. From Table 2 it may be said that the importance of irrigation can be justified in the light irrigation of kharif and rabi crops which have been the traditional crops in the drought prone areas or the semi-arid areas in India. This planning idea should be appreciated on the following two aspects: (i) the local people are well accustomed to the cultivation of traditional crops and (ii) light irrigation is worthwhile in preventing water-logging and alkalization of the soil caused by giving too much water to the field.

However, it is the fact that there are some drawbacks in the effective use of irrigation as follows: (i) unauthorized cultivation outside the localized area, (ii) violation of the authorized cropping pattern, and (iii) violation of the season. These three types of unauthorized irrigation create further difficulties for rural development. One of the very severe problems is the increase in water logging and salinity in low-lying lands. FUJIWARA (1982) has described the critical conditions as follows. Though the problem of water logging and salinity is inherent in a system of canal irrigation in a dry region, it has been aggravated in this project by unauthorized irrigation, leakage from canal and also by land conditions with shallow soil and lack of drainage facilities. In addition, one of effects on the land of water-logging and salinity is the continuous decrease in land value. The percentage of the water-logging areas by the distributary ranges be-

Table 2. Command and localized areas in the Left Bank Canal of Tungabhadra Project.

<table>
<thead>
<tr>
<th>Localized crops</th>
<th>Acreage &amp; Gunlas</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross command area</td>
<td>900,000</td>
<td></td>
</tr>
<tr>
<td>Localized (irrigable area)</td>
<td>602,698-36</td>
<td>100.0</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>20,843-29</td>
<td>3.5</td>
</tr>
<tr>
<td>Paddy</td>
<td>51,134-10</td>
<td>8.5</td>
</tr>
<tr>
<td>Kharif crops (Light)</td>
<td>220,666-11</td>
<td>36.7</td>
</tr>
<tr>
<td>Rabi crops (Light)</td>
<td>219,327-11</td>
<td>36.5</td>
</tr>
<tr>
<td>Cotton</td>
<td>74,048-30</td>
<td>12.3</td>
</tr>
<tr>
<td>Garden</td>
<td>15,678-25</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Note: 40 gunlas are equal to one acre.
Source: The Chief Engineer, TBP, Munirabad.

Figure 2. Irrigation calendar under Tungabhadra Project.
(From FUJIWARA, 1982, p. 47)
between 1.5 to 12.5%. The sample area of water-logging can be seen in Figure 3.

It may however be said that some of the difficulties mentioned above are brought by the nature of the project. The aim of the main canals and distributaries have been so designed that the greater part of the canals run on the higher part of undulating land surface, because the project has been planned to provide drinking water to many villages as well as irrigation water for dry-cum-wet crops.

3. Development through minor irrigation and soil conservation

The study of the Drought Prone Areas Program has been promoted by Singh (1978) and Srivastava (1978). Singh (1978) taking the sample study of the State of Pihar demonstrated that government recognition of drought prone areas no longer bears sufficient relation to the realities of the region. The study concluded that an agro-climatic study on a micro regional scale has to be promoted in order to obtain a more precise strategy for rural development. Srivastava (1978) pointed out the confusions which exist in the processes of planning, implementation and assessment of the development schemes.

The DPAP was executed in 1970 by the central government as one of the three core regional development programs for the Fourth Five Year Plan (1969-74). The program was an extension of the Rural Works Program introduced in the beginning of the Third Five Year Plan (1961-66). At the initial stage of the DPAP in 1970–71, the central government selected 74 districts from 13 states as the areas affected by drought and implemented various kinds of the labor intensive schemes such as minor irrigation, soil conservation, afforestation and road construction. The approved area under the program covered an area of about 20% of the total land with a population of 60 million or 12% of the national figure.

The basic objectives of the DPAP are primarily to avoid the severe effects of drought, secondly to stabilize the income of the people, particularly the weaker sections of the society, and thirdly to recover the ecological balance.

In the State of Karnataka, according to Puttaswamaiah (1975), 46 taluks (an administrative sub-unit of a district) from 10 districts grouped into five project areas were selected for this program. The total area under the

Figure 3. Crop localization and areas affected by water-logging in the Command Area of Distributary No. 31, Left Bank Canal, Tungabhadra Project.


(From Fujiwara, 1982, p. 50)
program is 58,741.1 km² with a population of about 7.4 million which forms 9.8% and 11.2% respectively of the area and population of the 74 districts in India affected by drought. The area affected by drought in India is 600,000 km² with 66 million people in 1971. The total cost of the project in the State of Karnataka was met by the central government with exception of 11 taluks of the Bijapur district, where the project cost was met with the assistance of the World Bank.

The Fifth Five Year Plan (1974–78) was slightly different in that: (i) fifty percent of the project cost was to be met by the state government, (ii) the basic concept was to emphasize the development of infrastructures at the expense of beneficiaries, and (iii) the water-shed development approach was to be established. Table 3 shows the percentage of the total cost of the projects incurred by each individual sector of the major development scheme under the DPAP. The scheme-wise percentage demonstrates the major development work planned for the Fifth Five Year Plan of the State of Karnataka. The maximum percentage was allocated to the development of minor irrigation (32.4%) then to soil conservation and dry land farming (21.7%), and finally afforestation (17.4%). The addition of those top three schemes accounts for 71.6% of the total planned cost.

V. Development of a village by the canal irrigation

The studied village, Yeradona, is situated in the command area of the Tungabhadra Project which was commissioned in 1953. The average annual rainfall over the last 50 years at Raichur, the district headquarters, and Bellary, an adjacent district headquarters, is 565 mm and 520 mm respectively. These data prove that the village is located in the semi-arid zone of climatic condition. Topographically, the village is situated on a gently undulating plain of vast erosion surfaces. The village area is divided into three units of landforms, viz., the upland, the valley plain and the gentle slopes in between. The upland ranges from 400 to 425 m in altitude and the valley plain ranges from 395 to 407 m. The main settlement of this village lies on the gentle slope of the eastern part. The village area is covered with red soil whereas the black cotton soil is limited only to the eastern upland. There are two distributaries, viz., No. 31/4 flowing on the eastern upland and No. 31/3–2 flowing on the western upland. The former is used for light irrigation in the eastern sector of the village and the latter is used for paddy
irrigation in the western sector (Sadakata, 1982).

The development of irrigation facilities has indirectly given rise to the increase in population of the village. The population was only 1,540 in 1961 with 332 households. In 1971 it increased to 3,173, and to 4,521 with 879 households in 1980. It is incredible to realize that the population has expanded three times its original size in twenty years.

1. Change in land use

There was a drastic change in land use after the introduction of irrigation to the village in 1957. Prior to the construction of the canal system, 5,757 acres were under dry cultivation, while 85 acres (1.3% of the total cultivated area) were irrigated through village tank and open wells (Balasubramanyam, ed., 1966, p. 29). The important dry crops in kharif season were jowar, groundnuts, bajra (Pearl millet: Pennisetum typhoidesum Pers.), and navane. The major crops grown in the rabi season were white jowar (locally known as bili jora), cotton, bengal gram, and safflower, with wheat and linseed grown as minor crops.

The construction of field channels in Yeradona village was completed in 1957. Since then wet land has been increasing in acreage year by year. At the time of the commission of the irrigation system, the Agricultural Department and the Irrigation Department settled the localization of the village as shown in Table 4. The drastic changes in land use and the Ayacut plan of the village through sub-distributaries are also shown in Figures 4 and 5. Before the introduction of canal irrigation, paddy was cultivated in the areas of the

<table>
<thead>
<tr>
<th>Localization</th>
<th>Extent</th>
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<tbody>
<tr>
<td></td>
<td>Acre</td>
</tr>
<tr>
<td>Heavy irrigation for paddy on red chalka soil</td>
<td>1,615</td>
</tr>
<tr>
<td>Light irrigation for Kharif crops like jowar, groundnuts, in red chalka soil</td>
<td>653</td>
</tr>
<tr>
<td>Light irrigation for Rabi crops for jowar and cotton in black clay or red soil</td>
<td>568</td>
</tr>
<tr>
<td>Light irrigation especially for cotton in red soil</td>
<td>238</td>
</tr>
<tr>
<td>Bagayat cultivation for garden crops</td>
<td>207</td>
</tr>
<tr>
<td>Total</td>
<td>3,281</td>
</tr>
</tbody>
</table>

**Source:** Balasubramanyam ed. (1966), p. 29.

Figure 4. Land classification in Yeradona before and after 1957.

The figures are shown in acres. (After Sadakata, 1982, p. 77)
valley plain which could be irrigated by the village tank. The paddy area constituted only 1.2% of the total cultivated area. However, after the establishment of sub-distributary No. 31/3-2, the paddy fields have been extended to the upland of the western part of the village, which is covered by red soil. On the other hand, in the upland of the eastern part of the village which enjoyed the irrigation facilities from sub-distributary No. 31/4, light irrigation crops were introduced. Cotton cultivation was started in the land composed of black soil and groundnuts in the mixed with red and black soil or red soil. The bagayat cultivation of garden crops was started east of the main settlement on the gentle slope towards the west. The surface water for irrigation in this area has helped to conserve ground water and is maintaining the water level of wells in the settlement.

As seen from the above discussion, the planning of irrigation channels and localization was made after sensitive consideration of physiographic conditions such as relief, soil and ground water in the village. The introduction of irrigation into the village created an irrigated area of 54.5% of the total land under cultivation and transformed the typical small community of self-sustaining agriculture in a dry land area to a more productive village with commercial crops such as paddy, cotton and groundnuts.

2. Difficulties in land management

Observing the fields in the village, there are some fields which have been water-logged and others which follow unauthorized cultivation. It is a pity to realize that the disruption in ecological balance can be seen in the fields, even though the introduction of irrigation might have been made after consideration of physiographic factors. Difficulties in land management can be clearly seen on the following three aspects.

First, out of the gross command area only about 67% was localized. However, some of the farmers are taking water to land outside the localized area which resulted in the reduction of water needed for the localized fields.

The second problem is the violation of the planned land use. The water distribution is planned according to the localized area. However, there is no separate control point for different crops. Farmers are able to take
water in any way they desire. This results in the violation of the planned cropping pattern. It is also obvious that some farmers are violating the planned water distribution.

The third problem arises out of the violation of the assigned seasonal water use. The Tungabhadra Project Authority has apportioned almost an equal area for crops in rabi and kharif season. However, there is a general trend for the farmers in the rabi season to grow the kharif crops which require more water than the rabi crops. The reason is that the farmers are well accustomed to grow kharif crops such as maize and groundnuts due to the nature of semi-arid climate. This causes the break-up of the planned water distribution for the rabi season.

The three types of unauthorized irrigation, mentioned above, bring various undesirable effects like: (i) water-logging and salinity in low-lying lands, (ii) lack of adequate water in the tail-end areas, and (iii) trends against the principle of economic and social welfare. If they are not brought under control, the whole water management will be upset and, further, the ecological balance in the village system might be disrupted.

It is our tentative conclusion that the expansion of water-logged plots in the village in the future are likely to continue and will probably be very difficult to stop the process. The major reason is due to the original Ayacut plan and the positioning of the distributary which runs rather in the higher portion of the village. In the long run, it is to be expected that the water will naturally infiltrate into the lower portion of the field which was allocated for light irrigation under the localization of the dry lands. Once the plots of light irrigation or of dry land are dampened, it becomes very difficult to cultivate dry crops such as jowar and bajra which are the major food crops for the local people. Taking all these facts into consideration, dispute often arises between the Irrigation Department and the farmers, and also among the farmers themselves in connection with water utilization.

3. Social changes in a traditional village

The commencement of canal irrigation to Yeradona village in 1957 had a two-fold impact on the traditional village. One was the development of commercial agriculture, and the other was the increase in population through migration.

The development of commercial agriculture brought about three further aspects of social changes. First, the socio-economic gap between the upper and the lower class families has been broadened, even though the living standards of the lower class have been raised considerably. Secondly, the upper class has moved from the main settlement to the outskirts or in the erstwhile fields in order to effectively manage their agricultural activity. As seen in Figure 6, there are many open spaces for homesteads in the main settlement. In this way the traditional jati-wise segregation of residential areas has loosened. Thirdly, with the drastic changes in the social and spatial structure of the village, the traditional village ties have been breaking down. Therefore, it seems that the villagers' cooperation for change and desire for the establishment of such infrastructure as a health unit, a nursery school, street-lighting, a piped water and sewerage system have not been achieved.

Regarding the rapid increase in population through migration, Yeradona village has two types of new settlements which were formed under different circumstances for two different purposes. The first type had been formed just after the completion of a dam. The Command Area Development Authority (1976) noted that the construction of the dam had resulted in the submergence of 38,726 acres of land in Raichur district, affecting 5,395 households and 22,752 people in 40 villages of Koppal taluk. Out of the 40 villages, 10 were completely submerged and compelled to move into the command area under the Tungabhadra Project. Those households without any land property in the submerged area were invited to settle down as agricultural laborers in other village within the irrigated areas. In Yeradona village, one big land owner donated his land of 6.03 acres (adjacent to the settlement) to the government, and 52 households were accepted to settle down there. The people have called the place “Yeradona camp” as shown in Figure 6. At the end of 1980, there were about 180 households of which half
Figure 6. Changing pattern of settlement in Yeradona.

1. Boundary of old settlement till 1955  
2. Boundary of original settlement  
3. Residential area by jati (Li: Lingayat, Ku: Kuruba, Be: Bedda, B.R.: Brahmín and Rajput Ot: Others)  
4. Moslem  
5. Open space for house site caused by the shifting to the outside of old settlement  
6. Houses came from other villages
of them came from the region of dry land of Raichur district, adjacent to the command area of Tungabhadra Project. Most of the adults, both male and female, are engaged in agricultural labor and form the poorest class in the village. Most of them are living in thatched houses without latrines and electricity. There are three small dug wells for drinking water in the camp, and no planned streets and sewerage can be seen. They have no established community contact with the people of the main settlement except concerning the contract of agricultural labor. It would be difficult to improve the living condition of these agricultural laborers at the present wage level. However, the laborers are more satisfied with the new condition, as they have been able to find a more stable employment than before.

The second type of settlement established consisted of migrants from outside the State with considerable experience in irrigation agriculture (Mahadev and Boregowda, 1982). In the majority of cases, these immigrants, mostly from the State of Andhra Pradesh, have not settled in the old settlement sites, but have established their own camp near their place of cultivation.

The Kindi camp in Yeradona village as seen in Figure 5 is a good example of this type. There were 87 households in December 1980 in the Kindi camp. Maida (1982) draws attention to the marked feature of the formation of the Kindi camp. At the initial stage, the camp was established as a pilot farm for paddy cultivation. This settlement evolved eventually into a full fledged “frontier line” from where all farming practice, information and further technical innovation for irrigated paddy had diffused widely and come into common use. It was a widespread practice among the initial settlers to call their relatives and friends to help with their agricultrual activities as agricultural laborers and invited them to join in the cultivation. The families from the State of Andhra Pradesh lived at first in houses of Andhra type with a hipped roof, but when they re-built their houses they followed the local type with flat roof. It is noteworthy that once there was a village road between the main settlement and Kindi camp, but this road has remained useless as a result of bad maintenance for a long time. This is also caused by the increasing separatism from the main settlement of the people of the Kindi camp year by year.

VI. Development of a village by various rural upliftment programs

The village Bidarakere in Chitradurga district is situated in the semi-arid region with an annual precipitation of about 600 mm and a possibility of drought at intervals over a period of 4 to 6 years. The climate of the village is hot and dry. The hottest period is in March and April when the mean temperature are between 27.8°C and 29.4°C. The coolest month is generally December when the temperature reaches to about 21.7°C (Padmanabha, 1978).

The extent of the village is spread over an undulating plateau with two shallow valleys running from west to east at a height of 690 ~ 750 meters above sea level. Most of the dry cultivable land can be categorized into red and black soil. The major crop sown in red soil is ragi and cotton, and onion is sown in the black soil as commercial crops. Agriculture is basically contingent upon the inadequate and uncertain rainfall. In the valley to the south there is a large tank with a water spread area of 130 acres. The wet land which is irrigated by the tank is no more than 46 acres, which is less than one third of the area of the tank itself. Furthermore, this wet land has become sterile by extreme salinity. So the main function of the tank seems to be providing water for drinking and washing rather than storing water for irrigation.

Taking the growth of population into consideration, it is remarkable that the growth rate for 1971–81 was higher than that for former decade. This was the result of reduction in emigration from the village in the 1970s after the effects of various development schemes were introduced in the village. It seems that the village economy is becoming more stable, even though the village is located in the drought prone area.
It must be noted that the development schemes in this drought prone area were rich in variety, and had considerable impact on the changes in socio-economic structure of the village. The major schemes established and executed in Bidarakere are set out in detail in Table 5. The opening of the Agricultural Assistant’s Office (in the Mid-1950s), the Agricultural Cooperative Society (1964), and the Rural Veterinary Dispensary (1974) had great

<table>
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<td>1. Rural development under semi-arid conditions</td>
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People are living in fear of annual drought in the region of the semi-arid condition. When drought occurs, the villagers, especially agricultural laborers and marginal farmers, are forced to leave the village for other places in search of food. The studied village Bidarakere is not an exception.
effect on the increased crop yield. The electrification (1945), the National Scheme for Piped Water (1974), and the People’s Housing Scheme (1975) had some effect on raising the living standard. Further, the Contour Bunding Works (1959) and the High Yielding Variety Program (1968) had a direct impact on the agricultural development. Taking into consideration all of the schemes introduced in Bidarakere, it may be said that they have certainly contributed to the improvements in the socio-economic condition of the village.

The contour bunding is one of the most important schemes among a variety of development programs for agricultural development. The Working Group of the Indian Government Planning Commission has established six strategies for rural development in the drought prone areas (Ministry of Rural Development, 1982). Among them the strategy involving water control is the most important. As has been mentioned above, there are three types of water development schemes, namely canal irrigation, minor irrigation including surface (tank) irrigation and ground water (well) irrigation, and soil conservation mainly by the contour bunding method. In Bidarakere village, development through contour bunding and bore-well irrigation is discussed in the following section in order to improve our understanding of the problems encountered as a result of such development programs.

2. Soil conservation through contour bunding method

The purpose of soil conservation in drought prone areas with uncertain and inadequate rainfall is not only to control soil erosion, but also to conserve soil moisture. It is commonly accepted in India that “soil conservation” means soil and moisture conservation. Methods of soil conservation in India have made great progress in the last 30 years, various methods based on slope, soil, rainfall etc. have been employed. The contour bunding scheme for soil conservation is applied principally in such conditions where (i) the area has annual rainfall below 800 mm, (ii) soil of good permeability with 12.5 mm per hour, and (iii) land slope below six percent. However, in areas of black soil, the regulation is applied for making graded bunding (terracing), without consideration for the volume of rainfall.

Soil conservation occupies the second most important position after minor irrigation in the budget of the Drought Prone Areas Program for 1974–78 in the State of Karnataka. Contour bunding was taken as the main scheme.

The contour bunding in Bidarakere village was executed by the Agricultural Department of the State Government from 1959–60 to 1969–70, and the work has been undertaken as one of the schemes under the DPAP from 1970–71 to 1979–80. The work has been done in 15 blocks in the village and covered 2,064 acres which presented 79% of total cultivable land till November, 1980. The total cost of the scheme was Rs. 166,040 which was paid to people of weaker sections such as agricultural laborers and marginal farmers as daily wages. It should be appreciated that the jobs created by it realized another major purpose of the Drought Prone Areas Program to secure employment for the weaker sections of the village.

The size of bund is decided after a detailed survey of landholdings, slope of fields etc. (Figure 7). It is true that contour bunding has had success in preventing sheet-wash of fields and in keeping rain water in the fields. This results in good crop yield in the fields near the bunding where the capacity for storage of water is much greater than in other more distant fields. Bunding is efficient in red soil areas, but not in black soil areas. In black soil areas, contour bunding has resulted in another type of field erosion which is known as gully erosion. It is due to the low permeability of black soil. In heavy rain, surface flow arises, with shower-type rushes to the outlet of the bund, and within a short time breaks down the area around the outlet. Further erosion results in a gully. In Figure 7, the newly developed gully of 1 to 3m in depth can be seen in the field of contour bunding at the southeastern end of the village. Owners of land with such heavy erosion find it impossible to repair this at their own cost.

Gully erosion is often related to a technical fault, and land owners have little understanding of the need for the introduction of contour bunding to their fields. The major purpose of the DPAP is to provide employment for the
weaker sections of society and that soil conservation was considered as a by-product of the Program. Therefore the land owners have been passive in the contour bunding work and they were not enthusiastic in maintaining and repairing the bunding. A good example to justify this view can be seen in the fact that no land owner has returned the cost of the bunding to the government. The government regulation was that the work cost should be repaid by installments within 20 years, starting from five years after commission of bunding. The average installment per year per beneficiary is said to be Rs. 4.5 to 5.5 per acre in Bidarakere. However, there was no beneficiary in Bidarakere who had paid the cost of work back to the government. This was also true for Jagalur taluk till the middle of 1980. The beneficiaries alleged that the work was carried out by the government without regard to the willingness of landowners to accept development schemes. The contour bunding in Bidarakere has demonstrated well the fact that passivity of villagers in development programs results in the low efficiency of development schemes.

3. The effects of bore-well irrigation

The bore-well irrigation is one of the major schemes in the development of minor irrigation systems. The largest percentage (32.4%) of the Fifth Five Year Plan for the State of Karnataka was entirely devoted to the development of minor irrigation.

SADAKATA (1982) reported the details of the development of bore-well irrigation in Bidarakere. In the village, there are 23 bore-wells, the location of which are shown in Figure 8.
There was only one open dug well in the village before independence. The rush of bore-well construction came during the latter half of the 1960s and the beginning of the 1970s. As a result, a total of thirteen bore-wells were opened. Before the introduction of DPAP, some farmers had taken out a “well loan” instituted under the Integrated Agricultural District Program which was initiated in 1961. Under the DPAP, farmers were able to take advantage of the well loans from the government linked banks.

With regard to land use, marked changes occurred after the introduction of bore-wells into the village. Until the introduction of them, the land in Bidarakere was divided into two types, namely dry land and wet land. However, since the introduction of bore-well construction, the use for dry land has been further divided into two groups, namely (i) dry land on the upland and the upper part of the slopes, and (ii) wet land by bore-well irrigation on the lower part of the slopes. The use of the wet land by the village tank has also been divided into two groups, namely (i) wet land in the valley bottom irrigated by the village tank only, and (ii) wet land in the valley bottom irrigated by both bore-well and the village tank. On examination of the crops in the fields irrigated by bore-wells, three types of cultivation can be found. The first is the cultivation of *ragi*, *jowar* and groundnuts of high yielding varieties which require a careful management of the water supply. The second is the cultivation of sugarcane, coconuts, banana and paddy which require a heavy water supply. The third type is the cultivation of mulberry or betel leaves which also require a sensitive control of water supply.

The bore-well type is generally an open square-dug well with sides of 10 to 15 meters and a depth of 5 to 15 meters. In many cases, subsidiary wells are dug in the bottom of the main wells with the aid of 2 or 3 steel pipes (a depth of 20 to 50m). The capacity for irrigation of a bore-well with a 3 to 5 HP motor or diesel engine varies from 1.5 to 10 acres, but in the case of Bidarakere, the average capacity is only 4.7 acres (SADAKATA, 1982).

![Figure 8. Morphological map of Bidarakere showing the location of wells in 1980.](From FUJIIWARA et al., 1984, p. 147)
The location of the bore-wells constructed in the 1950s are concentrated in the valley bottom (Figure 8). However, since the beginning of the 1960s the location of the bore-wells has been diffused into the gentle slope with thick weathered layer at both sides of the valley bottom. It is important to note that there is no single case of construction of a bore-well on the upland or the upper half of the slopes. It may be said that the capacity of bore-well irrigation on the village is reaching its maximum from the view point of water resources.

VII. Conclusion

The drought prone areas of India have long suffered from socio-economic backwardness. Much need to be achieved before the region can attain a higher standard of living and production. The studied villages, Yeradona and Bidarakere, are located in the semi-arid zone of the South Deccan plateau. The different strategies of development applied to each village have resulted in differences on the development of the socio-economic structure of the villages.

It can be derived that the development of water resources is the key factor for rural development in the drought prone areas in India. The first studied village was a good example of the development through large-scale canal irrigation and the second of development through rain and ground water (bore-wells). However, the present study has made clear the advantages and disadvantages of development. The effects of development found in this study can be summarized as follows.

The developmental effects in Yeradona village with canal irrigation are (i) the end of the constant fear of drought and the uncertainty of production as a result of the dramatic improvement in the agricultural system, and also the transfer from self-sustaining agriculture to commercial agriculture, (ii) the increase in disparity of standard of living among villagers, (iii) the delay of consolidation of public facilities in the settlement because of the loosened social structures, (iv) the increase in tension between the Irrigation Department and the farmers, and also among farmers regarding water-management, and (v) the fall of land value caused mainly due to water-logging and salination of agricultural land.

Effects of development programs in Bidarakere village with contour bunding and bore-well irrigation are (i) the increase in the employment opportunity and the decrease in out-going migration from the village because of the steady improvement in living standard through development programs mainly based on agricultural development and the consolidation of the infrastructure of the village, (ii) the change in the pattern of soil erosion from sheet-wash to gully erosion because of apathy on the part of the villagers for the development programs, and lastly (iii) the approach to the upper limit of water resource development through bore-wells.

Comparing these two patterns of rural development, it is certain that the standard of living of the villages has been raised by development efforts. The former showed sudden change and the latter a slow and steady change. However, both cases have developed a new type of disruption of the land-ecological balance. In the first village, the effect of the water-logging and salination of the fields forces the complete abandonment of cultivation. As a result, the farmers are not able to cultivate even dry land crops which had been the major crops before the introduction of canal irrigation. In the second village, the development of gully erosion due to contour bunding of fields is causing very critical problems. The farmers do not have enough funds to repair their fields destroyed by gully erosion.

It may safely be said that such disruption of the land-ecological system has resulted in the non-scientific approach to the cultivation of the fields by farmers, and at the same time, the delay in coping with the situation by the administration. However, it can be concluded that the most important factor for success is the villager's willingness to think in a proper and rational way to achieve development under such unstable climatic conditions as those of the semi-arid and drought prone areas.
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Notes

1) The term of “the weaker sections” is commonly employed by the Government of India as an administrative terminology. The weaker sections under the Integrated Rural Development Program is defined as such socio-economic groups as small and marginal farmers, sharecroppers, agricultural and non-agricultural laborers, rural artisans and families belonging to the Scheduled Castes and Scheduled Tribes who are below the poverty line. The definition of a family below the poverty line is one in which the monthly income is less than Rs. 62 per head. On average, a rural family has five members and thus those families having an income from all sources of less than Rs. 3,500 per annum may be regarded as living below the poverty line (Ministry of Rural Reconstruction, 1980, p. 1 & 4).

2) The word Ayacut is commonly used by the irrigation departments in India. It means an area served by a major irrigation project.

References


インド、デカン高原南部の干ばつ常習地域における農村開発

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干ばつ常習地域における農村開発の研究は、人間居住地域の安定的拡大の視点から、国際的な重要課題といえよう。本稿の目的は、デカン高原南部の干ばつ常習地域での現地調査を通じて、現行の農村開発事業における問題点を明らかにしようとした。

現地調査は、1980年秋、エルドナ村及びピダラケ村の両村で実施された。前者の農村開発は、1957年以降、大規模な灌漑用水計画を通じて進められた。後者では、1950年代後半以降、コンター・ボンドや用水井戸の建設など、比較的規模の大きい開発事業が多様に展開された。

調査の結果、両村をめぐる開発事業は、その手法を異にするものの、農業の発展と生活水準の向上に一定の開発効果を上げていることが評価された。他方、今後解決されなければならない課題の幾つかが明らかとなった。

エルドナ村では、灌漑用水路による過剰給水が、生態系のバランスを破壊し、耕地の塩化など深刻な問題を引き起こしていた。また、ピダラケ村では、農民がコンター・ボンドの過正な維持に消極的であるため、強度な表土流出によって耕地の荒廃が進みつつあり、加えて用水井戸の開発も、地下水源の限界から伸び悩みの状態であった。

デカン高原南部の干ばつ常習地域における農村開発は、今や開発手法の再検討が求められる。現行の手法の継続は、行政当局と農民の双方による急速な経済成長への強い期待も加えて、生態系の破壊を一層押し進め、さらに農民間の社会的緊張関係をも増大することになるであろう。

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