TANK IRRIGATION IN TAMIL NADU

A CASE STUDY WITH SPECIAL REFERENCE
TO PRODUCTIVITY GAINS AND
MAINTENANCE OF THE SYSTEM

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the requirements of the Degree of Master of Philosophy
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I hereby affirm that the research for this dissertation titled "Tank Irrigation in Tamil Nadu: A Case Study with Special Reference to Productivity gains and maintenance of the system" being submitted to the Jawaharlal Nehru University for the award of the Degree of Master of Philosophy was carried out entirely by me at the Centre for Development Studies, Trivandrum.

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Certified that this dissertation is the bonafide work of Sri S. Ramanathan and has not been considered for the award of any other degree by any University. The dissertation may be forwarded for evaluation.

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INTRODUCTION

Irrigation is a fundamental technical change which insures and increases agricultural productivity.[1] It is clear that irrigation could contribute to increased agricultural production in one or many ways: It can raise yields of particular crops, and make them more stable by facilitating planting at the optimal time and by enlarging the scope of fertilizer use; it can contribute to increasing the cropping intensity by reducing the extent of fallowing and/or by extending the effective cropping season; and it enables a greater diversity of crops to be grown permitting in the process a switch to high productivity, high value crops.

In the context of India, irrigation assumes an added significance. Given the fact that the reserves of uncultivated land are virtually exhausted, and given the need to increase agricultural production, there is a need to extend and improve irrigation facilities. Hence, there has been a great emphasis in various plan documents on increasing the irrigation potential.[2]

But it has been pointed out that "... there is a sizeable gap between the irrigation potential that has been created and its utilisation" (Government of India, [GOI], 1972: 135). Apart from the fact that the concept of "potential" is itself

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1. Irrigation in general leads to increases in productivity but, it has to be pointed out that exactly the opposite would happen if it is not properly managed. In many irrigated tracts, lack of proper drainage has led to problems like water-logging and salinity which have affected the vegetation in these areas (Jagathpathi, 1984). Hence, irrigation may have to be accompanied with effective drainage facilities in areas which are prone to water-logging.

2. See Vaidyanathan (1977).

highly notional, and may be based on a number of assumptions;[3] the Government's effort in bridging the gap has been largely technical in nature. The Government in its effort at improving the efficiency of irrigation projects has set up a number of Command Area Development Authorities (CADA's), which are mainly entrusted with the task of construction of field channels, related control structures, land levelling and land shaping, etc. (Jayaraman, 1981).

But, experience has shown that there is more to irrigation, than just its physical aspects. Though, the technical or physical aspects of irrigation are important in their own way, the manner in which the activities pertaining to irrigation, viz., the construction, the allocation of water and maintenance of physical facilities are carried out ultimately determines the efficiency of an irrigation source. Given an irrigation source, construction is an activity which has already been accomplished hence one can only go into the history of it. But, what is contemprory and more important is the issues concerning allocation of water and maintenance of physical facilities.

The above mentioned issues become relevant only for those irrigation sources which are outside the private irrigation works. In the case of private irrigation source; which may be defined as an irrigation source developed and used by an individual

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3. The "potential" is dependent on the storage capacity of the reservoir, and on a particular cropping pattern. Due to faulty designs or wrong calculations, it is possible that the storage capacity may be over/under estimated. Once an irrigation project comes into being a particular crop-regime is sought to be enforced; to spread the effects of irrigation to large areas by "light irrigation." (GOI, 1972: 134).
This is largely true in the case of what is referred to as large-scale irrigation projects which are constructed by the Government). It may so happen that, it would not be possible to enforce a cropping pattern, due to say "marked reluctance" among farmers (GOI, 1972: 134).

Jagathpathi (1984), points out that, in India with pathological frequency the dam is first constructed, and the canal systems are built slowly and lackadaisically thereafter often spread over many years. As a result of this, according to him, cultivators in the head-reach wherefrom the canal system starts have plenty of water available for many years, and hence start cultivating highly water-intensive crops, and later it becomes difficult to wean them away from this crop pattern. This naturally reduces the area that can be effectively irrigated by an irrigation system.

Apart from this Vaidyanathan (1977), points out that the highly nubulous character of ultimate potential is underlined by the large unexplained upward revision that are often made by various state agencies.

cultivator for his own use (e.g. privately owned wells), the above mentioned activities would be carried out by him to serve his own objectives. Subject only to certain constraints the individual has an unfettered control over its use, and he is also fully in control of implementing the decisions with regard to the activities mentioned above. Also, apart from providing some loans and subsidies, the planning exercises at the macro-level may not directly influence the development or use of private irrigation sources.

As distinct from private sources of irrigation, the community sources have to serve several beneficiaries; and no single individual has an over-riding right or control over the irrigation source. In such a situation, therefore, the water allocation problem is one of allocation between users, and also between uses (crops/seasons). Also, the obligation to maintain the physical facilities are spread among several beneficiaries. To put it differently, the allocation of water and maintenance of physical facilities, in a community irrigation source, can be termed as social activities. In as much as these are social activities, they would be governed by definite social rules, and there would be a "body" to frame and/or implement these rules; in other words, an irrigation organisation.

As mentioned earlier, the manner in which the above two activities are carried out in a community irrigation source - in other words, the functioning of an irrigation organisation in a community irrigation source - largely determines the efficiency of the irrigation source. To elaborate, the focus of our study is as follows: given an irrigation source, a certain organisation of irrigation determines the gains on accout of irrigation, and also its distribution among the different beneficiaries of the irrigation source. This in turn affects the very working of the irrigation organisation. In concrete terms, it means that the productivity gains on account of irrigation, and its distribution among different segments of the beneficiaries, i.e. the equity question, is crucially dependent on the irrigation organisation. And, the stability or the proper working of the organisation, or, in the final analysis, the efficiency of the community irrigation source itself, is ultimately dependent on the distribution of productivity gains of irrigation to different segments of the beneficiaries.

A study with such a focus is important because, as mentioned earlier, the measures adopted by the Government to tone up the efficiency of irrigation projects are largely of a technical nature, without an adequate understanding of the functioning of irrigation organisation at the community level. Hence, a study of irrigation organisation in community sources of irrigation is imperative, apart from the fact that such a study is unique and interesting in its own way.

A study with the above focus calls for a framework which is comprehensive enough to raise the relevant issues. Thus, at the very outset the attempt has been to evolve a framework. Partly, this is also a reflection on the state of the subject. It may be mentioned here that in the present work, our chief concern is with the community sources of irrigation, and private irrigation sources are not of direct interest to us. Nevertheless, a description of the role of private irrigation sources would be provided as and when necessary.

Leaving the abstract behind and coming to the concrete, the study is of a village in Chingleput district, Tamilnadu. The reason for selecting the village was that the <u>paraiyans</u> (Harijans) own sizeable extent of land in the village, which we felt would introduce an interesting dimension to the study. A survey of the village (village A) was carried out in the year 1982. We interviewed about 40 respondents in the village for our study. The choice of respondents was not based on random but purposive sampling. And the choice of respondent was dependent on the extent of land owned, the distribution of land in the tank's ayacut, viz., Upper, Middle and Last Reaches of the ayacut; the caste status, etc. Apart from this we talked to a cross-section of people in the village, either to cross check or to elicit more information. Since, we were more interested in qualitative rather than quantitative information, we did not use a structured questionnaire but only a check-list of questions. It has to be noted here that the year in which the survey was carried out was a year of poor rainfall hence, we were not able to observe the actual operations of many of the aspects described in the study.

As the study is an attempt at understanding the reality at a point of time no effort is made in describing the evolution of the irrigation system or the irrigation organisation over a period of time. And, if some information about certain aspects which refer to a period other than the present is provided it is only to clarify certain issues. In the present work, the descriptions of the physical aspects are limited to the extent, they are relevant in highlighting certain organisational aspects of irrigation. We have not made much effort at mapping the relationship between the nature/size of irrigation source and the irrigation organisation.

The rest of the study is divided into six chapters. In chapter 1, we review some of the studies on irrigation. The review is intended as a backdrop for evolving a framework for the study of irrigation organisations. In chapter 2, the concern is with the physical aspects of irrigation. In this chapter, first we describe the various sources of irrigation in Chinglepet district, and the factors that have conditioned their prevalence. We then take up the specific case of village A, and describe the technical features of the tank in village A, and land categories which are determined by the tank. In chapter 3, our concern is with what may broadly be termed as the socio-economic aspects. In this chapter, we describe the caste-structure in village A, the ownership of land categories described in the previous chapter, by caste-groups. In the same chapter, we describe the irrigation organisation that is supposed to be prevalent in village A. Chapter 4, is concerned with equity and productivity considerations of irrigation. In this chapter, after describing the share of different caste-groups in the gains of irrigation, we analyse how the rules of allocation of water, fare in terms of equity/productivity consideration. In chapter 5, we describe the present state of allocation of water and maintenance of physical facilities, and analyse the reasons for the negligent maintenance of physical facilities. Chapter 6, provides the conclusions of the study.

CHAPTER 1

REVIEW OF LITERATURE AND A FRAMEWORK FOR ANALYSIS

1.1 Review of Literature

In this section what we propose to do is to review some of the studies on irrigation. Our main concern in attempting a review is to bring together the major issues in as clear terms as possible, so as to set the stage for developing a certain framework for our own study.

1.1.1 Reports of Government Agencies

In the introduction it was pointed out that the measures adopted by the Government to extend and improve irrigation have largely been technical in nature. The attitude of the Government is reflected in many of the reports written under the aegis of the Government (for example, GOI, 1957; GOI, 1959 and GOI, 1972). These reports are principally concerned with the engineering aspects of irrigation, and almost always provide prescriptions which are essentially of a technical nature to tone up the efficiency of the irrigation projects.

The attitude of the Government (and, hence the various Government Reports) have been criticized by many for its excessive pre-occupation with the technical aspects related to irrigation or, the "hardware" aspects to the neglect of "software" components, viz., the network of institutions and administrative systems (Jayaraman, 1981). Chambers (1977: 340-341), had taken the various official documents to task for ignoring the "human-side of the organisation and operation of irrigation systems". According to him "there may be as many instances of these omissions as there are reports on irrigation". According to Vaidyanathan (1977), "a serious weakness of the command area and other similar programmes lies precisely in their tendency to view the organisational problem as one of strengthening the official machinery, and to skirt around the problem of building effective local institutions". And, "the lack of such institutions is an extremely severe constraint on the extent to which the efficiency and productivity of India's irrigation can be improved".

Implied in such criticisms of the Government attitude is that, though the technical aspects of irrigation are important, what ultimately determines the efficiency of the irrigation system is the manner in which allocation of water and the maintenance of physical facilities are carried out. The above mentioned activities assume relevance only in the context of community irrigation sources and not in the case of private irrigation sources. And, the manner in which these are carried out ultimately determine the efficiency of the community irrigation source. (see pp.3).

There are a number of studies which provide information about the manner in which the above mentioned activities pertaining to irrigation are organised, under different irrigation sources of the world, though not all the studies are in response to the concern mentioned above.[1] What we now propose to do therefore, is to review some of these studies which provide information on the manner in which activities pertaining to irrigation are carried out.

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1. Many of the studies were in response to Wittfogel's theory which attempted at a cross-cultural comparison of a political condition, viz. despotism, which he traced to a particular hydraulic setting. The main elements of his theory were, the imperative to exploit water resources for pre-industrial regimes, especially in arid lands; and, as a consequence of this a managerial state system which is despotic in nature (Wittfogel, 1970 and 1981). The theory provoked a sharp critical response, and stimulated a number of studies which wanted to examine the question of centralisation of authority in irrigated societies. These studies cast doubt on Wittfogel's hypothesis, but as Hunt and Hunt (1974) points out in most of the studies, there is a tendency to confuse between two distinct types of centralisation:

   "... one refers exclusively to authority in terms of the irrigation system The other refers to generalised political authority which may involve other functions of control outside or above simple water control. In one case authority is exercised over different decisions making rights in terms, exclusively, of the social and technical needs of the irrigation system perse. In the other case authority is exercised over water as one aspect of a complex political role or of a large multi-function political machine" (see also, Hunt and Hunt 1976).

   But, recently there has been lot of interest shown in developing what is termed as "user organisation" to improve the efficiency of irrigation sources (see Coward, 1977; Jayaraman, 1981; *The Hindu*, March 8, 1982 and July 27, 1983).

1.1.2 Other Studies on Irrigation

Given a community irrigation source (construction of which has already been accomplished) most of the studies recognize that,

(a) water will have to be allocated to fields from the source;

(b) the physical facilities, viz., the embankments, weirs, bunds, channels etc. have to be maintained.

Hence, the need for "irrigation organisation" is felt to carry out "regular activities", viz., (a) and (b) above.

1.1.3 Definition of an Irrigation Organisation

Unfortunately, except a few studies (Vaidyanathan, 1983; Narayana et.al. 1982), most of the studies are vague on "Irrigation organisation". For instance, Jayaraman (1981) and Pant (1981), talk in terms of group-action among farmers; Wade (1979), refers to corporate approach or corporate irrigation organisation, Pasternak (1978), discusses about co-operative networks and managerial structures etc, without adequately explaining what these terms mean. In fact some of the studies are pre-occupied with essaying the differences in forms for eg. community managed vs bureaucratically managed system (Chambers, 1977: 344 & 355; Coward, 1981: 25) or, concerned with providing labels such as "traditional irrigation leadership" (or what is referred to as "accountability model") (Coward, 1977) or, in classifying organisations as top-down, bottom-up, or middle-outwards (Chambers, 1977: 344). Apart from the fact that there is no correlation between form and effectiveness of irrigation organisations, it has to be pointed out that such labelling or classifications do not help in furthering our understanding of irrigation organisations or even in explaining what is an irrigation organisation.

This point is emphasised by Wright (1980: 16-20) who points out the need for greater clarity in the concept of irrigation organisation. According to him, irrigation has four distinct phases (viz., control of water source , the delivery of water, the actual application of water to the crops, and the drainage) each of which involves four distinct tasks (viz., facility construction, operation and maintenance, water allocation, and conflict resolution). According to him therefore, it is inappropriate and extremely misleading to view irrigation organisation as if it were a single unit handling all phases and tasks; rather it has to be viewed as arrangements for performing the four tasks in the four phases of irrigation. But, the approach which he outlines in his work to study irrigation organisation is too empirical, and may not allow generalized statements to be made about irrigation organisation.

Earlier it was pointed out that most of the studies recognise that in a community source of irrigation, certain regular activities have to be carried out, and to carry out these regular activities a need for irrigation organisation is felt (see 1.1.2). Though, as pointed out, most of the studies do not define or explain what is an irrigation organisation, what emerges from most of the studies explicitly or implicity is that these activities are governed by definite social rules (Coward, 1981: 19; Chamber 1977, 348; Narayana et.al 1982, etc). And, to frame these rules, and to implement them there is need for a "body" (Narayana, et.al. 1982: 8) or what is usually referred to as "water-authority roles" (Hunt & Hunt, 1976: 391; Coward, 1981: 19). But, each author uses different terminology to describe these, viz., rules and roles, thus causing a lot of confusion. For instance, Narayana et.al. (1982: 6), and Coward (1981: 20), when referring to the rules of allocation and maintenance term it as "institutions", and while referring to the "set of men" (Coward, 1981: 20) that are involved in implementing the rules or carrying out these activities, they term it as "organisation". On the other hand, Vaidyanathan (1983) uses these two terms, viz., organisation and institution inter-changeably when he refers to an irrigation organisation. He subsumes under these two terms both the rules that govern the activities and roles that are involved in implementing the rules or carrying out the activities.

1.1.4 Water-Authority Roles

From the various studies on "irrigation organisation" it can be observed that at the community-level or to be more precise, at the level of direct beneficiaries from the irrigation source, personnel who are responsible for framing or implementing the rules that govern the regular activities are usually chosen from within the community. They may be elected, selected (Wade, 1979; Coward, 1979: 226) or even picked up by the Government (the classic case is the Vel-vidane of Pul Eliya; Leach, 1971). Though, not specifically mentioned it is possible to discern two sets of personnel, one set which frames or oversees the implementation of rules, and the other which looks after the actual implementation for eg. the ditch-tenders.[2] The first set of personnel are usually large-landowners (Hunt & Hunt, 1976: 396) or people who wield political power (Jayaraman, 1981) or members of a dominant caste in a village (Jayaraman, 1981). On the other hand, the second set of personnel may be chosen from the lowest strata (economic or social) of the community. For instance, there is a practice of appointing Harijans as ditch-tenders in many places of South India.[3]

Hunt and Hunt (1976: 396) point out that this aspect of the problem, viz., involvement of the irrigation personnel in other social, economic or political structure has not received much attention. Therefore, what they do is "... to start from the position that there are (a) ranked local roles associated with social affairs and (b) ranked local roles associated with the management of the irrigation system and to have a preliminary look at how these two sets relate to each other" (1976: 396). And, they provide a number of instances of what they term as "role embeddedness" or the relationship between roles in managing the irrigation system and other roles in the local social organisation. But, importantly what they point

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2. For instance, Wade (1984) describes a case from Andhra Pradesh, where a village council, which he says is quite distinct from statutory village panchayat, is responsible for representing the interests of the users to the P.W.D. authorities, and it also appoints common irrigators who are responsible for allocation of water among users (see also Wade, 1979).

3. See Chambers, 1977: 346 & 351; Harriss, 1982: 130; Good, 1982; Hill, 1982: 274-275.

out is that where "... sufficient information on identity of office holders and identity of landowners (Pul Eliya, Sonjo, Sanjuan, Japan), (is available) a pattern emerges", viz., the landowners have gained as a result of their connection with the irrigation system (1976: 396-397).

We have put together, what the studies on irrigation have to say with regard to the "set of men" or "water-authority roles", who are responsible for framing and implementing the rules concerning the regular activities of irrigation. We would now go on to see what these studies have to say about the manner in which these activities are carried out under community irrigation sources, in other words, the rules of allocation of water and maintenance of physical facilities.

1.1.5 Rules of Allocation

The problem of water allocation in community sources of irrigation is largely one of delimiting the area to be irrigated, and deciding the amount of water that should be given to different users or different segments of the area entitled to irrigation. The limits of the service area or the area that can be irrigated by an irrigation source is usually well defined, but it may vary depending on the amount of water available in the irrigation source at the beginning of the crop-season. Once the decision regarding the area that can be irrigated by an irrigation source is made, the decision regarding the amount of water that should be given to different users comes to rest on the prevailing rules of allocation.

From the various studies which have provided information on the management of water allocation in community sources of irrigation, we gather that two different situations may prevail. They are viz., (a) water available in the irrigation source can irrigate the entire service area and (b) water available in the irrigation source cannot irrigate the entire service area. Given an irrigation source these two different situations may prevail at different points of time.[4]

4. See for instance Leach (1971: 53 and 170). He describes a case where these two situations prevail at two different points in a year.

In the case of the former, viz., (a) above, since the area that can be irrigated is known, the problem is one of allocating water to different fields.

In a situation where the water available in the irrigation source cannot irrigate the entire service area, the first problem that crops up is one of deciding the extent of land that can be irrigated with the available water. Once the extent of land that can be irrigated is decided the next problem is how the reduction (in acerage or the available water in the irrigation source) should be distributed among the different users. In such a situation the rules of allocation of water may provide for -

(1) equal access to water, or
(2) differential access to water.

In the case of Pul Eliya tank (Sri Lanka), an elaborate arrangement has been worked out to provide for equal access to water to all the users (Leach, 1971: 156-158, and 169). In another case, cropping pattern is sought to be enforced in different segments of the service area and water is allocated to the different segments based on that (Pasternak, 1978: 204-206). Chambers (1977: 247) provides a case from Tamil Nadu, where each cultivator is allowed same fixed acrage, and water is supplied only for that.

We also have instances, where rules of allocation provide for differential access to water, i.e. some individuals or communities have primary rights to water, and they are the last to suffer. Hunt and Hunt (1976: 391) point out that in San Juan, when there is a shortage of water, the center of the communal system, where the lands of more powerful people are located, gets more than its share (see also, Vaidyanathan, 1983: 107-108n).

On the basis of these studies, it can therefore be said that it is perfectly conceivable to have two sets of rules of allocation in an irrigation source — one set of rules when the water available in the source is capable of irrigating the entire service area, and another when the water available in the source is not capable of irrigating the entire service area.

Some authors have used certain terminologies to describe these water allocation rules. For instance, Glick identifies two alternative principles governing water allocation. One, the Syrian which is associated with large rivers and allocates water proportionally. In this model, when there is a water shortage, there is a proportional reduction in the allocation of water and everyone suffers equally. The other Yemenite model is based on small sources of supply (e.g. tanks) and water is allocated on the basis of fixed time measurement units. In the Yemenite model, when there is water shortage, some individuals or communities have primary rights to the water, and they are the last to suffer (Hunt & Hunt, 1976: 391). Hunt and Hunt (1976: 391), examining the relevance of such a classification have rightly pointed out that there is no necessary relationship between the size of the irrigation source, and the adoption of a particular water allocation principle.

Downing (1974: 117), borrowing from European law, distinguishes between the doctrines of riparian rights and prior appropriative rights. According to him under the riparian doctrine, owners of land located adjacent to a water source have rights to it whenever they wish, and under prior appropriative rights, priorities to water are determined by historical precedence or administrative fiat. He further notes that, the former corresponds with areas of excess water, and the latter corresponds with water-deficient regions. Varisco (1983), has p inted out that the uncritical use of such a distinction may only serve to obscure the full range of allocation options in a community. He further points out that any typology of water allocation options does not explain why people in a given community allocate the water the way they do.

This is precisely what is lacking in most of the studies, viz., the reasons for the adoption of a particular allocation rule in a given context. Also, in these studies the distinction between what is and what ought to be gets blurred. It is not very clear from most of the accounts whether the rules of allocation described are actually implemented at a given point of time or, whether the rules of allocation are an "ideal", i.e. the rules of allocation are supposed to be implemented in the manner described. This is so because, we get to know precious little from these studies about the responses or, conflicts over the implementation of these rules.

Having gone over the studies concerning the rules of allocation, let us now turn to the maintenance question dealt with in these studies.

1.1.6 Rules of Maintenance

The purpose of maintenance is to make sure that the physical facilities, viz., dams, bunds, control structures, distribution canals etc. function smoothly, and at the level for which they were designed. Indifferent maintenance of these could lead to reduced quantum of water being carried in the canals, increased waste due to leakage and spills, thus adversely affecting the interest of all the users. This may further reinforce the non-maintenance because some users may believe that they do not receive enough benefit to warrant their contribution towards maintenance. But, this aspect, viz., the inter-relationship between maintenance and allocation of water has not received much attention in the studies.

The studies which have provided information regarding maintenance of physical facilities have mostly concentrated on rules that govern the contribution by users towards maintenance. On the basis of these studies, the contribution by users towards maintenance can be broken down into two types. They are:

(a) Contribution towards maintenance is proportionate to the benefits received from the irrigation source. For instance, in '<u>Pul Eliya</u>' (Leach, 1971: 165),

> "... each Panguva ... shall have exactly equal rights to the total available water.
>
> As against these equal rights, each Panguva carries also exactly equal obligations with regard to the maintenance of the tank bund, maintenance of field fencing, etc."
>
> In Andhra Pradesh, "... the upkeep of village's network of irrigation ditches; ... is done by work groups based on sub-channels within the network, in which contributions from each owner are based on the owner's area irrigated by that particular sub-channel". (Wade, 1979).

In Vegamangalam (Tamil Nadu) when the long channel which brings in water to the village has to be cleared,

> "... every family with a share provides labour at the rate of one man per anna of land" (i.e. 1.60 acres of wet land plus 0.74 acres of dry land) [Chambers, 1977: 352 - 353].

(b) Contribution towards maintenance by users may be disproportionate to the benefits received by them from the irrigation source. For instance, in Nawagam village of Gujarat, "the committee solicits help in terms of man-power which is calculated as one male person per household" (Jayaraman, 1981). In the case of Rawalpura sub-minor in Gujarat, "the committee collected subscriptions from the farmers at the rate of Rs.5/- before each agricultural season for carrying out maintenance work by hiring agricultural labour" (Jayaraman, 1981).

We also have instances where non-compliance with rules regarding contribution towards maintenance may attract penalties ranging from fines (Jayaraman, 1981; Mirza, et.al 1975: 39) to loss of water rights (Mirza, et.al, 1975: 39; also Vaidyanathan, 1983: 105n).

But, it is not clear from these studies whether the rules regarding contribution towards maintenance by users, and penalties in case of non-compliance are actually enforced or these represent an "ideal" situation.

There are some studies which have not been much concerned with rules of maintenance but, have provided information regarding the actual state of maintenance in a given context. In Thaiyur village (Tamil Nadu), according to Djurfeldt and Lindberg (1975: 104), there is negligent maintenance of the irrigation system.

But, unfortunately they do not provide any specific reason for this, apart from saying that it is due to the disintegration of the village community. Chambers (1977: 353-354), provides two cases where there is a virtual breakdown of all maintenance activities, largely due to the clash of interests between cultivators in the upper-reach and tail-end of the ayacut.

Sengupta (1980) points out that in South Bihar, the Zamindars had once shown a lot of interest in the maintenance of the physical facilities, though, they did it by coercing the tenants to contribute labour. But, the zamindars lost interest once the produce rent system was commuted to fixed cash rent system. Due to the commutation, the surplus which the zamindars could extract from the tenants was fixed, and hence they lost interest in maintaining the irrigation system. It appears, therefore, that there may be a close connection between the forms of land-tenure and maintenance of physical facilities.

In sum, what we have attempted in this section is a review of some of the studies pertaining to community irrigation sources. Our main concern in reviewing the literature is to bring out the major issues in as clear terms as possible, so as to set the stage for developing a certain framework for the study of irrigation organisation. In fact, as elaborated above most of the studies have not dealt with the issues pertaining to irrigation in a comprehensive manner. Thus, there is a need for developing a comprehensive framework, to take care of atleast most of the issues. This is precisely what we propose to do in the next section.

1.2 A Framework

1.2.1 Irrigation Requirements

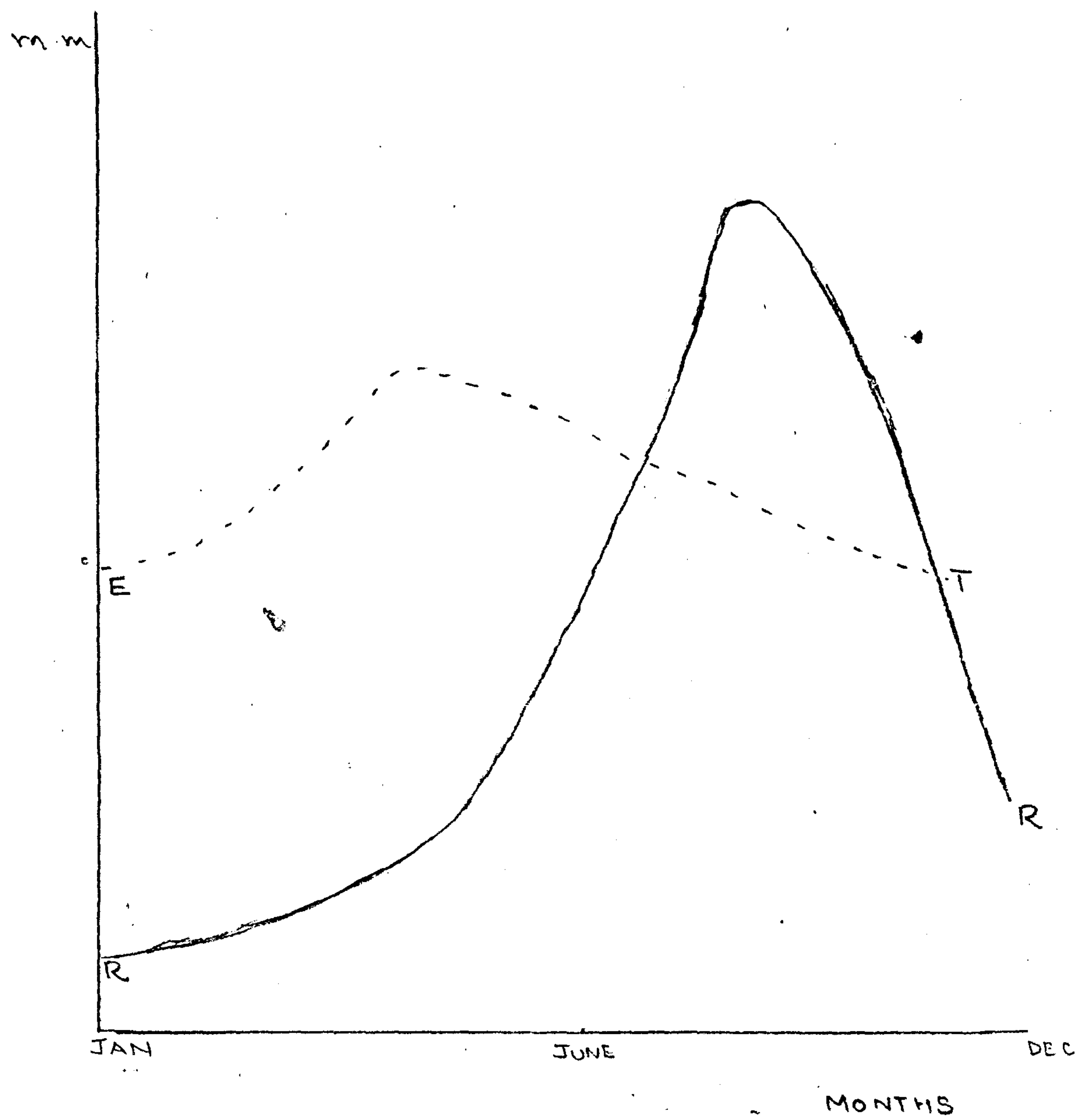
Water serves two essential functions in plant growth: (1) It maintains the plant temperature and (2) It facilitates absorption of nutrients from the soil. An 'ideal' situation is one where the plants do not suffer any moisture stress, i.e. the amount of moisture available is enough to permit the necessary rate of transpiration to maintain temperature. Also, the amount of moisture available in the root zone determines the amount of nutrients that is absorbed and the efficiency with which it is utilised.

Moisture, therefore, is constantly lost from the fields under crops on account of transpiration by plants, and evaporation from the exposed soils. The evapo-transpiration (ET) or, the crop-water requirement depends largely on solar radiation, humidity and other climatic factors. It is pointed out that except paddy which requires substantially more quantum of water for puddling and keeping the field submerged, the nature of crops grown seems to make no difference on the quantum of ET (Vaidyanathan, 1983: 8; also Clark, 1970: 5).

The chief source of moisture to replenish the moisture lost due to ET is effective rainfall (i.e. that part of the rainfall which is absorbed and retained in the soil). The relative positions of ET and effective rainfall in a year determines the length of the period in which crops can be grown solely based on rainfall, the timing of sowings and the nature of crops that can be grown.

In figure 1, we have portrayed a climatic type — which is the stylised picture of a climatic pattern characteristic of most parts of South Asia. It can be observed from the figure that effective rainfall (RR) is concentrated in about 3 to 4 months in a year and in other months RR is quite low. Barring these 3/4 months in the rest of the year RR is less than ET. To put it differently, for

FIGURE 1. ACLIMATIC TYPE



NOTE: RR - Effective Rainfall.
ET - Evapo-transpiration.

3 to 4 months in a year, the moisture available is on an average more than adequate to meet crop-water requirements, and crops can be grown in this period solely based on rainfall. It can also be observed from the figure that the quantum of moisture deficit (i.e. excess of ET over RR) is also large for about 8 to 9 months in a year. Irrigation requirement, i.e. "... the additional water needed to supplement probable local rainfall or soil water reserves upto the level of PET" (Potential evapo-transpiration) (Levine, 1980: 53) under these conditions is longer and also much larger. The irrigation requirement, can be met only if the surplus precipitation during the 3 to 4 months in a year is stored either in surface or underground for use in the other months.

1.2.2 Techniques of Irrigation and the conditions governing their choice

Broadly, therefore, the techniques of irrigation may be distinguished under two heads: gravity flow types and lifting types. What distinguishes one from the other is the source of motive power. Gravity flow, as the name suggests, has its source of power in the force of gravity whereas, any form of lifting calls for other sources of motive power (Narayana, et.al; 1982: 4).

Given these two types of irrigation, a question that immediately arises as to what determines the choice of an irrigation type in a given location. In a given location, the nature of water control needed, depends on agro-climatic conditions. For instance, in the climatic type portrayed in figure 1, where the irrigation requirements are longer and much larger,

the requirement can be met if there is a large surface irrigation project which can store the monsoon flows or the ground water must be tapped extensively. Though, the agro-climatic condition determines the nature of water control that is needed, what is feasible is determined by the topography, geological conditions, and state of art in irrigation engineering[5] (Vaidyanathan, 1983:27).

5. See Drower (1975) for a good description of irrigation technology upto 500 B.C.

Sengupta (1980) points out that some parts of South Bihar have a marked slope from South to North roughly at the rate of one metre per kilometre. Using this local topographic variations, ahars are constructed, which resemble a rectangular catchment basin with embankments only on three sides. The fourth side-the highest ground - is left open to allow drainage water to enter the catchment basin following the gradient of the country.[6]

In the Gangetic basic, in India, all the rivers flowing through the basin are perennial, largely due to the Himalayas. Also, the geology of plains is exceptionally favourable for ground water storage but, the intensive exploitation of the ground water was possible only with the introduction of energised pumpsets and the availability of techniques for tube-well construction (Vaidyanathan, 1983: 29). On the other hand, in South India, the rivers are largely seasonal; and the the geology is not very favourable for ground water storage. Hence, irrigation development in South India, was largely based on using local topographic variation to impound rainfall (Vaidyanathan 1983: 29).

We have pointed out earlier that the nature of water control that is needed depends on agro-climatic conditions, while what is feasible is conditioned by topography, geological conditions and the state of art in irrigation engineering. But, from this feasible set of choices what gets actually selected is essentially a function of socio-economic factors.[7]

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6. Sengupta (1980) says that the rivers in the South Bihar are dry for most parts of the year, but they suddenly turn into swollen torrents following heavy rainfall in Chotanagpur hills. Because of the slope of the country, and the fact that rivers are mostly sandy the water is carried down rapidly or percolates in the sand. In order to prevent this water going waste numerous artificial channels called pynes are constructed, and are led off from points facing the currents of these rivers to the agricultural fields. Sometimes pynes are impounded into ahars, ensuring storage of superflous water.

7. Ludden (1979) points out that in Tirunelveli district, the cost of lifting water makes it impractical as a normal means to irrigate foodgrains, so they are usually devoted to valuable market crops. And, for this reason he says that growth of well irrigation was both historically and socially linked to the development of commercial agriculture. He further points out that Nadars, were always commercially oriented. From palmyra cultivation, they diversified into tobacco and plantations. And, they were also known as supreme well diggers. Hence, the early Census records found them to be concentrated wherever there was well irrigation.

contd...

1.2.3 Activities pertaining to Irrigation

Given any type of irrigation source, there are three different tasks that are associated with it. They are viz.,

(a) Construction of the irrigation source , which is essentially an once and for all activity or, at best an intermittant activity,

(b) the allocation of water available in the source among different fields,

(c) the maintenance of the physical facilities so that they function at the level for which they were designed.

The latter two, viz., (b) and (c) are regular activities.

But, given an existing irrigation source, construction is an activity which has already been accomplished. For the present, it would involve going into its history, and hence, cannot strictly be of concern. What is contemporary and probably of more interest is how the allocation of water from an irrigation source and maintenance of physical facilities are carried out.

The regular activities, viz., (b) and (c) above, assume importance only in the context of irrigation sources which fall outside the ambit of private irrigation sources. In the case of private irrigation sources, which are sources developed and used by an individual cultivator for his own use, (e.g. private wells), the regular activities would be carried out by him in relation to his own objectives. He is also fully in control of implementing the decisions about these activities. On the other hand, a community irrigation source , as its label itself suggests,

contn. of footnote 7

Ludden further points out that during the colonial period, there was a bias towards large irrigation projects. The Government concentrated only on those projects referred to as "productive works" which generated adequate return on investment. And, relatively little state money went into projects referred to as "protective works" which generated inadequate returns on investment but, warranted investment as a check against famine. The tanks and small drainage systems etc. were peripheral as objects of investment, and were often patched up in a piecemeal fashion.

has to serve several users. And, no one individual has an over-riding control or right over the source. Hence, in a community irrigation source, the water allocation problem is one of allocation between fields owned by the members of the community. Also the obligation to maintain physical facilities is spread among all the beneficiaries of an irrigation source. Put differently, the allocation of water and the maintenance of physical facilities, in the case of community sources of irrigation, may be termed as social activities.

1.2.4 Single Community versus Multi-community Irrigation Sources

Before proceeding any further, we would like to distinguish the community sources of irrigation into two, viz., (a) single community sources, and (b) multi-community sources.[8] The single-community irrigation source may be defined as one which exists within a well defined geographical limit, viz., a village. The members of the village community would be the beneficiaries of the source, and they would also have more or less complete control over its operation[9] for eg. the Pul Eliya tank (Leach, 1971). If in a village there are more than one community irrigation sources, it would be considered as single community sources, as long as the members of the village community are the direct beneficiaries of the sources and they also have a complete control over their operation. The multi-community source may be defined as one from which more than one village community draw water for irrigation purposes. Hence, no single village community has complete control over its operation therefore, there may be a need for a Bureaucratic apparatus to allocate water between villages, for eg. the Dusi Mamandur tank in Tamil Nadu, which irrigates about 18 villages (Chambers, 1977). We would be concerned, in the present work, only with

8. In many of the studies on irrigation based societies, there is a lot of ambiguity regarding the definition of the scale of irrigation sources. To cite only a few; according to Downing (1974: 114), an irrigation source can be considered as small scale as long as the lowest level of Mexican political heirarchy, viz., the muncipality designs, builds and administers. And, such irrigation sources may show considerable variation in allocation, administration and physical size. Pasternak (1978: 200), uses a very ambiguous concept of a single source without defining or explaining what it means. Coward (1977), distinguishes between traditional irrigation systems and modern irrigation systems. According to him traditional irrigation systems are "usually small scale systems", one fails to understand why it should be so.

9. In the case of rainfed chain of tanks, the surplus water from the upstream tanks only flow down to the tanks lower down. Hence, the upstream tanks do not exercise any control over the water that flows into the tank lower down.

the single-community irrigation sources.

1.2.5 Definition of an Irrigation Organisation

Earlier, it was pointed out that allocation of water from community irrigation sources, and maintenance of physical facilities can be termed as social activities (see 1.2.3). In as much as these are social activities, they have to be governed by social rules. Hence, there is a need for a 'body' to frame rules, and also to implement them (Narayana, et.al; 1982: 6 and 8). The rules which govern the activities, and the body which frames and/or implements them may be formal or informal in nature.

Therefore, in the case of community sources of irrigation, an irrigation organisation may be defined as, "the mechanisms and procedures by which the decisions relevant to these tasks (viz., allocation of water and maintenance of physical facilities), are made and implemented" (Vaidyanathan, 1983: 45). The definition is a comprehensive one to embrace, the rules that govern the activities and a structure viz., a body or water authority roles to enact and/or implement these rules. Though, an irrigation organisation going by the above definition includes both the structure of an organisation and rules, for analytical purposes we would separate the two. First, we would describe the structure of an irrigation organisation, and later take up the rules of allocation and maintenance.

1.2.6 Structure of Irrigation Organisation

By structure of an irrigation organisation, we refer to the body or water authority roles that are responsible for framing the rules and/or implementing the rules of water allocation and maintenance. At a given point of time, the structure of an irrigation organisation may only be responsible for implementing the rules already in existence. The structure may also make minor modifications in rules if and when required. It is possible that the nature or composition of the structure of an irrigation organisation may have changed as a result of changes in land-tenure, caste or class relation, or due to Government interference and[10], changes in nature

10. See for instance, Jayaraman (1981).

and size of the irrigation source itself.

At a given point, the structure of an irrigation organisation may be differentiated in terms of the role of bureaucrats, who may be responsible for certain limited function, and water-authority roles at the community level. The "bureaucrats" refers to the paid professional staff hired to carry out specified tasks. There may be well-defined rules regarding their recruitment, responsibilities, and their remuneration. A good example is the Public Works Department (P.W.D.) of the Government.

At the community-level, there may be two different levels of water authority roles – One, roles which may be responsible for overseeing the implementation of rules, and may also arbitrate in case of disputes regarding the implementation of rules, and two, roles which do the actual implementation of rules at the field level, for eg. the ditch-tenders. The persons who perform these roles are usually chosen from within the village community.[11] They may be elected, selected, or even appointed by the Government (see 1.1.4.) They may receive some remuneration, for instance, the kandottam (ditch-tender) in Kanyakumari district, Tamil Nadu, is paid about 4 to 6 marakkals of paddy per acre per crop [12](Narayana, et.al. 1982: 27). Or, it may be a thankless task (Downing, 1974: 117), or even a risky one (Hunt & Hunt, 1976: 396) without any palpable gain.

As Hunt and Hunt (1976: 396) point out it is likely that persons who are responsible for management of irrigation system may be involved in other social, economic or political structures. Hunt and Hunt, refer to this as 'role embeddedness',

11. For instance in Andhra Pradesh persons who are responsible for overseeing the implementation of rules and who are referred to as Peddamanushulu, are nominated persons, and their continuation in the committee is re-affirmed every year (Wade, 1979); see also Jayaraman (1981). As pointed out earlier, the ditch tenders who are responsible for the actual implementation usually hold their position as a heriditary one. See also Chambers (1977: 351).

12. Good (1982) points out that in Tirunelveli (Tamil Nadu), the channel controller, a Harijan, apart from receiving maniyam in the threshing floor, which works out to two pakka per acre, has a grant of maniyam land with usufructory rights. According to Good, maniyam as distinct from sampalam which is a salary, is paid in recognition of the special characteristics by virtue of which a person acquires expertise to fulfil his function. (Pakka is a measure of volume approximately equal to 1 kilogram).

or the relationship between roles which manage the irrigation system and other roles in the local social organisation. The roles which are responsible for overseeing the implementation of rules may be persons who are dominant land owners, or representatives of a dominant caste or may wield political power (see 1.1.4). For instance, Jayaraman (1981) provides two cases from Gujarat where, in one case the irrigation committee is dominated by Patels (an agricultural caste) and the leadership is in the hands of a person who was an M.L.A. and also a minister of irrigation. In another case the committee is composed entirely of Patels, and the leader of the committee was the chairman of the village co-operative society.

On the other hand, persons who are responsible for the actual implementation of rules, viz., a ditch-tender may be drawn from the lowest strata (economic or social) of the community. For instance, there is a practice of appointing Harijan ditch-tenders in many places in South India (Chambers, 1977: 346 & 351; Harris, 1982: 130).

Having described the structure of an irrigation organisation, let us now take up the rules of allocation and maintenance.

1.2.7 Rules of Allocation

In community sources of irrigation, water will have to be allocated among fields, in the light of definite crop-water requirements. Rules, which may be formal or informal, have to be framed and implemented so as to meet these requirements. Rules of allocation, at a point of time, might have been evolved over a long period and are likely to have changed in response to changes in land-tenure, nature and size of irrigation source itself, or emerging conflicts.

Access to water from community irrigation sources can sometimes be held independently of land. In that case the discussion can largely ignore land. But, usually in community irrigation sources access to water is permanently and inalienably connected with land rights, and allocation of water is a function of land ownership (Hunt & Hunt, 1976: 391; and also Narayana, et.al; 1982: 6-7). In such a context, allocation of water may take two forms: (a) order-based allocation and (b) time-based allocation (Narayana, et.al; 1982: 7).

(a) <u>Order-based allocation</u>:

In this case the water is allocated to fields in an order. That is, plots immediately below the sluice may be irrigated first, the plots lower down next etc. (Chambers, 1977: 349). In this form of allocation, the cultivators who own plots in the upper reach or plots immediately next to the sluice are at a substantial advantage and have a good access to water (Vaidyanathan, 1983: 112n).

(b) <u>Time-based allocation</u>

In this case, each cultivator may be given access to water in terms of fixed time which may depend on the extent of land owned by each cultivator (Malhotra, 1982: 4-7; Chambers, 1977: 348). The time based allocation may be thought of as one way of providing equal access to water from the irrigation source.

Given a community source of irrigation, two kinds of situations may prevail at different points of time. One, the water available in the source is capable of irrigating the entire service area (or the ayacut); two, the amount of water available in the irrigation source is not capable of irrigating the entire service area (see 1.1.5). In the former case, since the area that can be irrigated is known, the problem is one of allocating water among different users. If, the form of allocation in such a case is order-based, the cultivators in the upper reach may draw more water than necessary thus depriving the cultivators in the tail-end areas of their legitimate share of water from the source (Chambers, 1977: 349).

On the other hand, in a situation where the available supply of water (net of losses) is not enough to irrigate the entire service area, the problem is one of how to distribute the reduction in acreage and quantum of water among the various users. In such a situation, two entirely different solutions may be adopted. One, the reduction may be distributed equally among all the users and two, certain users may benefit at the cost of the other users (see 1.1.5). And, in a particular context, whether equal distribution or differential distribution of reduction is found is critically dependent on the prevailing rules of allocation of water. Stated differently, it may be said that the equity in access for all the users or differential access for certain users to water is critically dependent on the prevailing rules of allocation of water.

1.2.8 Equity and Productivity Considerations

The equal access to water (not equal amounts of water) can be provided in one or many ways.[13] A classic case is that of Pul Eliya village in Sri Lanka, where the land holdings are so distributed, and the rules of allocation of water are so framed that the reduction in both area and quantum of water is shared more or less in the same proportion by all the users (Leach, 1971). The equity in access may also be achieved by allocating water to each user in terms of fixed time based on the extent of land owned by him.

Another way to achieve equity in access to water may be by enforcing a particular cropping pattern, for e.g., farmers may be asked to cultivate a particular food crop which is less water consumptive compared to paddy. In this case, larger number of farmers would benefit compared to the situation when paddy is grown. But, although paddy needs more water it also yields more, and it may be the case that paddy yields more both in absolute terms and relative to irrigation water used. Therefore, although more number of farmers would benefit in case of crop other than paddy is grown, the total output in that case would be less compared to a situation when paddy is grown in a smaller acreage.

As distinct from equity in access to water equal quantum of water may be provided to all the users irrespective of crop-water requirements. It may so happen in this case that the quantum of water supplied may not be sufficient to meet the crop-water requirements. Consequently, the total output in this case would be affected.

13. Under the Pani Panchayat Scheme in Maharashtra, "equitable distribution" of water is made on the basis of number of individuals in the family and not by the extent of land owned. Irrigation water is provided only for half an acre per capita which it is felt is enough to keep an individual above poverty line if a crop like jowar or groundnut is grown (Chaudhari , 1983).

Chambers (1977: 348), provides a case from North Arcot (Tamil Nadu), where each cultivator is allowed to cultivate only a fixed acreage, and water is allocated by rotation only for that. This is a case where every cultivator is allocated equal amounts of water, as distinct from equity in access. Chambers (1977: 350) points out that though the arrangement scores highly in terms of equity, distribution of water to small plots (it was 0.3 acre in 1972 during the Navarai season, i.e. January to May) spread across the ayacut would involve substantial water loss on account of percolation and evaporation. In this case therefore, the total output would be substantially less than would be the case had the same quantum of water been allocated to plots near the source of irrigation.

In a given context therefore, though the rules of allocation of water may provide for equity in access to water for all the users, the productivity gains of irrigation may or may not be achieved. To elaborate, in the case like that of Pul Eliya, where equity in access to water for all the users is sought to be achieved; assuming that a mono crop, viz., paddy is cultivated, the productivity gains of irrigation may be realized when water is allocated to plots characterised by the best sort of soil. But, given a mono crop, the productivity gains of irrigation may not be realised if water is allocated to plots characterised by all sorts of soil although, equity in access to water would be achieved. This is so because, plots characterised by the best sort of soil would yield higher output compared to plots characterised by all sorts of soil for the same quantum of water and the amount of nutrient that is applied. On the other hand, assuming that a multi-crop instead of paddy is cultivated, the productivity gains of irrigation may not be realized even if water is allocated to plots characterised by best sort of soil although, equity in access to water would be achieved. This is because, paddy compared to other food crops, yields more both in absolute terms and relative to irrigation water used.

The rationing of water, in a situation where the quantum of water available in the irrigation source cannot irrigate the entire service area, need not always be equal. The rules of allocation in such a situation may provide for differential access to certain users as opposed to equal access for all the users. We have instances where differential access to water is recognized, and it is part of an established custom that certain sections of the service area or users have first claim over available supplies (Vaidyanathan, 1983: 70 and 107-108n; Hunt and Hunt, 1976: 391). In general this differentiation is based on location, i.e. plots in the Upper Reach of the ayacut having priority over those in the Last Reach.

In a particular context, where differential access to water for certain segments of the ayacut or users is recognized, and only a portion of the service area is irrigated with the available supplies of water, the crop-water requirements may be met in an effective manner even when a highly water consumptive crop like paddy is grown. Nonetheless, in such a context, the productivity gains of irrigation may or may not be realized. The productivity gains of irrigation may be realised if the water is allocated to those portions of ayacut with the best sort of soil although, in this case equity in access to water is not achieved. On the other hand, the productivity gains of irrigation may not be realized if the water is allocated to those portions of ayacut characterised by all sorts of soil, and in this case both equity in access to water and productivity gains of irrigation would not be achieved. This is so because, in the former case the total output would be higher compared to the latter case.

It may therefore, be stated that while equity in access to water is necessarily dependent on the rules of allocation of water, the satisfaction of productivity considerations is also dependent on certain physical aspects such as soil types given the agronomic aspects, viz., the varieties of seeds used, cultivation practices adopted etc.

Assuming that in a particular context, where the differential access to water for certain users prevail and the productivity considerations are also satisfied, the gains of irrigation would accrue only to certain individuals, and the majority of users would not receive any of the gains of irrigation. In such a context, there could be a conflict between equity and productivity considerations.

To restate, it was pointed out that the allocation of water from the community source of irrigation is governed by definite rules. It was also pointed out that, it is perfectly conceivable to have two sets of rules of allocation of water. One, in a situation where the available water in the irrigation source is capable of irrigating the entire service area, and two in a situation where the water available in the irrigation source cannot irrigate the entire service area (Narayana, et.al; 1982:8). The rules of allocation in the latter case may satisfy either equity or productivity considerations, or both, or neither.

The rules of allocation that are adopted in a given context, and at a given point of time decides largely the gains of irrigation, and its distribution among the different segments of users in a community source of irrigation. Having described the rules of allocation let us now go on to take up the rules of maintenance of physical facilities.

1.2.9 Rules of Maintenance

The purpose of maintenance is to ensure that, physical facilities, viz., bunds, control structures, and distribution channels etc. function smoothly and at a level for which they were designed (see 1.1.6). The maintenance of community sources of irrigation may be broken down into: (a) intermittant maintenance activities and (b) regular maintenance activities.

(a) Intermittant maintenance activities are carried out as and when the situation warrants. For e.g. plugging leakages in the bund, and repair to sluice gates, etc.

(b) Regular maintenance activities have to be carried out at regular intervals of time. For e.g. clearing of supply and distribution channels.

The execution of intermittant maintenance activities requires technical know-how, labour and materials, while carrying out regular maintenance activities largely requires labour resources only.

The execution of intermittant maintenance activities involve:

(a) identification of the sources, and also likely sources of malfunctioning,

(b) the assessment of the magnitude of malfunctioning, planning and deciding the time of carrying out repairs, and

(c) it requires funds to procure materials and labour.

In case the structure of an organisation is differentiated in terms of role of bureaucrats, and water authority roles at the community level, it is likely that the bureaucracy may be responsible for carrying out intermittant activities. For instance, in the case of tanks irrigating 100 acres or more in Tamil Nadu, the P.W.D. is responsible for carrying out intermittant maintenance activities. If the bureaucracy is responsible for carrying out intermittant maintenance activity it would have the funds, technical know-how, and the manner in which the repairs are carried out would be governed by formal rules. If, on the other hand, the community is responsible for carrying out intermittant maintenance activity, the beneficiaries of the irrigation sources may have to contribute the required funds, and the technical know-how to carry out the repairs may be obtained from outside the community.

It is usually the case that the execution of regular maintenance activities which largely requires labour resources only is the responsibility of the community (Leach, 1971: 165-166; Chambers, 1977: 352-353). Carrying out the regular maintenance activities at the community-level therefore, would be governed by definite rules regarding the timing of carrying out repairs, and the extent of contribution of labour by the beneficiaries. Contribution by users towards maintenance may be: (a) proportionate to the benefits received from the irrigation source and (b) disproportionate to the benefits received from the irrigation source (see 1.1.6). And, there may be explicit penalties ranging from fines to loss of water rights in case of non-compliance with the rules.

In a community irrigation source, there may be an "ideal" state of affairs with regard to the regular activities described above, viz., allocation of water, and maintenance of physical facilities. By "ideal" we do not intend any degree of normative determinism but, simply that the activities are supposed to be carried out in a particular manner. For instance, it may be the case that in an irrigation source all the users must have equal access to water, atleast in a situation when the water available in the irrigation source can irrigate the entire service area. Or, the irrigation source may have to be maintained at certain level, and each beneficiary must contribute towards maintenance etc.

At a given point of time, there may be an "actual" state of affairs with regard to the regular activities. For instance, cultivators may draw water from the irrigation source when they are not entitled to it, or, all the users may not have equal access to water even when the water available in the source can irrigate the entire service area, or some of the beneficiaries may not be contributing towards the maintenance of irrigation source.

Thus, in a community irrigation source at a given point of time there may be a lack of correspondence between the "ideal" and the actual state of affairs with regard to allocation of water and maintenance of physical facilities. The lack of correspondence between the "ideal" and actual state of affairs in one of the regular activities may occur independently of the other regular activity. For instance, the poor maintenance may be due to changes in land-tenure (Sengupta, 1980; also Raju, 1941: 126), or due to the development of well irrigation. But, it has to be noted that even if the lack of correspondence in one activity occurs independently of the other activity, its impact would eventually be felt on the other activity also. To elaborate, if in a given context, poor maintenance of physical facilities is due to say changes in land tenure, the continued neglect of maintenance would eventually lead to poor allocation of water.

On the other hand, the lack of correspondence between the "ideal" and the actual state of affairs in one of the regular activities may be a result of the other.

For instance, let us take up one aspect, viz., non-contribution by certain beneficiaries towards maintenance of physical facilities. Earlier, it was pointed out that the allocation of water and maintenance of physical facilities are related (see 1.1.6). In as much as the rules of allocation of water determine who gets how much of the gains of irrigation, the rules of maintenance determine who bears how much of the cost of irrigation. If in a given context, the rules of allocation of water provide for differential access to water for certain segments of the ayacut or users, in a situation when water available in the source cannot irrigate the entire service area, other users who do not stand to gain on account of irrigation may not be willing to contribute towards the maintenance. The indifferent maintenance may lead to inefficient use of water due to leakage of water and spilling over, etc. consequently, affecting all the beneficiaries of an irrigation source. In the instance described above, it may be observed that there is a conflict between equity and productivity considerations with regard to allocation of water.

The framework as evolved above incorporates the issues around the construction of irrigation sources, maintenance of the physical system and allocation of water. What is left out however is the whole issue of conflict resolution as such which is not relevant to the concrete case investigated.

CHAPTER 2

PHYSICAL ASPECTS OF IRRIGATION

This chapter is concerned with what may broadly be termed as certain physical aspects of irrigation. The chapter is divided into four sections. In section 1, a description of the rainfall characteristics, irrigation requirements, the sources of irrigation that meet the irrigation requirements, and the factors conditioning the prevalence of these irrigation sources, for the Chinglepet district as a whole, is provided. This section is intended as a backdrop before we take up the specific case of the village under consideration. Section 2 is devoted to a description of the physical environment of village A, viz., its topography and rainfall characteristics. In section 3, a description of the technical aspects of the tank in village A - the only community source of irrigation - is provided. In section 4 a description of two land categories, in relation to the tank is provided.

2.1. Rainfall Characteristics and Types of Irrigation Sources in the District

In this section, to begin with, we would be describing the rainfall characteristics of Chinglepet district of Tamil Nadu. In the main, our concern would be with the distribution of rainfall in a year. Given the crop-water requirements,[1] the distribution of effective rainfall[2] in a year, provides an idea about the period available to raise crops wholly on the basis of rainfall, thus pointing to the quantum and duration of irrigation that would be required (see 1.2.1). This immediately takes

1. Fields under crop lose soil moisture on account of two reasons. One, transpiration by the plants and two, evaporation from the exposed soil between them. It can therefore be proposed that, the maximum crop-water requirements are a function of evapotranspiration (E.T.). And, E.T. is largely determined by the climate factors. (See 1.2.1; also Vaidyanathan, 1983: 8 and 96n).

2. Effective rainfall may only be a small portion of total rainfall. A significant portion of total rainfall may be lost in surface run-offs, and may not increase the soil moisture content. Effective rainfall, is dependent on the lay of the land, soil characteristics and intensity of rainfall.

us to the issue of types of irrigation sources that satisfy the irrigation requirements. Hence, a description of the various types of irrigation sources prevalent in the district would be made followed by a description of the factors which have conditioned their prevalence. Data on some of these factors, though available for the district as a whole, are hard to come by for the specific village under consideration. It is felt that, atleast some of these factors which are true of the district would also hold true for the specific village under consideration.

2.1.1 Rainfall

In Table 1, details regarding both the season-wise 'normal' rainfall (i.e. average rainfall based on fifty years), and actual rainfall in millimetres for the years 1950-51 to 1977-78 for Chinglepet district[3] is provided. In the district, precipitation occurs due to two distinct rainfall seasons, viz., the South-West monsoon, and the North-East monsoon. The South-West monsoon usually begins around the month of June, and is active till about September. The North-East monsoon usually begins around October and is active till December. It may be seen from Table 1, that there is considerable variation in the magnitude of rainfall in these two seasons across the years 1950-51 to 1977-78, and also in relation to the 'normal' rainfall. There is also sizeable variation in the total annual rainfall across these years, and in relation to the 'normal' annual rainfall.[4]

It may be observed from Table 1, that in the district, almost the entire precipitation falls during the seven months of the monsoon, i.e. from June to December. And, for about five months, viz., January to May, preceding the monsoon season there is little or virtually no rainfall at all.[5] The South-West monsoon (June to September), accounts for 32.84 per cent and the North-East monsoon accounts for 57.06 per cent of

3. It is pointed out that, almost the entire Chinglepet district, is in the high annual rainfall region with a normal annual rainfall of over 1200 mm (see Economic Atlas of Madras State, 1962: 21).

4. According to a map published in the Economic Atlas of Madras State (1962: 21), which uses coefficient of variability as a measure of reliability, a portion of the Chinglepet district especially near the east coast, has a very high coefficient of variability (over 30). For the remaining areas of the district, the coefficient of variability ranges from 25 to 30.

5. According to the classification of climates worked out, Chinglepet is described as falling into the Medium Tropical Transitional Bioclimate. In this type of bioclimate, there are five or six months of dry weather in a year (see Mencher, 1978:37).

Table 1

Season-wise Normal Rainfall and Actual Rainfall for the years 1950-51 to 1977-78 in Chinglepet District

(in m.m.)

Years	S.W. Monsoon (June to September)	N.E. Monsoon (October to December)	January to May	Total
(1)	(2)	(3)	(4)	(5)
1950-51	373.83 (41.76)	396.24 (44.32)	124.46 (13.92)	894.08(100.00)
1951-52	370.84 (39.78)	254.00 (27.25)	307.34 (32.97)	932.18(100.00)
1952-53	248.92 (32.89)	482.60 (63.76)	25.40 (3.35)	756.92(100.00)
1953-54	381.00 (37.59)	546.10 (53.89)	86.36 (8.52)	1013.46(100.00)
1954-55	457.20 (34.68)	609.60 (46.24)	251.46 (19.08)	1318.26(100.00)
1955-56	513.08 (47.42)	477.52 (44.13)	91.44 (8.45)	1082.04(100.00)
1956-57	561.34 (51.52)	510.54 (46.85)	17.78 (1.63)	1089.66(100.00)
1957-58	439.42 (42.50)	510.54 (49.39)	83.82 (8.11)	1033.78(100.00)
1958-59	319.20 (23.90)	972.40 (72.82)	43.80 (3.28)	1335.40(100.00)
1959-60	293.30 (31.85)	571.30 (62.03)	56.40 (6.12)	921.00(100.00)
1960-61	416.20 (23.79)	1227.20 (70.16)	105.80 (6.05)	1749.20(100.00)
1961-62	699.20 (59.03)	351.00 (29.64)	134.20 (11.33)	1184.40(100.00)
1962-63	520.80 (43.86)	518.30 (43.65)	148.30 (12.49)	1187.40(100.00)
1963-64	450.40 (41.24)	631.40 (57.81)	10.40 (0.95)	1092.20(100.00)
1964-65	364.80 (36.01)	629.20 (62.11)	19.00 (1.88)	1013.00(100.00)
1965-66	405.00 (38.92)	565.00 (54.29)	70.70 (6.79)	1040.70(100.00)
1966-67	543.00 (35.84)	879.20 (58.03)	92.80 (6.13)	1515.00(100.00)
1967-68	499.20 (42.96)	577.70 (49.71)	85.20 (7.33)	1162.10(100.00)
1968-69	335.00 (47.12)	330.50 (46.48)	45.50 (6.40)	711.00(100.00)
1969-70	305.10 (21.94)	1054.30 (75.80)	31.50 (2.26)	1390.90(100.00)
1970-71	545.80 (45.43)	570.80 (47.52)	84.70 (7.05)	1201.30(100.00)
1971-72	350.70 (33.80)	661.70 (63.77)	25.20 (2.43)	1037.60(100.00)
1972-73	292.90 (25.66)	841.80 (73.73)	7.00 (0.61)	1141.70(100.00)
1973-74	429.90 (46.27)	449.70 (48.40)	49.50 (5.33)	929.10(100.00)
1974-75	473.70 (61.00)	286.30 (36.87)	16.50 (2.13)	776.50(100.00)
1975-76	734.30 (48.84)	760.10 (50.56)	9.20 (0.61)	1503.60(100.00)
1976-77	548.70 (34.37)	984.40 (61.66)	63.30 (3.97)	1596.40(100.00)
1977-78	460.00 (28.14)	1101.50 (67.39)	73.10 (4.47)	1634.60(100.00)
Normal	397.70 (32.84)	691.00 (57.06)	122.30 (10.10)	1211.00(100.00)

Source: Government of Tamil Nadu (GOTN), Season and Crop Reports (various issues).

Note: The figures in parantheses represent row percentages.

the 'normal' annual rainfall. And, during the five months of January to May, only 10.10 per cent of the 'normal' annual rainfall is received. As pointed out earlier in this section, there is considerable variation in the quantum of rainfall during these two seasons, viz., South-West monsoon and North-East monsoon across the years 1950-51 to 1977-78. These variations apart, it can be stated that on an average the maximum amount of precipitation in the district falls during the three months of the

North-East monsoon (i.e. October to December).

The pattern of distribution of precipitation in the district can therefore be stated as follows: For about five months in the year (i.e. January to May), there is virtually no rainfall at all. There is a gradual ascent from June onwards with sizeable precipitation occurring in the four months of South-West monsoon. But, the maximum amount of precipitation which falls in the district is concentrated during the three months of North-East monsoon.

Having provided an account of the distribution of precipitation in the district, let us now take up the irrigation requirements of the district as a whole.

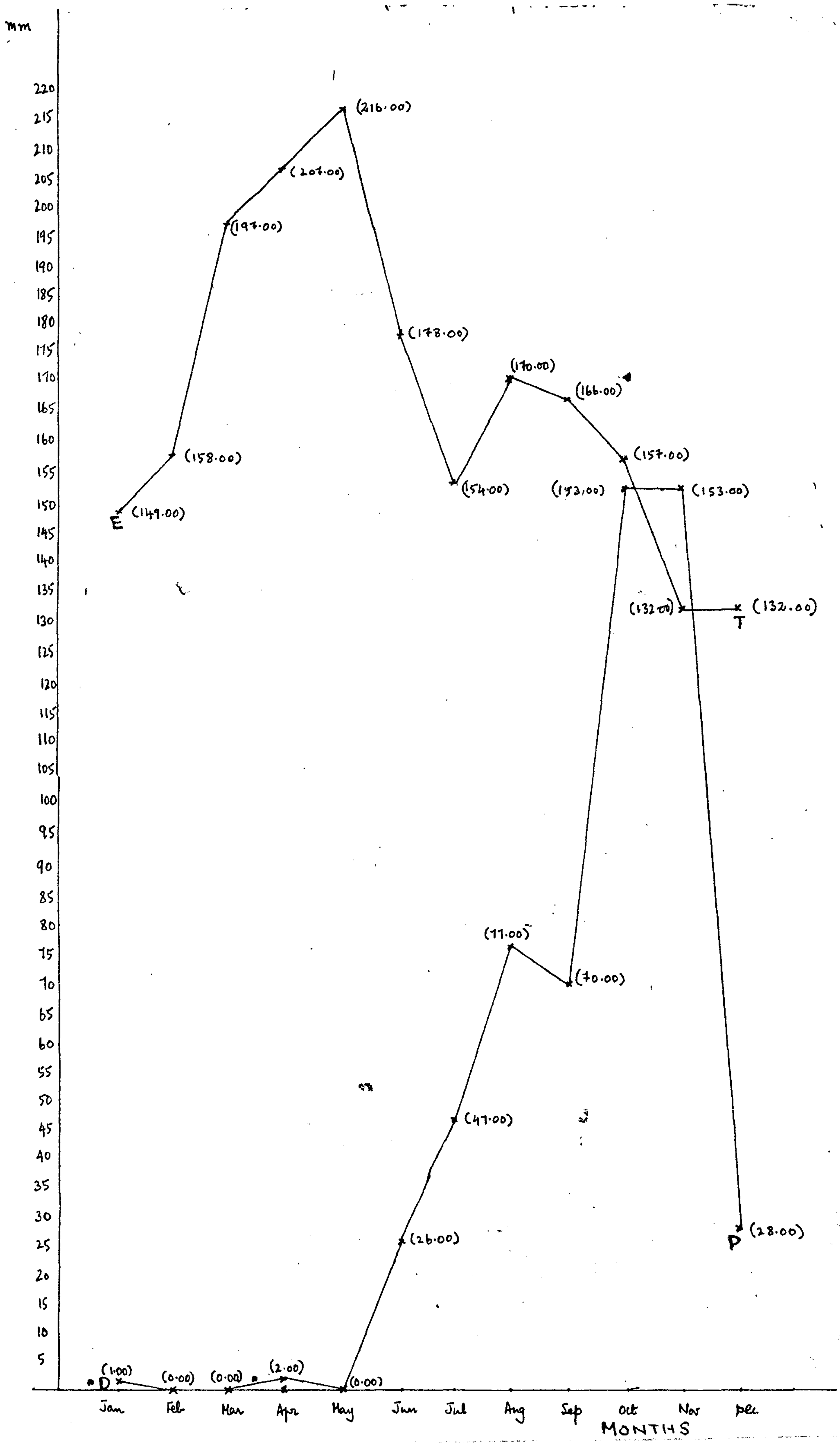
2.1.2 Irrigation Requirements of the District

In the previous chapter, it was pointed out that the relative positions of precipitation and evapo-transpiration in a year, provide an idea about the period available in which crops can be raised solely based on rainfall, thereby pointing out to the quantum and duration of irrigation that would be required (see 1.2.1). What we now propose to do therefore, is to look at the relative positions of these two variables in the case of Chinglepet district. We have plotted in figure 2, for Madras Centre for which data are available, the dependable precipitation at 75 per cent probability and the potential evapo-transpiration.

It may be seen from figure 2, that for eleven months in a year the potential evapo-transpiration (or crop-water requirements) is more than the dependable precipitation. And, only in the month of November, the dependable precipitation is more than the potential evapo-transpiration. The duration of moisture deficit period, i.e. the excess of potential evapo-transpiration over dependable precipitation, is therefore for eleven months in a year. In effect, this means that except for the month of November in all the other months crops can only be raised by supplementing rainfall with irrigation.

It may also be observed from the figure that the quantum of irrigation required to supplement rainfall is quite small in the month of October. In the case

FIGURE 2. RELATIVE POSITIONS OF DEPENDABLE PRECIPITATION AND EVAPO-TRANSPIRATION IN MADRAS CENTRE



SOURCE: VAIDYANATHAN (1983).

of the other ten months, the quantum of irrigation required is very large during the six months of January to June, and is quite substantial in the remaining four months. As opposed to this during the month of November, on the other hand, when dependable precipitation is more than potential evapo-transpiration, the problem is one of providing effective drainage to prevent water logging.

The situation that is obtained in Chinglepet district is therefore, one where the duration for which irrigation is required, and the quantum of irrigation required is quite large. Under such conditions irrigation needs can be met only if the surplus waters of the monsoon period are stored either on the surface or underground.[6] What we now propose to do therefore, is to describe the various types of irrigation sources that meet the irrigation requirements of the district.

2.1.3 Irrigation Sources in Chinglepet District

In the district there are four different irrigation sources, viz., tanks, wells, canals, and other sources like spring channels, etc. In Table 2, three-year moving averages of the net area irrigated by these sources for the years 1950-51 to 1977-78 is provided. In Table 3, the details of the proportion of area irrigated by the above mentioned sources in the total is provided. Based on all these, the following observations may be made.

The total net irrigated area in the district has shown an increasing trend from 1950-51 to 1962-63; though, the increase was sharper since 1957-58.[7] But, since

6. For an extended exposition on these aspects see Vaidyanathan (1983: 27-30).

7. It may be observed from the details presented below for a few time points that, the net irrigated area as a proportion of net sown area kept fluctuating. On the other hand, the net sown area had shown increasing trend throughout.

Year	Net area sown (hectares)	Net area irrigated (hectares)	Net area irrigated as a proportion of net sown area (per cent)
1950-51	258239	165253	64.0
1955-56	275166	166603	60.5
1960-61	327600	243802	74.4
1964-65	331747	204071	61.5
1970-71	335976	249161	74.2
1975-76	338957	243069	71.7
1978-79	345225	259770	75.2

Source: Season and Crop Reports, GOTN (various issues).

Table 2

Area Irrigated (Net) by sources in Chinglepet District
(Three year moving averages)

(in hectares)

Mid-year of the three year series	Canals	Tanks	Tube wells	Wells	Others	Total
1951-52	9882	119849	—	18124	2934	150790
1952-53	4870	120478	—	20009	2940	148297
1953-54	3784	134158	—	18108	2569	158620
1954-55	3990	138969	—	18432	2893	164285
1955-56	4450	149781	—	17450	3047	174729
1956-57	4905	153146	—	17174	3227	178452
1957-58	5225	158718	—	19088	3472	186509
1958-59	4494	157715	—	25585	4571	192377
1959-60	4096	169206	17	34749	5694	213762
1960-61	3902	181815	21	39559	6364	231661
1961-62	4785	196821	25	43198	7082	251910
1962-63	4978	187499	29	40495	6542	239543
1963-64	4836	176752	38	38448	6002	226077
1964-65	4517	167518	36	32277	4507	208856
1965-66	4868	173556	35	31705	5539	215702
1966-67	5209	180883	28	31764	6373	224257
1967-68	4917	158320	57	34857	6318	204472
1968-69	5058	155582	1462	36893	4912	203911
1969-70	5584	158237	3022	39104	4434	210386
1970-71	6744	182324	4583	39243	5345	238238
1971-72	7008	182733	5173	39225	5461	239599
1972-73	6895	174427	5806	39958	5558	232645
1973-74	5963	150032	6686	43117	5173	210970
1974-75	6750	142862	9425	49537	6873	215448
1975-76	7714	143377	13835	54446	6948	226320
1976-77	9116	161859	17608	58862	7407	254851

Source: Season and Crop Reports, GOTN, (various issues).

Table 3

The Proportion of Area Irrigated by Sources

Years	Canals	Tanks	Tube Wells	Wells	Others	Total
1950-51	11.34	76.70	-	9.97	1.99	100.00
1951-52	5.02	77.79	-	14.86	2.33	100.00
1952-53	2.67	84.11	-	11.68	1.54	100.00
1953-54	2.35	81.53	-	14.02	2.10	100.00
1954-55	2.17	87.85	-	8.74	1.24	100.00
1955-56	2.77	84.19	-	11.07	1.97	100.00
1956-57	2.69	85.17	-	10.14	2.00	100.00
1957-58	2.79	88.01	-	7.74	1.46	100.00
1958-59	2.93	82.29	0.01	12.67	2.10	100.00
1959-60	1.40	76.46	0.01	18.71	3.42	100.00
1960-61	1.57	78.99	0.01	16.98	2.45	100.00
1961-62	2.05	79.69	0.01	15.79	2.46	100.00
1962-63	2.07	75.93	0.01	18.54	3.45	100.00
1963-64	2.13	79.64	0.01	16.10	2.12	100.00
1964-65	2.24	79.66	0.03	15.91	2.16	100.00
1965-66	2.12	81.27	0.01	14.40	2.20	100.00
1966-67	2.40	80.41	0.01	13.89	3.29	100.00
1967-68	2.44	80.33	0.02	14.21	3.00	100.00
1968-69	2.37	68.83	0.07	25.80	2.93	100.00
1969-70	2.60	77.37	1.88	16.70	1.45	100.00
1970-71	2.88	77.27	1.89	15.77	2.19	100.00
1971-72	2.99	74.97	2.00	16.99	3.05	100.00
1972-73	2.90	76.53	2.62	16.38	1.57	100.00
1973-74	3.00	73.41	2.90	18.17	2.52	100.00
1974-75	2.51	61.00	4.25	28.72	3.52	100.00
1975-76	3.71	63.45	5.85	23.41	3.58	100.00
1976-77	3.73	64.83	7.61	21.54	2.29	100.00
1977-78	3.30	62.24	7.20	24.37	2.89	100.00

Source: Table 2.

1962-63, the net irrigated area has been fluctuating with no visible trend. Coming over to the different sources of irrigation, it may be observed that the net area irrigated by canals does not exhibit any trend, and the proportion contributed by it to the total is insignificant.

Tanks, account for the major proportion of total net irrigated area in Chinglepet district (see Table 3). It may be observed from Table 2, that the area irrigated by tanks had shown an increasing trend till 1961-62. And, the proportion of area irrigated by tanks also showed an increasing trend till 1958-59 (see Table 3). In fact, it may be stated that the increase in total net irrigated area between the years 1950-51 to 1960-61, was largely due to the increase in net area irrigated by tanks. Since, 1960-61 the area irrigated by tanks kept fluctuating. But, from the end of 1960's, there was a definite deceleration in both the area irrigated by tanks and the share of tanks in total net irrigated area.

But, the decade of 1970's has been something of a paradox with regard to tank irrigation. While the area irrigated by tanks, and the share of tank in total net irrigated area decreased, the number of tanks in the district increased. It may be observed from Table 4, where information on number of tanks in the district under two groups, viz., tanks with ayacut of 100 acres or more and tanks with ayacut less than 100 acres is provided, that the number of tanks increased in the period 1950-51 to 1977-78. It may further be observed that while the number of tanks had increased, the tanks with ayacut of 100 acres or more had decreased and the number of tanks with an ayacut of less than 100 acres had shown an increasing trend throughout.[8]

The factor that may account for this apparent paradox is - since, majority of tanks in the district receive their supply of irrigation water from precipitation flows, a reduction in the quantum of precipitation in a year may lead to a

reduction in the area irrigated

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8. It is not clear whether the increase in number of tanks with ayacut less than 100 acres, is due to the construction of new tanks, in the post-independence period or, reclamation of tanks that had fallen into disuse. And, whether the decrease in number of tanks with ayacut of 100 acres or more, is due to the fact that they had fallen into disuse?

Table 4

Number of Tanks in Chinglepet District, 1950-51 - 1977-78

Years	Number of Tanks		Total
	With ayacut less than 100 acres	With ayacut of 100 or more acres	
1950-51	1581	1047	2628
1955-56	1581	1047	2628
1960-61	1674	1579	3253
1964-65	1714	1483	3197
1970-71	1714	1518	3232
1975-76	2085	1404	3489
1977-78	2291	1362	3653

Source: Season and Crop Reports, GOTN, (various issues).

by the tanks. For instance, during the years 1968-69 and 1974-75, the quantum of precipitation during the North-East monsoon period was only 47.83 per cent and 41.43 per cent respectively of the 'normal' North-East monsoon rainfall. The annual precipitation during these two years was only 58.72 per cent and 64.12 per cent respectively of the 'normal' annual rainfall. And, during these two years the net area irrigated by tanks reduced drastically. During the years 1951-52, 1952-53, 1955-56, 1963-64, 1964-65, 1971-72, 1972-73 and 1973-74, when the net area irrigated by tanks was less compared to the preceding year, the precipitation due to the North-East monsoon, and the annual precipitation during these years were less compared to the 'normal' rainfall. It may therefore be stated that the reduction in precipitation explains, at least partially, the reduction in the net area irrigated by the tanks while, the number of tanks in the district have increased.[9]

9. Siltation of tank bed over the years, reduces the effective storage capacity of the tank, and consequently the area that can be irrigated. But, this still does not explain, why the total area irrigated by tanks declined when the number of tanks in the district increased. Unless, the siltation of tanks has been so extensive as to offset whatever new capacity has been created due to the increase in the number of tanks. This seems highly improbable. One factor which may account for the decline in the share of tanks in the total net irrigated area during the decade of 1970's, is the large-scale increase in the number of wells. We would be dealing with the growth in well irrigation subsequently in this section.

Tube-wells, as a source of irrigation came into force in the district in the year 1958-59. For about ten years the net area irrigated by them was less than 100 hectares. But, from the end of 1960's, the tube-wells shot into prominence as a source of irrigation, and have since then exhibited a sharp increasing trend.[10] It may be observed from the Table 2 and 3, that the increase in the net area irrigated by tube-wells was sharper in the years 1969-70 and 1975-76. It may be observed from Table 1, that the years preceding these two years were of poor rainfall. In 1968-69, the precipitation during the North-East monsoon and the total annual precipitation were only 47.83 per cent and 58.71 per cent respectively of the 'normal' rainfall figures. For the year 1974-75, they were only 41.43 per cent and 64.12 per cent respectively of the 'normal' rainfall figures. The poor rainfall during these years might have prompted the installation of more tube-wells, leading to an increase in the net area irrigated by tube-wells in the succeeding year.

Wells, have been gradually gaining importance as a source of irrigation in the district. It may be observed from Table 2, that the net area irrigated by wells exhibited an increasing trend from 1956-57 to 1961-62, and then kept fluctuating, and again exhibited an increasing trend from 1965-66 onwards. It may also be observed from Table 3, that the proportion of total net area irrigated by wells has been increasing since the end of 1960's. In fact, it may be stated that whatever increase took place in the total net irrigated area in the district during the 1970's was largely on account of wells (along with tube-wells). Like in the case of tube-wells, the increase in the area irrigated by wells may atleast partially, be related to the poor rainfall. For instance, the increase in area irrigated by wells in the years 1958-59, 1960-61, 1973-74, 1974-75, and 1975-76 might have been a result of low rainfall in relation to 'normal' rainfall in the preceding years (see Table 1). But, though in the years 1958-59, 1960-61 and 1975-76 there was excess rainfall in relation

10. The number of tube-wells in the district increased from 5 in 1960-61 to 6 in 1964-65. But, thereafter the number of tube-wells in the district increased significantly. The number of tube-wells in the districf was 1,325 in 1970-71 in 1975-76 it was 5,773 and it increased to 6,237 by 1978-79, Season and Crop Reports, GOTN, various issues.

to 'normal' rainfall, there was significant increase in the net area irrigated by wells in the succeeding years. Another factor which might have contributed for the increase in the net area irrigated by wells, especially in the decade of 1970's, is the Government intervention in promoting well irrigation. This aspect, viz., Government intervention would be taken up, later in this section (see 2.1.4).

In Table 5, details regarding the number of wells, number of wells having independent ayacuts, number of wells supplementing recognised sources of irrigation, and the net area irrigated by them is provided for few selected years. It may be observed from the table that the total number of wells showed an increasing trend since the mid-1960's. On the other hand, there is no such discernible trend in the case of

Table 5

Characteristics of wells in Chinglepet district, 1950-51 to 1977-78

Years	No. of wells used for irrigation			Net area irrigated (in hectares)	
	Total number	Having independent ayacut	Supplementing recognised sources of irrigation	Sole irrigation	Supplementary irrigation
1950-51	43053	21364	21877	16473	17218
1955-56	40618	20899	19616	18440	29275
1960-61	55689	37329	18365	41391	13513
1964-65	57988	33252	24926	32472	25611
1970-71	64247	38196	27376	39285	12943
1975-76	70795	36015	40553	56876	24411

Source: Season and Crop Reports, GOTN, (various issues).

number of wells with independent ayacut although, the net area irrigated by them had increased since mid-1960's. But, the number of wells supplementing recognized sources of irrigation had increased since 1960-61, and the increase was very significant between 1970-71 and 1975-76 although, the net area irrigated by them exhibit no trend.

The other sources of irrigation, viz., spring channels etc. account for an insignificant proportion of total net irrigated area, and hence, do not merit attention.

To recapitulate, the irrigation requirements of the district is considerable, both in terms of the duration and quantum required. Tanks are the chief source of irrigation in the district, and they account for the major proportion of total net irrigated area. But, the importance of tanks in the district has been declining gradually. On the other hand, the wells have been gradually gaining importance as a source of irrigation. The number of wells supplementing recognised sources of irrigation have also been increasing over the years in the district. This in effect (in the context of Chinglepet district) means that the investment in private sources of irrigation (viz., wells) are made to supplement tank irrigation, one of the causes could be the poor maintenance of community sources of irrigation. Be that as it may, but the investment in private sources of irrigation has another dimension, in that, it would further discourage the continuous process of care for the community sources of irrigation.

Having described the different types of irrigation sources in the district we now propose to go into the factors conditioning the prevalence of these types of irrigation sources in the district.

2.1.4 Factors conditioning the prevalence of different types of irrigation sources

In Chinglepet district, there are five rivers, viz., Palar, Araniar, Kortalayar, Cooum and Cheyyar.[11] They are highly capricious and uncertain in nature, and most of them have a maximum flow of six to eight weeks in a year. This is only to be expected, given the nature of distribution of rainfall in the district. Except a small storage work across Palar which is mostly used to feed some tanks, there is no diversion work or anicut which feed canal systems, across any of the rivers. All the rivers in the district are tapped at various places along their course to feed adjoining tanks. These rivers, therefore, are less useful as direct sources of irrigation than as feeders of tanks (Mencher, 1978: 40-43). The reason for this is not so much because the technology to construct dams to feed canal networks was not

11. For a description of the course of these rivers see Crole (1879: 2); and also Mencher (1978: 40-43).

available.[12] But, more so because all the rivers are highly capricious, and there are no extensive plains along the course of these rivers to permit canal irrigation.

The district, which is flat near the sea, is mostly characterised by undulating plains interspersed with conical or ridged hills elsewhere. Irrigation, therefore, inevitably as it were, had to be based on using these local topographic variations to impound the seasonal flow of precipitation. And, historically earthern bunds were erected across the valleys or slopes to impound the seasonal flow of precipitation, and also to store the seasonal flow of river water. These earthern bunds to store water are referred to as <u>eris</u> or tanks.

Tanks can be classified based on their source of water. Tanks supplied by rivers are referred to as system tanks, and are meant as storages to prevent river water going waste. This is achieved by erecting diversion weirs or making cuts in the banks of rivers and diverting water to the tanks. In the district, according to the P.W.D. authorities, there are five such tanks. Tanks otherwise, are usually at the whim of rains. These rain-fed tanks often form a chain, i.e. the surplus waters of one tank will flow down to a tank lying below and so on. Apart from these rainfed chain system of tanks, there are also rain-fed isolated tanks.

Wells, as noted earlier, are the second most important source of irrigation in the district. Traditionally, water was lifted from the wells either manually or by using draught power. Because of the huge costs involved in lifting water, well irrigation did not develop on a large scale in the district. In 1891-92, there were 10,624 private wells in the district, and the total number increased to only 24,616 by 1941 (Mencher, 1978: 44). The introduction of oil-engines around the beginning

12. In the Sangam literature (which were written prior to about 200 A.D. or so), there are references to cultivation of paddy by irrigation. But the irrigation was based mainly in diverting the seasonal inundatation flows in the rivers into ponds and tanks, from where water was led through channels. In this literature, there are also references to the adoption of lift irrigation practices to cultivate paddy (see Singaravelu, 1966: 43-46). But, the irrigation technology developed steadily thereaffer. For instance, most of the anicuts found across the river Tambraparani in Tamil Nadu were constructed around 13th or 14th century (see Pate, 1917: 170-172, and also Ludden, 1979).

of this century enabled those who were able to invest in them to lift more water at a lower cost. But, the large-scale use of oil-engines to lift water occurred around the mid 1950's only.[13]

The rapid rural electrification programme begun by the Tamil Nadu Government around the end of 1960's, provided an impetus for the intensive exploitation of ground water in the district. This enabled the fitting of wells with electric pumpsets and commissioning of tube-wells for irrigation purposes. A major factor, responsible for the emerging importance of wells in the district from the mid-1960's, apart from the rural electrification programme is the Government intervention in promoting well irrigation. In Tamil Nadu, from the Third plan onwards there was a shift in Government policy on minor irrigation. The shift in policy was not just a shift from major irrigation to minor irrigation but, it was more of a shift from public irrigation to providing subsidies for private irrigation, especially pumpsets and wells (Kurien, 1981: 122-123 and 129). Liberal credit facilities were also made available for the purchase of pumpsets and installation of tube-wells (Venkataramani, 1974: 41) and these were accompanied by subsidised supply of electricity for agricultural purposes. To recapitulate, in this section to begin with, after highlighting the irrigation requirements of the district - which is quite considerable both in terms of duration and quantum required - an account of the various sources of irrigation that meet the irrigation requirements was provided. It was pointed out that tanks occupy a prominent position in the irrigation scenario of the district but, their prominence has been on the decline in the past few years. On the other hand, the importance of wells has been gradually on the increase. Finally, an account of the factors that condition the prevalence of the different irrigation sources in the district was provided.

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13. The number of oil engines in the district increased from 1889 in 1950-51 to 2,181 by 1955-56, and 10,729 by 1960-61. But, their number declined thereafter, to 8,592 by 1964-65, and 4,730 by 1970-71 (Season and Crop Reports, GOTN, various issues). But, according to the Indian Livestock Census, GOI, 1956 and 1966, the number of oil engines in the district which was 4,519 in 1956 declined to 2,329 by 1966.

    One reason for the decline in importance of oil-engines in the district could be the rural electrification programme started around the end of 1960's which enabled the energisatation of wells by means of electric pumpsets, which were cheaper and less cumbersome compared to oil engines. This can be observed from the fact that the number of electric pumpsets in the district increased from 2,386 in 1956 to 19,655 in 1966 (Indian Livestock Census, GOI; 1956 and 1966). And, in 1977-78, out of the total number of about 75,621 dug-wells used for irrigation, 50,155 were fitted with electric pumpsets, and only 2,947 wells were fitted with diesel pumpsets (Season and Crop Reports, GOTN; 1977-78).

Tanks being prominent in the irrigation map of the district a micro-study of a tank should be useful at going behind the factors responsible for their decline in the district. It is with this backdrop that in the next section a description of the physical environment of village A is attempted.

2.2 Physical Environment of Village A

Moving away from the macro picture of the Chinglepet district, we now propose to describe the physical environment of the specific village under consideration (hereafter referred to as village A). Apart from the description of village location and topography, the emphasis here would be on the description of rainfall characteristics. The need for this emphasis is evident from the previous section where a description of the rainfall characteristics and, the consequent requirement of irrigation of the district was provided.

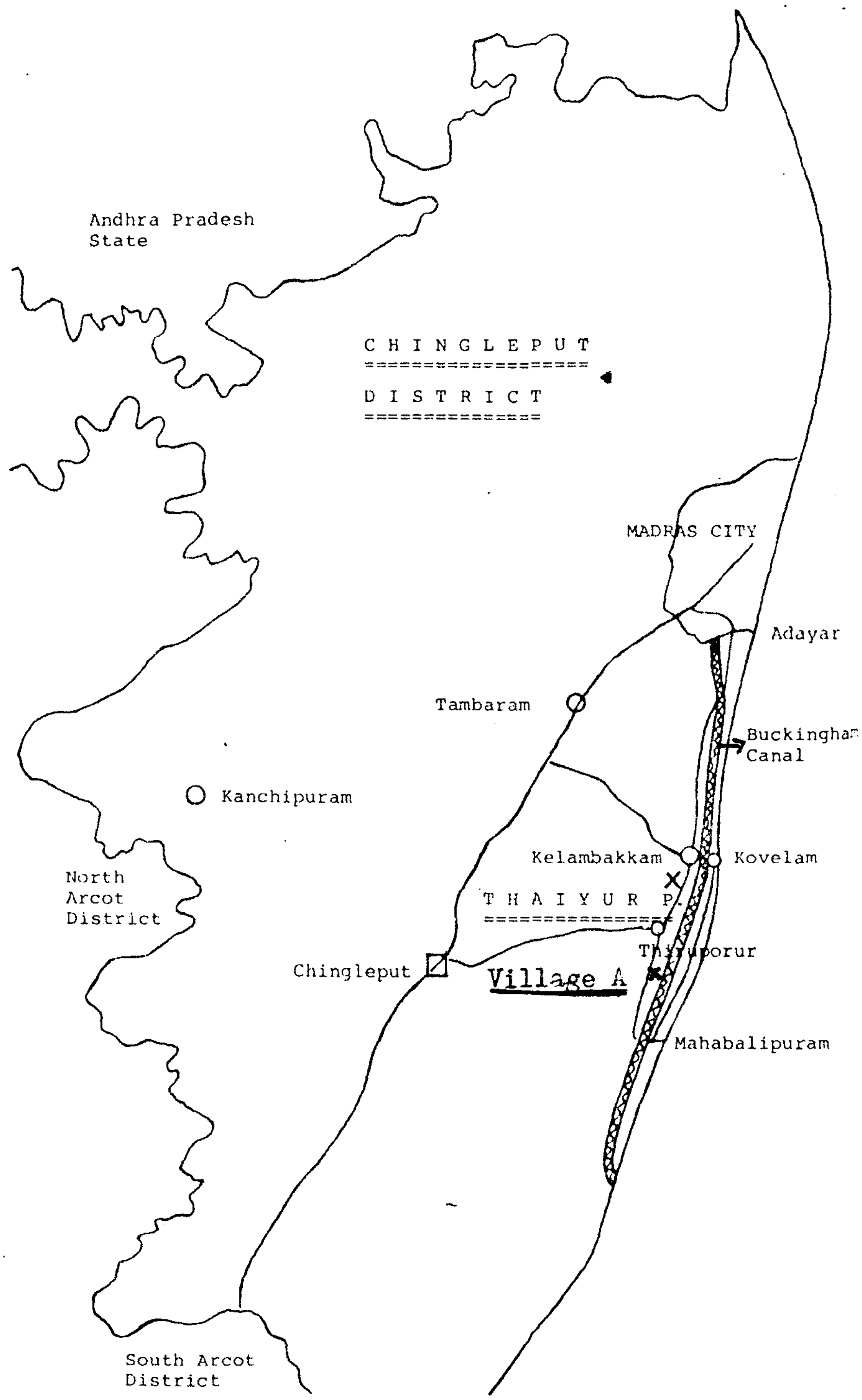
2.2.1 The Location

Village A, which is located in the Chinglepet taluk of Chinglepet district lies to the South-East of Chinglepet town, and is situated close to the coast of Bay of Bengal (see map 1). The village is situated near Tiruporur, an important religious centre on the Tiruporur - Tirukalikundram road. It is connected by road both to Chinglepet town and Madras city and, is about sixty kilometres away from the latter.

2.2.2 Topography

The village is characterised by a flat terrain except for one or two stony outcrops. To the North-West of the village, there is a small hillock and, the land gently slopes down from the North-West to South-East of the village. The slope downwards continues and, a portion of the cultivable land of the village, which lies to our right as we face eastward is slightly low-lying compared to the village-site and other cultivable lands. Almost towards the boundary of the village, close to the road

Map 1: Location of Village A



leading from Tiruporur to Mahabalipuram, the fields are all slightly low-lying, for, after that the lands start sloping towards the sea.

2.2.3 Rainfall Characteristics

Although our attempt is to describe the rainfall characteristics specific to village A, unfortunately, rainfall details specific to Village A are not available. But, two rain-guage stations are situated in the vicinity of village A. One, at Covelong (spelt as Kovelam in map 1), a fishing village on the Bay of Bengal coast which is about twenty kilometres away from village A by road. The other station is at Tiruporur, which is about six kilometres away from village A. The rainfall details of the latter station are not available for the period prior to the year 1981. The rainfall details of these two stations are available with the Department of Statistics of Tamil Nadu Government.

For our purpose, we rely on the rainfall details of Covelong[14] rain-gauge station, in the absence of specific village-level data on rainfall.[15] In Tables 6 and 7, details regarding the 'normal' rainfall and actual rainfall and, the proportion of rainfall due to different seasons to total 'normal' and total annual rainfall for the years 1976-1980, for Covelong rain-gauge station is provided.

Precipitation falls in the vicinity of Covelong rain-gauge station due to both South-West and North-East monsoons. It may be observed from Table 6, that the South-West monsoon accounts for 31.52 per cent of the 'normal' annual rainfall and, the proportion of annual rainfall due to South-West monsoon varied between 26.28

14. As the year 1981, happens to be an abnormal year we will not be taking it into account in our description of rainfall characteristics. And, since rainfall details prior to the year 1981 are not available for Tiruporur rain-gauge station we would be relying entirely, for our description, upon the rainfall details of the Covelong rain-gauge station.

15. Rainfall depends mostly on contour alignments and, orographic features hence, there is likely to be significant variations in quantum of rainfall even within short distances. And, it appears that rain-gauge station are established more for administrative convenience than any meterological consideration. The limitations not withstanding, we rely on the rainfall details of the Covelong rain-gauge station in the absence of specific village-level data. We assume that, rainfall details of Covelong station reflect broadly the rainfall characteristics of village A and, variations if any are insignificant.

per cent (1980) to 36.28 per cent (1977) for the years 1976-1980. The N rth-East monsoon, on the other hand, accounts for 58.77 per cent of the 'normal' annual rainfall and, for the years 1976-1980, the proportion of annual rainfall due to North-East monsoon varied between 61.78 per cent (1977) to 72.35 per cent (1980), It may be of interest to note here that, although the major proportion of annual rainfall falls due to the North-East monsoon, the quantum of precipitation which falls in one month (in the North-East monsoon season) usually accounts for the major proportion of annual rainfall. For the years, 1976, 1977, 1979 and 1980 the quantum of precipitation during the month of November accounted for 44.32 per cent, 40.69 per cent, 41.73 per cent and 46.39 per cent respectively of the total rainfall. And, for the year 1978, the precipitation during the month of October accounted for 46.12 per cent of the total rainfall. While this is so in the case of actual rainfall for the years 1976-1980, the quantum of precipitation during the months of October and November together accounts for 48.35 per cent of 'normal' annual rainfall.

The pattern of distribution of rainfall in a year in Covelong rain-gauge station may therefore be described as follows: For about five months in a year i.e., from January to May, there is little or virtually no rainfall at all. There is a gradual ascent from June onwards (onset of South-West monsoon) with peak rainfall during the month of November. The distribution of rainfall is extremely skewed with a major portion of the annual rainfall concentrated in one or two months (viz., October and November) in a year. This pattern of distribution of annual rainfall in Covelong rain-gauge station conforms more or less broadly with that obtained for the district as a whole (see 2.1.1).

In Table 7, the details regarding the number of rainy days in the case of 'normal' rainfall and the actual rainfall for the years 1979 and 1980 is provided. A rainy day, according to the meteorological department is of minimum 2.5 millimetre rainfall. It may be observed from the table, that the number of 'normal' rainy days is the highest in the months of October and November, viz., 10.7 days, compared to all the other months. In the year 1979, November had the highest number of rainy days (19 days), and the number was considerably lower in the month of October (12 days) nevertheless; higher than all the other months. In 1980, the number of rainy days in November was eleven and in October it was five which was less than that in the months of July (8 days) and December (6 days).

Broadly, therefore, one may hazard the following observation based on the details contained in Table 7, i.e. the monthly rainfall in Ocfober and November is spaced among more number of days compared to all the other months in a year. But, it is necessary to qualify the observation by pointing out that, on an average (i.e. normal) there are only 10.7 rainy days in the months of October and November i.e. for about 19 days , in each of these two months there is no rainfall. To put differently although the rainfall is spaced among more number of days in the months of October and November compared to all the other months, the number of non-rainy days in these two months, viz., 19 days, point to the fact that there is likely to be a break in the monsoon with a prolonged dry spell between two rainy periods.

Table 6

Proportion of Rainfall during different seasons to total annual rainfall

(in millimetres)

Years	January-May	S.W.Monsoon January-September	N.E. Monsoon October - December	Total Rainfall
Normal	127.0 (9.71)	412.2 (31.52)	768.6 (58.77)	1307.[illegible] (100.00)
1976	9.8 (0.68)	432.0 (30.22)	987.8 (69.10)	1429.6 (100.00)
1977	32.4 (1.94)	604.6 (36.28)	1029.7 (61.78)	1666.7 (100.00)
1978	38.8 (2.41)	436.0 (27.17)	1130.2 (70.42)	1605.0 (100.00)
1979	—	327.6 (29.19)	794.8 (70.81)	1122.4 (100.00)
1980	84.2 (8.14)	449.2 (43.46)	500.3 (48.40)	1031.7 (100.00)

Source: 1. Rainfall Statistics of Tamil Nadu for three years 1975-76 to 1977-78, GOTN, 1978.
2. The normal rainfall figures and rainfall figures for the years 1979 and 1980 were personally collected from Department of Statistics, GOTN.

Note: The 'normal' rainfall figures are averages based on actual rainfall figures of fifty years from 1901 - 1950.

Table 7

Rainfall Details for Covelong Station

(in millimetres)

Months / Years	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total
Normal	50.5 (2.4)	16.0 (0.9)	16.3 (0.8)	13.2 (1.1)	31.0 (1.2)	46.7 (3.6)	93.5 (6.6)	131.3 (8.3)	140.7 (6.7)	302.3 (10.7)	329.4 (10.7)	136.9 (5.5)	1307.8 (58.5)
1976	2.0	Nil	Nil	Nil	7.8	23.8	137.0	129.6	141.6	320.0	633.6	34.2	1429.6
1977	Nil	13.4	Nil	13.4	5.6	114.2	152.2	320.2	18.0	320.6	678.2	30.9	1666.7
1978	2.0	5.0	Nil	31.8	Nil	31.6	32.0	219.6	152.8	740.2	374.8	15.2	1605.0
1979	Nil	Nil	Nil	Nil	Nil	46.8 (5)	56.8 (4)	12.0 (2)	212.0 (6)	258.0 (12)	468.4 (19)	68.4 (5)	1122.4 (53)
1980	43.2 (2)	Nil	2.0	Nil	39.0 (1)	48.6 (5)	123.2 (5)	118.4 (9)	159.0 (11)	247.6 (9)	63.3 (8)	189.4 (6)	1031.7 (54)

Source: See Table 6

Note: The figures in Parenthesis denote the number of rainy days.

On the basis of details contained in the Tables 6 and 7, it is not possible to say anything about the breaks in monsoon, the intensity of rainfall or its variability.[16]

2.2.4 Irrigation Requirements of Village A

In the previous section it was pointed out that the relative positions of precipitation and evapo-transpiration in a year highlight the quantum and duration of irrigation that is required for crop growth (see 2.1.2 also see 1.2.1). Though data regarding precipitation is available for a rain-gauge station in the vicinity of village A, unfortunately no such information regarding evapo-transpiration is available. But, given the fact that the pattern of distribution of precipitation in Covelong rain-gauge station is not very different from that of the district as a whole, it can therefore be assumed that information regarding evapo-transpiration available for the district would more or less hold true in the case of Covelong also.

From Figure 2 above, it was noted that the duration of moisture deficit period is eleven months in a year, and it is only in the month of November that dependable precipitation is more than potential evapo-transpiration (see 2.1.2). To restate, except the month of November when precipitation is more than adequate to meet crop-water requirements, in all the other months there is a need for supplemental irrigation to meet crop-water requirements. It was also noted from the figure that the quantum of irrigation required during the month of October is less compared to the other months.

A point of clarification is imperative at this stage, to wit, the precipitation which falls during the month of November is on an average adequate to meet the crop-water requirements. But, as noted earlier in this section, in the

16. In pp. 35; 4n, it was pointed out that according to a map published in Economic Atlas of Madras State, (1962:22), the coastal areas of the Chinglepet district has a very high coefficient of variability; viz., over 30. Covelong, is situated on the coast of Bay of Bengal hence, it would have a very high co-efficient of variability.

case of Covelong rain-gauge station the duration of dry spell in the month of November is quite high (i.e. on an average about 19 days). Therefore, rainfall by itself cannot ensure soil moisture at appropriate levels. Hence, resort to irrigation in the month of November would be necessary depending upon the growth of the crop.

The question of irrigation leads immediately to the sources of irrigation that are available in village A. The chief source of irrigation in the village is a tank and, ground-water is not tapped very extensively. At present, there are about 32 wells in village A. Since the introduction of electricity 14 of these have been fitted with electric pumpsets and, 2 wells with diesel pumps. These 16 wells together irrigate about 50 acres of land. As pointed out in the framework, our chief concern is with the community sources of irrigation and, the private sources of irrigation are not of direct interest to us. Nevertheless, we would be discussing the role of private sources of irrigation in village A as and when necessary. In the next section, we propose to describe the technical features of the tank in village A, which is the only community source of irrigation in the village.

2.3 Technical Features of the Tank in Village A

Coming to the sources of irrigation, we now propose to describe the relevant technical features of the tank[17] in village A.

The tank under consideration,[18] is situated to the West of village A and, separated from the village by the road leading from Tiruporur to Tirukalikundram. The topography of the tank is one of gentle slope from North-West to South-East.

17. For a detailed description of the technical aspects of irrigation tanks in general see Ellis (1963: 230-272); also see Krishnaswamy (1947: 444-446); Ramaprasad (1981) and GOI (1959).

18. All the technical details regarding the tank under consideration presented here are from, "Descriptive memoirs of Irrigation works in Chinglepet", No.50, Madras Minor basin, Chinglepet district, 1923 (hereafter referred to as Tank Memoir, 1923).

The focus of a tank is on its bund and, in the tank under consideration the bund entirely made of earth is 8,495 feet long, excluding the waste-weirs. The rear-side of the bund is dotted with palmyra trees and thorny shrubs which hold the soil together. The front side of the bund (i.e. the water-side) has been revetted for a total length of 50.10 feet, by placing one foot thick stone on the bund and, packing them with gravel.[19]

The tank in village A is the last tank in a rain-fed chain of six tanks. Hence, it receives the drainage both from its free basin (Eri Ethir Vayil); which is the area which only drains into the tank, and from the combined catchment area, which is the area of the whole catchment above the tank (Ellis, 1963:269). In the case of the tank in village A, the area of the free basin is 3.38 sq.miles, and the area of the combined catchment is 8.72 sq.miles.[20] The tank receives all the run-off from its free basin but, from the remainder of its catchment only the balance which remains after the upper tanks have been filled is received (Ellis, 1963: 270). The maximum discharge from the combined catchment area into the tank under consideration is 1,810 cusecs.

The drainage from the free basin is conducted to the tank by means of a feeder channel (varavu-kal). The feeder channel is an unlined one and, originates near the hillock in the North-Western part of the village. Passing through the fringes of the nearby reserve forest it joins the tank in its left flank. The surplus waters of the upper tank (which is the drainage from the remainder of the catchment area) form into a stream and, empty into the tank.

The tank has four waste-weirs (or, surplus weirs); two in the left flank and, two in the right flank. The total effective length of the four waste-weirs is 204.75 feet and, they are capable of disposing of 1,853 cusecs, which is the maximum flood discharge likely to enter the tank, with a depth of two feet

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19. In irrigation tanks, the revettment is generally provided only in those portions of the bund where the wave actions may be considered to be intensive; see Ellis (1963: 238) and GOI (1959:15).

20. The difference between the combined catchment area and, the area of the free basin is the area of catchment intercepted by the upper tanks. But, this does not include the catchment area of the first tank in the chain. According to Ellis (1963:270), "... the whole catchment of the highest tank on each drainage is free".

[i.e. the difference between the Full Tank Level (FTL) and, the Maximum Water Level (MWL)]. The flood waters discharged over the weirs at times of high flood, form a madavu, traverse the entire length of the ayacut and, empty into the salt marshes adjoining the Buckingham canal.

The water-spread area of the tank at FTL is 22.81 m.sq.ft. and, its capacity is calculated to be 81.20 m.c.ft. According to the Tank Memoir, the tank receives two fillings annually. It is likely that the tank may receive one filling from the South-West monsoon, and another from the North-East monsoon. Or, it is also likely that, the quantum of water drawn from the tank may subsequently be replenished by precipitation flows. Be that as it may, the tank with two annual fillings therefore, has an annual storage capacity of 162.40 m.c.ft.[21] The tank is capable of irrigation lands for six months in a year and, the registered ayacut under the tank is 1,027 acres.[22]

The tank has two sluice-gates to release water for irrigation. The sluice No.1, from the left flank of the tank is locally referred to as the "Mettu-Madagu", and, sluice No.2 from the left flank is referred to as the "Palla-Madagu". The Mettu-Madagu, is a masonary sluice and, its barrel is blocked by sand bags to prevent water flowing out of the tank. The Palla-Madagu, on the other hand has a screw-gearing shutter.[23]

The Mettu-Madagu, has an independent ayacut of 30 acres, i.e., the distribution channel originating from the mouth of this sluice is capable of irrigating only 30 acres of land. The rest of the ayacut, about 1,000 acres or so, is irrigated by the distribution channel which originates from the mouth of Palla-Madagu.

21. The capacity of the tank given here is the one estimated by the Tank Restoration Scheme (TRS) party, which prepared the tank memoirs. The tank memoirs were prepared around the end of the 19th century (Krishnaswamy, 1947: 439), and the capacity of the tank might have reduced since then due to siltation etc. But, there has been no effort made by the P.W.D. authorities to estimate the present capacity of the tank. (see, The Hindu, February 17, 1983; and December 11, 1983).

22. Later, it would be pointed out that the tank irrigates only a portion of the total ayacut, for the major part of the six months.

23. It appears that formerly both the sluices were masonary in nature. The Tank Memoir, makes a reference to this and, says that, "... screw-gearing shutter will be provided to sluice No.2, as the ryot found difficulty in regulation ... of water".

Water released from the Mettu-Madagu, apart from flowing into the channel which irrigates the 30 acres, flows through another channel close to the tank bund, and empties into the distribution channel originating from the Palla-Madagu.

The distribution channel which originates from the mouth of Palla-Madagu and, upto the point where many branch channels (kilai-kals) branch out, is fairly wide and deep and, is referred to as the Podhu-kal (Public distribution channel). Prior to the point where kilai-kals branch out from the Podhu-kal, two channels branch out at right angle from the Podhu-kal (see map 2). The tank water which flows in the podhu-kal, is conducted through these kilai-kals to various portions of the ayacut. The kilai-kals are cut open to draw water and, irrigation from then onwards is done by field-to-field method.

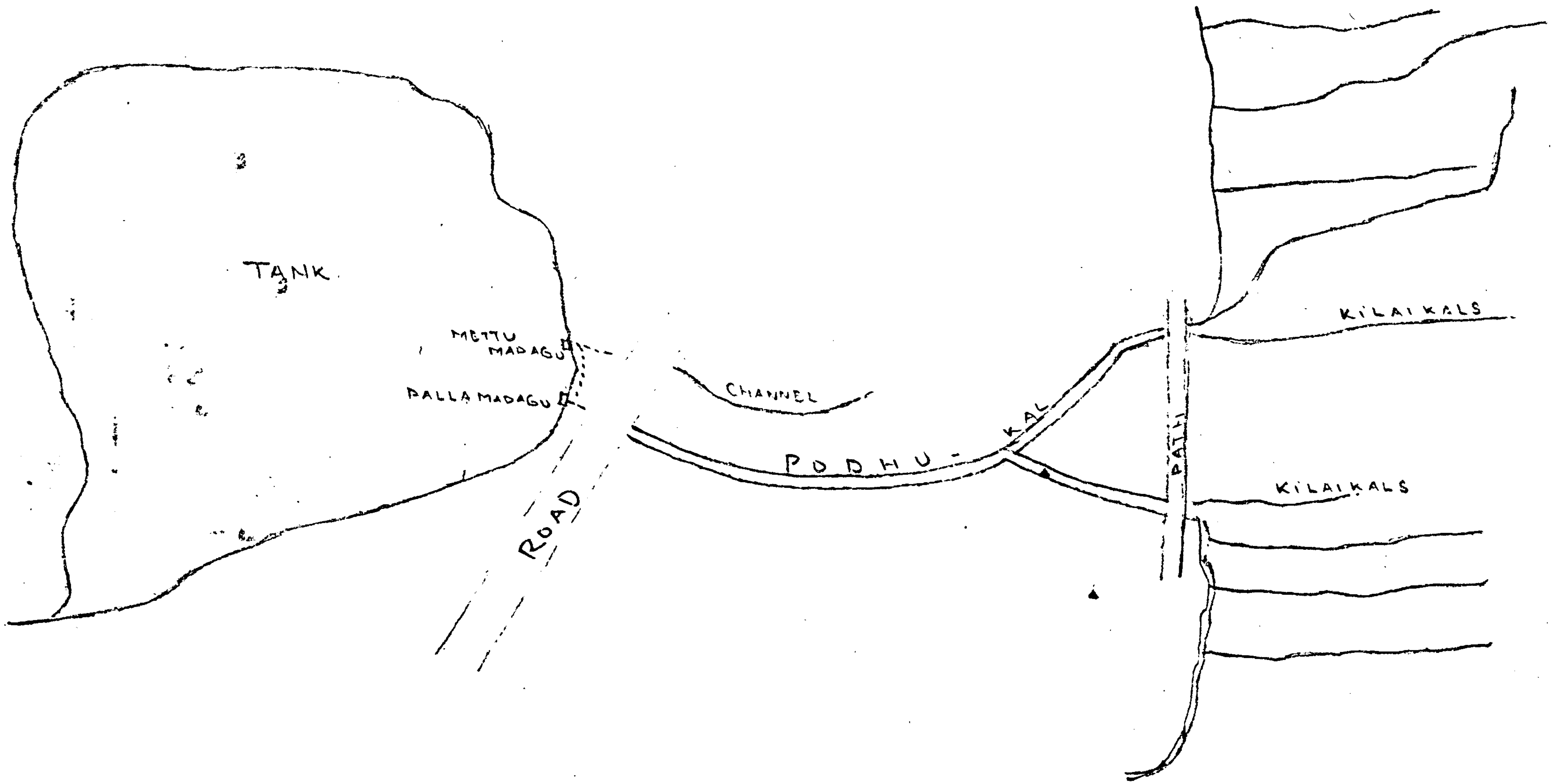
In the ensuing section, we propose to describe the land categories viewed in relation to the village tank.

2.4 Land Categories in Village A

Earlier, it was pointed out that the irrigation requirements of Village A are considerable both in terms of duration and quantum required (see 2.2.4). But, the irrigation requirement highlighted in that section was not crop-specific. It is pointed out by some writers that "... water requirements of all crops must be about the same, if they are grown on the same soil and for the same growing season" (Clark, 1970: 4). Nevertheless, irrigated paddy[24] compared to other irrigated crops requires substantially more quantum of water over and above ET, for keeping the fields submerged and for puddling and transplantation, and percolation losses in the case of paddy fields also tend to be relatively high (Vaidyanathan, 1983: 96 n). In the case of irrigated paddy therefore, the irrigation requirement is higher compared to other irrigated crops.

24. Whenever we speak of paddy in this section, we refer to transplanted paddy whose water requirement and as also the yield are higher compared to dry paddy.

MAP 2. A ROUGH SKETCH OF CHANNELS IN THE AYACUT



That apart, in the case of paddy, irrigation assumes an added significance. It is pointed out that, paddy is the most adaptable food crop and, if enough water remains on the soil until the maturing of the crop, it can produce atleast a little grain on soils that are unbelievably poor in plant nutrients.[25] It is also pointed out that continuous irrigation improves the poor or marginal paddy fields "over the first few years" as it "podzolises the soil ..., and then maintain(s) their fertility indefinitely" (Bray, 1983). This is made possible because, part of the nutrient requirements of paddy are met by irrigation, either in solution or suspended solids (Grist, 1970: 218; Clark, 1970: 23 and also Bray: 1983), consequently leading to the enrichment of the field. The above mentioned facts do show that in the case of paddy, there is a positive correlation between irrigation and yield.

In village A, the predominant crop is paddy.[26] Given the fact that ground water is tapped marginally in village A (see 2.2.4), and also given the fact that there is a positive correlation between irrigation and paddy yields, in the case of the tank - the only other source of community irrigation - proximity of fields to the tank determines the extent of access to water, its reliability, and consequently the yield of paddy.

In this section therefore, it is proposed to describe two land categories. One, plots in terms of reaches from the tank, which would provide an indication of the extent of the ayacut which experiences "difficult" water supply condition. Two, single and double crop lands, which would provide an idea about the extent of the ayacut irrigated once/twice in a year by the tank.

In Village A, the total extent of cultivable land is 1110.51 acres. The extent of dry land (Punchai) is 80.81 acres and it depends on sources of irrigation other than the tank. The rest of 1029.70 acres are wet lands (Nancai), which are irrigated by the tank. To restate, the total irrigable land or the ayacut commanded

25. See Grist (1970: 16).

26. The data regarding the extent of land under paddy would be given later.

by the tank in village A is 1029.70 acres.[27]

Let us now proceed to take up the land categories in village A.

2.4.1 Plots in Terms of Reaches

From the map of the tank and its ayacut we demarcated the ayacut into its Upper, Middle and the Last Reaches. Roughly, plots falling in the first 1/3 of the distance of the ayacut from the Palla-Madagu,[28] have been taken to constitute the Upper Reach. Plots falling in the next 1/3 of the length of the ayacut have been taken to constitute its Middle Reach. And, plots falling in the final 1/3 of the length of the ayacut have been taken to constitute its Last Reach.

The extent of plots in the Upper Reach is 181.26 acres, in Middle Reach it is 395.15 acres and, in the Last Reach the extent is 453.29 acres. The demarcation of the ayacut into its reaches, in a way suggests the portion of the ayacut which experiences "difficult" water supply condition. The plots falling in the Last Reach of the ayacut are the farthest from the tank and, they receive water from the tank only after the plots in the Upper and Middle Reaches are watered. Also, kilai-kals which conduct the tank water to various plots in the ayacut, are virtually non-existent for the major portion of the Last Reach.

Broadly, therefore it can be said that the majority of plots in the Last Reach experience "difficult" water supply condition relative to plots in the Upper and Middle Reaches which experience regular and assured supply of water from the tank.

2.4.2 Soil Characteristics Across the Three Reaches of the Ayacut

Before we go on to describe the other land category, we would very briefly describe the soil sorts prevalent in the plots across the three reaches of the ayacut.

27. The area of the tank's ayacut given earlier is the one given in the Tank memoir (see 2.3). But, according to the Adangal register of the village the tank's ayacut is 1029.70 acres. We would be using the latter figure for our purpose.

28. The reason for taking the distance from the Palla-Madagu is that, the channel originating from the mouth of this sluice irrigates almost the entire ayacut.

In Table 8, details regarding the extent of plots characterised by four different sorts of soils, to wit, good, ordinary, inferior and worst,[29] across the three reaches of the ayacut is provided.

Table 8

Extent of Plots characterised by different soil sorts in the three Reaches of the Ayacut

(in acres)

Soil sorts / Reaches	Good	Ordinary	Inferior	Worst	Total (row)
Upper	89.82 (49.55)	47.46 (26.18)	43.98 (24.27)	-	181.26 (100.00)
Middle	178.49 (45.17)	100.44 (25.42)	70.71 (17.89)	45.41 (11.52)	395.15 (100.00)
Last	-	21.51 (4.74)	70.45 (15.54)	361.43 (79.72)	453.29 (100.00)
Total (column)	268.31	169.41	185.14	406.84	1029.60

Source: Revision Survey and Resettlement Register of Village A, Madras, 1911.

Note: Figures in parentheses represent row percentages.

It may be observed from the table that 49.45 per cent of the total area of the Upper Reach is characterised by good sort of soil. And, only 26.18 per cent and 24.27 per cent of the total area of the Upper Reach is characterised by ordinary and inferior soil sorts respectively. In the case of Middle Reach, 45.17 per cent of the total area is characterised by good sort of soil. And, ordinary, inferior and worst sort of soils account for 25.42 per cent, 17.89 and 11.52 per cent respectively. In the Last Reach, on the other hand, ordinary and inferior sorts of soil account for 4.74 per cent and 15.54 per cent only. And, 79.72 per cent of the total Last Reach is characterised by the worst sort of soil. Thus, the major

29. Information regarding the soil sorts is from The Revision Survey and Resettlement Register of Village A, Madras, 1911. See Baden-Powell (1972: 59-62) for details regarding how the settlement party collected information regarding soil sorts, and how it was mapped for each village.

portion of the Last Reach i.e., about 80.00 per cent of the total extent of the Last Reach is characterised by the worst sort of soil.[30]

In sum the plots in the Upper and Middle Reaches of the ayacut apart from having access to regular and assured supply of water from the tank possess an added advantage of being characterised by better sorts of soil. While this is so in the case of Upper and Middle Reaches in the case of the Last Reach, majority of plots apart from experiencing "difficult" water supply condition from the tank, are also characterised by the worst sort of soil.

Having described the plots in terms of reaches let us now go on to describe the other land category, viz., single and double crop lands.

2.4.3 Single and Double Crop Lands

It was already pointed out that the registered ayacut under the tank is 1029.70 acres. We had also described the land categories, viz., plots in terms of reaches, which hold true for the ayacut as a whole. But, these are relevant only during the first crop-season which stretches from June/July to December. During the second crop-season, which stretches from January to April (i.e. non-monsoon months), the tank has to irrigate only a portion of the ayacut.

The Revision Survey and the Re-settlement Register (1911), for the village lists the survey numbers and their sub-divisions of certain plots as registered double crop-lands. The Adangal register of the village for the year 1981, also has a separate section under the heading "Nancai compound lands under the tank", and lists the survey numbers and their sub-divisions, of plots which are entitled to grow two crops in a year irrigated by the tank. For such registered plots, the

30. Apart from the fact that the major portion of the Last Reach is characterised by the worst sort of soil, being closer to the coast, the soil is extremely saline. The salinity makes cultivation a difficult proposition, and even if the lands are cultivated, the consequent yield is considerably low. And, the salinity problem, apart from making cultivation difficult, makes it difficult to dig wells in the Last Reach of the ayacut; because, the soil caves in. The dug portions have to be packed with concrete or stone slabs to prevent the soil from caving in, thus, substantially hiking up the cost of digging wells.

land-revenue that is payable is compounded by $1/4$ or $1/8$ of single harvest land-revenue. To put differently, these plots have to pay $1/4$ or $1/8$ more than the plots of comparable variety but growing only a single crop.

Baden-Powell (1972: 73), explaining how the revenue settlement under the Ryotwari tenure in Madras Presidency was arrived at mentions that, "... the second-crop payment can be compounded for by a fixed addition to the regular assessment on lands under uncertain sources of irrigation...". He further points out that such registered double crop land is entitled to a supply of water before other land so registered in case there is a need to limit the distribution.

The extent of such registered double crop lands in village A is 272.49 acres. i.e. 26.46 per cent of the total Nancai land, and they are found almost exclusively in the Upper and Middle Reaches of the ayacut. These 272.49 acres of double crop-lands are referred to in the village A as "compound lands". We are not aware when such a demarcation, viz., "compound" vs "non-compound" lands had occurred. It is likely that the demarcation might have evolved over a period of time.[31] It appears that 272.49 acres is the maximum extent that can be irrigated by the tank in village A during the four months of January to April.

2.4.4 Soil Characteristics of "Compound" Lands

Given the fact that "Compound" lands are found almost exclusively in the Upper and Middle Reaches of the ayacut, the soil sorts that characterise the "compound" lands can easily be anticipated. Nevertheless, we would very briefly describe the soil sorts prevalent in "compound" lands, the details of which are presented in Table 9. It may be observed from the table that 66.97 per cent of the total

31. Alaev (1982: 228), mentions that in South India (during C 1200–C 1750), "for the summer crop a part of the best land was allotted, and the productivity was high. Winter crops were grown on a much more extensive sown area and though the productivity was less by a half or one-third, the gross output was much abundant". Though, he does not provide reasons for the adoption of such a practice one presumes that it might be due to the availability of water for cultivation purposes. Such a practice which might have been customary for a long time, might have under the British revenue administration, become more formalized and legalised.

Table 9

Extent of "Compound" Lands characterised by different soil sorts

Soil sorts	Extent (in acres)	Proportion to the total "compound" lands (in per cent)
Good	182.50	66.97
Ordinary	46.34	17.01
Inferior	43.65	16.02
Total	272.49	100.00

Source: Same as in Table 8.

"compound" lands is characterised by good sort of soil. Ordinary and inferior sorts of soil account for only 17.01 per cent and 16.02 per cent respectively. It may also be observed from the table that the "compound" lands are not characterised by any worst sort of soil.

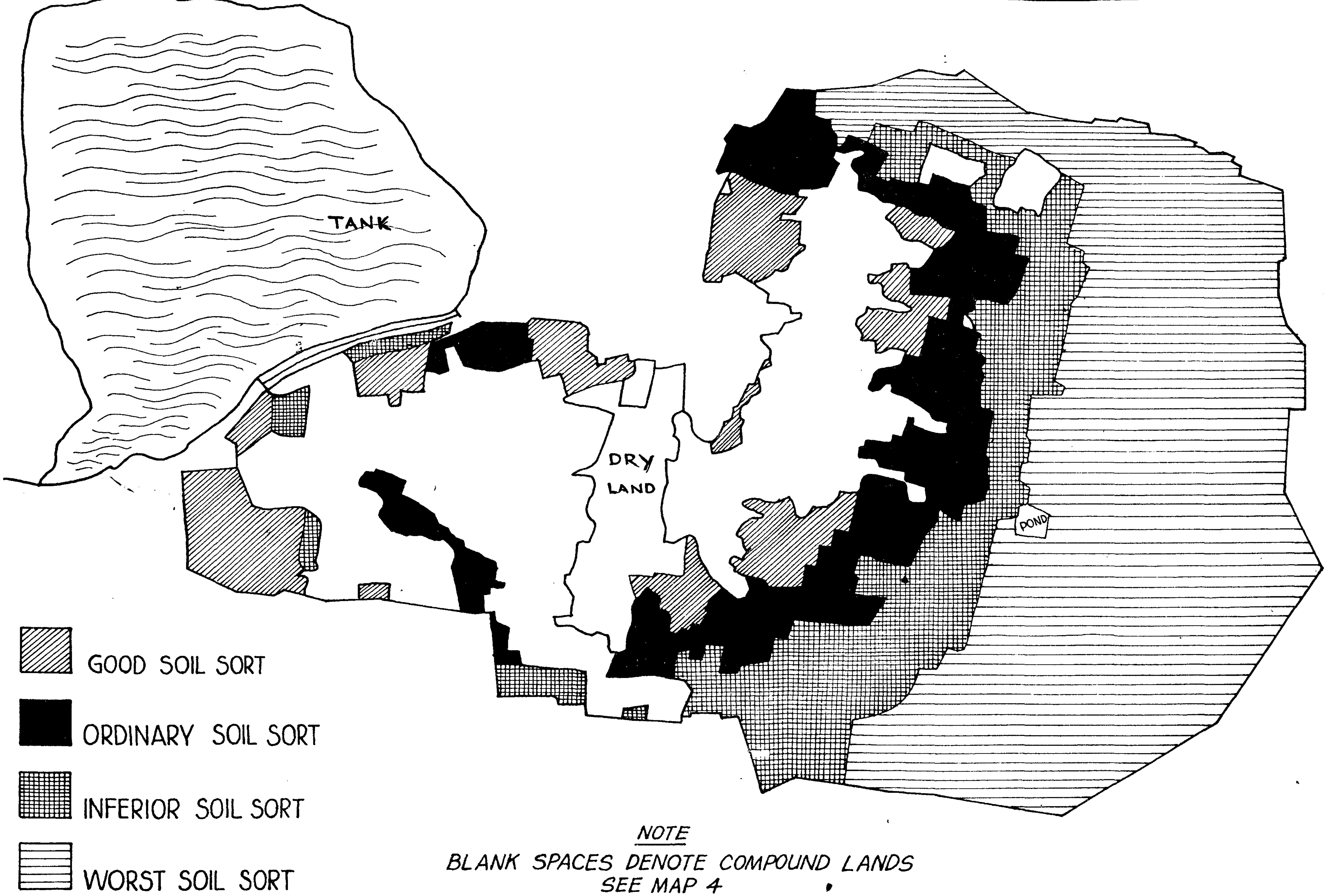
In sum, in this section we described two land categories: one, plots in terms of reaches across the ayacut and two, "compound" vs "non-compound" lands. The former provides an idea about the extent of land that have favourable/difficult access to water from the tank during the first crop season. The latter provides an idea about the extent of land that is irrigated twice by the tank. The relevance of such categorisation lies in the fact that, these indirectly provide an idea about who gains how much on account of the tank in the village.

As pointed out irrigation requirements of Chinglepet district are considerable both in terms of quantum and duration. Tanks occupy the prime place in meeting these irrigation requirements, and they are followed by wells. This picture more or less holds true in the case of the village under consideration. In the case of an irrigation tank, a community source of irrigation, proximity to it determines the extent of access to water, and consequently, the gains on account of irrigation. Hence, we described two land categories - land categories in relation to the tank in question - which provide an idea about the extent of the tank's ayacut which has a favourable access to water, and indirectly providing an idea about who gains how much on account of the tank.

In the next chapter, we propose to describe certain socio-economic aspects specific to village A.

MAP 3

SOIL CHARACHERISTICS OF 'NON-COMPOUND' LANDS

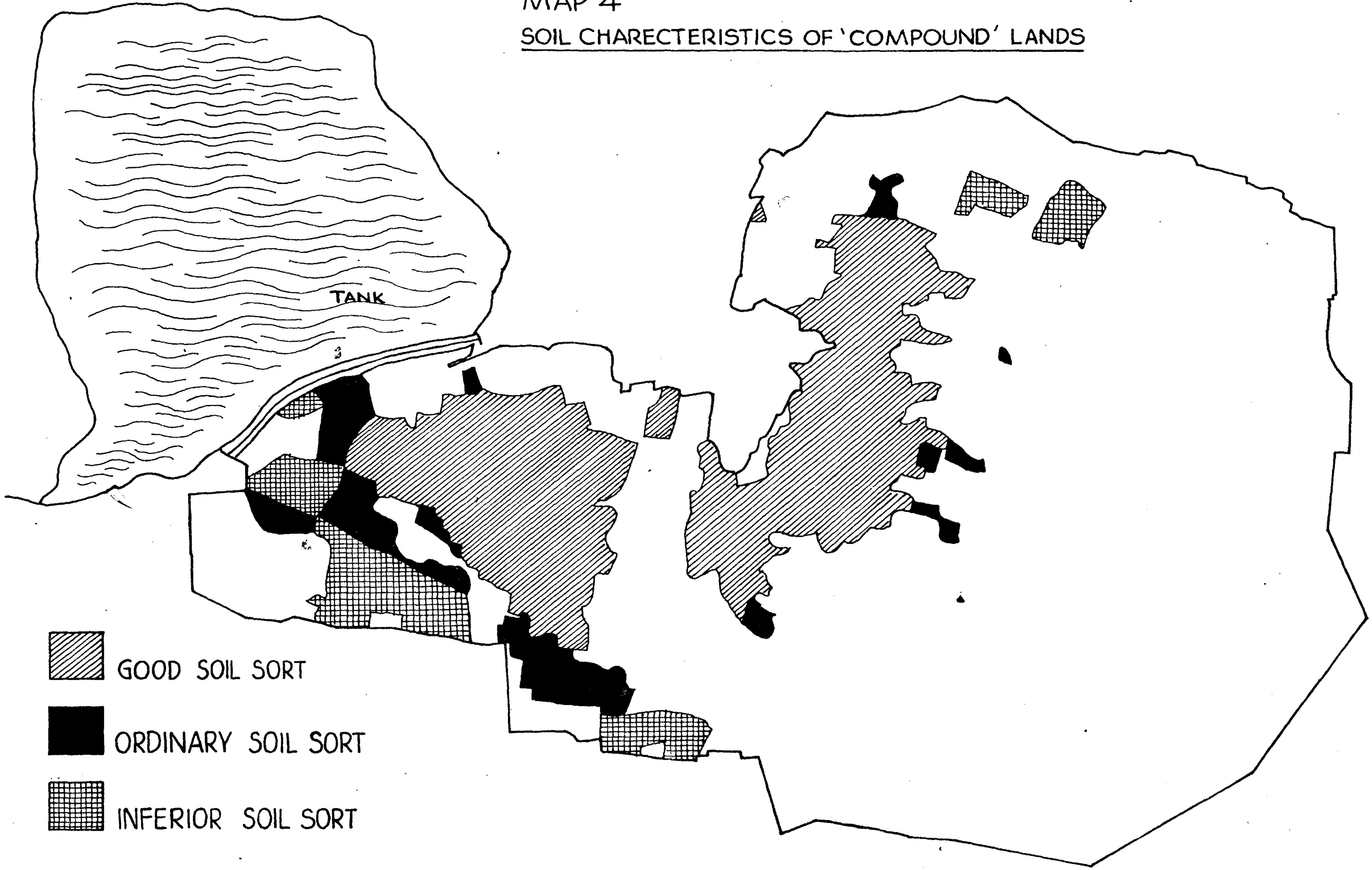


NOTE

BLANK SPACES DENOTE COMPOUND LANDS
SEE MAP 4

MAP 4

SOIL CHARECTERISTICS OF 'COMPOUND' LANDS



CHAPTER 3

SOCIO-ECONOMIC ASPECTS SPECIFIC TO VILLAGE A

In the previous chapter, we described two land categories which provide information regarding the extent/portion of lands which have favourable access to water. Implied in such a categorisation is whoever owns them enjoys a favourable access to tank water. Instead of viewing the ownership of these land categories in individual terms, it is analytically useful to view the ownership of these land categories in terms of certain groups. The problem then is one of identifying groups which are analytically useful. For our purpose, we find caste group as an analytical category provides better insights. In Section 1, therefore we suggest a classification of castes in village A. On the basis of this classification we describe in section 2, the ownership of land categories by caste-groups, which provides an idea about which caste-group has a favourable access to tank water vis-a-vis other caste groups in village A. In Section 3, our concern is slightly different. Therein we propose to describe the irrigation organisation that is supposed to be prevalent as distinct from what is actually prevalent now in village A.

3.1 Caste Structure in Village A

Here we propose to adopt caste as an analytical category. Therefore, in this section, a description of the caste structure prevailing in the village is followed by a classification of castes which would be of use in our analysis. After attempting the classification a detailed description of the role of three castes which are important in the village milieu is provided.

In the year 1981, the total number of households in village A was 425 and the total population 1998[1] which was divided among 12 castes and a few Muslims.

3.1.1 The Classification of Castes

Coming over to the classification of castes, one way in which it can be done is to classify the 12 castes in village A into three broad groups, to wit, Upper castes, Backward castes and Scheduled castes. This classification can be done on the basis of the list of Backward castes and Scheduled castes of the Tamil Nadu Public Service Commission (TNPSC). The castes which are not listed in either of these two groups may be deemed to be an Upper caste.

But what is more important for our purpose than the classification of castes into Upper or Backward is whether or not a particular caste provides labour input for agricultural operations. This assumes importance, as would become clear subsequently,in the context of contribution of labour input for the maintenance of the irrigation system in village A.

It is observed in the context of village A that castes which may be classified as Upper castes/Backward castes and, castes which may be classified as non-labouring/labouring are coterminous. That is, castes which may be classified as Upper castes do not provide labour input but essentially supervise labour contributed by other castes for agricultural operations. The castes which are listed as Backward castes by the TNPSC provide own labour for their agricultural operations. The Backward castes, apart from providing own labour in their fields may also work as agricultural labourers for their own caste cultivators or, occassionally to the Upper caste cultivators. The Scheduled castes have always been the labouring caste working for the Upper caste, the Backward caste and their own caste cultivators.

1. Personally collected from Village Record.

3.1.2 The List of Castes in Village A under different groups

The 12 castes in village A may therefore be listed under three groups, to wit, the Upper caste Non-labouring, the Backward caste - labouring, and the Scheduled caste. The names of the castes under each group is provided below.[2]

I. The Upper Caste Non-Labouring Group (UCNL)

(a) Brahmins
(b) Mudaliars
(c) Chettis
(d) Pillais
(e) Rajas
(f) Naidus/Kammas, and
(g) Nattans

II. Backward Caste Labouring Group (BCL)

(a) Gramani
(b) Naickers
(c) Mestris, and
(d) Asaris

III. Scheduled Caste (SC)

Paraiyan

IV. Miscellaneous

Muslims etc.

The above listing of castes chiefly under three groups apart from providing a classification of castes in terms of upper caste non-labouring/Backward caste labouring etc. also reflects the prevailing social heirarchy in the village. It must be remembered that the above listing does in no way reflect the economic heirarchy in terms of ownership of land prevailing among castes in village A.

The Role of three major castes in the Village Milieu

Though, there are 12 castes in village A except Naidus (UCNL), Naickers (BCL) and the Paraiyans (SC), the rest are not important demographically and/or in terms of

2. The classification is made on the basis of what is supposed to be the general pattern in village A, and aberrations if any have not been taken note of.

land owned by them. Therefore, what we now propose to do is to describe in detail the role of these three castes in the village milieu.

3.1.3 Naidus (UCNL)

It appears that the Telugu speaking Naidus (kammas) and Rajus/Rajas from Andhra Pradesh were the initial colonisers of village A. In the village one of the Naidu landowners house is referred to as the Pazhaiya veedu, i.e. the oldest house and, his ancestors were supposed to have been from one of the first families to settle down in the village. The other caste, viz., the Rajas who, according to the villagers were given to extravagant ways of living sold all their interests in the village and migrated away. This process, viz., the out-migration of Rajas was supposed to have been over by the year 1935.[3]

At present, most of the Naidus live in the main street in the ur (i.e. village proper) and, some of the Naidus live in the street which is at right angle to the main street. The Naidus in village A own the largest extent of land (see Table 11). There are about 4 Naidu households which own more than 30 acres of land each and,

Table 10

The Paraiyan Population in Village A

Year	Paraiyan Population	Total Population	Per cent of Paraiyan Population to total Population
1871[a]	288	699	41.20
1971[b]	1050	1684	62.35
1981[c]	1290	1998	64.56

Source: a. From T.K.Sundari - Personal Communication
b. Census, GOI, 1971.
c. Personally collected from Village Records.

3. According to the 1871 census, which provides village-wise distribution of population by castes, there were no Rajas living in village A at that time (personal communication from T.K.Sundari). But, according to the Resettlement Register of the Village for the year 1911, the Rajas owned sizeable extent of land in the village (about 165 acres of both wet and dry lands). It is likely that the Rajas might have migrated from the village prior to 1871, and operated as absentee landowners. And, they might have sold the lands which they owned in the village by 1935.

At present, there is only one Raja household in the village. The head of this household was formerly employed in the Bombay dockyard. He has very recently bought some lands, and has settled down in the village.

there are no landless Naidu household in the village. The only tractor in the village is owned by a Naidu, who is the owner of the Pazhaiya veedu referred to above. Apart from his personal use he hires it out to other cultivators. And of the 14 pumpsets in the village 10 are owned by the Naidu cultivators.

In village A, the Panchayat President has always been a Naidu. Though the office of Panchayat President is not valid now in Tamil Nadu, as no elections have been held, a Naidu officiates as the panchayat president. The present Panchayat President apart from being a land owner has recently leased in a rice mill in the village, which belongs to a Nattan from a nearby village.[4]

Almost all the Naidu cultivators in the village cultivate their lands directly. They employ Paraiyan casual labourers and some of the Naidu landowners also employ Paraiyans as Padials (attached labour). Few of the Naidu landowners have leased out plots of $\frac{1}{2}$ Kani to $\frac{3}{4}$ kani (i.e. 66 cents to 99 cents) to Paraiyans and, the tenant and his family is expected to work for the landowner whenever required and, they would be paid one rupee or one marakkal less than the prevailing cash/kind wages.

Lately, the children of the Naidu landowners who have had access to education have shown interest in jobs outside the village. Some of them have become school teachers and, the son of a prominent Naidu landowner is a bank employee.

3.1.4 Naickers (BCL)

The Naickers are also referred to as Pallis (Thurston, 1909, Vol.V: 139), Vanniars and Gounders (Harris, 1982: 51). According to Mencher (1978: 128),

> "the Vanniars are more clearly to be differentiated on the basis of their place of origin, those from South Arcot being called Padiyatchis, those from North Arcot Gounders, and those from Chinglepet (including those who came from North Arcot and have resided for many generations in Chinglepet) as Naickers" (see also Sivakumar and Sivakumar, 1979).

4. One other rice mill in the village belongs to a Chettiar family.

It appears that prior to the mid 19th century, the pallis were mostly agricultural labourers, and most of them were 'slaves' of Brahmin landowners (Kumar, 1965: 58). But a gradual transformation took place in their status most of them managed to acquire lands to become cultivators. Kumar (1965: 58), notes that "in 1871 and 1901 again, less than 20 per cent of pallis were agricultural labourers". She further points out that the 1871 Census Report stated that 70 per cent of the Pallis were cultivators. According to Mencher (1978: 149), "in the Sriperumbudur and Kanchipuram taluks (of Chinglepet district), by the end of the 19th century a considerable number of Pallis or vanniyars had come to own land". It must be pointed out here that the "... wonderful change (which) must have taken place... to bring more than two-thirds of them (Pallis) into the class of small farmers...",[5] was not the result of any conscious policy adopted by the British administration. But, wherever Naickers have emerged as landowners it has almost always coincided, especially in Chinglepet district,[6] with the out-migration of dominant landed caste from the village.

A more or less similar process seems to have occurred in village A, with regard to the emergence of Naickers as landowners. It is reported that formerly the Naickers were the tenants to the Rajas and some Naidus, and were also employed as agricultural labourers. In 1911, the Naickers owned only 5.81 acres of land in the village but, at present they own sizeable extent of land (see Table 11). It appears that the Rajas sold away most of their lands to their Naicker tenants when they migrated out from the village. We do not have much information regarding the exact mechanism by which the Naickers acquired lands in the village.

At present, in village A, there are no landless Naicker household. The Naicker households which own less than five acres of land, if necessary, supplement their income by working as agricultural labourers. But they work as casual labourers

5. 1871 Census Report quoted in Kumar (1965: 58).

6. Sivakumar and Sivakumar (1979), point out that the Pallis' emergence as dominant landholders in rural southern chinglepettu occurred in the void created by the departure of many Brahmins.

usually for their own caste cultivators and it is rare to find them working for other castes.[7]

3.1.5 Paraiyans (SC)

Based on the details contained in Table 10, it may be observed that the Paraiyans are the single largest caste in the village. The Paraiyans in village A may be termed as the numerically "dominant" caste, and it may be observed that their "dominance" has in fact been increasing. At present in village A, there are about 250 Pariayan households.

Most of the Paraiyans of the Village live in the Cheri (hamlet) which is slightly separated from the ur. It is situated to the left of the main road leading from the bus-stand. The other paraiyans have built their huts to the right of the main road very close to the bus-stand.

Though, the paraiyans own cultivable lands in the village, as it would become clear subsequently, most of their lands are located very unfavourably in relation to the tank. There are at present about 2 paraiyan households which own more than 10 acres of land and one household also owns a pumpset. These Paraiyan households identify themselves more with the Naidus than their own caste people and blame the other Paraiyans for all the ills of the village.

In the village besides few Asari households which are landless the rest of the landless households are all Paraiyans. These landless Paraiyan households as also some Paraiyan marginal farmers work as agricultural labourers. Earlier in this section, it was pointed out that the Paraiyans have always been agricultural labourers. Prior to the mid-19th century most of the Paraiyans who were held in a state of bondage by the Upper Caste landowners were referred to as adimais (slaves). But, gradually this form of labour arrangement, viz., slavery, was replaced by other forms of labour arrangements.[8] Below, we would detail the three forms of labour arrangement prevalent in village A at present, under which the Paraiyans are employed.

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7. See also Mencher (1978: 230).
8. We would be discussing this in detail in a later chapter (see 5.3).

3.1.6 Forms of Labour Arrangement

(a) Padials - There are at present about 15 Padials in the village, All the Padials are Paraiyans, and they are employed by the Naidu cultivators.[9] The Padials are farm servants usually engaged on a long-term basis as a part of an arrangement whereby they take a loan from their employers and agree to work full-time for them in return for which they are paid in kind (Sundari, 1981: 26) (as the etymology of the name would suggest, Padial means one who is paid by padi, a measure). It is reported that prior to the beginning of twentieth century most of the Paraiyan labourers in the village were employed as Padials. But this particular labour arrangement gradually broke down in village A during this century. In a later section, we would describe this particular labour arrangement in greater detail and analyse the reasons for its breakdown (see 5.3).

(b) Earlier, in this section it was described that some of the Naidu landowners lease out plots of ½ kani to ¾ kani to paraiyan labourers. The landowner has a first claim over the services of the tenant and his family and he also pays them less wages than the prevailing cash/kind wages. The number of such "partially attached labourers" in the village would be around 40-45, and all of them are Paraiyans.

(c) Apart from those employed in the form described in (a) and (b) above, the rest of the Paraiyan labourers are all casual labourers who are employed whenever required.

3.1.7 Alternative Employment Opportunities outside Village A

The village being quite close to Madras city - hardly, 60 kilometres away - about 50 Paraiyans from the village have managed to acquire jobs as lorry loaders.

9. Of the two Paraiyan households, owning more than 10 acres of land, one household had formerly employed a fellow paraiyan as padial. T.K.Sundari (personal communication), informs us that this appears to have been a single isolated instance in the entire district. She informed us, that this used to be talked about with astonishment by many Paraiyans whom she met in other villages. There seems to have been much resentment against this practice even within the village so much so that the household has discontinued the practice. At present the household employs two Paraiyan lads who do all the household chores.

The families of these labourers stay put in the village and supplement the family income by working as agricultural labourers in the village.

In sum, in this section we classified the castes in village A, under three groups. We also explained the role of three castes who are important in the village milieu. In the next section what we propose to do is to analyse the ownership of land categories (see 2.4) by caste-groups described in this section.

3.2 Ownership of Land Categories by Caste - Groups

Earlier, it was pointed out that the productivity of land and consequently the yield of paddy depends largely on the availability of irrigation. To that end, a description of two land categories was provided: (a) plots in terms of reaches from the tank and (b) "compound" vs "non-compound" lands. The former, provides an idea about the extent of the ayacut that experiences "difficult" water supply condition, and the extent of the ayacut that has favourable access to tank water during the first crop season. The latter category provides an idea about the extent of ayacut that is irrigated twice annually by the tank (see 2.4).

The land categories described, on the face of it, explain only the physical fact, viz., the relation of land to water (read as tank). But implicit in the description of land categories is the fact that whoever controls these land categories enjoys/does not enjoy favourable access to tank water. In this section therefore, we propose to take up the ownership of these land categories, in other words, the relation of man to water through the institution of private property in land. In the main, what we propose to do is to describe the ownership of these two land categories by the three caste-group (see 3.1.2) for the year 1981.[10]

10. In our present study we would only be describing ownership holdings and not operational holdings. In the village there is not much of tenancy proper, except the lands leased out by temples and by some chettiars, and the total extent leased out is around 30 to 40 acres. Hence, we have not included the information regarding tenancy in our study.

The source of data for landowership is the Adangal and Chitta registers of the village. But these registers do not provide the caste status of landowners. The same has been obtained on the basis of identification of caste status of landowners by the Talaiyari and Vettiyan of the village. Wherever it is possible we have cross-checked the information provided by both of them with other villagers.

With this introduction let us now take up the ownership of land categories by caste-groups. First, we would describe the ownership of plots across reaches by caste-groups.

3.2.1 Ownership of Plots Across Reaches

Table 11 provides details regarding the extent of plots owned by caste-groups across the three reaches of the ayacut in the year 1981. The table also provides details regarding the proportion of total land owned by each caste-group distributed across the three reaches. Table 12, provides details regarding the proportion of the total extent of each reach owned by caste groups. On the basis of details contained in these two tables the following observations can be made:

(a) The UCNL group owns the largest proportion of total cultivable land in village A, i.e. 45.57 per cent.

(b) The UCNL group owns major proportion of the total Upper and Middle Reach extent but, owns only a small proportion of the total Last Reach extent. The group owns 53.06 per cent of the total Upper Reach extent, and 65.80 per cent of the total Middle Reach extent but, owns only 29.31 per cent of the total Last Reach extent.

(c) It may be observed from the table that the Naidus owning 46.55 per cent of the total Upper Reach extent, 49.04 per cent of the total Middle Reach extent and 17.69 per cent of the total extent of the Last Reach, hold the dominant position within the UCNL group.[11]

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11. The Naidus, own 73.32% of the total land owned by the UCNL group.

Table 11

Ownership of Plots by Caste-Groups across the three Reaches of the Ayacut, in 1981

(in acres)

Reaches / Caste-Groups	Upper	Middle	Last	Total (Row)
1. UCNL	96.17 (19.81%)	258.31 (53.22%)	130.88 (26.97%)	485.36 (100.00%)
Naidus	84.37 (23.71%)	192.52 (54.10%)	78.99 (22.19%)	355.88 (100.00%)
2. BCL	62.58 (32.00%)	72.65 (37.15%)	60.34 (30.85%)	195.57 (100.00%)
Naickers	58.34 (39.59%)	39.07 (26.51%)	49.96 (33.90%)	147.37 (100.00%)
3. Paraiyans	10.99 (3.64%)	52.50 (17.38%)	238.57 (78.98%)	302.06 (100.00%)
4. Miscellaneous (a) Temple lands (b) Muslims (c) Joint pattas of different castes	11.50 (30.76%)	9.10 (24.34%)	16.78 (44.90%)	37.38 (100.00%)
Total (Column)	181.24	392.56	446.57	1020.37

Source: Chitta and Adangal registers of the village for the year 1981.

Note: The figures in parentheses represent the row percentages.

The Naidus are a part of UCNL group and the Naickers are part of BCL group

Table 12

The proportion of total extent of each Reach owned by Caste-groups in 1981

(in per cent)

Caste Groups / Reaches	Upper	Middle	Last	Proportion of extent owned by Caste-groups to total extent
1. UCNL	53.06	65.80	29.31	47.57
Naidus	46.55	49.04	17.69	34.88
2. BCL	34.53	18.51	13.51	19.17
Naickers	32.19	9.95	11.19	14.44
3. Pariayans	6.06	13.37	53.42	29.60
4. Miscellaneous	6.35	2.32	3.76	3.66
Total	100.00	100.00	100.00	100.00

Source: Same as in Table 11.
The Naidus are a part of UCNL group and the Naickers are part of BCL group.

(d) The BCL group, comes next in the order of importance with regard to landownership in the Upper and Middle Reaches. The BCL group, owns 34.53 per cent of total Upper Reach extent, 18.51 per cent of total Middle Reach extent and 13.51 per cent of the total Last Reach extent.

(e) The Naickers, like the Naidus, hold the dominant position within the BCL group.[12] They own 32.19 per cent of the total Upper Reach extent, 9.95 per cent of the total Middle Reach extent, and 11.19 per cent of the total Last Reach extent.

(f) The Paraiyans, fare quite poorly in the ownership of plots in the Upper and Middle Reach but, they own sizeable proportion of the total Last Reach extent.

12. The Naickers, own 75.35% of the total land owned by the BCL group.

They own only 6.06 per cent of the total Upper Reach extent, 13.37 per cent of the total Middle Reach extent but, own 53.42 per cent of the total Last Reach extent.

To restate, the UCNL group (read as Naidus), own major proportion of the total Upper and Middle Reach extent but, own only a small proportion of the total Last Reach extent. They are followed by the BCL group (read as Naickers), who own sizeable proportion of the Upper reach extent. The Paraiyans, on the other hand, own only a small proportion of the Upper and Middle Reach extent but, own major proportion of the total Last Reach extent. Having described the proportion of total extent of each reach owned by caste groups, we would now go on to describe the distribution of total extent owned by each caste group across the three reaches of the ayacut.

(g) Of the total land owned by the UCNL group, 73.03 per cent is distributed across the Upper and Middle Reaches, and only 26.97 per cent of the land is in the Last Reach of the ayacut. In the case of Naidus (UCNL), 77.81 per cent of their total holdings is distributed across the Upper and Middle Reaches of the ayacut, and only 22.19 per cent of their total holdings is in the Last Reach of the ayacut.

To put differently, in the case of the UCNL group, or the Naidus, roughly about 75 per cent of the total holdings owned by them is assured of favourable access to tank water during the first crop-season, and only about 25 per cent of their total holdings experience "difficult" water supply conditions.

(h) For the BCL group as a whole; 69.15 per cent of the total land owned by them is distributed across the Upper and Middle Reaches of the ayacut, and only 30.85 per cent is in the Last Reach of the ayacut. In the case of Naickers (BCL), 66.10 per cent of their total holding is distributed across the Upper and Middle Reaches of the ayacut, and only 33.90 per cent is in the Last Reach of the ayacut.

In other words, in the case of BCL group or the Naickers, like the UCNL group, major proportion of their total holding has a favourable access to tank water during the first crop-season.

(i) But, it is an altogether different tale in the case of Paraiyans. Only 21.02 per cent of the total land owned by them is distributed across the Upper and Middle Reaches of the ayacut, and 78.98 per cent of their total holding is in the Last Reach of the ayacut.

In other words, only about 21 per cent of the total land owned by the Paraiyans has a favourable access to tank water, and about 79 per cent of their total holdings is subjected to "difficult" water supply condition during the first crop-season.

In sum, in the case of UCNL group (read as Naidus), and the BCL group (read as Naickers), major proportion of their total holding is concentrated in the Upper and Middle Reaches of the ayacut. Hence, these two caste-groups have a favourable access to tank water during the first crop-season. On the other hand, in the case of Paraiyans, major proportion of the total land owned by them is concentrated in the Last Reach of the ayacut, and hence is subjected to a "difficult" water supply condition during the first crop-season.

Having described about the ownership of plots across reaches by caste groups, it is now proposed to take up the ownership of the other land category, viz., "compound" lands by caste-groups. This would provide an indication of the extent of access which each caste-group has to the tank water during the second crop season. The "compound" lands are located almost exclusively in the Upper and Middle Reaches of the ayacut (see 2.4.3). Given the fact that UCNL and BCL groups own the major proportion of the total Upper and Middle Reaches extent, it is easy to anticipate the ownership of "compound" lands.

3.2.2 Ownership of "Compound" lands by Caste-groups

Table 13 provides details regarding the extent/proportion of "compound" lands owned by each caste-group for the year 1981. It may be observed from the table that the UCNL group owns 67.52 per cent of the total "compound" lands. The Naidus (a component of UCNL group) own 59.60 per cent of the total "compound" lands, and the Naickers (a component of BCL group) own 18.13 per cent of the total "compound" lands. The Paraiyans on the other hand, own only 5.50 per cent of the total "compound" lands.

Table 13

Extent of "Compound Lands" owned by Caste-Groups in the year 1981

Caste Groups	Extent Owned (in acres)	Per cent to the Total
1. UCNL	183.98	67.52
Naidus	162.41	59.60
2. BCL	62.63	22.98
Naickers	49.41	18.13
3. Paraiyans	15.00	5.50
4. Miscellaneous	10.89	4.00
Total	272.50	100.00

Source: Same as in Table 11.
The Naidus are a part of UCNL group and the Naickers are part of BCL group.

To put differently, the UCNL group (or chiefly the Naidus within that group), have the maximum access to tank water during the second crop-season. They are followed by the BCL group (or chiefly the Naickers within that group), who have the next best access. The Paraiyans on the other hand hardly have any access to tank water during the second crop-season.

The scenario in village A, therefore, is one of extreme "inequity" with regard to access to water from the tank, both during the first and second crop-seasons. This "inequity", which is a direct result of the present ownership of land categories in relation to the tank, also, expresses broadly the prevailing social heirarchy in the village. As the above description shows, the "inequity" in access to water from the tank in the case of village A operates on a caste-basis.

Apart from the "inequity" in access to water, there also prevails another form of "inequity", viz., the ownership of plots characterised by different soil sorts.

If one may use the word, it 'clinches' the issue of inequality that prevails in the village. It is not proposed to describe in detail the ownership of plots by soil sorts but, only a brief description would be provided.

3.2.3 Ownership of Plots by soil sorts

In Tables 14, 15, 16 and 17 the details regarding the ownership of plots by soil sorts under both "compound" and "non-compound" lands is provided. It may be observed from the tables that the UCNL group (or chiefly the Naidus) owns the largest proportion of plots characterised by good soil sort, and the major proportion of total holdings owned by them is characterised by good sort of soil. The UCNL group is followed by the BCL group (or chiefly the Naickers), in the order in ownership of plots characterised by good sort of soil. But, the Paraiyans, on the other hand, own the largest proportion of plots characterised by worst sort of soil, and the major proportion of total holdings owned by them is characterised by the worst sort of soil. And, they own only a very small proportion of plots characterised by good sort of soil which forms an insignificant proportion of the total holdings owned by them. Importantly, though the Paraiyans own "compound" lands, more than 50 percent of it is characterised by inferior sort of soil, and only about 27 per cent of the total "compound" land owned by them is characterised by good sort of soil.

This "inequity" in the ownership of plots characterised by different soil sorts is due to the direct result of ownership of land categories described above. The majority of plots in the Upper and Middle reaches are characterised by good sort of soil, and almost all the plots in the Last Reach of the ayacut are characterised by the worst sort of soil (see 2.4.2 and Table 8). Given the fact that the UCNL and BCL groups own major proportion of the Upper and Middle Reaches extent, and the Paraiyans own the major proportion of the Last Reach extent; it naturally follows that the UCNL and BCL group own the major proportion of the plots characterised by good sort of soil, and the Paraiyans own the major proportion of plots characterised by the worst sort of soil.

Table 14

Ownership of 'Non-Compound' Lands by Soil Sorts in Village A in 1981

(in acres)

Caste Groups / Soil sorts	Good	Ordinary	Inferior	Worst	Total (row)
1. UCNL	67.30 (22.33%)	75.43 (25.03%)	48.73 (31.62%)	109.92 (36.47%)	301.38 (100.00%)
Naidus	54.20 (28.02%)	47. 48(24.54%)	23.42 (12.10%)	68.37 (35.3[illegible]%)	193.47 (100.00%)
2. BCL	9.73 (7.31%)	19.89 (14.96%)	42.50 (31.98%)	60.81 (45.7[illegible]%)	132.94 (100.00%)
Naickers	5.76 (5.87%)	15.60 (15.93%)	30.86 (31.50%)	45.74 (46.70%)	97.96 (100.00%)
3. Paraiyans	7.72 (2.68%)	26.12 (9.00%)	46.95 (16.35%)	206.27 (71.8[illegible]%)	287.06 (100.00%)
4. Miscellaneous	1.04 (3.93%)	1.63 (6.15%)	3.30 (12.45%)	20.52 (77.4[illegible]%)	26.49 (100.00%)
Total	85.79	123.07	141.49	397.52	747.89

Source: Same as in Table 11.

Note: The figures in parentheses represent the row percentages.
The Naidus are a part of UCNL group and the Naickers are part of BCL group.

Table 15

The proportion of total extent in each Soil Sort in "Non-Compound" Lands owned by Caste-Groups in 1981

(in per cent)

Caste Groups / Soil Sorts	Good	Ordinary	Inferior	Worst	Proportion of total 'non-compound' lands owned by caste-groups to total 'non-compound' extent
1. UCNL	78.45	61.29	34.44	27.65	40.30
Naidus	63.18	38.58	16.55	17.20	25.87
2. BCL	11.34	16.16	30.04	15.30	17.78
Naickers	6.71	12.68	21.81	11.51	13.10
3. Paraiyans	9.00	21.22	33.19	51.89	38.38
4. Miscellaneous	1.21	1.33	2.33	5.16	3.54
Total	100.00	100.00	100.00	100.00	100.00

Source: Same as in Table 11.
The Naidus are a part of UCNL group and the Naickers are part of BCL group.

Table 16

Ownership of 'Compound' Lands by Soil Sorts in Village A, in 1981

(in acres)

Caste Groups / Soil Sorts	Good	Ordinary	Inferior	Total (row)
1. UCNL	151.26 (82.21%)	16.61 (9.03%)	16.11 (8.76%)	183.98 (100.00%)
Naidus	134.77 (82.98%)	12.83 (7.90%)	14.81 (9.12%)	162.41 (100.00%)
2. BCL	22.67 (36.20%)	23.28 (37.17%)	16.68 (26.63%)	62.63 (100.00%)
Naickers	14.90 (30.15%)	18.52 (37.48%)	15.99 (32.37%)	49.41 (100.00%)
3. Paraiyans	4.11 (27.40%)	3.06 (20.40%)	7.83 (52.20%)	15.00 (100.00%)
4. Miscellaneous	4.47 (41.04%)	3.39 (31.13%)	3.03 (27.83%)	10.89 (100.00%)
Total	182.51 (66.97%)	46.34 (17.01%)	43.65 (16.02%)	272.50 (100.00%)

Source: Same as in Table 11.

Note: The figures in parenthes represent row percentages.

The Naidus are a part of UCNL group and the Naickers are part of BCL group.

Table 17

The Proportion of Total extent of each soil sort in "Compound" lands owned by Caste-groups in 1981

(in per cent)

Caste Groups / Soil Sorts	Good	Ordinary	Inferior	Proportion of total 'Compound' lands owned by caste-groups to total 'compound' extent
1. UCNL	82.88	35.84	36.91	67.52
Naidus	73.84	27.69	33.93	59.60
2. BCL	12.42	50.24	38.21	22.98
Naickers	8.16	39.97	36.63	18.13
3. Paraiyans	2.25	6.60	17.94	5.50
4. Miscellaneous	2.45	7.32	6.94	4.00
Total	100.00	100.00	100.00	100.00

Source: Same as in Table 11.

The Naidus are a part of UCNL group and the Naickers are part of BCL group.

In sum, what we attempted in this section, is an analysis of the ownership of land categories in village A, for the year 1981. It was pointed out that the prevailing land ownership pattern in village A, has determined unequal access to tank water for different caste-groups, both during the first and second crop seasons. It was pointed out that the UCNL group (or chiefly the Naidus) have the maximum access to tank water during both the first and second crop-seasons. They are followed by the BCL group (or chiefly the Naickers), in the order in terms of access to water from the tank. The Paraiyans, on the other hand, have the worst access to tank water during both the crop-season.

3.2.4 Historical Factors conditioning the present Land-ownership in Village A

It has to be observed here that the present land ownership pattern which determines unequal access to tank water on a caste basis, is not due to any machination on the part of the UCNL group or the BCL group. It is a result of certain historical circumstances, viz., the mirasi tenure which prevailed in most villages of the Chinglepet district, prior to the close of the 19th century. Under the mirasi tenure, which was communal in nature, one particular caste or community owned lands collectively in a village. Though, originally mirasi rights were granted to Vellala caste only, later, due to the dispensation of lands by the Hindu and Muslim rulers to the Brahmins and other castes, the monopoly of Vellalans was broken. But, usually no Paraiyans were allowed to own lands in mirasi villages.

It was probably only because of the Government intervention in attempting to change the form of tenure, that made it possible for the Paraiyans to acquire lands. The process probably began around 1859, when the mirasidars were asked to declare the extent of land which they wished to retain in their holding, and they were informed that, whether they cultivated them or left them waste, they would be liable for full assessment on them (Crole, 1879: 287-288). In 1869, the Government introduced formal Dharkhast rules in Chinglepet district which empowered the Government to settle outsiders in waste lands of the village

(Crole, 1879: 288 and 290). A more specific order concerning the settling of Paraiyans in lands was passed in 1892. By Government Order dated 30 September 1892, the Board of Revenue communicated to the collector of Chinglepet that "all lands that have already been or may in future be purchased by Government at sales for arrears of revenue should be reserved for assignment of Paraihs and other low castes for cultivation or for building purposes".[13]

In spite of all these interventions by the Government to settle paraiyans in lands, it is pointed out that even as late as 1890, the paraiyans who constituted,

> "... 25 per cent of the population possessed only 2 per cent of the land. The proportion would have been considerably lower if certain villages had not existed in which mirasi system did not prevail. These villages only amounted to one-eighth of the total but contained one-third of the holdings held by the Paraiyans" (Hjejle, 1969: 117).

The mirasi tenure, therefore provided the Upper caste the first choice of selecting best lands, for e.g. lands which have a good access to tank water. And, the Paraiyans, could only acquire those lands found to be undesirable by the Upper caste. Hence, the present "inequity" in the relation of man to water through the institution of private property in land operates on a caste basis.

3.3 Irrigation Organisation in Village A

Earlier (see 1.2.5) an irrigation organisation was defined to mean both the structure of an organisation and rules of allocation and maintenance. In this section what we propose to do is to describe the irrigation organisation in Village A, i.e. the structure of the irrigation organisation, and the rules of allocation and maintenance. In this section our concern would only be with what is supposed to be the case, reserving for a later chapter a description of the prevailing state of affairs with regard to the regular activities.

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13. G.O. 30th September, 1892, Numbers 1010, 1010A - Proceedings of the Board of Revenue 5.11.1892 No.723. We are thankful to T.K.Sundari for providing us this information.

The structure of the irrigation organisation in village A, is differentiated in terms of the role of bureaucrats and water-authority roles at the village-level. First, a description of the heirarchical arrangements of the bureaucratic apparatus would be provided followed by a description of the water-authority roles at the village-level.

3.3.1 The role of the Bureaucracy

In Tamil Nadu, all system tanks and tanks irrigating 100 acres or more are under the charge of the State Public Works Department (P.W.D.).[14] The tank in village A has an ayacut of 1027 acres hence, it is under the charge of P.W.D. The tank under consideration is under the charge of Kancheepuram division of P.W.D. The Kancheepuram division of P.W.D. is headed by an Executive Engineer (E.E.). The Kancheepuram division is divided into four sub-divisions, viz., Chinglepet, Madurantakam, Kancheepuram and Sriperumbudur. Each of these sub-divisions is headed by an Assistant Executive Engineer (A.E.E.). These sub-divisions are further broken down into circles,[15] For instance, the Chinglepet sub-divisions is broken down into three circles of Chinglepet, Tiruporur and Tirukalikundram. Each of these circles is headed by a Junior Engineer (J.E.) or an Assistant

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14. In the pre-colonial as also in the early phase of the colonial periods management and maintenance of tanks was supposed to have been done by village communities themselves (see Raju, 1941: 124-125). In fact, we have evidences of the existence of a popular committee to manage the uttiremerur tank in Chinglepet district (Krishnaswamy, 1982). It was the Famine Commission of 1881, which first adumbrated the policy of handing over tanks irrigating less than 200 acres to the Revenue Department after bringing them to a certain standard, and the tanks irrigating more than 200 acres were to be under the charge of the P.W.D. (which was set up in 1856-57 in Madras Presidency)(Report of the Committee appointed under Famine Commission to enquire into the management of irrigation works in Madras, Orissa and Midnapore; together with a supplement on Irrigation system in Soane canals, Behar; 1881:113, see also Krishnaswamy, 1947: 439).

15. With a view to ensure systematic inspection, and maintenance of minor irrigation source, the Government in 1936, ordered that the circle system should be introduced in all the districts where, in the opinion of the Collectors, the conditions were favourable for it. Under the circle system of inspection, each taluk is divided into number of circles compact and contiguous to each other and minor irrigation sources in each circle are attended to in rotation. In 1943, the Government ordered the suspension of the circle system of inspection where necessary and to give preference to tanks which would increase acreage under food crops with a view to augment food production. In 1949, the Government directed that all minor irrigation sources must be inspected every yea r. In 1957, the Government decided that the circle system ordered in 1936 should be enforced and followed rigidly in all the districts (see GOI, 1959: 59-61).

Engineer (A.E.). Below these J.Es or A.Es are the Work Inspectors and Mazdoors.

The tank under consideration falls under the Jurisdiction of the Tiruporur circle of the Chinglepet sub-division. The P.W.D. in this case is responsible for carrying out only the intermittent maintenance activities, viz., repairs to the bunds, sluice-gates etc. Having described the hierarchical arrangements of the P.W.D., let us now go on to describe the water-authority roles at the village level.

3.3.2 Water-Authority Roles at the Village-level

Though, the village panchayat has no responsibility with regard to activities pertaining to irrigation, the Panchayat President has always been responsible for implementing the rules or organising the allocation of water, and maintenance of channels. As pointed out elsewhere (see 3.1.3) in village A the Panchayat President has always been a Naidu. Though, at present the office of the panchayat president is not valid, a Naidu officiates as the panchayat president. Below the Panchayat President are the Kambukuttis (ditch-tenders), who are responsible for the allocation of water among the various users. In village A the job of a kambukutty is a heriditary one. There are at present nine kambukuttis, and all of them are paraiyans.[16]

The Kambukkuttis are paid by the cultivators themselves and they are paid one marakkal[17] of paddy per acre for each harvest. Apart from the job of allocation of water, the kambukuttis have to inform about deaths in the village, remove dead cattle, and guard the crop etc. For each of these jobs, the kambukuttis may be paid separately. Almost every cultivator we met vouched for the honesty of kambukuttis, though some big Naidu landowners felt they could be influenced by their own caste people to divert more water. In case of any

16. It is curious that Paraiyans are employed for such an important job as allocation of water. We are not aware of the reasons for following such a practice, and this is one aspect which needs to be studied.

17. Marakkal is a unit of volume measure used especially for grain. One marakkal is roughly equivalent to about 4.50 kgs of paddy.

grievance against any kambukutty, the panchayat president is informed, and a village meeting is called, where after an enquiry, and if found quilty he is removed, and another person is appointed in his place.

In matters of dispute over water allocation, it is attempted to be solved within the village itself. For arbitration, the next levels are the Revenue Inspector (RI), Tahsildar, Deputy Collector, and Collector in that order.[18] Having described the structure of the irrigation organisation we would now go on to describe the rules of allocation and maintenance in village A.

3.3.3 Rules of Allocation

The rules of allocation of water from the tank in village A, is evident from the land categories described earlier (see 2.4.1 and 2.4.3). To restate, in village A there are two sets of rules of allocation. One set of rules is followed during the first crop-season, i.e., during the months of July to December/January when the entire ayacut of 1029.70 acres has to be irrigated. The rules of allocation during this period provide for equal access to water for all the users. Another set of rules is followed during the second crop-season, i.e. during the months of January to April; when only a portion of the ayacut, viz., 272.50 acres has to be irrigated. The rules of allocation during this period provide for differential access to water for certain segments of the ayacut (see 2.4.3 and map 4).

In the first crop season, the water from the tank is usually released around the end of October only. The reason for such a practice would be explained in the next chapter, where an account of the agronomic aspects related to the

18. One particular cultivator felt he did not get adequate quantum of water because the channel which takes off at right angle from the podhu-kal is blocked in the night, and water was allowed to pass in the channel only in the day. He wanted the channel to be kept open in the night also. Hence, he tried to short circuit the heirarchy, and petitioned directly to the Deputy Collector. It was supposed to have been referred back to the Tahsildar, who in turn referred it to the R.I. The R.I., met the village panchayat President who told her that the issue would be settled amicably. But, so far there has been no effort at changing the existing rules.

first crop-season would be provided. In the month of October, the panchayat president convenes a meeting of all the cultivators. The Talaiyari, a last level employee of the Revenue Department is deputed to inform all the paraiyan cultivators in the cheri to gather for the village meeting. In the meeting the date for opening the mettumadagu (sluice No.1) is decided.

Once the date is decided, the opening of the sluice involves clearing the sand which blocks the barrel of the sluice. The mettumadagu, when opened during the first crop season is again temporarily blocked once precipitation falls. The mettu-madagu is supposed to pass water for about 4 months. Once the water from the tank stops flowing out of mettu-madagu, another village meeting is convened to decide the date for opening the palla-madagu (sluice No.2). The palla-madagu is opened sometime in the month of March or so and it is supposed to pass water for about 2 months. The palla-madagu has a screw gearing shutter (see 2.3.) hence, its opening involves unscrewing with a gear. The gear for the same is in the custody of the panchayat president. Once the sluices are opened, the water which flows down the podhu-kal is diverted into the various kilai-kals (see map No.2) by the kambukkuttis. Then onwards, irrigation is done by field-to-field method, by farmers who divert the water from the kilai-kals into their fields.

Having described the rules of allocation of water from the tank in village A let us now go on to describe the rules of maintenance of the tank.

3.3.4 Rules of Maintenance

Maintenance of a tank consists of keeping (a) tank bund, sluice gates, waste weirs and (b) the distribution and feeder channels in good condition. While the first set of tasks are intermittent in nature, the second are more regular.

The execution of the former requires technical know-how, labour and materials. It involves (a) identification of the sources and also likely sources of malfunctioning, (b) the assessment of the magnitude of malfunctioning, planning and deciding the time of carrying out repairs, and (c) it requires funds to procure materials and labour. On the other hand, the execution of the latter, viz., regular maintenance activity largely requires labour resources only.

In the case of tank under consideration, the P.W.D. is responsible for carrying out repairs in the tank bunds, sluice-gates and waste-weirs in case of any malfunctioning, and also maintain them at certain specified standards. The P.W.D. executes the repair works or maintenance by inviting tenders from its approved list of contractors, and the work is allotted to whoever quotes the lowest bid. The funds for execution of these repairs is made available from the general budget of the State Government.

While the P.W.D. is responsible for maintaining tank bunds, sluice-gates, etc. maintenance of the feeder channel, and the distribution channel is the responsibility of all cultivators owning wet lands.[19]

In village A, clearing of the varavu-kal (feeder channel) is an annual task which is carried out before the onset of the monsoon. The Podhu-kal, is usually cleared twice in a year; once, sometime before the monsoon begins, and second around January or so. The date for clearing the varavu-kal, and podhu-kal is decided in a village meeting and all cultivating families owning wet lands are expected to send one representative for contributing labour towards the maintenance of these irrespective of the extent of land owned. The clearing of the channel from Mettu-Madagu, which irrigates about 30 acres is the responsibility of cultivators who own them. The clearing of kilai-kals, is the

19. Krishnaswamy (1947: 450) points out that, "the separation of certain items of work into ryot's work has not been done by reference to the historical fact of these items alone having formed part of the ryots share from time immemorial. It is easy to see that it was because the Tank Restoration Scheme Party laid emphasis on maintaining the bunds and sluices at certain specified standards of efficiency that the work is being done on those lines".

responsibility of cultivators who own lands in that particular stretch. The respresentatives of the cultivating family have to bring with them the spade, and other implements that may be required for carrying out the maintenance activity. In case, any expenses are incurred it is met from the village common fund. There appears to be no practice of imposing penalties in case of non-compliance with the rules of maintenance.

In sum, this section was devoted to a description of the irrigation organisation in village A, viz., the structure of irrigation organisation, and the rules of allocation of water, and rules of maintenance of physical facilities. What emerges importantly is that (a) the roles that constitute the structure of an irrigation organisation are embedded in other social and economic roles in the village. For instance, the person responsible for implementing and arbitrating the rules of allocation and maintenance is also a Panchayat President, a member of the Upper caste, and a landowner, and the persons responsible for actual implementation of rules of allocation at the field-level are all paraiyans (see 1.2.6). (b) There are two sets of rules of allocation of water which are in operation at different time points in a year. One, provides for equal access to all the beneficiaries and, the other provides differential access to certain users (see 1.2.7). (c) The contribution by beneficiaries towards maintenance of physical facilities is disproportionate to the benefits received from the tank (see 1.2.9).

As mentioned in the beginning of this section our concern in this section is only with what is supposed to be the case. A description of what is the actual situation would be done in a later chapter.

To recapitulate, this chapter was concerned with certain socio-economic aspects specific to village A. To begin with, a classification of castes in village A was suggested which would be analytically useful. On the basis of this classification an analysis of the ownership of land categories in village A was made. It was pointed out that the UCNL group (or the Naidus) have the maximum access to tank water during both the first and second crop-seasons. They are followed by the BCL group (or the Naickers) who have the next best access to tank water. The Paraiyans, on the other hand, have the worst access to tank water. But, this at best is a qualitative evidence and a quantitative assessment of the relative gains of access to tank water for different caste-groups would be made in the next chapter. In this chapter, a description of the irrigation organisation in village A was also provided. Importantly, it was pointed out that the roles that constitute the structure of the irrigation organisation are embedded in other social and economic roles in the village; there are two sets of rules of allocation in village A; and the contribution of beneficiaries towards maintenance is found to be disproportionate to the benefits received from the tank. The last aspect is further substantiated in chapter 5.

CHAPTER 4

EQUITY VERSUS PRODUCTIVITY

Given a community irrigation source, the irrigation organisation or, more specifically the rules of allocation prevailing in a given context determine the gains of irrigation, and the distribution of gains among different claimants. To elaborate, in a community irrigation source, given the crop-water requirements, the quantum of water available in the source determines the extent of land that can be effectively irrigated. But, the manner in which water is allocated from the irrigation source determines how large or small the gains of irrigation would be, and also its distribution among different claimants.

Upto now, whatever reference has been made to the gains or, more specifically, the distribution of gains of irrigation among different claimants in village A, has been indirect. To recall, earlier we described two land categories in relation to the tank in village A, viz., plots across reaches, and "compound" vs "non-compound" lands and the ownership of the same by caste groups (see 3.2). It was pointed out that the UCNL group (or chiefly the Naidus) have the maximum access to tank water both in the first and second crop season. They are followed by the BCL group (or chiefly the Naickers). And, the Paraiyans have the worst access to tank water during both the crop-seasons. The above description at best provides qualitative evidence regarding the relative advantage which each caste-group has with regard to access to water from the tank. And it does not provide any idea regarding the order of magnitude of gains which accrues to different caste-groups on account of the tank.

This chapter therefore, is addressed to the issue of the order of magnitude of gains, i.e. the share of different caste-groups in the gains of irrigation in village A. It is imperative here to point out that, in this chapter our concern is only with the gains of irrigation which accrue to each caste-group on account of the total land owned by them. We are not at all concerned with the share of gains of irrigation which accrue to different economic groups, viz., agricultural labourers, tenants, land-owners etc.

Subsequent to the discussion of the shares of gains of irrigation, we propose to describe how the rules of allocation of water from the tank in village A, fare in terms of equity versus productivity considerations. In the light of our inference with regard to equity/productivity considerations, we propose to contrast the rules of allocation of water in village A with that obtained in the Pul Eliya village in Ceylon.

4.1 Agronomic Aspects

Prior to taking up the issue of share of different caste-groups in the gains of irrigation in village A, we propose to describe very briefly, the agronomic aspects related to the crop seasons in village A. A detailed account of the same can be found in an appendix to this chapter.

In village A, there are three crop-seasons. The first crop-season begins in July and ends in December/January; the second crop-season stretches from January to April and, the third crop-season, from April to July. These three crop-seasons, in official parlance are referred to as Samba, Navarai and Sournavari respectively. The tank in village A irrigates crops only during the Samba and Navarai crop-seasons. The crop grown during the Sournavari crop-season are dependent entirely on lift irrigation. Our concern in the present work is chiefly with the community source of irrigation, viz., the tank (see 1.2.4). Also, our immediate concern in this chapter is with the shares of gains accruing to the caste-groups in village A, on account of the tank. Hence, in this chapter we would only be concerned with the first crop-season (Samba) and the second crop-season (Navarai).

4.1.1 The First Crop-Season

The first crop season, July to December, coincides almost entirely with the monsoon period in the district and hence is dependent on precipitation till the end of October. From then on resort to irrigation from the tank is made whenever required (see appendix 4A). In this crop-season almost all cultivators grow only paddy and, only long duration paddy varieties are grown.

During the first crop-season, there is substantial yield differences in paddy output between plots in Upper/Middle Reaches and the Last Reach of the ayacut. According to the farmers, the plots in Upper/Middle Reaches of the ayacut yield on an average about 14 bags of paddy per acre (of 75 kgs, i.e. about 1,050 kgs per acre); while, the plots in the Last Reach of the ayacut yield on an average about 9 bags of paddy per acre (i.e, about 675 kgs per acre).

The reasons for the low yield of paddy in plots in the Last Reach compared to plots in the Upper/Middle Reaches are:

(a) The predominance of worst sort of soil in the Last Reach of the ayacut (see Table 8 and also 2.4.2), and the consequent higher nutrient requirements.

(b) The lower application of nutrients in the Last Reach of the ayacut - the cultivators who own plots in the Last Reach of the ayacut (especially Paraiyans) apply on an average only about 6-8 cart loads of manure per acre compared to about 10-15 cart loads of manure per acre applied by cultivators who own plots in the Upper and Middle Reachs of the ayacut.[1]

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1. The reason for the reduced application of manure by cultivators in the Last Reach is that the plots in the Last Reach are situated quite far away from the village site. And, a cart owner charges about Rs.25/- to transport two cart loads of manure to the plots in the Last Reach. The cost is felt to be quite prohibitive by most of the cultivators (especially Paraiyans) who do not own carts.

   In other words, though majority of plots in the Last Reach require more nutrients compared to plots in the Upper and Middle Reaches of the ayacut, the economic position of most of the cultivators who own plots in the Last Reach (chiefly Paraiyans) does not allow it.

(c) The "difficult" water supply situation.[2]

It is difficult to separate out the relative role of each of the three factors mentioned above, contributing to the poor yield of paddy in the Last Reach during the first crop-season. At best, one may be permitted to make a qualitative statement based on the fact that availability of water is very important for paddy that "difficulty" in availability of water from the tank during the last stages of crop-growth may be a major contributing factor for the low yield in the Last Reaches of the ayacut, during the first crop-season.

Having described about the first crop-season, let us now take up the second crop-season.

4.1.2 Second Crop Season

The second crop-season, in village A begins around January and ends in April. During this period there is virtually no precipitation (see 2.2.3), hence, the second crop is dependent entirely upon the tank. In an earlier chapter (see 2.4.3), while describing land categories, it was pointed out that 272.50 acres are registered as "compound lands" and, these lands have a prior claim to water over all other lands during the second crop-season (see appendix 4A).

In the second crop-season, short duration High-yielding varieties (HYV's), such as IR-8 and IR-20 are grown (see appendix 4A). According to the villagers, the yield of paddy in this crop-season, averages about 19 bags (i.e. about 1,425 kgs) per acre. The reasons for the high-yield during the second crop-season, compared to the first crop-season,[3] are the combination of HYVs, chemical fertilizers and, the major factor, viz., access to assured and regular supply

2. This is due to the fact that plots in the Last Reach of the ayacut receive water only after the plots in the Upper and Middle Reaches of the ayacut are watered. Also, the Last Reach cultivators complained about the tendency of Upper and Middle Reach cultivators to corner away as much water as possible. But, importantly the "difficulty" in water availability is due to the absence of field channels for the major portion of the Last Reach extent.

3. The difference in yield is about 375 kgs which is difference between the average yield of plots in the Upper and Middle Reaches and the average yield in the second crop-season. The reason for taking into account only Upper and Middle Reaches is because of the fact that "compound" lands are located almost entirely in the Upper and Middle Reaches of the ayacut.

of water from the tank. Thus, the cultivators who own "compound" lands are at a substantial advantage compared to those who do not own them.

Having described briefly the agronomic aspects and productivity of land during the first and second crop season, let us now go on to take up the crucial issue , viz., the share of different caste-groups in the gains of irrigation in village A.

4.2 Share of gains of Irrigation accruing to different Caste-groups

As mentioned in the beginning of this chapter, the ownership of land categories at best provides qualitative evidence regarding the relative advantage which each caste-group has with regard to access to water from the tank. It does not provide any information regarding the order of magnitude of gains accruing to different caste-groups on account of the tank. This, immediately leads us to the question of estimating the gains of irrigation.

One way of measuring the share of gains of different caste-groups may be to measure the share of different caste-groups in the total output. But, the fact is that irrigation does not account entirely for crop output. Nevertheless, in the absence of any other physical measure of gains of irrigation, and given the fact that there is a strong correlation between availability of water and paddy yield, an estimate of the share of each caste-group in the total output vis-a-vis their share in total extent of land may provide an idea regarding the gains which accrue to each caste-group on account of the tank.

It has to be noted here that in the year 1982, when we conducted our survey in village A, the crop-operations of the first crop-season were mid-way (and, it happened to be a year of deficient rainfall also) hence, we were not able to obtain the yield figures for that year. Also, in the three years preceding the year 1982, the annual rainfall was deficient, consequently, the yields were considerably, affected. Hence, the yield figures (yield figures across reaches during the first crop-season and yield figures of "compound" lands during the second crop-season) which we would be using in this chapter are yield figures which majority of respondants felt to be the normal yields[4] in a normal year of rainfall.

Regarding the question of estimation of share of each caste-group in total output, we detail below the manner in which the same has been calculated:

(a) First, we multiplied the actual extent of land owned by each caste-group in each of the three reaches of theayacut with the average yield of the paddy of each corresponding reach. Summation of output which accrues to each caste-group on account of land owned in each reach would provide the total output which accrues to each caste-group in the first crop-season on account of total land owned by them. For instance, the UCNL group owns 96.17 acres in the Upper Reach, 258.31 acres in the middle Reach and 130.88 acres in the Last Reach. By multiplying 354.48 acres (which is the total Upper and Middle Reach extent owned by UCNL group) with 1,050 kgs (which is the average yield of paddy in both Upper and Middle Reaches), and 130.88 acres with 675 kgs (which is the average yield of paddy in the Last Reach) we get the output which accrues to UCNL group on account of land owned in each reach of the ayacut. Summation of these two output figures provides the total output which accrues to UCNL group during the first crop-season.

(b) In the same manner we calculate the total output which accrues to the other caste-groups, viz., BCL group and Paraiyans, etc.

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4. Though, it would have been instructive to obtain yield figures by soil sorts we were not able to obtain the same because the year we conducted our survey and the preceding three years were years of poor rainfall consequently affecting the output. Apart from this most of the respondents from the Upper and Middle Reaches of the ayacut did not make much of the soil differences in affecting the eventual yield. On the other hand, majority of respondents from the Last Reach felt that the poor quality of soil in their plots considerably affected the output. Many of them felt that the problem of salinity which characterises most of their plots is an added factor which affects the output in the Last Reach.

(c) Summation of the output which accrues to each caste-group provides us the total output during the first crop season.

(d) For the second crop-season, we multiply the total extent of "compound" land owned by each caste-group with the average yield of paddy during the second crop-season. This provides us the output which accrues to each caste-group during the second crop-season.

(e) Addition of the output which accrues to each caste-group provides us the total output during the second crop-season.

(f) From the total output during the second crop-season, the excess "compound" land revenue which is paid by cultivators owning "compound" lands can be netted out. It was mentioned earlier that the owners of "compound" lands have to pay $1/_4$ or $1/_8$ more than the plots of comparable variety but growing only a single crop. This excess of $1/_4$ or $1/_8$ "compound" land revenue adds up to Rs.515.26.[5] Converted into product terms it works to about 367.35 kgs of paddy,[6] which may be deducted from the total second crop-output. The netted output may be apportioned among each caste-group according to the per cent share of "compound" land owned by them. For instance, the UCNL group owns 67.52 per cent of "compound" lands hence, 67.52 per cent of netted output during the second crop-season may be credited against the UCNL group. The same process may be carried out in the case of other caste-groups also.

(g) Summation of the output during the first and second crop-seasons provides the total output during both these crop-seasons.

(h) We can then calculate the per cent share of each caste-group in the total output during both the crop-seasons.

5. It is interesting to note that the land revenue that is paid by the cultivator has virtually not changed at all between the years 1911 and 1981.

6. We have divided the excess "compound" land revenue, i.e. Rs.514.26 by Rs.105, which is the price of one bag of paddy of 75 kgs in 1981, this gives us about 4.8 bags of paddy which is equivalent to 367.35 kgs.

But, a problem crops up in that, as pointed out earlier in this chapter there is a significant difference in yield between plots in the Upper and Middle Reaches, and the Last Reach of the ayacut. These differences in yield across reaches were attributed to three factors, to wit, (a) differential land quality; (b) differential input use and (c) differential acess to water.[7] It was also pointed out that it is difficult to separate out the relative role of each of these factors in contributing to the differences in yield across reaches. Given the fact that about 79 per cent of the total land owned by the Paraiyans is in the Last Reach of the ayacut, their share in the total output would be less, for reasons other than access to tank water .

A simple way to take care of this problem in the first crop-season, may be to first calculate the total output, which can be calculated by taking the relevant total extent across each reach of the ayacut and multiplying it with the corresponding average yield figures, and add up the output across each reach to get the total output. The total output in the first crop-season may then be apportioned to the different caste-groups according to the net area owned by them. For instance, the UCNL group owns 47.57 per cent of the total net area of land hence, 47.57 per cent of the total output during the first crop-season may be apportioned to the credit of UCNL group. In the same manner we may apportion to the other caste-groups the total output of the first crop-season based on the proportion of net area owned by them. The output figures which arecredited in such a manner for each caste-group may be interpreted as the output which would accrue to each caste-group from an average quality of land with an average input use. This procedure, we believe would take care of the factors a and b mentioned above, viz., differential land quality and differential input use; contributing to the differences in yield across reaches during the first crop-season.

7. The differential access to water is not entirely due to rules of allocation but, more importantly due to absence of field channels for majority of plots in the Last Reach of the ayacut.

The same procedure may be carried out in the second crop-season also. In the case of second crop-season excess "compound" land revenue payment may be deducted from the total output to obtain net gains. This net output may be credited against each caste-group on the basis of proportion of "compound" lands owned by them. The output figures credited in such a manner may also be interpreted as the output which accrues to each caste-group in the second crop-season, from an average quality of land with an average input use.[8]

We may now add the output credited against each caste-group in the first crop-season (which is the output which would accrue to each caste-group from an average quality of land with an average input use), and the output which is credited to each caste-group in the second crop-season (netted of "compound" land revenue), to obtain the total output for each caste-group for both the crop-seasons. And, we may then compute the per cent share of the output of each caste-group in the total output of both the first and second crop-seasons. For instance, 4,22,997 kgs of paddy is the output credited against the UCNL group for the first Crop season, and 2,62,171.50 kgs of paddy accrues to them in the second crop-season. Adding up these two output figures, we calculate its share in the total output which is 12,922,37.25 kgs of paddy. In the same manner we calculate the share of the other caste-groups in the total output.

The share of output of each caste-group thus obtained may be compared with their share in the total net area to get an idea about the order of magnitude of gains of irrigation which accrues to each caste-group. We have chosen the net area share, and not the gross area share for comparison with the output share for the reason that when we use gross area share we remove the impact of cropping intensity on the share of output of each caste-group. And, in the context of village A, higher cropping intensity means larger access to tank water. By removing

8. The output figures credited in such a manner would not be different from the figures obtained by the procedure described earlier viz., d, e, and f above. See also Table Nos 18 and 19 (Col.5).

the effect of cropping intensity on the share of output of each caste-group, we are in effect removing the effect of larger access to tank water on the share of output of each caste-group. The context of our enquiry being the gains of relative access to tank water, we cannot remove the effect of access to water on the share of output of each caste-group. Hence, we use net area share and not gross area share for comparison with the share of output of each caste-group.

The details arrived at on the basis of procedure described above have been presented in Table 18. The table contains details regarding the extent of land owned during the first crop, the "corrected output", i.e. the output credited against each caste-group for the first crop-season based on the extent of land owned by them, the extent of "compound" land owned by each caste-group, the "corrected" output credited against each caste-group in the second crop-season which is netted of "compound" land revenue, the total output which accrues to each caste-group from both the first and second crop season, the net area share of each caste-group, and the output share of each caste-group in the total output.

The details contained in Table 18 may be compared with the details in Table 19. The Table 19, is similar to the Table 18, except for the difference, viz., the output figures shown under column No.3 of the table are not corrected output. The figures under that column represent the actual output which accrues to each caste-group in the first crop-season. The procedure by which these were arrived at have been outlined in a, b and c above.

A comparison of column 8, in both Table 18 and Table 19, shows that the share of output of UCNL group is higher by 2.37 per cent in Table 19. Interestingly, there is no change in the case of Naidus, a component of UCNL group. The share of output of BCL group is higher by 0.73 per cent, and that of Naickers, a component of BCL group is higher by 0.42 per cent. On the other hand, the share of output of Paraiyans is less by 3.08 per cent.

Table 18

The share of "Corrected" output of Caste-groups in village during first and second crop-seasons

Caste Groups	Area owned Ist crop (in acres)	Output[a/] Ist crop (in kgs)	Area owned IInd crop (in acres)	Output[b/] IInd crop (in kgs)	Total output I & II crop seasons (in kgs)	Net area share (in per cent)	Output share (in per cent)
1	2	3	4	5	6	7	8
1 UCNL	485.36 (47.57%)	429997.00 (47.57%)	183.98 (67.52%)	261940.57 (67.52%)	691937.57	47.57	53.56
Naidus	355.88 (34.88%)	344033.76 (34.88%)	162.41 (59.60%)	231215.31 (59.60%)	575249.07	34.88	44.53
2 BCL	195.57 (19.17%)	173282.37 (19.17%)	62.63 (22.98%)	89149.80 (22.98%)	262432.17	19.17	20.31
Naickers	147.37 (14.44%)	130526.73 (14.44%)	49.41 (18.13%)	70334.46 (18.13%)	200861.19	14.44	15.55
3 Paraiyans	302.06 (29.60%)	267561.73 (29.60%)	15.00 (5.50%)	21336.98 (5.50%)	288898.71	29.60	22.36
4 Miscellaneous	37.38 (3.66%)	33083.65 (3.66%)	10.89 (4.00%)	15517.80 (4.00%)	48601.45	3.67	3.76
Total (column)	1020.37 (100.00%)	903924.75 (100.00%)	272.50 (100.00%)	387945.15 (100.00%)	1291869.90	100.00	100.00

Note: a/ The output credited against each caste-group is corrected output, see text.
b/ The output credited against each caste-group is netted of compound land revenue.

The figures in parentheses represent column percentage.

The Naidus are a part of UCNL group and the Naickers are part of BCL group.

Table 19

The share of output of Caste-groups in village during first and second crop seasons

Caste Groups	Area owned Ist crop (in acres)	Output Ist crop (in kgs)	Area owned IInd crop (in acres)	Output IInd crop[a/] (in kgs)	Total output I & II crop seasons (in kgs)	Net area share (in per cent)	Output share (in per cent)
1 UCNL	485.36 (47.57%)	460548.00 (50.95%)	183.98 (67.52%)	261940.57 (67.52%)	722488.57	47.57	55.93
Naidus	355.88 (34.88%)	344052.75 (38.06%)	162.41 (59.60%)	231215.31 (59.60%)	575268.06	34.88	44.53
2 BCL	195.57 (19.17%)	182721.00 (20.21%)	62.63 (22.98%)	89149.80 (22.98%)	271870.80	19.17	21.04
Naickers	147.37 (14.44%)	136003.50 (15.05%)	49.41 (18.13%)	70334.46 (18.13%)	206337.96	14.44	15.97
3 Paraiyans	302.06 (29.60%)	227699.25 (25.19%)	15.00 (5.50%)	21336.98 (5.50%)	249036.23	29.60	19.28
4 Miscellaneous	37.38 (3.66%)	32956.50 (3.65%)	10.89 (4.00%)	15517.80 (4.00%)	48474.30	3.67	3.75
Total (column)	1020.37 (100.00%)	903924.75 (100.00%)	272.50 (100.00%)	387945.15 (100.00%)	1291869.90	100.00	100.00

Note: a/ The output credited against each caste-group is netted of 'compound' land revenue.

The figures in parentheses represent column percentages.

The Naidus are a part of UCNL group and the Naickers are part of BCL group.

This difference in output share may be taken to reflect the differential gains on account of differential land quality and differential input use. The increased share in the case of UCNL group and the BCL group may be seen as reflecting the fact that these two groups own better lands and also use more inputs compared to Paraiyans. And, the decreased share in the case of Paraiyans may be seen as reflecting the fact that Paraiyans own lands of poor quality, and also use less inputs compared to UCNL and BCL group. If this is so, can the absence of any change in the case of Naidus (a component of UCNL group) be taken to reflect the fact that they own lands of average quality, and also apply average quantum of input?

The output share in Table 18, can therefore be taken as reflecting the differential gain which accrues to each caste-group on account of irrigation.

It may be observed from columns 7 and 8 in Table 18, that while the share of UCNL group in the total net area is 47.57 per cent; their share in the total output is 53.56 per cent. In the case of Naidus (a component of UCNL group), their share in the total net area is 34.88 per cent but, their share in the total output is 44.53 per cent. In other words, in the case of UCNL group (or chiefly the Naidus), their share in the total output is more than commensurate with their share in total net area. In the case of BCL group, while their share in total net area is 19.17 per cent, their share in the total output is 20.32 per cent. And, in the case of Naickers (a component of BCL group), their share in total net area is 14.44 per cent, and their share in total output is 15.55 per cent. In other words, the share of the BCL group (or chiefly the Naickers), in the total output is more or less equivalent to their share in total net area. On the other hand, in the case of Paraiyans, while their share in the total net area is 29.60 per cent, their share in the total output is only 22.36 per cent. Restated, the share of Paraiyans in the total output is less than commensurate with their share in total net area.[9]

To put differently, we can state that in village A, the major proportion of the gains of irrigation accrues to the UCNL group (or chiefly the Naidus), They are followed by the BCL group (or chiefly the Naickers) in that order. The Paraiyans, on the other hand receive hardly any of the gains of irrigation.

The reasons for such a state of affairs in village A may be attributed to two contributory factors. One, a minor one, and the other the chief contributory factor. They are:

(a) It was pointed out earlier that the majority of plots in the Last Reach of the ayacut experience "difficult" water supply condition during the first crop-season (see 2.4.1). It was also pointed out that it is one of the reasons for the poor yield of plots in the Last Reach vis-a-vis the plots in the Upper and Middle Reaches (see 4.1.1). But, the "difficulty" in availability of water for majority of plots in the Last Reach is not importantly due to the rules of allocation of water from the tank during the first crop season but, more so due to the absence of field channels for majority of plots in the Last Reach.

(b) But, the major contributory factor is that the rules of allocation of water from the tank during the second crop-season, provides for differential access to water for certain segments of the ayacut, viz., 272.50 acres of "compound" lands. The second crop-season, affords conditions for growth of HYVs (see appendix 4A), and as pointed out earlier in this chapter, the productivity in this crop-season is higher compared to the first crop-season. Given the fact that the UCNL group (or chiefly the Naidus) own the major proportion of "compound" lands (see Table 12), the major proportion of the total output during this crop-season, or, the

9. The Adangal register of village A for the faslis 1389 (1979) and 1391 (1981) declares, 157.30 acres and 119.68 acres as current fallow. About 98.00 per cent of the plots declared as current fallow are in the Last Reach of the ayacut, and most of them are owned by Paraiyan landowners. We have not taken account of these facts in computing the gains of irrigation. Suffice it to say here that the gains which accrues to paraiyan cultivators would be considerably lower than what is shown in the text.

gains of irrigation during this crop-season accrues to them. The BCL group (or chiefly the Naickers) follow next in the order. The Paraiyan who own only a small proportion of the "compound" lands, therefore, get hardly any of the gains of irrigation in this crop-season.

4.3. Equity and Productivity

To put it differently, the rules of allocation of water from the tank, which provides for differential access to certain portions of the ayacut in the second crop-season, affords larger access to water from the tank for certain beneficiaries compared to other beneficiaries, and hence is extremely inequitable in nature. Largely, as a result of this, the major proportion of the gains of irrigation in village A, accrues to the UCNL group (or chiefly the Naidus). The UCNL group is followed by the BCL group (or chiefly the Naickers) in the order. But, on the other hand, the Paraiyans in village A receive hardly any of the gains of irrigation.

While the rules of allocation of water from the tank is inequitable, let us now go on to see how it fares in terms of productivity considerations. It appears that, given the crop regime prevailing in village A during the second crop-season, viz., paddy, the water available in the tank during the months January to April, net of losses, is capable of meeting the crop-water requirements of 272.50 acres only. Any effort at extending the area irrigated during the second crop-season may therefore, lead to a situation where the crop water requirements are not met in an effective manner affecting the total output.

Given such a limiting condition, an optimal choice would be one where the best lands are irrigated first, followed by the next best, etc. To elaborate, in an earlier chapter (see 2.4.4), we pointed out that 66.97 per cent of "compound" lands are characterised by good sort of soil, and 17.01 per cent and 16.02 per cent of "compound" lands are characterised by ordinary and inferior sort of soils respectively. An optimal arrangement would be to irrigate the 66.97 per cent of "compound" lands characterised by good sort of soil first, followed by lands characterised by ordinary and inferior sort of soil.

But, it may be observed from map 4 that, the "compound" lands immediately below the tank are characterised by ordinary and inferior sorts of soil, and the lands characterised by good sort of soil are slightly away from the tank. It may also be observed from the map that "compound" lands characterised by good sort of soil do not run in contiguous stretch. Hence, any arrangement to irrigate the best lands first, followed by the next best, etc. would involve substantial transmission losses of water consequently affecting total output in the second crop-season. So there is a trade-off, and the prevailing arrangement therefore, appears optimal in satisfying the productivity considerations.

To restate, the rules of allocation of water from the tank in village A, during the second crop-season, though inequitable, fares well in terms of productivity. It should be interesting to compare this case with that of Pul Eliya village in Sri Lanka with a different set of rules for water distribution. Such a comparison would highlight the problem of equity and productivity in much sharper focus.

4.4 Rules of allocation of water in village A and Pul Eliya — a comparison

In the Pul Eliya economy the basic resource is the scarce water (Leach, 1971: 17). In order to provide equal access to this scarce water, the irrigable area under the tank is divided into two, viz., the Upper Field and the Lower Field. The Upper Field is roughly twice the size of the Lower Field, and is further divided into two. In all, the irrigable area under the tank is divided into three segments which are divided into three portions each. These portions are further divided into shares or strips. And the order of portions and strips in the Upper and Lower Fields is reversed (Leach, 1971: 156-158, and 169).

The holdings of each farmer are equally distributed between these various divisions.

Given such a land-tenure arrangement, during the Maha season, when rainfall is much heavier attempts are made to irrigate the entire ayacut (Leach, 1971: 53). On the other hand, during the Yala season rainfall is less, and

> "if the villagers are to cultivate rice in the old field during the Yala (April/September) season they will decide from the start either to cultivate the whole of the field or two-thirds of the field (that is, the whole of the Upper Field only) or just one-third of the field (that is, northern half of the Upper Field only). No pooling of proceeds or reallocation of holdings is necessary since the land is already divided up in such a way that each share holder works the whole or two-thirds or one-third of his total holding as the case may be" (Leach, 1971: 170).

It may be observed from the above description that in Pul Eliya, there are two sets of rules of allocation of water. One, when the water available in the irrigation source can irrigate the entire service area, viz., the Maha season, and two, when the water available in the irrigation source cannot irrigate the entire service area, viz., the Yala season. In the latter case, all the beneficiaries are entitled to equal access to water from the irrigation source. Though, the rules of allocation of water in the Yala season satisfy the equity considerations it is difficult to say on the basis of available information, whether they satisfy the productivity considerations also. To elaborate, if in the Yala season, the water available in the irrigation source is capable of meeting the crop-water requirements of one-third of the total area only, then the first one-third portion of total field would be cultivated. If the plots in this portion are characterised by good sort of soil then the maximum output that is feasible given the water availability, may be realized. On the other hand, if plots in this portion are characterised by inferior sort of soil relative to plots in the other two portions then the total output that is feasible given the water availability may not be realized. But, it has also to be noted here that allocating water to another portion in case the first portion is not characterised by good sort of soil may lead to loss of water on account of transmission and evaporation consequently affecting total output.

On the basis of available information therefore, it is difficult to say whether the rules of allocation of water during the Yala season in Pul Eliya satisfy productivity consideration also. In the case of village A, on the other hand, the rules of allocation during the second crop-season though inequitable are optimal in terms of productivity considerations.

In sum, this chapter was concerned with the equity and productivity considerations of irrigation. To begin with, an analysis of who gets how much of the gains of irrigation in village A was made. It was pointed out that the distribution of gains of irrigation in village A is highly skewed with the UCNL group at one end of the scale cornering away all the gains, and the Paraiyans at the other end, hardly receiving any of the gains of irrigation. This state of affairs has come about because of the fact that rules of allocation in village during the second crop-season have determined certain land categories, viz., "compound" and "non-compound" lands and, only the former has access to water during the crop-season. The ownership of these land categories -- which is a result of certain historical conditions -- accounts for the skewed distribution of gains of irrigation. In this chapter it was also pointed out that though the rules of allocation in the second crop-season are inequitable they are optimal in terms of productivity considerations.

APPENDIX - 4 A

AGRONOMIC ASPECTS

I. The First Crop Season

The first crop-season in village A begins around the month of July and ends in December/January. It can be observed that the crop-season coincides almost entirely with the monsoon period in the district. It was pointed out earlier that there is virtually no rainfall in Covelong station during the months of January to May.[1] The beginning of this crop-season is therefore dependent on the onset of S.W.Monsoon. In fact, the major portion of this crop-season is dependent upon rainfall. Thus agronomic aspects related to this crop-season are conditioned largely by the rainfall characteristics.

The fields are ploughed and prepared for this crop-season around the month of June using pre-monsoon or early monsoon showers. After ploughing the fields a couple of times, farm-yard manure is mixed with the soil and the fields are ploughed again. In this crop-season, farm-yard manure is applied predominantly by almost all the cultivators and the only chemical fertilizers used is urea.[2] The reasons for the predominant use of farm-yard manure in this crop season are:

(a) The first crop-season in village A is dependent upon precipitation till about October.[3] As described elsewhere (see 2.2.4), in all these months potential evapo-transpiration is greater than dependable precipitation. Also, there are likely to be prolonged dry spells between two rainy periods in all these months. In the absence of a regular and required quantum of water, application of chemical

1. The precipitation during these months accounts for less than 10.00 per cent of the total normal rainfall.
2. The amount of urea applied averages about 50 kgs per acre.
3. We would be going into the reasons for it subsequently.

fertilizers would harm the crop than, facilitate its growth. Hence, the predominant use of farm-yard manure in this crop-season.[4]

(b) The farm-yard manure is usually transported by means of carts to the fields. The transportation is done before the crop operations of the first crop-season commence. For, this is the only period in the year when transportation of manure by carts is possible, because, the major portion of the ayacut would be dry facilitating the movement of carts.

After ploughing and preparing the fields, the seeds are sown either by using a seed drill or by direct broadcasting. The reason for sowing the seeds in this fashion is that the rainfall in the month of July is not adequate to puddle the soil to facilitate transplantation of seedlings. Most of the cultivators in village A, use a seed-drill which is referred to as Goru-kalapai. The seed drill is made of a bamboo pole, in which are fixed four iron-furrows of equal length. These iron furrows have holes in them to which are fixed iron rods cylindrical in shape which in turn are connected to a wooden bowl at the top. A handle is fixed to the bamboo pole and a pair of cattle are yoked in the front. One person holds the handle, and drives the cattle and another person keeps pouring, the seeds into the wooden bowl. The seeds fall through the iron cylinders and are planted in neat rows of four at a time. Once this process is completed another instrument called Palavu, which has a flat iron board is used to break the clods of soil and cover the seeds. Cultivators who do not own Goru-kalapai resort to broadcasting of seeds in this crop-season.

In this crop-season, the seeds are drilled or broadcast without previous germination. The seeds germinate either due to the sub-surface moisture or remain dormant until the advent of rain. In plots where seeds are drilled, once the seeds germinate and sprout an instrument called Pavattan is used to remove weeds. Pavattan is similar in design to Goru-kalapai, except that it has flat edges and is sent in between the rows of seedlings to remove whatever weeds that may have grown.

4. Grist (1970: 33) points out that, "in India it has been found that manuring lowers the water requirements of the crops and that farm yard manure is more effective in this respect than artificials".

In this crop-season almost all cultivators grow only paddy[5] and only long-duration paddy varieties are grown. Mencher (1978: 253) points out that in Chinglepet district:

> "for the samba season only long-duration seeds are used for a number of reasons. First of all, they are considered to be the finest quality. Secondly, it is not thought advisable to plant a crop that will be ready to harvest in the middle of the north-east monsoon. A long-term seed will only mature in January, after the rains have ended and drying and threshing operations can be carried out more easily".

Besides, it is also pointed out that the existing selection of High Yielding Varieties (HYV) of paddy do not offer a variety well adapted to the wet season conditions (Harris, 1982: 166 and 155); Anden-Lacsina and Barker, 1978: 23; see also Mencher, 1978: 253).

In village A, the varieties of paddy that are grown are Ponni, Bayyagunda and Vadamsamba. Vadamsamba has a crop duration of 155 days and Bayyagunda has a crop duration of 167 days. It is pointed out that both these varieties can be cultivated in dry lands and can withstand drought (GOI, 1961: 28). But, in village A most cultivators prefer Bayyagunda to other varieties in the first crop-season.

Except the month of November in all the other months in a year the potential evapo-transpiration is greater than the dependable precipitation; therefore, there is a need for supplemental irrigation to meet crop-water requirements (see 2.2.4). Though, there is a need for irrigation, resort to irrigation in village A during the first crop-season, is made only around the end of October. The reasons for this are:

(a) The quantum of precipitation in the months prior to October do not bring in enough inflow of water into the tank to warrant the opening of sluice-gates.

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5. Some of the Paraiyan cultivators informed us that they grow Ragi in some of their plots which they use for their consumption needs. We have not been able to get information regarding the extent of land under Ragi, because, the Adangal and other registers pertaining to the village declare all lands to be under paddy.

(b) As described earlier, though on an average the rainfall is adequate to meet crop-water requirements in the month of November, the average number of rainy days are around 10. In other words, on an average 20 days of the month are dry (see 2.2.4). And, it is around the end of October or so that the plant (of the first crop-season) starts heading and flowering and prolonged dry spells between two rainy periods at this stage may cause serious decrease in yield. Hence, from about the end of October onwards, water is released from the tank for the first crop-season whenever the need for irrigation is felt, i.e. whenever there is a long dry spell between two rainy periods. And the water releases from the tank is stopped as soon as precipitation falls.

To restate, the first crop-season in village A is dependent entirely on precipitation till the end of October and from the end of October onwards resort to irrigation is made whenever required. Hence, this crop-season in village A is referred to as Puzhudi-kal payir.[6] It has to be noted here that, as the crop-season is dependent on precipitation in the initial stages, the decision by a cultivator, especially if he owns plots in the last Reach of the ayacut, to cultivate the plots is not based on the availability of water in the tank but, on other considerations.[7] Having provided an account of the agronomic aspects of the first crop-season, let us now go on to describe the agronomic aspects of the second crop-season.

II. Second Crop-season

The second crop-season in village A, begins around January and ends in April. During this period there is virtually no precipitation, hence, the second crop-season is entirely dependent upon the tank (see 2.2.3). In an earlier chapter,

6. "Pulithikal, or dry seed cultivation, is commenced when the Nunjah land is wet with rainfall... The growth (after the seeds are sown) is produced by the moisture of the ground. It is again left for a month and a half, or two to grow in the moisture caused by rainfall, and not by irrigation. After this periods the fields are kept constantly irrigated..." (Crole, 1879: 37).

7. The Adangal register of village A for faslis 1389 (1979) and 1391 (1981) declares, 157.30 acres and 119.68 acres as current fallow. About 98.00 per cent of the plots declared as current fallow are in the Last Reach and most of these plots are owned by Paraiyan landowners.

while describing land categories, it was pointed out that 272.50 acres are registered as "compound" lands and these lands have a prior claim to water over all other lands during the second crop-season. It was also pointed out that we are not aware of how the demarcation of these lands had evolved (see 2.4.3).

The tank in village A receives two fillings (see 2.3). At the beginning of the second crop-season, the quantum of water available in the tank depends on the quantum of precipitation which fell during the North-East monsoon, and the amount of water released from the tank during the first crop-season. During the four months, viz., January to April, there is virtually no inflow into the tank. Assuming that the tank is filled to full capacity (i.e. 81.20 m.c.ft)[8] at the beginning of the second crop-season, there would be extensive evaporation losses from the tank during January to April, leading to reduced availability of water in the tank for irrigation purposes. It appears, therefore, that water that is available in the tank, net of evaporation losses is capable of meeting crop-water requirements of crops grown in 272.50 acres only. To put it differently, assuming full capacity, 272.50 acres appears to be the maximum that can be irrigated by the tank during the second crop-season.

Unlike the first crop-season, in the second crop-season, the decision by a cultivator to cultivate his lands depends on the availability of water in the tank at the beginning of the crop-season. On seeing the tank filled to capacity at the beginning of the crop-season, the cultivators who own plots adjacement to "compound" lands may also decide to grow a crop.[9] In the initial stages when water is available in plenty, these plots would be allowed to draw water, but in the last stages of the crop-season when there is an acute demand for water, these

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8. In an earlier chapter, we pointed out that the capacity is one which was estimated by the Tank Restoration Scheme (TRS) Party. We are not aware of the present capacity of the tank as no effort has been made by P.W.D. to estimate it (see 2.3, 21n).

9. According to the Adangal registers for the faslis 1389 and 1391, (i.e. 1979 and 1981), 106.63 acres and 36.29 acres respectively of "non-compound" lands were cultivated during the second crop-season.

lands would not be allowed to draw water, thus leading to conflicts.[10]

In this crop-season, seedlings are transplanted unlike in the first crop-season. This is because the land is ploughed and reduced to a puddle using the tank water. Hence, this crop-season is referred to locally as Sedai-payir.[11] About 25 days after transplantation urea is mixed with chemical fertilizers like complex 17,17,17 and applied. Urea is again applied after the 45th days or so. The amount of urea applied in this crop-season ranges between 50 to 75 kgs per acre and the amount of chemical fertilizers like complex 17 17 17 applied averages about 100 kgs per acre. Use of pesticides is resorted to in this crop-season.

In this crop-season short duration High-yielding varieties (HYVs) such as IR-8 and IR-20 are grown. IR-8 is a semi-dwarf variety, which has a crop-duration of about 135-150 days and is medium-coarse in quality (Harris, 1982: 80). But it lacks resistance to bacterial blight, tungrovirus etc. (Anden-Lacsina and Barker, 1978: 30). On the other hand, IR-20 which has a crop-duration of 130 days, is of fine quality (Harris, 1982: 80), and, is also moderately resistant to tungrovirus and leaf hoppers (Anden-Lacsina and Barker, 1978: 30). Hence, most of the cultivators in village A who grow a second-crop prefer IR-20, to other varieties.

The reason why HYVs are grown in the second crop-season and not during the first crop-season is because, as mentioned earlier, the existing selection of HYV's does not offer a variety well adapted to the wet season conditions. It is also pointed

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10. We were informed by some of the villagers that a Paraiyan landowner who did not own "compound" land cultivated his land during the second crop-season in 1981. When he has not allowed to draw water during the last stage of the crop-season, he was supposed to have brandished an aruval and threatened that he would physically assault anybody who stopped him from drawing water. It was also pointed out to us that this was a freak case and usually conflicts over water stop at shouting and gesticulating.

11. In Sedai-Payir, "the land is irrigated by water from tanks and channels, ploughed four or five times ..., and thus reduced to a puddle" (Crole, 1879:36).

out that, the yields are much higher and show much less variability when HYV's are cultivated, under irrigation, during the dry season, than they are when the varieties are grown in the main wet season. And, the reason for this seems to be the lower level insolation due to greater cloud cover during the monsoon period (Harris, 1978: 155; also Anden-Lacsina and Barker, 1978: 23).

CHAPTER 5

THE PRESENT STATE OF ALLOCATION AND MAINTENANCE — AND ITS LOGIC

In an earlier chapter, our account of the state of allocation of water from the tank, and maintenance of physical facilities in village A, was restricted to a description of what is supposed to be the case or, the "ideal" state of affairs. In this chapter, therefore, to begin with we would be concerned with the present state of allocation of water from the tank and maintenance of physical facilities in village A or the actual state of affairs with regard to these two activities. The description would show the extent to which there is a lack of correspondence between the "ideal", and the actual state of affairs.

It may be pointed out in the beginning itself that, there is not much of a gap between the "ideal" and the actual state of affairs with regard to allocation of water. But there is a yawning gap as it were, with regard to the maintenance of physical facilities. Hence, after a brief description of the present state of allocation of water, we would describe in detail the present state of maintenance of physical facilities. Later in the chapter, we would be going into the reasons for the present state of maintenance of physical facilities in village A.

In a sense, this chapter would highlight the present state of irrigation organisation in village A, and reasons for the same.

5.1 The Present State of Allocation of Water

In village A, there are two sets of rules of allocation of water from the tank - one, during the first crop-season, when the entire ayacut of 1,027 acres has to be irrigated by the tank, and two, the second crop-season, when a portion of the ayacut, viz., 272.50 acres has to be irrigated by the tank (see 3.3.3).

As far as we could gather there has been no changes in these rules of allocation in the recent past. The dates of opening of the two sluices, viz., the Palla-Madagu and the Mettu-Madagu is decided in the village meeting (see 3.3.3). But, it is clear from the responses of many villagers that the Naidu landowners control the decision with regard to the opening of these two sluices. This is not surprising considering the fact that the Naidu landowners own major portions of land in the Upper and Middle Reaches, and hence, would allow tank water to be released only when required by them. While this is so in the case of opening of Mettu-Madagu, the Palla-Madagu is opened in the middle of the second crop-season, and the Naidu landowners who own 59.60 per cent of "compound" lands can have their way with regard to the oepning of this sluice. In fact, the Naidu landowners manage to have their writ run through the Naidu Panchayat President who is the final decision enforcing authority with regard to irrigation in the village.[1]

In the first crop-season, when water is released from the tank, "ideally" all segments of the ayacut are to have equal access to tank water. But the majority of plots in the Last Reach of the ayacut experience "difficult" water supply condition (see 2.4.1). And, this is one of the reasons for the poor yield of plots in the Last Reach compared to plots in the Upper and Middle Reaches of the ayacut (see 4.1.1). But, the "difficulty" in water availability is not because of rules of allocation but, more due to the absence of field channels for majority of plots in the Last Reach (see pp. 102, 2n).[2]

In the second crop-season, the rules of allocation of water from the tank provides for differential access to certain segments of the ayacut, viz., 272.50 acres of "compound" lands. In the previous chapter it was pointed out that the

1. In fact some of the Naidus pointed out that it is they who decide the date of meeting, and ask the Panchayat President to convene a meeting on that date.

2. It is interesting to note that the Paraiyan cultivators have made no effort at rectifying this problem, when asked, everyone was blaming the other cultivators for not co-operating in the effort. One reason for the absence of any initiative on the part of Paraiyan cultivators to dig the channels could be because the effort involved is not commensurate with the gain that may accrue as a result of it.

rules of allocation in the second crop-season, though extremely inequitable fares well in terms of productivity considerations. From the overall planning objective in India, viz., the need to increase agricultural productivity/production, the rules of allocation in the second crop-season in village A therefore, fare remarkably well.

5.2. The present state of maintenance of physical facilities

Having described the present state of allocation of water from the tank in village A, we would now describe the present state of maintenance of physical facilities. But, our account would be restricted to the description of the maintenance of varavu-kal, podhu-kal, only and would not be concerned with the repair or the maintenance of bund, sluice-gates, waste-weirs, etc. This is because, as mentioned earlier (see 3.3.4) the former is a regular activity which has to be carried out once or twice in a year; while, the latter is only carried out as and when the situation warrants. Also, in the execution of the former maintenance activity, all those who benefit from the irrigation source have to be involved, hence, apart from the problem of mobilizing all the beneficiaries, the contribution by the beneficiaries itself would be dependent on a number of factors. On the other hand, the repair or maintenance of tank bund, sluice gates, etc. would be carried out as and when the situation warrants, by the P.W.D. on the basis of well defined formal procedures (see 3.3.4). Hence, a description of the execution of regular maintenance activity, apart from being interesting in its own way, is also quite important.

With this backdrop, let us now go on to describe the present state of maintenance in village A.

In village A, at present there is a virtual breakdown of regular maintenance activity, viz., the maintenance of varavu-kal and podhu-kal. According to the villagers, the varavu-kal which conducts water from the free basin to the tank has not been cleared at all for the past 15 years or so. Currently, the varavu-kal is completely silted up, and is covered with thorny bushes. On the other hand, there is some semblance of maintenance of the podhu-kal. But it was pointed out to us that there is poorer and poorer turn out of beneficiaries to clear the podhu-kal. According to some senior villagers, the clearing of the podhu-kal and varavu-kal used to resemble a festive occasion, when about 150 to 200 individuals used to converge to clear them. Currently, the clearing of podhu-kal resembles nothing of that kind.

The time of our survey in village A, i.e. in 1982, was one of poor rainfall. The tank's sluice was not opened till mid-November, because there was not much water in the tank to warrant the opening of the sluice. Since, there was virtually no rainfall at all in the month of November, the plants began to wilt. Hence, after a village meeting[3] it was decided to open the sluice, and save the standing crop atleast in a few plots. The mettu-madagu, was therefore opened on 16, November. Once the sluice was opened, it was found that the water did not pass in the podhu-kal, because it was blocked by weeds. Interestingly, though the podhu-kal is supposed to be cleared once before the advent of monsoon, it was not cleared at all till then. The sluice was blocked immediately and the Talaiyari was asked to inform all the beneficiaries to assemble for clearing the podhu-kal. But virtually none turned up for clearing the podhu-kal. While most of the cultivators were busy clearing away the kilai-kals. A prominent Naidu landowner informed us that many people especially paraiyan cultivators demanded wages to clear the podhu-kal, which the Naidu landowners, were unwilling to pay.

The Naidu landowners, who would be the chief beneficiaries once the tank water is released, themselves had not sent anybody to clear the podhu-kal. When none turned up for clearing the podhu-kal, some of the prominent Naidu landowners who still commanded some padials (see 3.1.4 and 3.1.7) were forced to send them, and other tenants to clear the podhu-kal. Apart from a couple of Naicker cultivators, a prominent paraiyan cultivator who identifies himself more with the Naidus than the

3. Unfortunately, we were unable to attend this particular village meeting.

Paraiyans (see 3.1.6), and owns plots in the Upper and Middle Reaches of the ayacut, also took part in clearing the podhu-kal in that year. There were only about 40-50 persons, involved in clearing the podhu-kal.

Suffice it to say here that there is a virtual breakdown of regular maintenance activity in village A. In other words, there is a sizeable gap between the "ideal" and the actual state of affairs with regard to regular maintenance activity. In the next section, what we propose to do, therefore, is to describe the reasons for the breakdown of regular maintenance activity in village A.

5.3. The Reasons for the Breakdown of Regular Maintenance Activity

In the previous section, it was pointed out that the execution of regular maintenance activity, viz., maintenance of varavu-kal and podhu-kal, i volves mobilising all the beneficiaries and the contribution by beneficiaries would be dependent on a number of factors. It was also pointed out in that section that, at present there is a sizeable gap between the "ideal" and the actual state of affairs with regard to maintenance of varavu-kal and podhu-kal. In other words, at present, there is a virtual breakdown in maintenance of these due to non-contribution of labour by many of the beneficiaries. In this section therefore, it is proposed to go into the reasons for the non-contribution of labour by many of the beneficiaries in village A.

Earlier, it was pointed out that the allocation of water and maintenance of physical facilities are related to one another (see 1.1.6). For, the rules of allocation determine who gets how much of the gains of irrigation, and the rules of maintenance determine who bears how much of the cost, viz., contribution towards maintenance of physical facilities. Hence, the cost that a beneficiary is willing to bear is dependent on the gains which he receives from the irrigation source.

In the previous chapter it was pointed out that, the Paraiyan cultivators in village A receive hardly any of the gains of irrigation, and especially so during the second crop-season. But, they are expected to contribute labour towards maintenance of podhu-kal in the month of January (i.e. in the beginning of the second crop-season), In this sense, the rules of maintenance in village A are inequitable besides being disproportionate to gains received, viz., the contribution by each beneficiary is independent of the extent of land owned.

The Paraiyan cultivators, in village A who receive hardly any of the gains of irrigation compared to the Naidu and Naicker cultivators are not willing to contribute labour for maintenance. This is so because, most of them feel that their contribution towards maintenance is disproportionate to the gains which they receive from the tank. As mentioned in the previous section, the paraiyans in village A are at present willing to contribute labour for the maintenance of podhu-kal only on the basis of specific contractual obligation, viz., payment of wages. If the Paraiyans had provided labour for maintenance earlier, it was mostly as a proxy for the Upper-caste cultivators. This was due to the fact that they were personally dependent on the upper caste cultivators in the form of attached labourers.

In an earlier chapter, it was pointed out that prior to the end of 18th century, there existed a form of tenure, which was communal in nature. Under this communal form of tenure referred to as the mirasi tenure, one particular caste owned lands collectively in the village (see 3.2.4). It has been pointed out that there is a relation between the mirasi tenure, and the agrestic servitutude that prevailed in many places in Madras Presidency (Hjejle, 1967: 79). Under the mirasi tenure, the paraiyans were held in a state of bondage, and were referred to as adimais (slaves) who could be sold or mortgaged along with the land (Hjejle, 1967: 75 and 79). The adimais were usually communally owned and among the previleges attached to the mirasi was a share in the labour of these people (Hjejle, 1967: 79).

The Paraiyan adimais, apart from providing labour for agricultural operations of their masters, "... had to perform various other taks when called upon by their masters to do so. The more important of these were the repair of the irrigation works..." (Hjejle, 1967: 84). Gough (1981: 105) mentions that, "in Thanjavur the communally owned agricultural slaves were the class especially set aside for building and digging out the irrigation channels and cultivating wet rice". It appears therefore that under the mirasi tenure, the entire labour for agricultural operations used to be provided by adimais, part of which used to be deployed for maintenance of irrigation works.

With the enactment of Slavery Abolition Act in 1843, the prevailing labour arrangement had slowly disintegrated and another form of labour arrangement, viz., padials came into being. Padials, are farm servants who are engaged on a long term basis as a part of an arrangement whereby they take a loan from their employers and agree to work for them full-time in return (Gray, 1918: 6; and Sundari, 1981: 26). And, in Chinglepet district, the padial in most cases was a paraiyan.[4] The padial, apart from providing labour for agricultural operations, had to perform various other tasks for the landlord. In fact, not only the labour of the padial, but the labour of his entire family is often tied to the landlord's house.[5]

Gough (1981: 51) mentions that in Thanjavur district of Tamil Nadu the Panniayals (equivalent of padials in Chinglepet district), "... had other collective obligations to the village as a whole, such as digging out the irrigation channels and dragging the temple cars in village festivals".[6] We were informed that in village A also prior to around 1940 or so, most of paraiyans in the village who were employed as padials used to act as a proxy for the upper caste landowners, especially

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4. "The Padiyal is in the vast majority of cases a paraiya. Of the 98 villages in Chinglepet district which I visited the padials in 71 villages are all paraiyas, in one village the padials are all vanniyars, while in 16 villages most of the padiyal are paraiyas the remainder being Nayaks, vanniars, Idaiyars and other castes. In other 10 villages there are no padiyals at all" (Gray, 1918: 15).

5. See Gray (1918: 8).

6. See also Gough (1981: 181 and 220-221).

the Naidus, in contributing labour for maintenance. This was so, because, the Naidus in village A, do not contribute labour for agricultural operations but, essentially supervise the agricultural operations carried out by the Paraiyan labourers (see 3.1.2).

In village A, at present the padial labour arrangement has more or less broken down. The reasons for the breakdown of padial labour arrangement are:[7]

(a) Most of the paraiyans in village A have become relatively autonomous vis-a-vis the upper-caste, through acquiring some lands in the village, even though the lands are in the Last Reach of the ayacut, (see 3.2.1 and Table 11).

(b) Availability of alternate employment for Paraiyans in Madras city. As pointed out earlier the village being quite close to the Madras city, about 40-50 Paraiyans have managed to find jobs as lorry loaders, and other odd jobs in the city (see 3.1.8).

In village A, therefore, at present the Paraiyans do not contribute labour for maintenance of varavu-kal and podhu-kal as a proxy for upper-caste Naidu land-owners. And, if the Naidu landowners do manage to extract labour for maintenance from some Paraiyans who are still personally dependent on them, viz., their padials and tenants, it is only a small proportion of the entire Paraiyan population in the village.

Interestingly, though the Naickers are a labouring caste, most of the Naicker cultivators have not been contributing labour for the maintenance of the podhu-kal and/or the varavu-kal. In the earlier chapter (see 3.1.5) it was pointed out that the Naickers have only recently emerged as landowners in the village. Prior to about

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7. It is pointed out that prior to depression of 1930's, a large number of people, mostly paraiyans (Hjejle, 1967: 108), migrated from Tamil Nadu to Sri Lanka and other countries to work in plantations. The depression choked of most of this migration, and in fact caused a net return of migrants to Tamil Nadu (Gough, 1981: 53; and Baker, 1981: 581). This helped in swelling the ranks of unemployed agricultural labourers in Tamil Nadu, which apart from forcing the wages down, also led to changes in the methods of employing labourers (Baker, 1981:581). The landowners who had formerly relied on hiring padials, now found it expedient to dispense with it, and rely on hiring agricultural labourers from the growing pool of casual labourers (Baker, 1981: 581-582; also Gough, 1981: 53).

1930 or so, the Naickers were mostly tenants and agricultural labourers. With the migration of Rajas from the village, the Naickers acquired lands and became landowners. The Naickers, in their previous status as tenants and agricultural labourers might have contributed labour for maintenance of podhu-kal and varavu-kal, as a proxy for their upper-caste landowners. But, in their new found status as landowners they are not willing to contribute labour for maintenance, even though, they stand to gain from the tank. One factor which could have influenced this is the fact that the Naidus, who are the chief beneficiaries of irrigation source have not made any effort towards the maintenance of podhu-kal and varavu-kal. And, any effort on the part of Naicker cultivators to clear them would benefit the Naidu landowners most and not the Naicker landowners. This is probably one of the reasons for the unwillingness on the part of Naicker landowners to contribute labour towards maintenance.

Thus, the non-contribution of labour by Paraiyans, both as landowners and as proxies for upper-caste landowners, towards maintenance, and the unwillingness to contribute on the part of Naicker cultivators, would probably explain the reduced outturn of people towards maintenance of varavu-kal and podhu-kal, and consequently, the negligent maintenance of the same.

What is left open, however, is why an alternate arrangement, for instance, in terms of wage labour, has not emerged. In the previous section, it was pointed out that the Paraiyans demanded wages to clear the podhu-kal, which the Naidu landowners were unwilling to pay. This is so, inspite of the fact that Naidus are the major beneficiaries from the tank, and they stand to gain if the podhu-kal is cleared. One reason for the relutance on the part of Naidus to pay wages to clear the podhu-kal could be the emerging role of wells as supplementary source of irrigation.

It was pointed out earlier (see 2.1.3) that the number of wells supplementing recognized sources of irrigation have been increasing in Chinglepet district.

It was also pointed out that the increase might be a result of the fact that many of the tanks might have been fallen into disuse or it could be used as an escape route to circumvent organisational procedures in community sources of irrigation. We also pointed out the increase in number of wells supplementing recognized sources of irrigation would discourage the continuous process of care for community sources of irrigation.

In an earlier chapter (see 3.1.4), it was pointed out that of the 14 wells fitted with electric pumpsets, 10 are owned by the prominent Naidu landowners in the village. All these 10 wells fitted with pumpsets, are used to supplement the tank irrigation. In effect, these 10 wells fitted with pumpsets permit most of the Naidu landowning households to carry on their agricultural operations, independently of the tank. Hence the Naidus are not much interested in maintenance of podhu-kal, which explains why no alternate arrangement of maintenance has emerged in village A.

In sum, in this chapter we considered the present state of allocation of water and maintenance of physical facilities and analysed the reason for the same. We pointed out that there is not much of a gap between the "ideal" and the actual state of affairs with regard to allocation of water. On the other hand, there is a sizeable gap in the case of maintenance of physical facilities. Coming to the reasons for the same we pointed out that the Paraiyans are not willing to contribute, since the gains of irrigation are not proportional to the labour that is contributed towards maintenance, there is a reduced dependence on Paraiyans, as a result of breakdown of padial labour arrangement and the unwillingness to contribute labour by Naickers, in their new found status as landowners. We then analysed why an alternate arrangement has not evolved, and attributed the same to the growing importance of wells as supplementary sources of irrigation.

CHAPTER 6

CONCLUDING OBSERVATIONS

In the context of India, irrigation is of vital importance. In community irrigation sources the rules of allocation determine land categories. To elaborate, in a situation when the water available in the irrigation source can irrigate the entire service area, if the system of allocation is order based, then land categories like Upper Reach, Last Reach are determined. And, in a situation when the water available in the irrigation source cannot irrigate the entire service area, if differential access to water is provided, then we have two land categories, viz., lands which are entitled to water and lands which are not entitled to water. Since, atleast in India, water rights are not separated from land rights, control over the irrigation source is exercised through control over land. Who controls the irrigation source ultimately determines the distribution of gains of irrigation.

In a situation when the water available in the irrigation source can irrigate the entire service area, although the rules of allocation provides for equal access to all the beneficiaries, those who control the Upper and Middle Reaches stand to gain by virtue of their nearness to the source of irrigation. In a context when the water available in the irrigation source cannot irrigate the entire service area, and differential access to water for certain users is provided, though, the productivity gains of irrigation may be achieved, equity in the distribution of gains of irrigation is not satisfied. Hence, there is likely to be a conflict between equity and productivity which would have a bearing on the maintenance of the irrigation system.

But, the conflict is a non-issue as long as one particular caste or group control all lands. For instance, in Tamil Nadu, prior to the end of the 19th century, under the mirasi tenure which was communal in nature, one particular caste (essentially the Upper castes) controlled all the lands in a village. Even if, within a caste there were divisions along class lines (in terms of extent of land owned), since, there were mechanisms for equalisation of advantages of holding land, everybody received a share in the productivity gains of irrigation.

Since, one particular caste controlled all the lands in a village (usually, Paraiyans were not allowed to own lands), they had complete control over the irrigation source. According to Ludden (1978), "control of irrigation enabled the Vellala-Brahmin elite to avoid physical labour, which became associated with the physical lowness (pallam) of irrigated lands and channels (pallakal) and the ritual lowness of Palla cultivators (pallakudi). Untouchable cultivators were encumbered with overwhelming social disabilities, by which their potential independence as producers was eliminated, their mobility restricted, and their client status perpetually reinforced".

Thus, under the mirasi tenure there were two neat divisions, viz., the land-owning class and the labouring class. And, the division was on communal lines. While the entire gains of irrigation accrued to the Upper caste landowners, the Paraiyan labourers who were tied to the Upper-caste landowners in the farm of adimais had to act as a proxy for them and contribute labour for the maintenance of the irrigation source.

Although, the form of land tenure has changed from communal ownership to individual ownership and the lower castes have managed to acquire land in the present times, the Upper castes as a group still manage to control the irrigation source through their control over land. This is a direct result of the historical conditions described above. In village A, for instance, about 75 per cent of the lands owned by the Naidus is distributed across the Upper and Middle Reaches of the ayacut. In effect, this means that 75 per cent of the land owned by Naidus has a favourable access to water during the first crop-season. The Naidus also own 60 per cent of the total "compound" lands in the village. In other words, they have the maximum access to tank water during the second crop-season.

The Naidus in village A apart from their control through land also control the final decision making authority with regard to allocation of water and maintenance of physical facilities, viz., the Panchayat President, who has always been a Naidu. On the other hand, the Paraiyans have been entrusted with the task of allocating water in various channels. In fact, wherever evidences have been available (in the case of South India) it can be found that the Upper castes always control the decision making body and the lower castes are entrusted with the task of allocating water in various channels.

On account of their control over the irrigation source, major portion of the gains of irrigation in village A accrues to the Naidus. They are followed by Naickers in that order. On the other hand, Paraiyans receive hardly any of the gains of irrigation. It may be observed in this specific case that the gains of irrigation have been determined on a caste basis and reflects the social hierarchy in the village.

At a stage when the lower castes become relatively autonomous vis-a-vis the Upper castes and the distinction between the landowning and labouring class gets slightly blurred, the conflict between equity and productivity considerations assumes crucial importance. The lower castes who are no more in a dependency status vis-a-vis the Upper castes may not be willing to provide labour for maintenance if they do not receive a share in the productivity gains of irrigation commensurate with the extent of land owned by them. They may in some cases be willing to offer labour for maintenance only on the basis of specific contractual obligation, viz., payment of wages. This is precisely what is happening in village A.

The Upper castes who are not willing to share the productivity gains of irrigation with the lower castes, and who also are unwilling to accept the changed conditions, may invest in private sources of irrigation, viz., wells, to circumvent the irrigation organisation. The wells would provide them autonomy to carry on cultivation irrespective of the state of community irrigation source. Since, technology is not scale neutral, the lower castes who do not receive much of the gains of irrigation may not be able to invest in wells. This would further exacerbate the prevailing inequity.

As the dependency on well water increases, the dependency on community source of irrigation would decrease leading to poor management of the same. This could result in further inequitable distribution of water from the community irrigation source.

Investment in wells may be a technical solution for this malady as far as the larger landowners are concerned. But the technical solution is only a short-term remedy, in the sense that in the long-run ground water on which wells are dependent for their supplies call for recharging. The recharging could only be facilitated by proper conservation of precipitation which would call for some sort of surface storage. The system of tanks is one of the modes evolved for such conservation, the maintenance of which would call for socio-institutional reforms which could in some way make for a more equitable distribution of the gains of irrigation and ensure proper maintenance. Thus, though, technical solutions may serve the interests of certain segments of society institutional reforms are a necessity for long-run solution of the problem.

GLOSSARY OF TAMIL WORDS

1.	Adangal	-	register of land records kept for each village, which provides for each survey number and their sub-divisions informations on the extent of land, the revenue assessment, whether one or two crops are cultivated on the said plot, the numberof the patta and the name of pattadar, if leased out, the name of the tenant, the share of the landowner, (usually under these two columns even if the land is leased out it is entered as direct cultivation by the owner), the month when the crop was sown, the details of crop sown, the extent sown and the month when harvested etc.
2.	Adimais	-	Slaves
3.	Aruval	-	a particular kind of knife
4.	Cheri	-	a hamlet inhabited by Paraiyans which is separated from the village proper.
5.	Chitta	-	a register of land records kept for each village, which lists according to Patta number the extent of land under various survey numbers and their sub-divisions owned by each Pattadar.
6.	Eri	-	a body of water farmed by throwing a mound or bank across a valley or hollow ground (tank).
7.	Eri Ethir Vayil	-	area of the free basin.
8.	Kambukkutty	-	a ditch - tender, invariably a Paraiyan who allocates water in the various channels.
9.	Kani	-	a Tamil measure of area equal to about 1.33 acres.
10.	Kilai - Kals	-	branch canals.
11.	Madavu	-	stream
12.	Marakkal	-	a unit of volume measure, used especially for grain equivalent to about 4.50 kg's of paddy.
13.	Mettu - Madagu	-	upper sluice.
14.	Mirasi	-	system of land-tenure in the pre-British India in which lands were controlled by one particular community.
15.	Nancai	-	wet land irrigated by a tank.
16.	Navarai	-	the second crop-season in chinglepet district which begins in January and ends in April/May.
17.	Padi	-	unit of volume measure, equal to about one-fourth of a marakkal.
18.	Padial	-	attached labourer, who is paid by the Padi.

19. Palla-Madagu - lower sluice.

20. Pazhaiya-veedu - oldest house.

21. Podhu-kal - public distribution channel.

22. Puncai - dry land usually irrigated by a well.

23. Puzhudi-kal Payir - dry seed cultivation

24. Samba - agricultural season, from August to January.

25. Sedai-Payir - wet cultivation

26. Sournavari - the third crop-season, from May to August.

27. Talaiyari - a village servant, his work involves police duties, as well as collecting land-revenue.

28. Ur - village proper.

29. Varavu-kal - feeder channel or supply channel.

30. Vettiyan - a village servant, usually a member of the Paraiyan caste.

BIBLIOGRAPHY

I. Government Publications

Crole, Charles Stewart (1879): The chinglepet, Late Madras District: A Manual compiled under the orders of Madras Government, Madras, Asylum Press.

Ellis, W.M., (1963): Irrigation, Government Press, Madras.

Government of India (1881): Report of the Famine Commission

Government of India (GOI), (1958): Indian Livestock Census, (1956), Vol.II, Ministry of Food and Agriculture, New Delhi.

————————,(1958): Report of the Minor Irrigation Committee, (1957), GOI Press.

————————,(1959): Report on Minor Irrigation Works in Madras State, Committee on Plan Projects, New Delhi.

————————,(1961): Census of India, Madras, District Census Handbook, Chinglepet, (Vol.I).

————————,(1972): Indian Livestock Census, 1966, Vol.II, Ministry of Food and Agriculture, New Delhi.

————————,(1971): Census of India, Tamil Nadu, District Census Handbook, Village and Town Directory, Chinglepet District.

————————,(1972): Report of the Irrigation Commission, Vol.I, Ministry of Irrigation and Power, New Delhi.

Government of Madras, (1911): Revision Survey and Re-Settlement Register (of village A), Revenue Settlement Office Party No.1, Saidapet.

————————, (1923): Descriptive Memoirs of Irrigation Works in Chinglepet, No.50, Madras Minor Basin, Chinglepet District, Public Works Department, Madras.

Government of Tamil Nadu (GOTN): Season And Crop Reports, (various issues), Issued by the Director of Statistics, Government of Tamil Nadu.

————————,(1978): Rainfall Statistics of Tamil Nadu for Three years (from 1975-76 to 1977-78) issued by the Commissioner of Statistics, Madras.

Gray. J. (1918): Statistics of Wages, Board of Revenue, Madras. Revenue Settlement, Survey, Land Records and Agriculture, Proceedings No.106, 29 May 1918.

Krishnaswamy, S.Y. (1947): Rural Problems in Madras (Monograph). Government Press, Madras.

Pate, H.R., (1917): Madras District Gazetters, (Tinnevelly), Government Press, Madras.

Thurston, Edgar (1909): Castes and Tribes of Southern India (Vol.V), Government Press, Madras.

II. Other Publications

(a) Newspaper articles

Jagathpathi, G (1984): 'The Future of Irrigation' in The Hindu, June 14, 1984, Madras.

Krishnaswamy, S.Y, (1982): 'Tanks, a question of restoration' in The Hindu, April 3, 1982.

Reporter, Madras (1982): 'A modernisation which can brook no delay' in The Hindu, March 8, 1982.

——————— (1983): 'Tank irrigation acquires new significance' in The Hindu, July 27, 1983.

Reporter, Madurai (1983): 'Drought in Tamil Nadu': is short duration crops the answer, in The Hindu, February 17, 1983.

——————— (1983): 'The barren lake districts' in The Hindu, December 11, 1983.

(b) Articles Published in Journals

Bray, Francesca, (1983): 'Patterns of Evolution in Rice- Growing Societies', Journal of Peasant Studies, Vol.11, No.1.

Baker, Christopher, (1981): 'Colonial Rule and the Internal Economy in Twentieth-Century Madras', Modern Asian Studies, Vol.15, part 3.

Coward Jr, Walter. E, (1977): 'Irrigation Management Alternatives: Themes from Indigenous Irrigation Systems', Agricultural Administration, Vol.4.

Chaudhari, Parimal, (1983): 'Equitable Water Management', Business India, Issue No.127.

Good, Anthony, (1982): 'The Actor and the Act: Categories of Prestation in South India', Man (N.S), Vol.17, No.1.

Hunt, Robert. C, and Hunt, Eva (1976): 'Canal Irrigation and Local Social Organisation', Current Anthropology, Vol.17, No.3.

Hjejle, Bendicte, (1967): 'Slavery and Agricultural Bondage in South India in the Nineteenth Century', Scandinavian Economic History Review, Vol.XV, (1-2).

Jayaraman, T.K., (1981): "Farmers' organisation in surface Irrigation Projects, Two empirical studies from Gujarat", Economic and Political Weekly, (EPW), Vol.XVI, No.39.

Ludden, David, (1978): 'Ecological Zones and Cultural Economy of Irrigation in Southern Tamil Nadu', Journal of South Asian Studies, New series, Vol.1, No.1.

Ludden, David, (1979): 'Patronage and Irrigation in Tamil Nadu: A long-term view', Indian Economic and Social History Review, Vol.XVI, No.3.

Pant, Niranjan, (1981): 'Utilisation of Canal Water below outlet in Kosi Irrigation Project - Administrative and Community level solutions', EPW, Vol.XVI, No.39.

Sengupta, Nirmal, (1980): 'Indigenous Irrigation and Irrigation organisation of South Bihar', Indian Economic and Social History Review, Vol.XVII, No.2.

Sivakumar, S.S., and Sivakumar, Chitra, (1979): 'Class and Jati at Asthapuram and Kanthapuram: Some comments towards a structure of Interests', EPW, Vol.XIV, No.s 7 and 8.

Vaidyanathan, A. (1977): 'Performance and Prospects of Crop Production in India', EPW, Vol.XII, Nos. 33-34.

Varisco, Daniel Martin, (1983): 'Sayl and Ghayl: The Ecology of Water Allocation in Yemen', Human Econoly, Vol.11, No.4.

Wade, Robert, (1979): 'The Social Response to Irrigation: An Indian Case Study', The Journal of Development Studies, Vol.16, No.1.

(c) Books

Alaev, L.B, (1982): 'The Systems of Agricultural Production' in Tapan Ray Chaudhuri and Irfan Habib (Eds.), The Cambridge Economic History of India, Vol.I, Cambridge University Press.

Anden-Lacsina and Barker, (1978): Changes in Rice Farming in Selected Areas of Asia, The International Rice Research Institute, Philliphines.

Baden-Powell. B.H, (1972): The Land-Systems of British India, Vol.III (Reprint) Johnson Reprint Corporation, New York.

Chambers, Robert (1977): "Men and Water: the organisation and operation of Irrigation" in B.H. Farmer (ed), Green Revolution, Macmillan.

Clark, Colin, (1970): The Economics of Irrigation, Pergamon Press, London.

Coward Jr, Walter.E, (1980): Irrigation Development: Institutional and organizational Issues, in E.Walter Coward, Jr. (ed), Irrigation and Agricultural Development in Asia, Cornell University Press, London.

Downing, Theodore. E, (1974): 'Irrigation and Moisture - Sensitive Periods: A Zapotec case', in Downing and McGuire Gibson (eds.), Irrigation's Impact on Society, University of Arizona Press, Afizana.

Djurfeldt, Goran and Lindberg, Staffan (1974): Behind Poverty, The Social formation in a Tamil village, Curzon Press, Lund.

Drower, M.S., (1975): 'Water-supply, Irrigation, and Agriculture' in Charles Singer et.al. (eds.), A History of Technology, Vol.I (from early times to fall of Ancient Empires (500 B.C), Oxford Press.

Gough, Kathleen (1981): Rural Society in Southeast India, Cambridge University Press.

Grist. D.H., (1970): Rice, Longman, London.

Harriss, John. (1982): Capitalism and Peasant Farming, Oxford University Press, Bombay.

Hill, Polly, (1982): Dry Grain Farming Families, Cambridge University Press, Great Britain.

Kurien C.T., (1981): Dynamics of Rural Transformation:A Study of Tamil Nadu: 1950-1975, Orient Longman, New Delhi.

Kumar, Dharma (1965): Land and Caste in South India:Agricultural labour in the Madras Presidency during the Nineteenth Century, Cambridge University Press, Great Britain.

Leach. E.R. (1971): Pul Eliya:a village in Ceylon, Cambridge University Press, Great Britain.

Levine, Gilbert (1980): 'The Relationship of Design, operation and Management' in E.Walter Coward, Jr. (ed), Irrigation and Agricultural Development in Asia, Cornell University Press, London.

Mirza, et.al. (1975): Village organizational Factors Affecting Water - Management Decision-making Among Punjabi Farmers, Water Management Technical Report No.35, Colorado State University.

Mencher, Joan P. (1978): Agriculture and Social Structure in Tamil Nadu, Allied Publishers, Bombay.

Malhotra S.P. (1982): The Warabandi System and its Infrastructure, Publication No.157, Central Board of Irrigation and Power, New Delhi.

National Council of Applied Economic Research (NCAER) (1962): Economic Atlas of Madras State, NCAER, New Delhi.

Pasternak, Burton, (1978): 'The Sociology of Irrigation: Two Taiwanese villages' in Arthur P. Wolf (ed) Studies in Chinese Society, Stanford University Press, Stanford.

Raju, Sarada A. (1941): Economic Conditions in Madras Presidency 1800 - 1850, University of Madras, Madras.

Singaravelu. S. (1966): Social Life of the Tamils: The Classical Period, University of Malaya, Kuala Lumpur.

Venkataramani. V. (1974): Minor Irrigation in Tamil Nadu, Madras Institute of Development Studies, Tamil Nadu.

Wittfogel, Karl A. (1970): 'The Hydraulic Civilizations' in William L. Thomas Jr. (ed), Man's role in Changing the face of Earth, Vol.I, University of Chicago Press.

----------------. (1981): Oriental Despotism: A Comparitive study of Total Power, Vintage Books, New York.

III. Unpublished Sources

Government of Tamil Nadu: Adangal Register of Village A for the years 1979 and 1981, Revenue Department, Tiruporur, Madras.

——————————: Chitta Register of Village A for the years 1979 and 1981, Revenue Department, Tiruporur, Madras.

Narayana et.al, (1982): An approach to the study of Irrigation: Case of Kanyakumari District, Centre for Development Studies (CDS), Working Paper No.147.

Ramaprasad (1981): 'Rural Technologies for utilising surface waters' in Rural Technology Lecture Notes, Vol.II, Indian Institute of Science, Bangalore.

Sundari T.K. (1981): Caste and the Rural Economy: Report of a field study in Chinglepet District, CDS Working Paper No.130.

Vaidyanathan A (1983): Water Control Institutions and Agriculture: A comparative perspective, CDS Working Paper No.178.

Wade, Robert (1984): The Community Response to Irrigation: Management of the Water commons in Upland South India, Paper presented in 'Conference on Community Responses to Irrigation', Bangalore, January 4-7, 1984.

Kelly, William Wright (1980): Water Control in an Agrarian State: Irrigation Organisation in a Japanese River Basin 1600-1870, Ph.D dissertation, Brandeis University, University Microfilms International.