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B.P. 22 - MARRAKECH

MOROCCO

COMMON RESSOURCES PROPERTY

MODERN IRRIGATION IN "MIDDLE TESSAOUT"-MOROCCO

February, 1985

Prepared for the Common Property Steering Committee, Board on Science and Technology for International Development (BOSTID), National Research Council-Washington.

I beg the reader to excuse this audacious rough draft. The text will have to be rewritten in good English. My thanks to Khadija Touqui who, however, has accepted to correct just some flagrant mistakes.

COMMON PROPERTY RESSOURCES

MODERN IRRIGATION IN "MIDDLE TESSAOUT"

M O R O C C O °

The "Middle Tessaout" Perimeter, officialy called "Upper Tessaout" (1), is situated in the piedmont of Atlas mountains, at 70 Kms (kilometers) in the East of Marrakech City (see map in the appendix). Before the construction of the "Moulay Youssef dam in 1970, the plain was irrigated for centuries by tradional "seguias" (tradional mud canals) derived from the "Oued Tessaout" (Tessaout River).

The flow of the "oued" was irregular in an arid and precarious environment (less than 300 mm (millimeters) of rainfall per year).

Nowadays the perimeter is a modern irrigated one. The purpose with the construction of the dam and with the modern equipment of "Middle Tessaout" consists of regularizing the flow and guaranteeing the irrigation. Therefore it is possible to diversify cultures and to try bringing up outputs and incomes.

I- ATTRIBUTE RESSOURCES

1- Features :

The storage dam capacity is of 265 millions m3 (cubic meters
The irrigable surface is of 53.000 ha (hectares) where lives

° In this text, the principal notions will be used as defined in the Oakerson's paper : "Amodel for the analysis of common property problems", according to the Steering Committee wishes.

a hundred of thousands inhabitants in 1982 (some 14.000 rural families).

The irrigated area covers four different sectors (see map in the appendix) :

a- A sector of modern network of canals which receives high water allowances (26.000 ha with an average of 7.500 m3/ha).

b- A sector without modern equipment, but with high allowances, upstream of primary canals (2.000 ha of 6.000 m3/ha).

c- A sector without equipment where traditional irrigation remains with ancient water rights and insufficient allowance (25.000 ha with an average of 3.000 m3/ha).

d- An area irrigated by ground water, downstream of the perimeter.

The analysis will be centered here on the weedly modernized area (a), although sectors (b) and (c) are also concerned by regularized flow.

Water is derived from the head of the perimeter by three primar canals from which water is supplied by 37 secondary canals (see map). The network of secondary canals which stretches for 170 Kms generally follows ancient "seguias" tracing. This procedure has been adopted in order to safeguard the integralit of groups homeland.

Nevertheless, grids of third and fourth order canals have completely changed the traditional system downstream of this

network. They represent the most startling innovation in the irrigators' environment and have an important role within the new constraints of irrigation (see p . 4).

2- Constraints :

Theoretically water management is easier today than before regularization. Irregularity of flow and complexity of use and holding rights have been replaced by the incorporation of water in public property and the guarantee of allowances in proportion to surface of fields and nature of planting.

However, this management has some inevitable constraints. The essential principle of irrigation which governs all the system is to meet opportunetly water needs of plants in any phase of their growth. In this target, monthly allowance rule is established in the basis of plants needs and in the limits of reservoir retaining capacity.

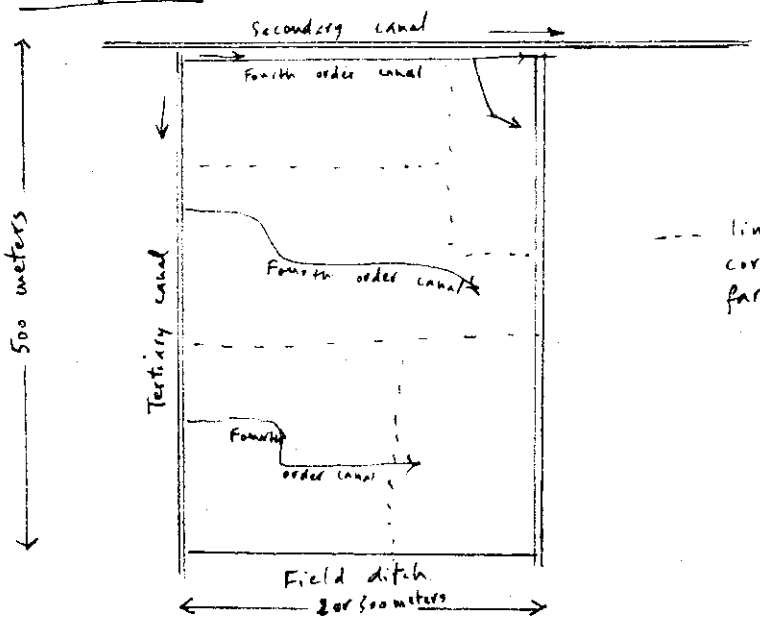
Continuous aduction arises in primarly and secondary canals. As concerns distribution, it is organized by third and fourth order canals and has two forms :

- In critical period, when peak irrigation is necessary, all the tertiary canals are used at the same time;
- In other periods, these canals function in turns.

Two forms of grids have been realized in order to supply the patches from tertiary canals :

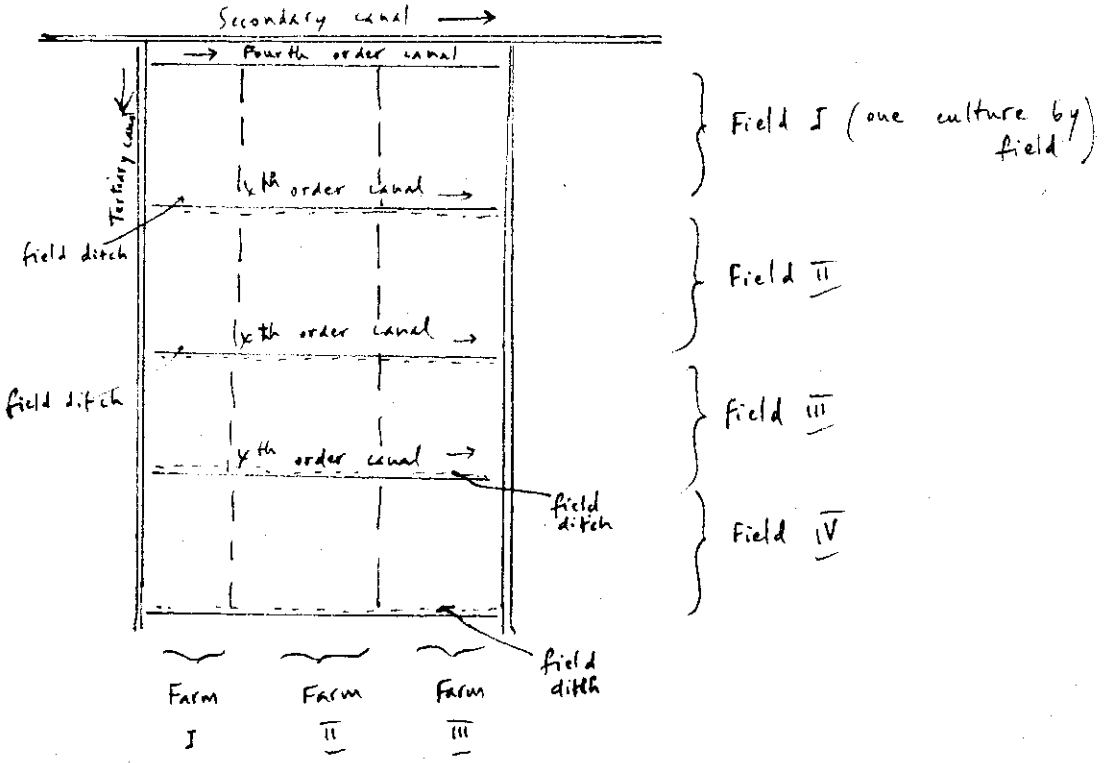
- The grid A :

- The grid A :



In this kind of grid, quaternary canals can have multiple tracings according to the micro-relief and the forms of patches limits. Regrouping patches and levelling soil can be undertaken or not.

- The grid B :



Ingineers call this grid "rational grid". Forms and dimensions of secondary and tertiary canals are like those in grid A. But regrouping patches is necessary, and such some important equipments as clearing of stones and bushes or levelling. The target is to irrigate a single culture by field supplied by each quaternary canal. The appropriate way consists of using plenty of siphons at the same time along the quaternary. This technique seeks to master and control homogeneous flow in all parts of the plot. It requires discipline and cooperative organization among users. Their farms are actually parallel to the tertiary canal and they practice the same culture on each field supplied by a quaternary canal.

This lay-out of canals, farms and fields is reputed to be efficient and productive insofar as mechanized works are facilitated and losses of water avoided. But it is undertaken only when the surface of farms is above 2,5 ha. Below this limit, farms and patches are confined in grid A. They represent more than 70 % holdings and 20 % of the equiped surface. If planted areas, which have received just an elementary equipment, are substracted, grid B finally covers half of the modernized sector.

There are planted productive cultures as sugar beet, cotton, varieties of fodder, which benefit from technical and finantial assistance of the State. Crop rotation is organized among field supplied by quaternary canals and plants receive high volumes of water.

Whether in grid A, grid B or in planted areas, it is essential to remember that the key constraint consists in the allowance rule, as mentionned before. That is disclosed in any sector by the presence of controllable sluice gates which govern the supply to each tertiary canal.

3- Remarks about attribute ressources :

a- Jointness :

Users are tied by the necessity of satisfying water needs of plants anywhere and at any time. All of them are submissive to the allowance rule and to the moments of opening and closing tertiary sluice gates. They have to organize irrigation in turns among tertiary canals, and downstream,amon themselves. In grid B they must irrigate together the part of a farm belonging to a same field at the same time.

Jointness thus stretches out to all the system of irrigation : reservoir storage, aduction and distribution works are simultaneously concerned. Flow from the dam to the plot gives its rythm to multiple actors in addition to irrigators : managers of the dam, canals network administrators, guardians and keepers of each order of canals and sluice gates.

b- Excludability and divisibility :

However, jointness can assume various aspects and meet some problems. Confrontation with excludability and divisibility discloses them.

These two last notions are not relevant concerning eventual

users out of the irrigated perimeter. Upstream of it, diversion of water is almost impossible. The flow takes a tunnel before emerging in the head of the primeter (see map).

On the contrary, excludability and difficulties with divisibilit can occur between the irrigators in the perimeter :

b1- Different allowances in proportion to surface patches :

Water allowance is different per hectare or for the same plant in grid B and in other sectors. Water assignement in grid A and in planted areas is lower because it is based on prevision of less intensive agricultural system than in grid B. Whereas small farmers plant in practice greater surfaces and cultures with higher water needs than the previsions ingineers and agronomists. For instance, culture of fodder is essential for them in order to produce milk and thus to dispose of current treasury. In return, the outputs are lower than in grid B.

Those differences give rise to problems among users of various sectors and to complaints to "water management Office". For farmers of grid A and planted areas, supplying to their fodder 6 hours per week while it demands 8 hours to the same culture in grid B is an obvious injustice.

b2- Disparity between supply and demand :

Management is founded on the satisfaction of water needs of plants. Estimations of monthly water assignement try to reach this target. But they are based on theoretical needs which are often contrary to the real demand of irrigators.

This misunderstanding between previsions and demand concerns any irrigator in any sector. It can provocate conflicts between

users or with the administration.

Such situation discloses possibilities of excludability and problems of fair distribution among the irrigators. There jointness can have other functions. It can be confined in opposed groups, one against the other, or against administration.

II- DECISION - MAKING ARRANGEMENTS :

It would have been possible for the administration to manage all the irrigation system, from the reservoir storage to the patches, without any participation of irrigators. That what reall occurs in many irrigated perimeters of Morocco.

But in "Middle Tessaout", irrigators participation has been wishe in order to graft modern principles of management on ancient and traditional communal organization. The purpose of governemental managers consisted in letting local irrigators groups to exercise some responsabilities as in the past in order to economize management and upkeeping expenses.

Before the dam construction, the vitality of communal principles was obvious in many actions : mobilization of water from the rive to the seguias, aduction, distribution, unstopping and upkeeping. Basic groups like collectivities and villages had a high role in this matter.

The graft of traditional prerogatives with modern principles of management starts to be undertaken within the collectivities homelands whose limits have been preserved by the equipements. An irrigators cooperative grouping is created on each secondary sector. 37 groupings are functionning in 1978, when the perimeter

equipment is wholly achieved. It is important to bear in mind the great place of the administration in this action. That is clear in the organization rules and functionning groupings.

1- Operational rules :

Operational rules appear in the groupings by-law. All of them are based on the respect of the constraints of the canals modern network as described in section I. "Rational" water assignement to various categories of sectors and grids as defined by managers imposes the specific kind of application of partition rules. At the same time, the bylaw specifies that water distribution among users on secondary and tertiary sectors is conceived and carried out jointly by users and administration.

2- Collective choice :

Collective choice and codification of relationships among individuals are apparently assured within deliberation and decision groupings organs : the General Meeting and the Grouping Office.

General Meeting is annual and concerns all the grouping members. But they are too numerous, more than 500 in some groupings. Then many of them are absent in practice, but the decisions are taken in any case.

The grouping Office is elected for one year by the General Meeting. It carries out its decisions which concern particularly sanctions and judicial actions against those who do not respect operational rules.

Collective choice is trully codified according to the administration wishes. For instance, it is impossible to formulate neither

the "veto" nor to choose another system of water partition different from the one which is imposed by technical managers and administrative autorities. From this point of view, both individuals and groupings are in the same boat.

3- External Arrangements :

External arrangements are obviously prevalent in the "Decision-Making Arrangements" as proved by the kind of codification of operational rules and collective choice. Local initiative of irrigators looks seriously restricted by the administrative control which is interested in the main point in conforming the water management with the modern constraints of irrigation.

But external arrangements can have a weak impact in practice. When managers declare that traditional communal relationships can help the irrigators managing the new irrigation system, they forget some facts :

- The new technical environment : Technical change is radical downstream of secondary canals : many equipments (clearing bush, levelling ...), plots regrouping, various orders of canals, special grids, sluice gates ... This new environment necessarly carries along many changes in the relationships between the farmers. Individuals or groups behaviour can be adapted or not to the traditional communal principles..

- Limits of external arrangements : Some examples show that Decision-Making Arrangements don't give the same importance to all the operating rules, then some constraints of technical

canals network attributes are neglected.

Disparity between water supply and demand has already been mentionned. Another example is offered by the lack of any reference in operational rules to the constraints of "grid B". Administration, ingineers, local official employees and irrigators are in harmony in this matter. This omission looks very strange when we know that equipment of grid B is the most expensive in the perimeter.

Another serious obstacle to external arrangements is represented by the absence of a groupings authentification up to now. This situation cannot offer them enough credibility and a whole adhesion of irrigators.

All these factors play a great part in giving more freedom to irrigators, but in the fringe of technical constraints and official decision-making arrangements.

III- A DYNAMIC MODEL OF INTERACTIONS :

The feedback between various kinds of behaviour during the observed period (1970-1982) requires a dynamic analyzing model. Irrigators groupings spend some efforts adapting the constraint of network and the external arrangements to their specific needs. It is an opportunity to describe endogenous (or non official) decision-making arrangements as applied in grid B and in the distribution of water. The retort of administrative and technical managers consists in trying to enforce their own system by strengthening the control on the network and on the users.

Description of this interaction enables to analyze the strategies of individuals and groups.

1- Internal Decision-Making Arrangements :

a- Grid B :

This kind of grid, called "rational grid", has been described above and its usefulness has been underlined. But no one in the perimeter respects the constraints of grid B. In order to lower the costs of equipment, the administration has suppressed the levelling since 1973. But it has been continuing to build the fourth order canals with their paths and field ditches. The same technique of irrigation is used either in grid B or in other sectors. Constraints of submersion oblige irrigators to practice breaches in quaternary canals in order to derive water toward small quadriges built on the same field. These quaternary canals are broken and micro-relief hinders homogenous flow of water on the field. Therefore losses of water and dangers of erosion are higher.

These trends increase with the practice of many cultures on the same field while grid B implies only one culture in each field. It is an obvious signe of parceling out and no observance of official crop rotations. Mechanized works become impossible and thus outputs can decrease. But such a situation agrees with technicity level and immediate needs of the farmers.

b- Distribution of water :

Conception of network and decision-making arrangements mentionned in sections I and II are widely founded on the

necessity of satisfying the water needs of plants. But users and managers don't have the same definition of "needs". Thus local practice does not correspond with prescribed rules.

b1- Administrative methods of distribution :

Calculations of water needs are based on an annual census of cultures surfaces by tertiary canals. Therefore it is possible to know the flow which has been supplied taking into account the variation of canals sections and the specific features of the sluice gates. Them flow is converted on time of weekly and monthly service by each tertiary canal on behalf of assigned cultures.

But there are some problems which make the strict application of this system very hard. The census of cultures, which is undertaken only in grid B, is not sure. In the other sectors, theoretical estimations are decided beforehand.

Furthermore, thousands of farmers cannot logically irrigate the same culture at the same time. Periods which different works take place for each culture in each farm can be different. That is one of many factors which let necessarely more freedom to irrigators than expected by ingineers and agronomists. Then, groupings and individuals have their own procedure of water distribution.

b2- Irrigators methods of distribution :

- Distribution between tertiary canals : Simultaneous functionning of all the tertiary canals occurs in rare periods. Rotation between them is frequently organized according

to cultures which have to be irrigated in administrative schedules. The target of the farmers is to reduce the rotation period in order to supply plants which really need to be served in the first place. Since the action on the rythm of rotations is impossible without the agreement of official managers, they themselves organize exchanges between the tertiary canals.

This procedure was really possible before local official employees keep and close eye on each tertiary sluice gate.

- Distribution downstream of tertiary canals :

It is more difficult to "control" what occures downstream of the tertiary canal. Practices on grid B have shown it. Irrigators seek the same target : to balance supply and demand of water. Time of irrigation with the same flow is officially fixed for each culture : for instance 6 hours per hectare for olive-trees, 7 hours for cereals, 8 hours for lucern ... But they ignore deliberately these standards.

Their systems of distribution are adapted to the duration of suppl and the importance of surfaces to irrigate. The key principle is to supply water to each user by tertiary canals at each irrigation. Many procedures are used. In one canal, the duration of irrigation by culture is reduced. In another, priority of irrigation is fixed by drawing of lots between the users if its duration in the tertiary is too short. In other places, irrigation in file is prefered, with lengthed turns between users (2).

These examples rapidly evocated hereshow some methods used by the irrigators in order to maintain jointness and reciprocity, but in specific ways not predicted by external arrangements.

2- Reinforcement of External Arrangements :

a- Damages and infringements :

Irrigators behaviour does not occur without damages on modern water works and inequivocal infringements of official decision-makings.

We have some examples of infringements in one sector of about 300 irrigators in 1982 :

- Damages of padelocks	42
- Damages of padelocks with threats and insults to official keepers	6
- Diversion of water without damages	20
- Damages of secondary and tertiary canals and other water works	35
- Diversion of water with threats or violence toward keepers	3

b- Disaffection to groupings :

The preference to internal arrangements leads users to open over-riding of the groupings bylaw.

There are problems with statutory contributions of upkeepings

waterworks and supervising aduction and distribution.

- Generally contributions rates are very low : less than 6 % of management expenses in 1983 for instance.
- Contributions overdues are very high. Only two among the 37 groupings are in order.
- On the contrary, disponible ressources are too poor. They just reach 15 % of contributions overdues.

Such facts induce the administration to stength its control.

c- Reinforcement of official management :

The great thing of administration by creating irrigation groupings was to save some water works maintenance and management expenses. These groupings had to participate to these charges. But irrigators behaviour induced the administration to stengthen its intervention.

This fact is shown by the increase of public management expenses and of the number of official employees. From 1977 to 1983, management expenses have doubled and the upkeeping have tripled. On the other hand, the number of public employees especially responsible for the network, aduction and distribution management has doubled also in eight years, from 64 in 1975 to 129 in 1983!

Concerning this aspects, it is important to remember that needs o public employees expressed in perimeter without any irrigators participation to the network management are about one employee by 200 equiped hectares. This average is already reached in "Middle Tessaout". But nowadays, the new needs expressed in this

perimeter by some managers are one employee by 85 hectares! Such requirement is symptomatic of the kind of relationships between farmers and administration (3).

3- Strategies within external and internal decision-making arrangements :

Practices within internal groupings arrangements as described above don't occur without problems. They take place among groups belonging to different sectors (grid B, grid A, planted areas), or to different tertiary canals. They can take place too among individuals anywhere at the same time.

Therefore, such problems jeoperdize the minimum of jointness and reciprocity which are necessary to maintain the irrigation. In order to safeguard them, there are some ways which play a great role in the social relationships set. For instance, a strict application of external arrangements during a limited period can be the best method in order to benefit from an additional water supply. On the contrary, a refusal of this application can be a good means to enter into negotiation with the perimeter managers. Such behaviour and others can be assumed by the same actors. Each of them depends on the importance of interests ~~and~~ at stake.

Leaders' role is essential in these strategies. Classical target of leaders is to assert their local power. They can defend groups interests against administrative meddlings. At the same time, they can help local authorities with organizing social control and regulation. It is possible that authorities prefer

to spare people than to oblige them to respect technical constraints and external arrangements. In this case, leaders have a high role in maintaining the "statu quo" at the expense of modern and rational irrigation management.

IV- CONCLUSION : OUTCOMES AND PROSPECTS :

1- In "Middle Tessaout", there are two models of technical constraints and decision-making arrangements :

- An exogeneous model : irrigation networks are carried out and rules are dictated by technical and administrative authorities.
- An endogeneous model : parallel decision-making arrangements arise within irrigators groups. Such procedure helps them to get along with the constraints of their new environment.

2- Aspects of the first or the second model are used within specific relationships in order to maintain a minimum of jointness and reciprocity in the irrigation system. These relationships are particularly organized and orchestred by local leaders and local official authorities.

3- Interactions induced by the two models take place then regardless of the basic principles on which modern and rational common ressources management is founded, such as economy of public expenses or reduction of public

upkeeping establishment. As a result, non economical facts occur such as water losses, dispersion of culture patches without respect of prescribed crop rotations, destruction of some equipments as levelling and quaternary canals, erosion, fall of outputs.

4- New trends are settling now because of administrative control reinforcement. Vertical relations between farmers and official keepers are replacing traditional relationships of the groups such as communal behavior or mutual control It is possible that individual relationships be more prevalent in the future than interactions model controlled by leaders and official authorities as mentionned above (point 2). Such eventuality could induce less reciprocity (and more free-riding) among irrigators.

5- According to all these facts, "public property" looks more prevalent in "Middle Tessaout" than "common resources property". Adapted commons management requires an effective participation of the first people concerned by any environment change, with appropriate, progressive and economic technology.

FOOT NOTES

1- Geographically, this area would rather be called "Middle Tessaout". "Upper Tessaout" is located in the Atlas mountains.

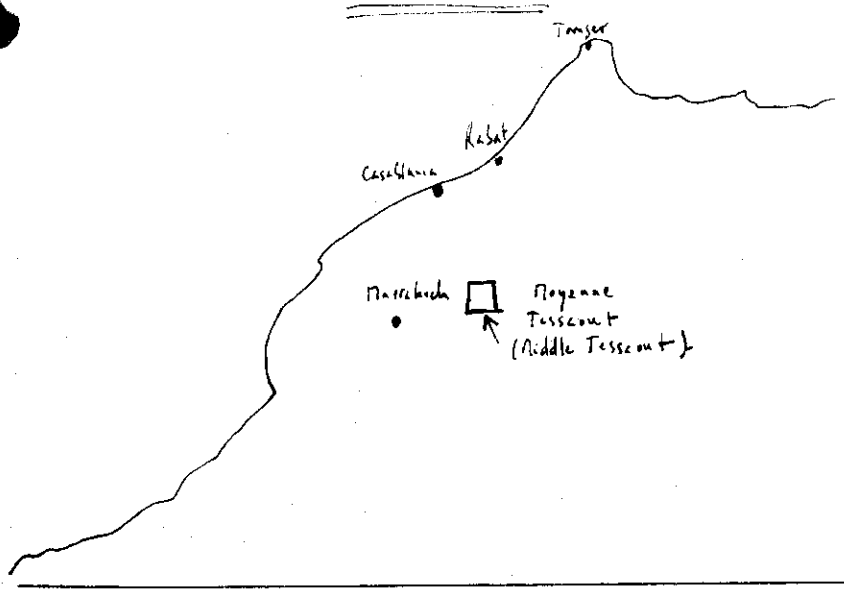
2- Clifford Geertz, observes individual behavior in all the process of irrigation in Morocco , and, on the contrary, a collective process in Bali (see "The dry and the wet : traditional irrigation in Bali and in Morocco", translated to french in "Bali : Interprétation d'une culture", Gallimard, Paris, 1983). But surroundings of Marrakech mobilisation of water from rivers is collective and irrigation of patches is individual.

3- Daniel Feinstein studies the impact of waterworks in "Middle Tessaout" on local collective prerogatives, as announced by his work title : "Upper Tessaout Perimeter. An analysis of the impact of a state-financed comprehensive waterworks project on the prerogatives traditionnally exercised by colle ctives in the Upper Tessaout Perimeter of Morocco and the prospects for the assertion of local control in the wake of State intervention. A contribution to the debate over the Relative Strength of the Central Authority and of user groups in the Presence of Surface Water Irrigation". Harvard, September 1979, 134 p;

Discussing Wittfogel thesis, the author underlines their relevance to under developped context, but recognizes at the same time possibilities of self-management of collectivities. Nevertheless, his conclusion is : "... what characterizes the 'Upper Tessaout' is the limited range over which (local irrigation groups) can assert prerogatives in the face of the thoroughness of the government intervention" (P. 113).

APPENDIX

SITUATION



LEGEND

SCALE : 1/350 000

- Primary modern canals
- Secondary modern canals
- And canals
- Ground water irrigation
- Water tunnel

MIDDLE TESSAOUT " IRRIGATION PERIMETER