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A Review of French Literature Sources

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The Setting

This work was undertaken in response to interest expressed by a number of groups and institutions involved or interested in irrigated agricultural development in the Sahel. The WMS-II small-scale irrigation systems study (carried out under USAID's Water Management Synthesis II Project), USAID's former Sahelian Development Planning Team in Bamako, and the Club du Sahel/O.E.C.D. in Paris, are among those that have recently indicated the need for a review of French literature sources dealing with this topic. Since most West African irrigation development has been undertaken by the French, it is desirable to provide a working french-language bibliography to the English-speaking audience. In 1981, Sheldon Gellar, prepared an annotated bibliography for the Club du Sahel, drawing on English language sources and dealing with participatory and management issues worldwide. With the onset of a newly funded WMS-II small-scale irrigation systems study carried out by Cornell in Niger, it was decided to prepare a bibliography and review of French literature dealing with the Sahelian irrigation experience alone.

Introductory Comments

This bibliography and literature review is the result of a search executed in Paris from January to June of 1984 and concentrates on French language sources. The objective of the bibliography is to catalog literature describing the agricultural water management experience in the West African (francophone) Sahel; Senegal, Mali, Upper Volta (now Bourkina Fasso), Niger, and Chad. Given the area defined for the WMS-II small-scale irrrigation systems study, we have emphasized small- and medium-scale systems of irrigation and agricultural water management.

The report is made up of a literature review followed by two bibliographies. The first is an annotated bibliography presenting documents judged to be of significant and demonstrated importance given the defined area of consideration.

The great majority of these works were examined first-handed by the authors. The second bibliography contains only occasional annotations. Its purpose is to present the large body of works judged less important by the authors, or which went unexamined due to time constraints or lack of access to the documents. Readers will note that the second bibliography contains some references from countries or schemes outside the consideration of the literature review. Both bibliographies do include occasional English language sources where judged desirable.

Appendix A provides a guide to the libraries in Paris where Sahelian irrigation literature can be found. Where possible, a key letter (A,B,C,I,O) or letters have been given in the bibliography to indicate the libraries where non-periodical references can be consulted. The key letter D indicates that a work can, as of the time of this writing, be purchased at the Documentation Française (address in Annex A).

Several of the references are reports given at the conference, "Agricultural Development and Peasant Participation; Water Policy in Africa" held at the University of Paris I/Centre d'Etudes Juridiques Comparatives on October 14-15, 1983. The proceedings from this conference are to be published later in 1984 by the French Centre National de la Recherche Scientifique, (CNRS) and are listed as reference 26.

The authors would gratefully welcome any corrections, suggestions, or comments. They may be contacted at the Department of Agricultural Engineering, Cornell University, Ithaca, N.Y. 14853.

Review of the Literature

In recent years it has been widely accepted that successful irrigation development must involve greater participation by the farmers in the design, construction, operation, and maintenance of irrigation systems than has been customary in the past. This is particularly true of small-scale systems, where providing external personnel to manage development and operation of these systems quickly becomes prohibitively expensive, given the lower production levels of small schemes. Indeed, some authors define "small-scale irrigation" not in terms of the surface area of a scheme, but by the extent to which it is locally controlled.

In order to provide a bibliography relevant to the needs of those working in small-scale irrigation development, the authors have first tried to provide sources describing and analyzing the farmer's role, both active and passive, in irrigation in the Sahel. Therefore, descriptions of independently (farmer) operated systems, of which traditional systems are an important part, make up the first category of literature. A second category of literature addresses government developed schemes. Here we have looked for socio-economic evaluations, particularly those examining the consequences for the farmer in such matters as land tenure, family economics, and participation in system management.

Also included in the bibliography are two categories of literature not necessarily connected with the farmer's role, but that we feel are of value to small-scale irrigation workers. In the technical realm, we present literature describing small-scale irrigation technologies and alternatives to full water control that show promise for development. Finally, to set the context within which irrigation has been planned and developed in the Sahel, we provide methodologies produced by the various French ministries and consultants involved in African irrigation development. These methodologies fall into the categories of planning, management, and technical design.

To recapitulate, this review presents literature in the following four categories:

1) Descriptions of independently operated water management systems ("aménagements hydro-agricoles") including traditional systems.
2. Socio-economic evaluations of small- and medium-scale government managed schemes.
3. Small-scale or "alternative" water management technologies.
4. French methodologies for the planning, design, and management of irrigation systems.

I. Documentation of independently operated systems, including traditional systems.

The traditional agricultural water management techniques in the Sahel fall into three categories: 1) flood agriculture, with no control of floodwaters, 2) flood agriculture using techniques of water control, and 3) "irrigation systems" with more or less complete water control, given an available water source.

The most significant of these categories in terms of cultivated area is flood agriculture without water control, termed by GALLAIS (17) as "adaptive" water management. The first of these techniques is floating rice culture as practiced in the Inland Delta of the Niger River, which is well documented. GALLAIS' classic work Le Delta Intérieur du Niger (40) describes the techniques and considers at length its role in the economic life of the Delta inhabitants. GUILLAUME (41) and SOGETHA (33) include description of the hydrologic constraints of flooded rice cultivation, and BIDAUX (39) some of the agronomic aspects. In the same region, we find the "fluvio-pluvial" recession cultivation of sorghum and other crops. This technique has been documented by GALLAIS (17 and 40), GUILLAUME (41), HARLAN and PASQUEREAU (42), SOGETHA (33), and VIGUIER (46). Another type of recession agriculture is that practiced in the Senegal River Valley, and documented by SOGETHA (33).

Beyond these techniques of adaptation are methods of water control. GALLAIS (17) considers the tradition of agricultural water control in the Sahel to be weak and writes (translated):

> "The weakness of the traditional hydraulic experience largely explains the frequent failures of agricultural water management projects developed in West Africa."

He goes on to present a number of cases where farmers actually avoid taking advantage of flood waters or other sources to cultivate their crops, preferring to grow rainfed crops.

This view is, however, contradicted by FUNEL and LAUCOIN (16), who write (translated):

> "Irrigation is far from being a technique unknown to Sahelian farmers, as one observes, wherever the conditions are appropriate (shores of rivers or streams, depressions with a shallow water table), the presence of irrigated crops, usually practiced in the dry season. There is no lack of gardens where onions, maize, tobacco, manioc, sorghum, gombo, fruit trees and the principal European vegetables are grown near the large urban areas."

Indeed, our own research would support the view that indigenous agricultural water control techniques are both widespread and economically significant, in spite of the fact that in many areas irrigated crops are often given second priority to rainfed crops. In the domain of flood related agriculture, GALLAIS (40) himself refers to a number of techniques of floodwater control in the Inland Delta, using dikes, canals, or combinations of the two.

More widespread, however, than these flood management techniques are the irrigated gardens mentioned in the above quote from FUNEL and LAUCOIN, and found throughout West Africa. They include a source of water, such as a river, seasonal stream, lake, reservoir, or well. Water lifting is done by chadouf, by manual lifting with a container attached to a cord, or sometimes simply by the farmer carrying the water up to the garden, as found in the Dogon Plateau in Mali.. In the Air Mountains of NIGER, the dallou system uses animal traction to raise water (ROYER, ref. 60).

An obvious adaptation of these traditional systems involves using a hand- or motor driven pump to lift the water. Since the enormous labor requirements of traditional systems is much reduced by the use of a pump, the surface cultivable by one farmer is increased.

There are several references to these farmer managed irrigated gardens (BOUQUET (36 and 37) in CHAD; GALLAIS (40 and 47), GUILLAUME (41), SAPIN (44), TURLIN (48), in MALI; NICOLAS et al. (63), MAINET and NICOLAS (62), ROYER (60), RAYNAUT (64), in NIGER; ROORDA van EYSINGA et al. (77), SALL (78) in SENEGAL; LAHUEC (81), d'AT de St FOULC (79), PALLIER (83), in UPPER VOLTA).

Unfortunately, the only one of these references that gives any detailed analysis of the financial and hydraulic management of a system is RAYNAUT; the other references tend to be merely descriptive. In general, the systems are favorably viewed as an important economic activity, but only one of the several vocations of a Sahelian farmer. As these crops are mostly cultivated in the dry season, they serve in part to stem the seasonal exodus of underemployed adult men and provide an important income in what can often be a time of hardship. These systems flourish where there is an urban market for the produce (see ROORDA van EYSINGA et al. (77), SALL (78), d'AT de St FOULC (79)).

II. Socio-Economic Aspects of Irrigation in the Sahel.

The French socio-economic literature treating irrigation in the Sahel appears at first to be substantial. What is disturbing, though, is the lack of data and specific case study on which this literature is based. Some quotes illustrate this dearth in three different areas. In Annex II of their book summarizing the irrigation installed and projected in the Sahelian countries, FUNEL and LAUCOIN (16) write, "The insufficiency of socio-economic data has obliged us to retain only the most commonly used technical indicators." At the individual project level, GADELLE (21) specifies a preliminary study of the human environment as one

of the studies necessary for the implantation of an irrigation development. But he writes, "There exist only a few examples of this type of study in view of helping the realization of an hydro-agricultural project." On the other hand BOURDEL (53) notes a lack of careful a posteriori analyses. He writes in the introduction to his paper, "The true impact (of irrigation development) on the existing structures (farmers, villages, regions) and the relations which tie the affected populations has hardly been elaborated until now by a posteriori evaluations. Using only economic ratios, they try most often to demonstrate the economic value of the project without making a true evaluation." Thus, in addition to the general lack of socio-economic data cited by FUNEL and LAUCOIN, there is a lack of socio-economic study both in advance of and after the fact of irrigation development.

Among references treating the SAHEL in general, we find a number of substantial works FUNEL (15), FUNEL and LAUCOIN (16), SEDAGRI (19)) that consider the socio-economic aspects of irrigation. While general in scope, they draw from a number of case studies, notably in the Senegal River Valley of SENEGAL and in the Ader Doutchi Maggia region of NIGER. We shall see shortly that these two areas are the only ones in the Sahel that have benefitted from substantial a posteriori evaluation. We should also mention GALLAIS' review article (17) on hydro-agricultural management in the Sahel, which touches on a number of factors to be considered, including management structures and social impacts. A final work treating the Sahel in general is BELLONCLE's report (25), which discusses literacy training, an important aspect of irrigation system management that he terms an "absolute precondition to the participation" of the farmers in irrigation system management.

In CHAD, BOUQUET's works (36 and 37) describe in depth the poldered systems of Lake Chad and analyze some of the socio-economic problems involved in government attempts to develop irrigated agriculture. The bibliography to L'homme et les plaines alluviales (37) contains a large number of references pertaining to the plains of Lake Chad. To the south of N'djamena, MAGNANT (34)

discusses the suitability of a proposed irrigation project given the socio-economic context of the area. A SATEC report (35) considers both technical and socio-economic aspects of the Chari River village irrigation perimeters as they stood in 1975. Of interest is the description of the role of village management committees.

Regarding MALI, there is disappointingly little socio-economic irrigation literature. Aside from documents on the Office du Niger, which as a large scheme is outside the stated focus of our study, we were only able to find socio-economic "snapshots" of areas affected by or to be affected by irrigation development (République du MALI (43), TRICART (45), GUILLAUME (41)). Thus, the effects of irrigation development are weakly documented.

NIGER, by contrast, has benefitted from comparatively intensive study of the socio-economic problems of irrigation development. HOROWITZ' Niger, an Institutional Profile (50) reviews much of this literature. Study has concentrated on the Ibohamane project, which at 590 hectares is the largest of the Ader Doutchi Maggia schemes (BOURDEL (53), Rep. du NIGER (58), VACHETTE (183), SOGETHA (181), LOMBARD (57), FUNEL (56), DIARRA (54)). Of these references, BOURDEL is the most comprehensive, and evaluates in turn the VACHETTE and SOGETHA studies. In general, the Ibohamane project is considered a mixed success. It has raised considerably the value of production in the area and stimulated the development of a monetary economy. The negative impacts, however, have been serious. BOURDEL cites a significant loss in soil fertility. As two thirds of the irrigated surface area was planted in cotton, local production of food crops decreased. The project led to greater inequity between rich and poor and, according to DIARRA, between men and women. Again, the context of these reports should be recalled; the other schemes in the Ader Doutchi Maggia are considerably smaller than Ibohamane. Thus, the effects of these less well documented schemes may not have been so serious.

Outside the Ader Doutchi Maggia, one finds little ex-post evaluation of irrigation projects. A minor exception is KEITA's report (66) which considers some

of the effects of the Tiliabery scheme.

Regarding management structures, METZENTHIN (68) discusses the schemes of Sona and Lossa, while RAIMONDO's short article (69) examines the Toula scheme. LAUCOIN's two articles (51 and 52) consider the cooperative management structures developed for irrigation schemes in Niger, concentrating again on the "pilot" case of Ibohamane.

Under the rubric of "socio-economic studies," we also find LAYA (67), ECHARD (55), MAINET and NICOLAS (62), and NICOLAS et al. (63). These reports were all written in anticipation of the implantation of irrigation projects. The latter two, concerning the Goulbi de Maradi, discuss the problems the authors foresaw accompanying irrigation development.

In SENEGAL, there is considerable socio-economic discussion of irrigation in the river valley, and particularly of the P.I.V. (périmètre irrigué villageois) schemes. (FRESSON (73), FEDIORE (72), HOCHET (74), BONNEFOND (71), WEIGEL (76), MAYER (31)). Sylviane FRESSON's report on the P.I.V.'s in the department of Matam is the best known of these accounts. FEDIORE and MAYER largely reiterate her findings. WEIGEL discusses the particular case of the P.I.V.'s in the Bakel region. These small perimeters rely heavily on farmer labor to construct the irrigation works and leave a great deal of decision making power to the farmers. The results are generally viewed as favorable; capital costs per hectare were a fraction of costs found on large-scale government projects, while yields were higher. The only serious disadvantage mentioned is that the surface area allocated to each farmer is much too low to provide for his family's needs. In general, though, these schemes are the only irrigation projects in the Sahel that are viewed as clear successes. It would come as a paradox that many authors, such as FEDIORE, see these projects as just a passing phase, necessary to train farmers for the impending development of large-scale irrigation in the Senegal River Valley. FUNEL and LAUCOIN (16) write, "In the first analysis one could hypothesize that these types of projects should spread rapidly. That would be to forget that they

correspond to technical and social conditions which come from limited, non-generalizable cases." This view is however contradicted by MAYER, who states, "the method described could immediately be applied to about 100,000 hectares in the Sahel."

Outside of the Senegal river valley, we would note SALL's paper "Transformations sociales dans une banlieue maraichère, l'exemple de M'Bidieum", (78), which describes market gardening in the Dakar area.

In UPPER VOLTA, we found very little presentation of the socio-economic aspects of irrigation systems. Jean d'AT de St FOULC (79) describes some examples of farmer participation in a number of private and government irrigation systems in the country.

III. Small-Scale or "Marginal" Water Management Technologies Showing Promise for Irrigation Development.

We have presented references describing small-scale irrigation technologies used in the Sahel. Also included are "marginal", i.e. partial, water control techniques. This latter category consists primarily of technologies harnessing river floodwaters.

Of first mention is the FAO report of proceedings from a conference in Ouagadougou on the subject of small-scale irrigation development (29). This report considers the whole range of potentially useful technologies for small-scale irrigation in West Africa.

Considering these technologies in turn, an obvious first category is that of small scale pump irrigation. Accounts with technical details of such systems include FRESSON's report (73) on the PIV's (périmètre irrigué villageois) in SENEGAL, and the SATEC report (35) on PIV's developed on the Chari River in Chad. In NIGER, the Sona-Lossa rice perimeters are described by METZENTHIN (68) and by CHAROY et al. (65), and a novel small-scale system in the Maradi

region is presented by LANCELOT (61). In the above mentioned FAO report, WATT and BOUTON consider problems specific to pump and well development.

A second technology is that of earth retention dams, which are built on valleys away from the major rivers to capture seasonal runoff. The Ader Doutchi Maggia schemes in NIGER are the best documented of these schemes. Technical details are provided by SOGREAH's 1982 report (59). In UPPER VOLTA, GADELLE (80) describes some of the organizational difficulties encountered in the execution and maintenance of the small reservoir schemes that are widespread in the country.

The management of bas-fonds (depressions) is another possibility for small-scale irrigation development. GILLET (30), drawing heavily from KILLIAN and TESSLER (112), presents a methodology for bas-fonds development. J. CALES' chapter in the FAO report also concerns the development of bas-fonds.

A final category to consider is that of controlled submersion, usually of rice. This is a technology of partial control that can in fact be applied on a large scale, as in the case of Operation Riz-Mopti in MALI. Reviews of the techniques used to achieve varying degrees of water control on the Niger and Senegal Rivers are given in FUNEL and LAUCOIN (16) and in ARGUILLON (28). GUILLAUME (41) and SOGETHA (33) present some of the agronomic and hydraulic factors influencing the design of these schemes, with the latter reference also presenting a short methodology for the design of such schemes. The third volume of the same SOGETHA report considers the potential of flood control to improve recessional sorghum cultivation, although this technology has been only sparsely applied in West Africa. The account of the development of Lake Horo (Rép. du MALI, Ministère de la Production (43)) describes a special case of controlled flooding. Finally, we should mention DIALINAS' contribution to the FAO report, "La riziculture en submersion controlée."

IV. Methodologies

We have presented a number of methodologies published by the French Ministry of Cooperation (the equivalent of USAID) as part of their series "Techniques Rurales en Afrique." The Manuel de gestion des périmètres irrigués (20) by SCET-International is a comprehensive guide to the management of irrigation systems, although it is unfortunately oriented to large, centrally managed schemes. Also in this series are two technical manuals, Les ouvrages d'un petit réseau d'irrigation by SOGETHA (23) and Manuel de l'adjoint technique du Génie Rural-Travaux sur un périmètre d'irrigation by SOGREAH (24). A third technical manual published by the Ministry of Cooperation, though less readily available, is ARRIGHI de CASANOVA's Etablissement de projet de réseaux d'irrigation (22). Although not a methodology per se, CHAROY et al.'s report Evaluation fréquentielle des besoins d'irrigation. . . (65) is a good example of design work by French specialists, in this case for a small scale project on the Niger River. Finally, GADELLE's Les étapes d'un aménagement hydro-agricole dans les pays en voie de développement (21) presents the procedure for the planning of an irrigation project. Gadelle notes the unfortunate lack of preliminary studies of the human environment in the planning of irrigation development. Other works considering planning are Des BOUVRIES' and BABINI's chapters in the FAO report (29) on small scale irrigation in West Africa.

Annotated Bibliography

SAHEL

Works dealing with entire Sahel region or several countries therein.

Bibliographies, Lists of Publications (see also Moris et al. (18))

1. Autorité du Bassin du Niger, Centre de Documentation Index, Golfe de Guinée, Le Bassin du Fleuve Niger et les Etats Membres de l'Autorité du Bassin du Niger, Niamey; 1981.

   Index No. 6, 02501-02719 available at Antenne Documentation Sahel (A)

2. Comité Interafricain d'Etudes Hydrauliques (C.I.E.H.) Etudes réalisées et diffusées de 1961 à présent. Ouagadougou: 1975. (A)

3. Id. Liste d'études. Ouagadougou; 1976 (A)

4. Id. Catalog du Centre de Documentation Boston: G.K. Hall, 1977, 2 vols. (ref GELLAR (9))

5. Id. Liste des publications. Ouagadougou; 1978. (A)

6. Commission du Fleuve Niger, Centre de Documentation Index 00001-00500, 00501-01000 Niamey; May 1975, May 1976. (A)

7. FAO Service d'Informations Documentaires, Bibliographie des travaux de la FAO sur la zone sahélienne en général. Rome; 1977, 53p. (A)

8. Id. Bibliographie des travaux de la FAO sur les Iles du Cap Vert, la Haute-Volta, le Mali, la Mauritanie, le Niger, le Sénégal, et le Tchad, à partir de 1972 Rome; 1978 (A)

9. GELLAR, Sheldon Planning Management and Participatory Development Issues in Irrigation Projects; A Selected Annotated Bibliography Paris; CILSS/OECD, 1981 SAHEL D(81) 147.

Treats worldwide English-language irrigation literature. Some references from Sahel region literature. Available from Club du Sahel.

10. JOYCE, Stephen J. and Françoise BEUDOT, Eléments de bibliographie sur la sécheresse au Sahel Paris; OECD, 1976, 1977

Lists holdings of the Antenne Documentation Sahel (see guide to libraries). Updatings by Mrs. Beudot published yearly since 1977. Most updatings are available from the Antenne Documentation Sahel. (A)

11. MASSONI, PERROT, FOURCADIER Liste bibliographique des travaus effectués dans le bassin du Fleuve Niger par les chercheurs de l'ORSTOM de 1943 à 1968. Bondy, France; ORSTOM, 1971 (B)

12. Sahel Documentation Center Sahel Bibliographic Bulletin, E. Lansing, Mich.

Published quarterly since 1977.

13. O.M.V.S. Amenagement et Mise en Valeur du Bassin du Fleuve Senegal. Saint-Louis, Senegal; O.M.V.S. Documentation Center. (ref GELLAR (9))

"The documentation center of the O.M.V.S. at Saint-Louis has more than 25,000 documents. It has published an index of its holdings since January 1971. Center has most extensive collection of materials on Senegal River Basin. Most materials in French." (quoted from Gellar, (9)).

14. OUEDRAOGO, Ismael; Mark NEWMAN, David W. NORMAN. The Farmer in the Semi-Arid Tropics of West Africa; A Partially Annotated Bibliography Andhra Pradesh; International Crops Research Institute for the Semi-Arid Tropics, 1982, 122p.

1045 references, including many on irrigation.

General and Review Articles

15. FUNEL, Jean-Marie
Les systèmes ruraux sahéliens. Contribution et annèxe à "Essai de définition d'une stratégie anti-sécheresse dans le Sahel de l'Afrique de l'Ouest." Rapport général 1975 SCET-International Paris; SEDES, 1978 439p. (C)

Includes case studies of Office du Niger (MALI), S.A.E.D. (SENEGAL), and Ader Doutchi Maggia schemes (NIGER). Sees bad planning in Maggia schemes; didn't account for non-agricultural activities of prospective farmers. General discussion of "rural systems"; social units, distribution and consumption patterns, production systems, ecological factors. States that rainfed agriculture must provide major part of growth in production, but irrigation projects needed to produce commercializable surpluses, stabilize locally consumed production, and settle migrants leaving over-populated areas." If some agricultural investments are not accepted by the Sahelian population where they would be in the Sudanian zone, it is because the economic risk is lower in the latter case . . . a longer rainy season leaves fewer labor bottlenecks.

16. FUNEL, Jean-Marie and Guy LAUCOIN
Développement en zones arides; Politiques d'aménagement hydro-agricole. Paris; Agence de Coopération Culturelle et Technique, 1981, 212p. (A)

The most comprehensive and authoritative consideration of irrigation development in the Sahel. Analyses the development of irrigation systems, considering in turn the production, land tenure, and financial/management sub-systems. Presents methodology for project evaluation. Refers constantly to specific examples, mostly from SENEGAL and NIGER. Of particular interest is consideration of effects of irrigation projects on land tenure in the lacustrine zone in MALI, the Gorgol in Mauritania, and Ibohamane in NIGER (pp. 30-41). Summary of irrigation techniques describes; successive "generations" of river irrigation systems giving partial to complete water control; Office du Niger; and Ibohamane systems. Annexes summarize irrigation programs in the Sahelian countries; "The insufficiency of socio-economic data has allowed only the more common technical indicators to be retained."

17. GALLAIS, Jean
"Options prises ou ignorées dans les aménagements hydro-agricoles en Afrique Sahelienne" in Cahiers Géographiques de Rouen, 1976 no. 6 pp.77-95 (A)

Excellent review article of the problems of irrigation in the Sahel. Reviews traditional systems of water management, including flood related agriuclture; sees "weak tradition" in the area of agricultural water control, systems more of an "adaptive" nature. Goes on to consider factors to be considered in irrigation development; scale of schemes, management structures, economic objectives, ecological and social impact.

18. MORIS, Jon, D. THOM, and W.R. NORMAN.
Prospects for Small-Scale Irrigation Development in the Sahel. Report Prepared under Water Management Synthesis II Project for Science and Technology Bureau. Washington, D.C.; USAID, 1983 (draft).

Extensive bibliography includes many references on small-scale irrigation in SENEGAL, MALI, and NIGER. Report considers particular problems faced by Sahel countries in irrigation development. Separate chapters consider status of irrigation in MALI and NIGER. Prospects for small-scale and community-based irrigation systems are considered.

19. SEDAGRI Aspects socio-économiques des aménagements hydro-agricoles. Paris; Secrétariat d'Etat aux Affaires Etrangères, 1971 (B).

Presents a number of case studies of irrigation projects in Africa, including the Ibohamane scheme (NIGER) and the SAED programs (SENEGAL). For Ibohanne, discusses technical aspects of system, method of attribution of parcels to participating farmers (his family's work capacity the "determining" factor), and cooperative and management structures. Presents economic results. For SAED, presents then current cooperative structures, lists weaknesses; which include instability of land tenure. Describes new structues to be implemented, based on smaller "Producer Groups", stable land rights, and rigorous contract between farmers and SAED.

Methodologies (see also FAO (29)

(a) **for irrigation system management**

20. SCET-International Manuel de gestion des périmètres irrigués. Paris; Ministère de la Coopération, 1977 272p (A, D)

Exhaustive management guide oriented towards large government schemes, includes hydraulic management, financial management, organization of farmers. Impact of physical factors on production systems. Management of equipment, including mechanized. In annexes are case studies from SAED in SENEGAL, Riz-Mopti in MALI, and SOMMALAC in Cameroon; includes examination of land tenure transformations.

(b) **for irrigation development planning** (see also FAO (ref. 29).

21. GADELLE, Les étapes d'un aménagement hydro-agricole dans les pays en voie de développement Paris; SEAE, 1969 78p. bibl. (B)

Methodology for hydro-agricultural development. Describes stages in necessary studies, amongst which is a study of the human environment. This should include demographic data, state of health and sanitation, educational, and traditional and non-traditional social organization. Also need to examine existing economic activities (agriculture, pastoralism, forestry, fishing, gathering, crafts), and their place in the natural environment. "There exist only a few examples of this type of study" (preliminary study of human environment) "in view of helping the realization of an hydro-agricultural project." States that problem of commercialization is the origin of most failures in irrigation projects.

c) **technical** (see also CHAROY et al. (55))

22. ARRIGHI de CASANOVA, Etablissement de projet de réseaux d'irrigation Paris; Ministère de la Coopération, 1974 77p (C).

Fairly simple guide to the design of an irrigation project given physical and agronomic parameters.

23. SOGETHA Les ouvrages d'un petit réseau d'irrigation Paris; SEAE, 1969 192p. (B,C,D)

Technical manual to structures used for small irrigation works.

24. SOGREAH Manuel de l'adjoint technique du génie rural; travaux sur un périmètre d'irrigation Paris; Ministère de la Coopération, 1975, 381 p. (D)

Technical manual. Review of systems of irrigation; technolcgical elements-hydraulic, topographic, and geotechnical. Realization of works; structures used, surveillance of construction. Maintenance of an irrigation system.

Farmer Participation

25. BELLONCLE, Guy
"Des systèmes de gestion simplifiés élaborés dans les langues maternelles des paysans, comme préalables absolus à toute participation des populations à la gestion des aménagements hydro-agricoles." Communication to CEJC Colloquium (see ref. 26).

Describes Belloncle's system of crash literacy training as a requirement for involving farmers in irrigation management. Contracts are translated into native languages using arabic alphabet. Example from Republique du NIGER. Mentions 4 reports from Office du Niger (MALI), SAED (SENEGAL), ONAHA, (NIGER), and SODEFEC (Ivory Coast), which Belloncle hopes to publish in one volume. See also BELLONCLE (ref. 70).

26. Centre National de la Recherche Scientifique,
Proceedings from conference; "Développement agricole et participation paysanne. Un exemple; la politique de l'eau en Afrique" held by CNRS and the Centre d'Etudes Juridiques Comparatives at the Sorbonne. Paris; to be published 1984.

Includes examples from throughout Africa. Those from Sahel are referenced separately in this bibliography.

27. FREDERICQ, A; and J. RABES
"Le point de vue d'un bureau d'études" Communication to CEJC Colloquium (see ref.26).

Slightly rambling discussion of the role of the state, the consulting engineer, and the farmer. Points out difficulties in trying to elicit farmer participation in the initial phases of a project, and discusses how farmer involvement can be developed as a project evolves. Calls for coherent policies from governments and funding agencies in the matter of farmer participation.

Small-Scale and "Marginal" Technologies

28. ARGOUILLON, J.
"Les surfaces potentielles pour le développpement de la grande irrigation dans la Vallée Supérieure du Niger" in L'Agronomic Tropicale v. 29, no. 5 (May 1974).

Chapter two includes summary description of principal kinds of hydro-agricultural management in the upper Niger Valley; natural submersion, controlled submersion, complete control.

29. FAO Rapport du Seminaire FAO/DANIDA sur le développement des petits aménagements hydro-agricoles en Afrique de l'Ouest vol. 2 Rapports Techniques. Rome; 1975 (B).

Proceedings from conference held in Ouagadougou, UPPER VOLTA from 29 September to 6 October 1975. Sixteen reports treating; planning of water resource development, use of small water courses, floodwaters, and groundwater for small-scale water resource development, and problems specific to small-scale hydraulic projects. Des BOUVRIE and BABINI present short planning methodologies, while annex to Des Bouvrie's article includes summary of sources of irrigation water found in or potentially useful in West Africa. Concerning specific irrigation techniques/technologies are: J. CALES, "Les aménagements de bas-fonds..."; J. DIALINAS, "La riziculture en submersion controlée; J.M. GRESILLON, "Quelques problèmes posés par la réalisation et l'entretien des petits barrages en terre. . ."; M.A. BOUTON, "Développement de forages profonds; S.B. WATT, "Les méthodes d'approches pour le pompage de l'eau. . ."; D.B. KRAATZ, "Aspects saillants des structures des systèmes d'irrigation."

30. GILLET, N.
"Caractérization et mise-en-valeur des petites vallées ou bas-fonds pour l'agriculture irriguée." L'Agronomie Tropicale v. 28 no. 11 (Nov. 1973)

Considers place of bas-fond development in West Africa. Presents methodology for their development, including various stages of study, pilot project. Of the farmers, he writes "it is indispensable that the new systems be adapted to their technicity, lifestyle, and economic activities, and that they be convinced of the interest of the planned operations." Of the proposed methodology; "This methodology is obviously only applicable in regions where one finds a sufficient number of hydro-agricultural complexes of similar or identical characteristics to justify and recoup the costs of preliminary studies." Considers small- and large-scale bas-fond development in UPPER VOLTA.

31. MAYER, J.
"Un grand programme de périmetres d'irrigation villageoise en Afrique Sahélienne." in Maîtrise de l'espace agraire et développement en Afrique Tropicale. Logique paysanne et rationalité technique. Actes du Colloque de Ouagadougou 4-8 decembre 1978. (Memoires de l'ORSTOM no. 89) Paris; ORSTOM, 1979 (O).

Describes general characteristics of village irrigated perimeters (PIV); "20 hectares on average, pumped water from perennial or semi-perennial water course. Works undertaken by affected population." Gives results from Matam perimeters. States that "the method described could immediately be applied to about 100,000 hectares" in the Sahel.

32. SATEC
Irrigation par pompage au Sahel; les périmètres villageois: compte rendu de la scéance de travail du 10 avril 1975 Paris; 1975 (I).

Reports initial problems of first PIV's (three in SENEGAL, two in CHAD). Considers agronomic problems (transplanting, varieties, water needs). "Priority should be given in farmer training programs to the theme of respect for the agricultural calendar. . . and methods of soil cultivation." Presents planned and actual capital costs, agricultural and economic results from first campaigns. Consideration of groundwater sources, solar pumping.

33. SOGETHA
L'utilisation agricole des eaux de crue en Afrique
Grenoble; SOGETHA/Ouagadougou; C.I.E.H. (B) 3 volumes

Three volumes consider 1) spreading seasonal floodwaters, 2) use of river floods, and 3) recessional cultivation of sorghum. Volume 1 not available at BDPA. Volume 2 concentrates on flooded rice cultivation, presents agronomic and hydrologic factors. Gives concise summary of project design methodology. Examples from SENEGAL, MALI, and NIGER are presented. Volume 3 considers the two main types of recessional sorghum cultivation; "type Senegal" and "type Niger." For each type, considers possibilities for development by water control and agronomic improvement.

CHAD

34. MAGNANT, J.-P.
"Les réactions paysannes à un projet de développement rizicole au sud de N'djamena." Communication to CEJC Colloquium (see ref 26).

Describes physical and human environment of a proposed project, never realized. Considers changes in the traditional society, evolution of exchange economy. "In the majority, the farmers of the region are starting to produce with a view to commercialization. Irrigated vegetable gardens are found throughout region, production intended essentially for sale. "We can speak of a veritable explosion of market gardening in those regions where there is a shallow water table."

Chari River Systems

35. SATEC
Projet d'extension des périmètres villageois irrigués le long du Fleuve Chari (Tchad) Paris; 1976 109p. & annexes (I)

Extensive report describes development of small perimeters on Chari River as of 1975. Perimeters of roughly twenty hectares, fed from river by diesel pumps. Canals and terracing built by farmers themselves. Sorghum grown for auto-consumption, cotton for sale. Agronomic and economic results presented. Describes organization and responsibilities of village management committees in matters of; technical tasks, such as water control, pump operation; finance; administration. Extensive annexes include aspects of human and physical environment, agronomic and economic results, technical and management aspects of project.

Lake Chad

36. BOUQUET, Christian
"La maitrise de l'eau dans les polders et wadi du Lac Tchad" Communication to CEJC Colloquium (see ref. 26).

Describes traditional water management around Lake Chad; recessional cultivation of maize, triple culture of wheat and maize by chadouf, dikes to isolate fertile low-lying areas from floods. Relates attempts by the state to implement these techniques on a larger scale, discusses reasons for failure; labor mobilization, attribution of parcels, high capital costs. Concludes state implemented schemes are incompatible with traditional agriculture and economy.

37. BOUQUET, Christian
"L'homme et les plaines alluviales en milieu tropicale. Iles et rives du sud-Kanem (Tchad). Etude de géographie régionale. Travaux et documents de géographie tropicale no. 13, Centre d'Etudes de Géographie Tropicale. Bordeaux; University of Bordeaux, 1974 bibl. (C)

Regional geographic study, includes description of cultivation techniques used in polders (see previous reference). Extensive bibliography.

38. MATON, Guy
"La mise en valeur des polders du lac Tchad" Coopération Développement v. 27 (1969) pp.25-34

Describes development of government schemes in polders. Of traditional system (see BOUQUET 36), Maton writes "This system of irrigation by use of water from a superficial phreatic water table, and the absence of any means of drainage, favor the concentration of salt in the fields. The farmers are thus obliged to move their parcels as the saline areas extend. then finally go to cultivate an unoccupied polder. No program of intensive development can be accompanied by such nomadism."

MALI

Inner Delta and Lacustrine Zone

39. BIDAUX, J.M.
"La riziculture en eau profonde au Mali." L'Agronomie Tropicale v. 26 (1971) pp. 1100-1114,

Describes floating rice cultivation in Inner Delta region from agronomic standpoint. In pluvio-fluvial system, rice gets water for initial growth during rainy season. Subsequently the rice grows with the rising flood waters that inundate the fields.

40. GALLAIS, Jean
Le Delta Intérieur du Niger - Etude de géographie régionale Dakar; IFAN, 1967 2 vol. bibl.

Comprehensive geography of the Inner Delta and Lacustrine Zone of the Niger River in Mali. Includes physical geography, ethnography, descriptions of all facets of economic activity. Of relevance to irrigation and water management are his descriptions of flooded rice and flood recession (décrue) agriculture. Some indigenous techniques of flood control for agricultural use are described, including the construction of canals and dikes to accelerate or delay the flood's rise/recession. Small irrigated gardens on southern border of Delta mentioned, as well as farmers' spontaneous construction of irrigated wheat fields near the canal of Pondori water management scheme.

41. GUILLAUME, M.
Rapport d'une mission d'étude des aménagements hydro-agricoles dans la Vallée du Niger et leur possibilités d'extension Khartoum; Mission d'Etude des Amenagements du Niger (M.E.A.N.), 1958-9 3 vol. 327p. (B)

Comprehensive, though dated, review of agricultural water management systems in present day MALI. Considers first human and physical geography of the region. Then presents traditional flooded rice and recessional sorghum agriculture. Describes projects that had been implemented to improve water control for both types of culture. Describes canal irrigation systems; traditional manual systems in the lacustrine zone, Office du Niger (4th section of report), and three other schemes involving government intervention.

42. HARLAN, Jack and Jean PASQUEREAU
"Décrue Agriculture in Mali" Economic Botany 1968 pp. 70-74.

General description of flood recession (décrue) agriculture in the Inner Delta and Lacustrine Zone.

43. République du Mali, Ministère de la Production
Etude socio-économique de la zone du Lac Horo et des mares de Niafunké et de Diré. Paris; SEAE SEDES, 1972 3 vol. (C)

Describes regions of proposed hydro-agricultural schemes in the Lacustrine Zone. Includes land tenure systems and traditional agricultural systems; décrue, floating rice, calebasse irrigation. Proposed projects for Lake Horo and nearby depressions are described.

44. SAPIN, P.
"Le blé au Mali" L'Agronomie Tropicale v. 35, no. 2 (Feb. 1980) bibl.

Short description of traditional irrigation of wheat on plains of Diré, Kesson, and Killi.

45. TRICART, Jean
L'aménagement du Lac Faguibine (République du Mali) Paris; P.U.F., 1962 40p. (B)

Discusses history of region, land tenure, details of cultures (sorghum, wheat, millet, maize, cotton, rice, cowpeas, barley). Considers economic activities; migrations, pastoralism, fishing, crafts. Monetary economy is traditional in region. Considers possibilities for hydro-agricultural development, and problems involved; hydrologic, cartographic, geologic.

46. VIGUIER, P.
"Les sorghos á grain et leur culture au Soudan Francais" Revue de Botanique Appliquée et d'Agriculture Tropicale v. 25 (1945) pp. 163-225

Includes consideration of recessional sorghum cultivation.

Dogon Plateau

47. GALLAIS, Jean
"Le paysan Dogon (République du Mali)" Les Cahiers d'Outre-Mer no. 70 (1965) pp. 123-43

Considers irrigated gardens; highly refined horticultural techniques, "mediocre" hydraulic techniques. The Dogon transports earth and constructs, at the price of an enormous waste of energy, his gardens next to the water instead of controlling the follow and guiding it towards the cultivable parts."

48. TURLIN, H.L.
Opération régionale du pays Dogon. Bamako; Institut d'Economie Rurale, 1967, 3 vol. (B).

In anticipation of development project on Dogon Plateau. Volume 1; summary document. Vol. 2; proposed hydro-agricultural development project. Vol. 3; horticultural techniques on the Bandiagara (Dogon) Plateau.. One example of gravity irrigation schemes observed at Kassa consisted of primary canals running down the slope, feeding secondary canals that deliver water to contoured terraces. In all other places water delivery was manual (see previous reference).

NIGER

49. Club du Sahel/CILSS
Development of Irrigated Agriculture in Niger: General Overview and Perspectives Paris, OECD, 1979. Original in French (A)

Reviews the current status of irrigation in Niger, and presents development plan for five year period 1980-85. Useful reference, but little specific information on irrigation systems.

50. HOROWITZ, Michael
Niger: A Social and Institutional Profile Washington D.C.; USAID, 1983 bibl.

Chapter on irrigated agriculture reviews a large volume of literature, including many French language sources. Of particular interest is section on small-scale irrigation. Extensive bibliography.

51 LAUCOIN, Guy
"L'animation des aménagements hydro-agricoles; vers l'autogestion des aménagements au Niger." Développement et Civilisation no. 44 (June 1971) pp. 54-62.

Proposes structuring of farmer cooperatives into small sectorial groups, whose representatives work with extension agents to vulgarize new techniques needed in intensive irrigated agriculture. Proposes a sequence to be followed in working towards self-management. Presents Ibohamane as a case study of organization and methods described.

52. Ibid.
"La gestion des aménagements hydro-agricoles au Niger" Développement et Civilisation no. 51 (Jan.-Mar. 1973) pp. 21-31

Gives brief history of evolution from centralized, authoritarian management of irrigation projects through first attempts to organize and involve farmers in the management of these schemes (Ibohamane). Primarily discusses problem of attribution of fields.

Ader Doutchi Maggia (especially Ibohamane) (see also FUNEL (15), LAUCOIN (51 and 52), SEDAGRI (19).

53. BOURDEL, Christian
Essais d'évaluation des conséquences d'une opération d'irrigation en pays de la zone sahélienne sèche, exemple Ibohamane au Niger. Paris; Ecole Nationale du Génie Rural des Eaux et des Forêts, 1976 (A)

Report has three sections. First analyzes and criticises evaluations done by SOGETHA (181) and VACHETTE (183), argues for new techniques of evaluation. Second describes situation before management, and means and objectives of project at its inception. Of particular note is the specification of peasant participation in the attribution of parcels, and subsequently in the operation of the system through the action of cooperatives. Final section describes effects of project, including degradation of soils, fixation of population, considerable increase in commercial exchange. Participation objectives not fully realized.

54. DIARRA, Marthe
Aménagement hydro-agricole d'Ibohamane: Document 5. Contribution à l'analyse des effets de l'amenagement sur les femmes dans les domaines de l'artisanat, du commerce, de l'élevage, et des relations sociales Tahoua (Niger); Projet FAO Formation, 1982 Module de Suivi, Atelier Finale, Mimeo.

"Documented how some women, suffering a loss of income. . ., attempted to recoup by various craft and small-scale entrepreneurial activities, and by investing in livestock. There seems little doubt, however, that at least for the medium term, their economic positions have been marginalised substantiallyby their eviction from their farms and their exclusion from tenancies on the scheme." (quoted from HOROWITZ, ref. 50).

55. ECHARD, Nicole
Etudes socio-économiques dans les vallées de l'Ader Doutchi Maggia Paris-Niamey; Etudes Nigériennes no. 15, 1964.

Socio-economic study of the Ader-Doutchi region before implementation of irrigation projects.

56. FUNEL, Jean-Marie
Le développement régionale et sa problématique étudiés à travers l'expérience de Tahoua Série Méthodologie de la Planification no. 9 Paris; Ministère de la Coopération, 1976 336p. (B, D)

Describes regional development near Tahoua. Valuable in that it describes the ensemble of projects in the Ader Doutchi Maggia, not just Ibohamane. Evolution of management of schemes in the region is described. In area of attribution of parcels, for example, initial methods led to farmer rebellion. System developed for Ibohamane scheme allowed peasants to take a large part in decisions involved with attribution. Relative success of this model led to its use on other schemes. Management of schemes was decentralized to increase farmer acceptance and involvement in decision making and maintenance. Agronomic and economic results of schemes presented.

57. LOMBARD, Pierre
"Les petits périmètres irrigués du Niger" in Cahiers du CENECA, Colloque Internationale 1976 report no. 4222. (B)

Describes small irrigation perimeters in the Ader Doutchi Maggia, which use small earth - dam reservoirs and gravity distribution of water to cultivate cotton and sorghum. The reservoir basin itself is used for vegetable gardening as the water level recedes. Author presents Ibohamane as a case study, essentially summarizing results of the socio-economic evaluation published by the Nigerien Commissariat General au Developpement (reference 58).

58. République du Niger. Commissariat Général au Développement, Etudes et Programmes Tahoua. Analyse des transformations socio-économiques dues à l'aménagement hydro-agricole d'une région, Ibohamane. Tahoua; Dec. 1971 (C).

Analyses economic and social transformations in the region of Ibohamane after the first three compaigns. Considers evolution of; commerce, local markets, family budgets and consumption, agricultural techniques, dry season exodus, marital situation, scolarization, religion. Project stimulated local economy, use of wage labor. Created greater inequity, and a certain breakdown of traditional solidarity. Introduction by Claude ARDITI is a scathing criticism of report, saying that authors did not have sufficient data to make the conclusions they did. Available at Service du Plan, Tahoua (Niger).

59. République du Niger. Office National des Aménagements Hydro-Agricoles (O.N.A.H.A.). Projet de réhabilitation des aménagements hydro-agricoles au Niger -Périmètres de l'Ader Doutchi Maggia. 2 ème étape. Avant-projet sommaire et étude de préfactibilité. Grenoble; SOGREAH/Paris; Louis Berger, Nov. 1982. 3 vol.

Report contains data and calculations to be used for rehabilitation project currently under way. Includes technical information on the dams and perimeters of the Ader Doutchi Maggia schemes.

Air Mountains

60. ROYER, Ralph "The Dallou Irrigation System" in MORIS et al.
Prospects for Small-Scale Irrigation Development in the Sahel Washington, D.C.; USAID, 1983 (draft) (see ref. 18)

Describes dallou system; Animal powered pumping from well, 2-12 meters deep, using a pulley system. Water distributed by canal network to garden beds. Children used to control water following a rotation system. Variety of crops grown in gardens, of 1 hectare size on average. Author suggests technical improvements

to system, including concrete lined wells, improved animal harness, lining canals, use of holding basins, live fencing, and synthetic water bags.

Maradi Region

61. LANCELOT, Yves
"L'exemple du Ruwana au Niger' Actuel Développement no. 56-57, (Sept-Dec. 1983) p.59.

Describes technology used for a small-scale well-water/pump irrigation perimeter in the Maradi region.

62. MAINET, G. and G. NICOLAS
La vallée de Goulbi de Maradi: Enquête socio-économique Etudes Nigériennes no. 16 Niamey; IFAN, 1964 (B,C)

In-depth socio-economic study of Goulbi de Maradi. Irrigation techniques described. Forty-five ha. of wheat irrigated by a combination of chadoufs and canals delivering water from the outlet of Lake Madaroumfa. Chadoufs used to irrigate vegetable gardens/orchards (see RAYNAUT (64)). Authors present problems they anticipate in event of irrigation development: 1) Canal maintenance; weak tradition of cooperative action. 2) Organization of water distribution. 3) Crop selection, problems of monoculture. 4) Animal traction, problems of maintaining animals. 5) Deforestation. 6) Difficulty in excluding nomads' herds from fields and water sources.

63. NICOLAS, Guy, Hubert DOUMESCHE, and Maman dan MOUCHE
Etude socio-économique de deux villages Hausa. Enquête en vue d'un aménagement hydro-agricole, Vallée de Maradi (Niger) Etudes Nigériennes no. 22 Niamey; IFAN, 1968 (B, C).

Detailed socio-economic description of two villages due to be resettled as part of a proposed irrigation reservoir scheme. Briefly describes irrigation methods used on the shores of the natural lake Madarounfa; water lifting by chadouf into canals, with water control by assistant. Describes problems the authors anticipated if the scheme had been implemented. Scheme would have required a complete change in local way of life (commercial cultures, complete commitment to irrigated agriculture, use of draft animals themselves requiring water).

64. RAYNAUT, Claude
Quelques données de l'horticulture dans la vallée de Maradi Etudes Nigériennes no. 26 Niamey; IFAN/CNRSH, 1969 164 p. (B, C).

Describes and analyses irrigated gardens in Maradi region, consisting of; a well 4-5m deep, a chadouf, a system of canals and beds, and a fence to protect the gardesn. Very wide variety of vegetables and fruits cultivated. Analyses social and micro-economic results. Dry season exodus reduced by this opportunity for dry-season employment. Absolute net receipts higher for small gardens, because of lower maintenance costs. "(There were) many difficulties in obtaining from the farmer an accounting; if his receipts had in fact been higher than his costs, and in what proportion. The garden is only one element among many others (of a farmers activities)."

Niger River Schemes

65. CHAROY, J., F. FOREST, and J-C LeGOUPIL (IRAT)
Evaluation fréquentielle des besoins d'irrigation pour l'optimisation d'un projet d'aménagement hydro-agricole Paris; IRAT, 1978 (I)

Technical consideration of the LOSSA project. Presents physical and climatic data, soils, statistically analyzes needs for irrigation water to specify system design, including pump capacity, pipe sizes. Considers rotation schedule.

66. KEITA, M.
"L'intervention en milieu rural et capitalisme agraire dans la région de Tillabéri." in L'agriculture africaine et le capitalisme, by Samir AMIN, Paris; Editions Anthropos, 1975 pp. 185-232 (C, O)

Briefly describes irrigation project at Tillakeina (cotton cultivation). System of family parcels formed into cooperatives failed because of elevated costs to farmers, unwillingness of young men to work for the monetary benefit of family chiefs. Institution of salaried farmers attracted young workers, raised yields from 800 to 1500 kg/ha. On the regional level, discusses effects of rice commercialization system; deprives women of important activity (decortication, sale of rice). Artifically low prices impoverished farmers, benefited private middlemen.

67. LAYA, Dioulde
Recherche et développement. Le projet de mise-en valeur des cuvettes de Kutukalé et Karma en pays Songhay Etudes Nigériennes no. 24 Niamey; IFAN 1969 (B,C)

Socio-economic study in anticipation of irrigation project. Fourth chapter treats "problems of development"; immigration, economic structures, and social structures.

68. METZENTHIN, Thierry
Compte d'exploitation prévisionnel de l'aménagement hydro-agricole de Sona-Lossa (Niger). Organisation et gestion des aménagements du fleuve -Rapport de stage Nogent sur Marne/CNEAT, 1974 bibl. (B).

First considers briefly the place of irrigation in NIGER, and describes activities of the Union National de Crédit et des Coops (UNCC) in the management of irrigation projects. Considering particularly the Sonna-Lossa perimeters on the Niger River, the author describes the physical system of irrigation; electric pumping, piped distribution system, individual gates for each 1 ha. field. Analyses costs and revenues of the project. Discusses system of management, and farmers' role therein.

69. RAIMONDO, Pasquale
"L'aménagement hydro-agricole de Toula" Le Courrier, no. 47 (Jan.-Feb. 1978), pp. 83-4 (A).

Glowing description of 260 ha. rice production scheme. Physical infrastructure described as of "high technical quality". Success of the scheme in management and production is attributed to the rapid mastery of system management by farmer cooperatives. Production exceeded initial objectives. Toula the only Niger River scheme having 100% payment of "redevances" (land rents). Toula used as a model for the development of other schemes along the river.

SENEGAL

Senegal River Systems (see also FUNEL (15), SEDAGRI (19))

There is a great body of literature on irrigation in the Senegal River Valley, of which we present only a small fraction. These systems are of both large and small scale, and include the well known "perimetres irrigues villageois" projects. Note that a reference treating villages on the Mauritanian bank of the river has been included (HOCHET, 74).

70. BELLONCLE, Guy
Propositions pour la mise en place des systèmes de comptabilité et de gestion maitrisable par les paysans sur les périmètres irrigués encadrés par la SAED. Rapport de la mission effectuée du 21 mai au 5 juin 1982 (C)

Mission to SAED PIV's and larger perimeters, where SAED is attempting to devolve responsibility to farmer groups on areas of 25 hectares. Describes development of documents to be used for accounting by farmer groups, using Belloncle's usual method (see ref 25). Author states "accounting and management constitute, for a weakly monetarized area hardly familiar with the world of paperwork, a 'technology' as foreign as the diesel motor." Concludes that both SAED employees and farmers must learn a common written language if SAED's program of farmer responsibilization is to succeed. States that "literacy" of the managers is developing with more difficulty than literacy of the farmers.

71. BONNEFOND, Phillippe
Systèmes de culture irriguée et systèmes de production paysannes sur la rive gauche du Fleuve Sénégal Dakar; ORSTOM Belair, 1981 44p., bibl. (O)

Presents and analyzes a number of irrigation systems found along the Senegal River, both large and small scale. Then analyzes the place of these systems in the larger context of the traditional production systems, which include agriculture, livestock raising, and fishing. Bibliography refers to many works in the same vein (production systems analysis).

72. FEDIORE, Ibrahima
"Les formes de participation paysanne à la mise-en-valeur des aménagements hydro-agricoles (SAED an Senegal)" Communication to CEJC colloquium (see ref 26), bibl.

Describes PIV's developed by SAED; "a decentralized micro-management with heavy use of human investment, self-managed by small social groups at the village level. Can only assure part of a farmer's needs in cereals. Manual preparation of fields a labor bottleneck, disliked by family members. Bibliography includes lesser known reports.

73. FRESSON, Sylviane
La participation paysanne sur les périmètres villageois d'irrigation par pompage de la zone de Matam au Sénégal. Paris; OECD Development Center, 1978 65p. & annexes, available in English (A)

Evaluates small irrigated rice perimeters in Matam department. Three parts; economic results, effects of local participation on operation and maintenance, and identification of conditions necessary for participation. Project characterized by low capital costs, yet gave substantial production. Farmers involved in all phases

of project; site selection decisions, production system, organization of producer groups, credit mechanisms, and system upkeep. Work executed by farmers themselves, costs borne by producer groups. Ethnic homogeneity sought in composition of producer groups. "Delegation to the farmers of some decision-making powers is facilitated by decentralized organization and non-compulsory methods."

74. HOCHET, Anne-Marie
La femme Toucouleur dans la société rurale actuelle en voie de mutation. Thèse troisième cycle Paris; E.P.H.E., 1975 334 p. bibl. (C).

Study of the role of Toucouleur women on the Mauritanian side of the Senegal River. First part gives description of the villages studied; including changes induced by recent introduction of a small-scale rice irrigation perimeter; reduced dependence of village concerned on imported revenues (from emigrated family members) to supply their food needs. Gives brief mention to role of women in rice cultivation and a small irrigated perimeter of vegetables cultivated by women.

75. MATHIEU, P.
"Agriculture irriguée, réforme foncière, participation paysanne; Le cas de la zone du Lac Guiers dans la vallée du Fleuve Sénégal." Communication to CEJC Colloquium (see ref. 26).

Discusses the concurrent effects of the Law of the National Domain ("land to be used by he who can make best use of it"), and the impending development of the Senegal River. Describes efforts by those with capital, social standing, and political power to gain control of potentially irrigable land. Gives example of Lake Guiers. Concludes that Senegalese policy will now tend to favor economic return over equity or participation objectives.

76. WEIGEL, J-Y
"Irrigation et participation paysanne dans la région de Bakel (Vallée du Sénégal)" Communication to CEJC Colloquium (see ref. 26).

Considers PIV's in Bakel region. Farmers refused to agree to SAED's initial conditions, requiring that SAED's role be essentially in technical matters. Perimeters in Bakel area exceptional, because they include collective fields, some managed exclusively by women. The lower castes, who hold relatively little rainfed land, are more interested by irrigated crops.

Market gardening in Dakar area

77. ROORDA Van EYSINGA, S. NAVEZ, L. DIENG
Notes sur quelques problèmes du maraichage traditionnel au Cap-Vert Dakar; Ministère du Développement Rural et de l'hydraulique, 1974 44p. (C).

Appendix to a previous report (not located); describes irrigated market gardening in the Cap-Vert peninsula of Senegal. Concentrates on salinity problems and groundwater.

78. SALL, Alioune "Transformations sociales dans une banlieue maraichère, L'exemple de M'Bidieum" Environnement Africain, supplément series études et recherches no. 77-21. (Dec. 1977) (A)

"Results of an inquiry attempting to describe a form of agriculture which is developing more and more in Cap-Vert and around the large towns; the family

operated market garden" (quoted from Antenne Sahel bibliography, updating number 4).

UPPER VOLTA (now BOURKINA FASSO)

79. d'AT de SAINT-FOULC, Jean
Les expériences paysannes de développement des cultures en Haute-Volta", communication to CEJC Colloquium (see ref. 26).

Quickly gives what he sees as reasons for failure of irrigation projects in the Sahel; bad or overauthoritarian management, economic disincentives, badly adapted technical design. Then describes three case studies. In the market gardening cooperative of Kongoussi, several younger farmers bought their own pumps and established perimeters apart from government scheme they had been in. Has given higher production and better quality than government perimeters. Coop members have bought truck to market their produce. Describes rehabilitation of gravity rice scheme in Kou Valley, leaving small village coops to manage the system as much as possible. Finally describes spontaneous development of irrigated vegetable gardens by lake Lumbila. Comments on astuteness of farmers in marketing their produce. Very interesting report, though little analysis.

80. GADELLE,
Rapport de mission en Haute-Volta. Considérations générales sur les aménagements hydro-agricoles. Paris; SEAE, 1968, 56p. (B).

Discusses problem of elevated capital costs, suggests studies should be the responsibility of one bureau d'études, which should also be involved in supervision of construction. Briefly describes crops and irrigation techniques. The latter include development of; 1) plains lower than upstream dams, where heavy soils and gradual slopes lead to drainage problems, 2) fields above reservoirs, by pumping, where soils are lighter and drainage problems less severe, thus allowing earlier cultivation of vegetable crops. Quickly describes management of systems.

81. LAHUEC, J.-P.
"Les jardins de saison sèche a Zaongho (région de Koupéla)" in Cahiers de l"ORSTOM, Série Sciences Humaines v. 5, no. 20 (1970), pp. 67-87.

Describes vegetable gardening in bas-fonds (depressions), where chadouf is used to raise water. Gardening introduced to region by a French missionary ca. 1920. Size of gardens about 200-400 m^2, never more than 1000 m^2. Most family heads involved in gardening. Onions, tomatoes, cabbage, lettuce seeded in nurseries, where they are watered frequently by children. Fruit trees, planted in association, are gradually displacing vegetable gardens.

82. MARCHAL, J.-Y.
Un périmètre agricole en Haute-Volta: Guiedougou, Vallée de Sourou," in Cahiers ORSTOM, Série Sciences Humaines, no. 1 (1976).

Farmers became much more committed to irrigated agriculture once they were consulted in choice of crops.

83. PALLIER, Ginette
"Un ilot de cultures maraichères en zone soudano-sahélienne; les jardins du Lac de Bamen Haute-Volta." Les Cahiers d'Outre-Mer, no. 111, (July-Sept. 1975) pp. 252-74.

"On the shores of Lake Bam, the government of Upper Volta has created an irrigated vegetable perimeter of 60 hectares, which has specialized in the production of green beans destined for export to France; history and management of the cooperative; technical infrastructure and means of land attribution; production, commercialization and revenue to the farmer." (quoted from Antenne Sahel Index, vol. 2 (ref. 10))

Non-Annotated Bibliography

SAHEL

General: Articles treating the Sahel countries in general, or whose focus is on a number of countries, or an unknown locality.

84. Afrique Agriculture. "Irrigation: méthodes nouvelles et perspectives." No. 33 (April 1978), pp. 60-83. (A)

85. Afrique Agriculture. "Sahel: cultures irriguées." No. 59, (July 1980), pp. 44-57. (A)

86. ATTIYA, Habib Hydraulique étatique, hydraulique paysanne. Paris; CNRS, 1981. (Irrigation experience from Tunisia, ref. HOROWITZ (50))

87. BELLONCLE, Guy. Alphebétisation et gestion des groupements villageois en Afrique Sahelienne. Paris: Club du Sahel, Ouagadougou: CILSS, 1982, 270p. (A) (experiences in SENEGAL, MALI, NIGER and UPPER VOLTA.)

88. BICHAT, H. "L'aménagement des petits bas-fonds à vocation agricole." L'Enfant en Milieu Tropical, No. 103, (1976), pp. 32-36. (C)

89. BOUDET, G. Manuel sur les paturages tropicaux et les cultures fourragères. Vol. 4, Paris; SEAE, (IEMVT), 1978, 258p. (. . . irrigation for intensive production of forage) ref. NBA index (1))

90. CAPONERA, Dante A. Le droit des eaux dans certains pays Africains. Rome; FAO, 1981, 289p. (A) (Includes UPPER VOLTA)..

91. CARRUTHERS, Ian D. (Ed.) L'Aide au développement de l'irrigation. Rapport du Colloque du Comité d'Aide au Développement, 1984 (A) (Includes chapters on irrigation works along the Niger River, in UPPER VOLTA and in Mali; available in English.)

82. CHABROLIN, Robert. "Aspects financiers et psychologiques de l'intensification de l'agriculture par irrigation." Techniques et Développement, no. 5, (1973), pp. 24-28. (B)

93. CILSS La mise en valeur des terres neuves au Sahel. Synthèse du Séminaire de Ouagadougou. . ., Ouagadougou: CILSS, Club du Sahel. (B)

94. CRUZ, J.-F. et CHEZE, B. Etude de groupes motopompes pour l'irrigation. Rapport de Mission, Antony; CEEMAT, 1979, 92p. (B)

95. Des BOUVRIE, C. Perspective Study for Agricultural Development in the Countries of the Sahel Zone: Irrigation Development in Mali, Niger and Upper Volta. Accra, Ghana; FAO Regional Office for Africa, 1975. (ref. HOROWITZ (50))

96. EDIAFRIC L'Economie des pays du Sahel, l'eau et l'irrigation. Paris; EDIAFRIC, La Documentation Africaine, 1976, 212 p. (A) (Some description of projects, a lot of numbers and projections, bibl.)

97. EDIAFRIC Le dossier Sahel; les cultures irriguées et les aménagements hydro-agricoles dans le cadre des deux premiers programmes Vol. 3. 1977-85. (A)

98. FAO Programmes d'irrigation dans les villages. Vers une utilisation rationnelle de l'eau. Commission Européenne d'Agriculture, Tel Aviv: 1970, Rome: FAO, 1971 (B) (FAO Bulletin d'Irrigation et de Drainage, No. 4).

99. FAO Club du Sahel: groupe des cultures irriguées. Rapport Général (Mar.) 1977. 82p. (A) (Results of a five month mission, summarizes water resources of the region.)

100. GIRARDIER, J.-P. et VERGNET, M. "La pompe solaire et le développement rural integré." in La Technologie Appropriée; Problèmes et Promesses, par JEQUIER, Nicolas. Paris; OECD Development Center, 1976, 391p. (A)

101. LAHLOU, O. "L'irrigation localisée ou micro-irrigation." Hommes Terre et Eaux, v. 6, no. 23, (1977), pp. 47-53. (B) (Irrigation in Morocco.)

102. LECOMTE, B. "Participation paysanne à l'aménagement et techniques des projets." Article under "Environnement et Aménagement en Afrique." Revue Tiers-Monde, vol. 19, no. 73, (Jan.-Mar. 1978) (A)

103. MAYER, J. Riziculture traditionnelle set ameliorée. 3 vols., Paris; SATEC, 1971. (I) (Vol. 1: La plante, les techniques culturelles, vol. 2: L'opération production rizicole a Madagascar, Vol. 3: La micro-hydraulique, application à la riziculture; report in context of rice cultures in Madagascar; ref. SEDAGRI, 1971).

104. MEREDIEU, J. de. Interet des aménagements hydro-agricoles de petites et moyennes dimensions en Afrique Noire. Rome; FAO, 1959, 7p. (B) (Very general).

105. Purdue University. The Costs and Benefits from Small and Medium Sized Irrigated Perimeters in the Sahelian Countries. West Lafayette: Agricultural Economics Department, West Africa Program; ICRISAT, 1978, 103pp.

106. RAULIN, Henri La dynamique des techniques agraires en Afrique Tropicale du Nord. Paris: CNRS, 1967, 247p. (B)

107 ROUSSIN, J.-P. Aspects juridiques des problèmes de l'eau dans les états membres du Comité Inter-Africain d'Etudes Hydrauliques. (Thesis) Université de Grenoble II, 1974.

108. SOGETHA Irrigation gravitaire par canaux; conception du périmètre, etude des canaux et leurs revêtements. Paris; Ministère de la Coopération, 1976, 296p. (Technical manual, presently out of print, but found at O.E.C.D. Development Center Library.)

109. TROUVE-BESSAT, Collette. "Sahel: l'irrigation, oui: mais pour qui?" Croissance des Jeunes Nations, no. 226, (March 1981), pp. 27-29. (C)

110. VAN DE WALLE, F.M. Study of irrigated farming in the West African Sahel. Accra; 1976, 6p. (A) (Project proposal to study a variety of water management techniques.)

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111. GUILLOBEZ, S. Etudes morphopédologiques: Projet Bagre, Rapport général (campagnes 75, 76, 77). Paris; IRAT, 1977, 89p. (A) (irrigation project)

112. KILIAN, TESSLER. "Méthode d'investigations pour l'analyse et le classement des bas-fonds dans quelques régions de l'Afrique de l'Ouest. Classement d'aptitude des terres à la riziculture. L'Agronomie Tropicale, no. 9, (1973), pp. 846-924.

113. Ministère da la Coopération. Evaluation des quantités d'eau nécessaires aux irrigations. Ministere de l'Agriculture, CTGREF, Groupement d'Aix en Provence, Division Irrigation, Paris; 1979, 204p. (A) (Technical aspects - climate, soils, plants, elements of water application.)

114. VALET, S. Détermination in situ des propriétés physiques, hydriques, et hydrodynamiques des sols des terrasses du Niger. Niamey; INRAN, 1977, 10p. (ref. NBA index (1))

115 VALET, S. Rapport sur la seconde prospection hydro-pédologique des sols des terrasses du Niger à Sona. Mise au point d'une méthodologie simple. Etude de la variabilité des résultats des facteurs hydriques. Niamey; INRAN (and GERDAT), 1977 (Aptitude for irrigation; from NBA index (1))

116 VALET, S. Résultats d'essais d'irrigation de complément sur sorgho-arachide et coton sur le périmètre irrigué de Lossa, saison des pluies '79. Niamey; INRAN, (Dec. 1979), 53p. bibl. (ref. NBA index (1))

117 VALET, S. et MARCESSE, J. "Prospection hydropédologique, amélioration foncière et essais d'irrigation sous cultures en vue des terrasses du Fleuve Niger à Tillabéry; (synthèse sur cinq ans de recherche a l'aide de sondes àneutrons)." L'Agronomie Tropicale, v. 35, No. 2, (Apr.-June, 1980), pp. 115-134.

Methodologies

118 BENEDIC, P. Note méthodologique. Evaluation économique et financière des projets périmètres d'irrigation villageois. Paris; SATEC, 1977, 44p. (ref. FUNEL AND LAUCOIN (16))

119 BERGMANN, Helmuth. et BOUSSARD, J.-M. Guide de l'évaluation économique des projets d'irrigation (version révisée). Paris; OECD, 1976, 261p. (C) (bibl.)

120 DELGADO, Felisa, Méthode d'évaluation des investissements de mise en valeur des ressources hydrauliques. (Thesis) Université de Montpellier I, 1975.

121 FUNEL, LEMELLE and ACHERIAUX. Analyse économique d'une opération d'aménagement hydro-agricole. (Paris; Ministère de la Coopération, 1980, 126p. (B,C) (Methodologies for evaluating rice projects).

122 SOGETHA Les petits barrages en terre. Paris; SEAE, 1968, 241p. (B) (Technical methodology)

Outside CILSS: Includes countries in part within sudano-sahelian climatic zone, although outside CILSS.

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124 UNDP/FAO Report to the government of Ghana on irrigated agriculture in the upper and northern regions. 1969 (ref. OUEDRAOGO et al. (14))

125 USHE-UBA. An analysis of the spatial patterns and physical determinants of agricultural systems in the Hadejia flood plain. M.A. thesis, Ahmadou Bello University, Nigeria, 1973. (ref. OUEDRAOGO et al. (14))

Health Aspects

126 PHILIPPON, B. and MOUCHET, J. "Répercussions des aménagements hydrauliques à usage agricole sur l'épidémologie des maladies à vecteurs en Afrique Inter-Tropicale." CENECA, Colloque, 1976 (B) (Describes water borne diseases).

CHAD (All works concern the Lake Chad Region)

127 BOUQUET, Christian "La culture de blé dans les polders du lac Tchad." Les Cahiers d 'Outre-Mer, No. 86, (Apr.-June, 196), pp. 203-214. (C)

128 HAUTIER, J. Rapport de pré-etude pour la réalization des études socio-économiques intéressant la zone des cuvettes lacustres et ouadi du lac Tchad. Paris; BDPA, 1962, 77p. (ref. BOUQUET (37))

129 HAUTIER, J. La commercialization traditionelle du blé dans la zone des cuvettes lacustres et ouadi du lac Tchad. Paris; BDPA, 1963, 76p. (Ref. BOUQUET (37))

130 JACOB, M. et al. Problèmes sociaux et économiques de l'aménagement des polders de Bol, Bol-Guini et Bol-Berim. Paris; BDPA, 1963, 2 vols., 213p. 256p. (Ref. BOUQUET (37))

131 Ministère de la Coopération (France). Note de présentation sur les polders de Bol au Tchad. Paris; 1978, 20p. (C) (Brief technical and financial history, bibl.)

132 MOSRIN, J. Historique des polders du lac Tchad. Fort-Lamy; Doc. inédit, 1963, 17p. (Ref. BOUQUET (37))

133 MOSRIN, J. Note concernant le développement de l'entreprise "polders" Fort Lamy; Direction Gén. Economique et Transp., 1966, 17p. (Ref. BOUQUET (37))

134 SOGETHA Etude d'un polder expérimental dans la région de Bol. Fort Lamy; 1963. (Ref. BOUQUET (37))

135 SOGETHA Aménagement, selon la méthode traditionelle, de trois polders de la région des cuvettes lacustres du lac Tchad. Fort Lamy; 1963. (Ref. BOUQUET (37))

136 VERLET, M. Aspects humains de l'utilization de trois polders de la région du lac (Soro Dalairom, No. Madirom et Tchingam). Paris; BDPA, 1963, 172p. (Ref. BOUQUET (37))

THE GAMBIA (Treats development of Gambia River, which also flows through SENEGAL).

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140 DIARRA, N'golo "Le jardinage urbain et suburbain au Mali-le cas de Bamako." Journal d'Agriculture Tropicale et de Botanique Appliqué, vol. 22, (Oct.-Dec. 1979), pp. 359-364

141 FOFANA BA SAYON Les problèmes d'aménagements dans la Vallée du Fleuve Niger (Mali). Rouen; University 1978 Thesis under the direction of J. GALLAIS). (Ref. FUNEL & LAUCOIN (16))

142 FOFANA, Mamadou. Le développement agricole et le déficit céréalier au Mali. Montpellier: Université, Faculté de Droit et Science Economique, 1981, 282p. (thèse de troisieme cycle) (A)

143 LEYNAUD, E. et ROBLOT. La modernisation dans la Haute Vallée du Niger. Paris; BDPA, 1961, 4 vols. (B)

144 LEYNAUD, Emile Les cadres sociaux de la vie rurale dans la Haute Vallee du Niger. Paris; BDPA, 1961, 2 vol. 253p. (B)

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146 SATEC Etude de reconnaissance de la Vallée du Niger dans la région de Gao. Paris; 1975 (ref. FUNEL & LAUCOIN (16))

Inland Delta and Lacustrine Zone

147 GALLAIS, Jean "La vie saisonnière au sud du Lac Debo." Cahiers d'Outre-Mer, vol. 11, Bordeaux; 1958, pp. 117-141.

148 GRANDET, C. "La vie rurale dans le cercles de Groundham." Les Cahiers d'Outre-Mer, vol. 11, (1958) pp. 25-46. (Describes irrigated nurseries used for décrue millet/sorghum, and bas-fonds rice culture).

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152 République du Mali. Projet de développement des cultures vivrières dans la zone lacustre. Bamako; Ministère du Développement Rural, 1972, 3 vol., 33p., 92p., 143p. & annexes.

153 SIMEON. Etude de cas: Mali, projet zone lacustre. Montpellier; Institut d'Agronomie Méditerranee, 1982, 17p.

Dogon Plateau

154 COYNE et BELLIER Mission d'expertise sur les barrages en pays Dogon. Bamako; Ministère du Développement Rural, 1979, 69p. (C) (Technical report on dam conditions.)

155 GUGGENHEIM, Hans et Rosalie FANALE. Shared Technology; a Project for Water Storage and Irrigation in Dogon Villages. Dakar; ENDA, and London; IAI, 1976, 16p. (C)

Office du Niger

156 COTRAIT, F. "Evolution du secteur agricole de Baguinéda, Rép. du Mali." Machinisme Agricole Tropicale, no. 66, (no date), pp. 51-59. (ref. NBA index (I) No. 02519-79)

157 DIALLO, Ibrahima Modernisation agricole et changements sociaux. Les conditions de vie des paysans des terres irriguée de l'Office du Niger, au Mali. SI, Sn, 1975, 261p. (bibl., ref. FUNEL & LAUCOIN (16))

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162 FESTINGER, Georges La mise en valeur du casier pilote de Kaedi; situation sociologique de référence; la mise en oeuvre du changement et les perspectives d'évolution sociologique. Paris; IRAM, 1977. (ref. FUNEL & LAUCOIN (16))

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165 République Islamique du Mauritanie. Irrigated Agriculture (RAMS project - rural assessment and manpower surveys). Ministry of Economy and Finance, 1981, 182p. (A)

166. SOGREAH Aménagement de l'Aftout es Sahel. PARIS; 1974 (ref. FUNEL & LAUCOIN (16))

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168 ARRIGHI DE CASANOVA, Jacques. Etude et financement d'aménagements hydro-agricoles. Rép. du Niger, S.I., 1961, 76p. (B)

169 BELLONCLE, Guy "Une expérience d'animation coopérative au Niger" in DESROCHE, Henri and Placide RAMBAUD: Villages en développement; Contributions à une sociologie villageoise; Actes des premier et deuxième colloques d'Albiez-le-Vieux, 1969 et 1970, Paris; Mouton et Co., 1971, pp. 201-227. (A)

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Ader-Doutchi-Maggia

178 MONNIER, Pierre. Etude socio-économique des vallées d'Ibohamane et de Tegef. Paris-Niamey; CNRS-IFAN, 1967, 122pp. (ref. FUNEL (56))

179 SOGETHA Etude agro-économique de la vallée de Badéguicheri. Pour le compte du Commissariat General au Developpement (Rep. du Niger), 1969. (Ref. FUNEL (56) can be found at Service du Plan, Tahoua)

180 SOGETHA Etude agro-économiques de l'aménagement hydro-agricole de la Maggia. Pour compte du Commissariat Général au Développement (Rép. du Niger), missions 1966, 67, 68, 69 Rapport Final. (ref. FUNEL (56),can be found at Service du Plan, Tahoua)

181 SOGETHA Etude agro-économiques de l'aménagement hydro-agricole d'Ibohamane. Pour compte du Commissariat Général au Développement (Rép. du Niger), missions 1969, 70, 71 Rapport Final. (ref. FUNEL (56)), can be found at Service du Plan, Tahoua)

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185 BERNUS, Edmond "Les palmeraies de l'Air." Revue de l'Occident Musulman et de la Mediterranee. 1972, pp. 37-50.

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192 HASSANE, G.S. Irrigation et développement dans la Vallée du Niger; le cas des aménagements hydro-agricoles en amont de Niamey. Niamey; Université de Niamey, (Oct. 1979), 175p. (bibl., ref. NBA index (1))

193 MAMADOU, O. Contribution à l'étude socio-économique sur les aménagements hydro-agricoles de Saga-Libore et N'Dounga. Niamey; Institut de Recherches en Sciences Humaines, 1978. (ref. HOROWITZ (50))

194 RAVIGNAN, François de "Un village au Niger devant les experts occidentaux." Le Monde Diplomatique, no. 284, (Nov. 1977) (A)

195 République du Niger. Aménagement hydro-agricole de la cuvette de Karmac. Projet: études d'avant projet. Ministère d'Economie Rurale, Génie Rural, Rome; FAGRARIA, 1964, 2 vols. (B)

196 TOURE, Oumara L'aménagement du Niger: le cas des aménagements hydro-agricoles du Tillabéri. Paris; Ecole des Hautes Etudes en Sciences Sociales, 1978, 169p.

SENEGAL

Senegal River: Includes schemes in Delta and Middle Valley. Works treating small-scale systems exclusively are listed under a separate heading.

197 Anonymous "Aménagement de la Vallée du Sénégal." Cahiers des Ingénieurs Agronomes, no. 318, (Aug.-Sept. 1977), pp. 11-15. (A) (Farmers' response to collective organization of work).

198 ABELIN, Philippe "Domaine national et développement au Senegal." Bulletin de l'IFAN, v. 41, serie B, no. 3, 1979. (ref. MATHIEU (75))

199 ADAMS, Adrian "The Senegal River Valley: What Kind of Change?" Review of African Political Economy, no. 10, 1977, pp. 33-59. (ref. HOROWITZ (50))

200 AURIOL, O. Notes relatives a certains groupements de producteurs de la SAED. Richard Toll; ISRA, 1981, 76p., dactyl.

201 BESSIS, Sophie "Faut-il construire les barrages sur le Sénégal?" Jeune-Afrique, July 22, 1981, pp. 53-56.

202 BONNEFOND, Philippe; O. AURIOL Etude des systèmes de production des paysans pratiquant la culture irriguée dans le cadre de la SAED, Premiers résultats. Richard Toll, Dakar; ISRA, ORSTOM, 1980, 100p. (A, O)

203 BONNEFOND, Philippe et CANEILL J. "Systèmes de culture irriguée et unités de production paysannes sur la rive gauche du Fleuve Sénégal." Etudes Scientifiques, 1981.

204 BONNEFOND, Philippe et al. Etude d'unités de production de paysans pratiquant la culture irriguée dans le cadre de la SAED. Richard Toll, Dakar, Paris; ISRA, ORSTOM, IRAT, INA PG, 1981.

205 BONNEFOND, Philippe, "L'introduction de la culture irriguée sur les rives Sénégalaises du bassin du Fleuve Sénégal." Economie Rurale. no. 147-148, (1982) (ref. MATHIEU (75))

206 BONNEFOND, Robert; MAYER, Jaques. Les rizicultures paysannes, améliorations possibles. Paris; SEAE, 1973.

207 BOUTILLIER, J.-L. La moyenne vallée du Sénégal. Paris; Ministère de la Coopération, INSEE, 1962, 368p. (Includes description of décrue agriculture; ref. GALLAIS (17))

208 COURAUD, Philippe Etude du fonctionnement de quelques unités de production encadrées par la SAED. (Memoire, DAA), Paris; INA PG (Chaire d'Agronomie), IRAT, ISRA, 1980, 128p., dactyl.

209 DUBOIS, J. et al. Aménagement de marigot près de Bakel (Sénégal). Série Etudes et Recherches, No. 81/83, (Mar.) Dakar; ENDA, 1983, 65p.

210 HERVOUET, J.-P. Les éleveurs riziculteurs du moyen delta du Sénégal (les Peuls et l'aménagement). Mémoire de Maitrise, Dakar; 1971. (ref. GALLAIS (17))

211 JAMIN, J.-Y. Etude d'unités de production de paysans pratiquant la culture irriguée dans le cadre de la SAED. Richard Toll; ISRA, 1981, 27p., dactyl. (Rapport Annuel)

212 KEITA, Modibo "De la culture de décrue à la culture irriguée." Le Moniteur Africain, No. 757, (August, 1977), pp. 47-58. (A, C)

213 N'DIAYE, M. Etude des systèmes de production en cultures irriguées. Richard Toll; ISRA, 1980, 16p. multigr.

214 OMVS Etude socio-économique de l'OMVS. Dakar; OMVS, 1980, 5 vols. (ref. MATHIEU (75))

215 OMVS Evaluation des effets sur l'environnement d'aménagements prévus dans le bassin du Fleuve Sénégal. Harrisburg (A); Gannet & Fleming. (A)

216 PLASSAN, Jacques "Systèmes de culture et structures agraires dans les campagnes Sénégalaises." Cahier du Centre de Développement de l'Université de Rennes, no. 1, 1982.

217 Republique du Sénégal Programme d'action à court et moyen termes; rapport de fin de premier phase. Ministère du Développement Rural et de l'Hydraulique, SI, SAED, SCET-International, 1976, 6 vols. (Régions du Fleuve, Olodou et Backel) (ref. FUNEL & LAUCOIN (16))

218 SAED, SONED, SEDES Loi-programme agricole; bilan diagnostic, analyse des systèmes de production agricole et perspectives: Etude analytique des différentes structures du développement rural. Tome II, Ministère du Développement Rural et de l'Hydraulique, Sénégal, 1977. (A) (ref. FUNEL & LAUCOIN (16))

219 SATEC Programme du développement de la riziculture dans le delta du Fleuve Sénégal. Paris; 1968, 4 vols. (C)

220 SECK, S.M. Irrigation et aménagement de l'espace dans la moyenne vallée du Sénégal. Thèse pour le Doctorat d'Etat en Géographie, Université de St.-Etienne, 1981. (ref. MATHIEU (75))

221 THEVENIN, Pierre Synthèses des évaluations riz-coton-arachides au Sénégal. Ministère des Relations Extérieures, Coopération et Développement, Paris; 1982, 47p. (A) (Treats irrigated rice project in the Senegal River Valley.)

222 WEIGEL, J.-Y Irrigation et système traditionnel de culture dans la région de Bakel (Vallée du Sénégal), ORSTOM, (August) 1980.

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223 DACHRAOUI, A. Les périmètres villageois de la Vallée du Fleuve Sénégal. Paris, St. Louis; FAO, 1978, 3 vols. (Dimension Optimale et Mode d'Exploitation, 53p; Méchanisation des Aménagements, 53p; Prix du Metre Cube d'Eau d'Irrigation, 43p.)

224 DIAGNE, Papa Syr. "Une expérience originale: les petits périmètres de Matam." Notes Africaines, No. 149, pp. 8-10., IFAN, (January 1976), pp.8-10

225 Direction de la Formation Permanente/FAO. "Après une enquete détaillée auprés de quatre périmètres (Nabadji I et les 3 P.I.V. de Ndouloumadji-Dembé)." Conférence: Analyse de Périmètres Irriguées Villageois (PIV) de la zone de Matam, Rome; (May 1982), 125p. (ref. BELLONCLE (70))

226 GOUDIARD, R. Réflexions sur six années d'expérience d'une opération de petite hydraulique agricole. (July-August 1980), 250p. roneo. (ref. BELLONCLE (70), FEDIORE (72))

227 Overseas Development Institute Using Indigenous Skills and Institutions in Small-Scale Irrigation: Example from Senegal. London; 1983, 11p. (Network paper 8B)

228 SAED Evaluation agro-économique des petits périmètres de Matam. Ministère du Développement Rural et de l'Hydraulique, St. Louis; 1975, 26p. (ref. FUNEL & LAUCOIN (16))

Other

229 SOW, A. "Evolution du système de production agricole dans la région du Cap-Vert." Cahiers Africains d'Administration Publique, no. 17, (July 1977), pp. 59-65. (A) ("urban-rural relations, concept of integration. Production systems; colonial, post-independence, current tendencies)")

UPPER VOLTA

230 ARRIVETS, J. Résultats de riziculture sans aménagement en zone soudanienne; L'exemple de bas-fonds du centre Haute-Volta. Ouagadougou: Ministère du Plan, Développement Rural, de l'Environnement et du Tourisme, IRAT, 1974, 23p. (C)

231 BELLOT, C.B. et BELLOT, J.-M. "Pour un aménagement du cours moyen de la Volta Noire et la Vallée de Sourou." Les Cahiers d'Outre-mer, v. 31, no. 123, (July-Sept. 1978), pp. 271-286. (C)

232 BELLOT, C.B. L'aménagement des vallées des Voltas et l'exemple de Kaibo. Grenoble; Université Scientifique et Médical de Grenoble, Institut de Géographie Alpine, 1976. (ref. OUEDRAOGO et al (14))

233 BELLOT, J.-M Potentialités pour un aménagement du cours moyen de la Volta Noire et de la vallée de Sourou Grenoble; Université Scientifique et Médical de Grenoble, 1977. (Studies region: natural environment, demography, village organization, agricultural land use, socio-economic development processes; (ref. OUEDRAOGO et al (14))

234 BEYRARD, N. "L'aménagement des Vallées des Voltas." Afrique-Agriculture, no. 25 (Sept. 1977), pp. 32-41. (ref. FUNEL & LAUCOIN (16))

235 BOURRICAUD, Francois Aménagements hydro-agricole de la vallée de Sourou; Conclusions générales. Bordeaux: Institut des Sciences Humaines Appliquées, 1959. (B)

236 CHAVANCY, Felix (et collab.). Bilan et diagnostic des actions entreprises au titre de l'Aménagement des Vallées des Voltas (1971-1976). Paris; Ministère de la Coopération; Ouagadougou; Ministère du Développement Rural (Autorité des Aménagements des vallées des Voltas), 1976, 38p. & annexes. (ref. FUNEL & LAUCOIN (16))

237 DARLOT, A. Observations sur le programme de construction des petits barrages en terre en Haute-Volta. (August 1961), 32p. (C) (strictly technical)

238 OUEDRAOGO, Ouendkouni Etudes des aménagements hydro-agricoles et des déplacements de populations en Afrique de l'Ouest: l'exemple de la Haute-Volta de 1900 à nos jours. Thèse Doctorat d'Etat, Université de Bordeaux III, inscript. no. 3685, répertoire de thèses 1978. (ref. OUEDRAOGO et al. (14))

239 PETER, Jean E. "La situation et les perspectives d'aménagement des Vallées des Voltas." Afrique Agriculture, no. 14 (Oct. 1976), pp. 48-51. (ref. FUNEL & LAUCOIN (16))

240 RAYNAUD, G. Organization régionale de développement, Haute Volta; cellule vulgarization; opération riz: fiches techniques. Haute Volta, Ministère du Développement Rural, O.R.D., Komoe, 2 vols. (rice 30p.; market gardening, 4 p.). (B)

241 République de la Haute Volta. Programme d'hydraulique au Sahel. Paris; SCET-International, 1973, 3 vols.

242 SAWADOGO, P. et al. Enquete socio-économique par entretien non-dirigé avec les exploitants dans parcelles de Tiébélé Ouagadougou; 1975. (ref. OUEDRAOGO et al. (14))

243 VOGEL, Jean. "Heurs et malheurs de l'aménagement des vallées des Voltas." Croissance des Jeunes Nations, no. 247, (Feb. 1983), pp.27-30. (A)

APPENDIX A

Key and Guide to Libraries in the Paris Area

The following is a list of libraries in the Paris area, with holdings relevant to irrigation in the Sahel, which are open to public consultation at the indicated hours. The letters in the left-hand column are the keys used in the bibliography to locate documents. Hours given are those effective as of spring 1984.

(A) Antenne Documentation Sahel, Development Center of the OECD. 94, rue Chardon Lagache, 75016 Paris. Tel 524-84-88. Metro Exelmans. Public hours 2pm - 6pm, T,W,Th. Françoise BEUDOT, documentalist

Specializes in literature related to drought control in the Sahel. Most holdings are from the last ten years. Unlimited photocopies, 1 franc per copy.

(B) Bureau pour le Développement de la Production Agricole (B.D.P.A.), Centre de documentation. 27, rue Louis Vicat 75738 Paris Cedex 15. Tel. 638-34-75. Métro Vanves-Malakoff. Public hours 2pm-6pm, M-Th; 2pm-5pm, F.

Stores the holdings of the BDPA and its affiliated company SCET-International, two of the most important French firms involved in agricultural development in francophone Africa. Unlimited photocopying, 1.50 francs per copy.

(C) Ministère de la Coopération, Centre de Documentation. 1 bis, Ave. de Villars, 75007 Paris. Tel. 555-95-44. Métro St. François-Xavier. Public hours 9-12am; 2-6pm W,Th.

The Ministry of Cooperation is the French equivalent of USAID. It is wise to arrive at 9am, as seating is limited. Limited photocopying.

(D) Documentation Française, library and bookstore. 29-31, quai Voltaire, 75340 Paris Cedex 07. Tel. 261-50-10. Métro Quai d'Orsay. Open 9am-6pm M-F.

Those works marked with a D are available for sale at the Documentation Francaise at the time of writing of this report.

(I) Institut de Recherches Agronomiques Tropicales (IRAT). 45 bis, Ave. de la Belle Bagrielle, 94130 Nogent-sur-Marne. Tel 876-12-33. Métro RER Line A, Nogent-sur-Marne. Public hours 9-12am, 2-6pm, M-Th.

Holdings mostly in the areas of agronomy and crop production.

(O) Office de la Recherche Scientifique et Technique Outre-Mer, (ORSTOM), Centre de Documentation. 70-74, Route d'Aulnay, 93140 Bondy. Tel 847-31-95, Public hours 12-5:30pm, W-Th; 12-4:30pm F.

ORSTOM works in the areas of physical and human geography. Call the library to get directions. Limited photocopying.

APPENDIX B

Abbreviations Used in the Text

We have tried to present the full names of organisations mentioned in the text by abbreviations, but in some cases this has not been possible.

A.B.N.	Autorité du Bassin du Niger
B.D.P.A.	Bureau pour le Developpement de la Production Agricole
C.E.J.C.	Centre d'Etudes Juridiques Comparatives
CENECA	
C.E.E.M.A.T.	Centre d'Etudes et d'Expérimentation du Machinisme Agricole Tropical
C.I.E.H.	Comité Inter-Africain d'Etudes Hydrauliques
C.I.L.S.S.	Comité Inter-Etat pour la Lutte contre la Sécheresse Sahélienne
C.N.E.A.T.	
C.N.R.S.	Centre National de la Recherche Scientifique
C.N.R.S.H.	Centre Nigérien de Recherches et Sciences Humaines
C.T.G.R.E.F.	
D.G.R.S.T.	Delegation Générale a la Recherche Scientifique et Technique
EDIAFIC	Editions Africaines
E.N.D.	
E.N.S.A.	Ecole Nationale Supérieure Agronomique
E.P.H.E.	
G.E.R.D.A.T.	Groupement d'Etudes et de Recherches pour le Développement de l'Agronomie Tropicale
I.A.I.	
I.C.R.I.S.A.T.	International Crops Research Institute for the Semi-Arid Tropics
I.E.D.E.S.	Instut d'Etudes du Développement Economique et Social
I.F.A.N.	Institut Fondamontal de l'Afrique Noire
I.N.A.P.G.	
I.N.R.A.	Institut National de la Recherche Agronomique
I.N.R.A.N.	Institut National de la Recherche Agronomique Nigerién
I.N.S.E.E.	Institut National de la Statistique et des Etudes Economiques
I.R.A.M.	Institut de Recherches et d'Applications de Méthodes de Développement
I.R.A.T.	Institut de Recherches Agronomiques Tropicales et de Cultures Vivrièress
I.S.E.A.	

I.S.R.A.	Institut Sénégalais de Recherches Agricoles
N.B.A.	Niger Basin Authority
O.E.C.D.	Organisation for Economic Cooperation and Development
O.C.D.E.	
O.D.I.	Overseas Development Institute
O.N.A.H.A.	Office National des Aménagements Hydro-Agricoles (NIGER)
O.R.S.T.O.M.	Office de la Recherche Scientifique et Technique Outre-Mer.
P.N.U.D.	Programme des Nations-Unis pour de Développement
P.U.F.	
S.A.E.D.	Société d'Aménagement et d'Exploitation des terres du Delta (SENEGAL)
S.A.T.E.C.	Société d'Aide Technique et de Coopération
SCET-Int	Société Centrale pour Equipmement du Territoire International
S.E.A.E.	Secrétariat d'Etat pour les Affaires Etrangeres
SEDAGRI	Société d'Etude pour le Développement Agricole
S.E.D.E.S.	Société d'Etude pour le Developpement Economique et Social
SODEFEC	
SO.GE.T.H.A.	Société Générale des Techniques Hydro-Agricoles
SO.GR.E.A.H.	Société Grenobloise des Etudes d'Aménagement Hydraulique
SONED	
U.N.D.P.	United Nations Development Programme
U.N.C.C.	Union National du Crédit et des Coops
U.S.A.I.D.	United States Agency for International Development
W.M.S.-II	Water Management Synthesis II Project