Irrigation and Human Welfare
A Workshop Report

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Rutgers University/Cook College
INTERNATIONAL AGRICULTURAL AND FOOD PROGRAM WORKING PAPERS

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2. Whelan, W.P. 1983. The nutritional component of farming systems research.

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Acknowledgments

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Abstract

In 1982, a group of faculty at Rutgers University interested in the effects of water-related projects on human well-being formed an informal Working Group on Water and Human Welfare. Members recognized both the importance of irrigation in many less-developed countries (LDCs), and the variety of positive and negative welfare effects which irrigation may have. Furthermore, the Working Group participants felt that more attention should be given to developing methods by which the planning and implementation of water-related projects in irrigated areas could better integrate major types of welfare considerations.

To explore the pertinent issues, a workshop was held at Rutgers University on November 7-8, 1983. The program of the workshop is given in Appendix 1. Participants were invited from various organizations concerned with irrigation, water supply and sanitation projects LDCs (Appendix 2). A brief background paper and seven discussion papers were prepared for the workshop by members of the Rutgers Working Group. Summaries of the seven discussion papers comprise the final section of this report. Copies of these papers are available upon request.

This document is intended as an interpretive report of the workshop, and represents an attempt to summarize and synthesize the discussions that took place. The report is not a systematic record of all the points made during the course of the discussions.

Focus of the Workshop

The three specific objectives of the workshop were: (1) to examine ways in which concerns about complex relationships between water and human welfare could be integrated in the planning, design, operation and evaluation of irrigation and related water supply and sanitation projects; (2) to identify obstacles to the development of an integrated approach, and to consider how such obstacles might be overcome; and (3) to identify research and training needs to foster a more integrated approach.

Although the welfare consequences of irrigation are many and varied, those that were the focus of attention during the workshop may be grouped into three categories. The first category comprises "production-based" effects. These are the welfare consequences that result from production changes caused by irrigation. Since irrigation can be viewed as an activity designed primarily to increase agricultural production, these production-based effects represent consequences directly associated with the purpose of the irrigation projects.

Unintended consequences of irrigation comprise a second category of welfare effects. Of major importance are changes which have negative implications for human health and for environmental support systems. Significant interrelationships exist among irrigation water supplies, methods of disposal of human wastes, and household water utilization. As a result of these interrelationships, irrigation frequently changes the prevalence of water-related diseases, including schistosomiasis, malaria and various diarrheal diseases. Additional health consequences considered include (1) the

possibility of poorer human nutrition resulting from irrigation-induced changes in patterns of production and consumption, and (2) the potential for increased exposure to toxic hazards as a result of contamination of environments with fertilizers and pesticides. A variety of other social and economic consequences of irrigation, such as changes in the distribution of income and wealth, also fall in this category.

The third set of welfare consequences considered consists of complementary nonagricultural benefits which could accrue if certain additional investments were made in conjunction with the development or improvement of irrigation. The most notable examples involve activities designed to improve sanitation and household supplies of drinking water.

These categories of welfare effects are interrelated in important ways. For example: (1) agricultural production consequences of irrigation are related closely to changes in nutritional well-being, and (2) the manner in which an irrigation project provides for drinking water may have an important bearing on the health consequences of irrigation.

Six of the seven papers prepared for the workshop dealt with selected aspects of these welfare consequences of irrigation. Small's paper "Agricultural Production Considerations in the Development and Management of Irrigation" considered issues associated with the production benefits. Unintended health consequences were the topic of three papers. Dennis' paper "Parasitic Hazards of Irrigation Projects" dealt primarily with the vector-borne disease of schistosomiasis. Shisler's paper, "Irrigation Projects and Mosquito Vectors" dealt with mosquito-borne diseases, particularly malaria.

Health consequences associated with changes in nutrition and with toxic chemicals were considered by Roundy in his paper "Nutritional and Toxic Hazards to Households and Communities in Irrigation." Two papers explored questions of complementary benefits. Singley's paper "Sanitation and Water Supply" considered the importance of composting as a means of separating human wastes from irrigation water and disposing of them in a safe manner. Aspects of the utilization of water for household and other nonagricultural uses were discussed by Cosminsky in her paper "Sociocultural Factors in Irrigation and Domestic Water Management."

The seventh paper prepared for the workshop, "Institutional Issues" by Poxer, considered questions associated with institutional obstacles to dealing with the three categories of welfare effects in a more integrated manner.

The purposes of the seven papers were to present a variety of welfare issues raised by irrigation, and to provide thereby a beginning point for the workshop discussions. The approach of the papers was deliberately broad both conceptually and geographically. This approach was taken in recognition of the fact that despite the importance of the welfare issues, current knowledge about how to deal with them remains limited.

Summary of the Discussions of the Workshop

Obstacles to a More Integrated Approach to Irrigation Projects

Several obstacles to a more integrated approach to the planning, development and operation of irrigation systems were identified.

1. Biases in the decision-making process for irrigation investments. The approach to irrigagtion projects suggested in the discussion papers emphasizes "micro-level" concerns--i.e., concerns about impacts which a given project may have on individuals who farm and live in the project area. But the decision-making process associated with investments in irrigation is typically more "macro" oriented toward national political-economic goals and considerations. The potential for conflict between these two sets of concerns exists because the macro-level set does not necessarily incorporate the micro-level concerns. For example, public investment in irrigation is sometimes motivated by a desire to provide additional resources and income to farmers who have been disadvantaged by a nation's agricultural price policies. Or, irrigation investments may result from a government's political perception that its survival depends on increasing national food production. Given these types of short-run pressures, sufficient attention is unlikely to be given to the long-run negative consequences of irrigation. This may lead to a type of irrigation development that is not sustainable.

Furthermore, political mechanisms which would allow these "micro-level" concerns to be articulated in the decision-making process are frequently absent. When an appropriate political framework does exist, strong reaction to proposed projects by those who will be most directly affected is sometimes encountered. This provides a feedback link between the micro-level concerns of the affected individuals, and the macro-level concerns which generated the project proposal. The inadequacy of such a link in many nations weakens one potentially significant mechanism to offset some of the unfortunate macro-level biases of the decision-making process.

Investment decisions may also be biased by factors related to donor agencies, which have their own pressures to fund projects. A nation may be encouraged to undertake projects even when it lacks the capacity for their adequate maintenance. Under such circumstances it is not surprising that little attention is given to the unintended problems that may result.

2. Institutional rigidities. A common institutional barrier to a more integrated consideration of irrigation projects is the division of responsibilities for irrigation-related activities and consequences. Within national governments, planning, construction and operation of irrigation projects are generally the responsibility of an agency in either a ministry of agriculture or a ministry of public works, while health concerns fall within the purview of a ministry of health. Separation of production and health concerns also exists within most donor agencies. As a result, those concerned with the planning, implementation and operation of irrigation systems may have little awareness of the health implications of their activites. And seldom is there an effective mechanism for the concerns of people in a ministry of health to be communicated to irrigation agencies, and thereby influence irrigation planning and design.

Another instutional obstacle is the nature of project and budgetary cycles. Donor agencies are under pressures to commit funds "efficiently". There is little difference in overhead costs between large and small projects, and donor agencies therefore are biased toward large projects. Yet, such projects may be more prone to unfavorable unintended consequences, and the resulting problems may be more difficult to alleviate.

Furthermore, the project basis for the activities of both donor and implementing agencies leads to a perception of a project as a discrete entity to be planned for, designed, constructed in final form, and then turned over to some operating agency. It must be realized that irrigation investments would be more successful if projects could evolve and change over time as the various participants gradually learn and respond to the consequences of their activities. For example, the location of certain types of permanent structures such as turnouts from the irrigation laterals need not be incorporated into the initial design, but rather left until a few years of experience showed where they are best suited. Unfortunately, such an approach is generally viewed as a violation of good project planning principles. The difficulty is that these principles are based on an implicit assumption that it is possible to obtain all the knowledge needed to develop an adequate plan for the project at a single point in time in advance of its implementation. Yet such an assumption generally is not valid because of both the scale of many irrigation projects and the complexity of the physical changes that they create. The assumption is particularly invalid with respect to the knowledge needed to plan the details of the terminal facilities of an irrigation system.

A final institutional factor is the technical bias common to both donor and implementing agencies. This bias results from the fact that knowledge about technical aspects of irrigation activities is frequently greater than knowledge about the non-technical or social aspects. The result is a tendency to conclude that any problems that arise from an irrigation project can be "fixed" by known techniques. The fact that social factors may

preclude the efficacy of many of these techniques is easily overlooked because of a lack of understanding of the processes underlying these social responses.

3. Inadequate knowledge. The ability to deal effectively with the human welfare concerns raised in the workshop is hindered by a lack of knowledge about the effects of certain activities, and of how to deal with these effects. Conceptually, it is difficult to understand the totality of the system being impacted by irrigation, and this limits the ability to prescribe desirable courses of action for implementing agencies. Another difficulty is that current knowledge is based primarily on empirical case studies, and not on an overall conceptual framework. In the absence of an adequate conceptual framework, the fact that irrigation projects are site-specific and unique in such a variety of ways makes it very difficult to determine the extent to which results from case studies can be generalized.

In addition to these conceptual problems, the methodological framework for dealing with many of the unintended consequences and complementary nonagricultural benefits of irrigation is very inadequate. Techniques for measuring these effects frequently are not well developed. Furthermore, some participants suggested that it may be undesirable to attempt to quantify some of these effects in monetary terms because of the subjective judgements about the value of human life and health which such measures imply.

4. Costs. A more integrated approach to irrigation imposes increased costs, particularly in the planning and construction stages of projects. Both monetary and time costs are associated with obtaining additional information, obtaining local participation, and constructing additional facilities. Some

of these costs are incurred to prevent undesirable welfare consequences of irrigation; however, ex ante uncertainty both about the likelihood of these consequences in any particular situation, and about their significance increases the difficulty of justifying these activities.

5. Inadequate human capital. An integrated approach to irrigation is difficult because there are few people with the requisite training and skills. In some areas, such as mosquito control, a shortage of technically skilled manpower exists. But more generally the problem appears to be the absence of a large body of people who have the training or experience to appreciate and recognize the range of effects that irrigation may have on people. Most irrigation specialists are trained in a rather specific, narrow way, and their education seldom systematically exposes them to the broad range of concerns of irrigation.

Overcoming the Obstacles

In addition to identifying factors which frequently hinder the development of an integrated approach to the consideration of irrigation projects, the workshop also dealt with questions of how to help overcome some of the impediments. Three general approaches were identified.

1. Changing accepted institutional procedures regarding irrigation projects. One possible approach to dealing with the health consequences of irrigation would be for agencies to accept explicitly the notion that projects should not have a debilitating impact on health, and then to identify a minimum set of complementary investments or activities that would normally be

expected in order to assure this result. These complementary investments and activities might include village water supplies for household utilization, sanitation facilities, local participation and user education. If such a set of minimum investments were accepted as the norm, planners who wish to eliminate any minimum standards would be required to justify the exclusions. This procedure would thus shift the burden of proof associated with these complementary investments away from those who wish to include them in a particular project and onto those who feel they should be excluded.

2. Address areas where clear complementarities exist. Both conflicts and complementarities exist among the various human welfare concerns raised about irrigation projects. It is difficult to deal with areas of conflict among the objectives; however, partial solutions in areas of complementarities appear more promising. Three specific areas of complementarity emerged from the workshop discussions.

First, healthy workers are more productive than those who are ill. Thus there exists at the national level a complementarity between the health and production concerns associated with irrigation. This complementarity is particularly important with respect to the maintenace of the irrigation system. A well-maintained system functions better in supporting increased agricultural production, and concurrently results in environmental conditions that are less favorable for the hosts of human parasities.

A second specific area of complementarity is the need for effective monitoring. To meet the production goals associated with an irrigation system, a monitoring procedure is needed to permit the flow of information regarding

the agricultural situation at the field level to those operating the system. This allows modifications to be made in water allocation procedures. But to deal effectively with many of the potential negative consequences of irrigation, effective monitoring is also needed. The workshop participants generally agreed that it was neither feasible nor cost-effective to try to anticipate all of the possible negative effects of irrigation in the planning and design stages. Monitoring and evaluation procedures that would provide an "early-warning" system and permit problems to be detected and cured in their early phases would be more effective. Although the monitoring needs associated with various consequences vary, the common requirement of all monitoring approaches is the need for local information. The ability and commitment to obtain local information for assessing unintended consequences of irrigation is likely to foster willingness to obtain such data on agricultural production consequences, thus enhancing the agricultural performance of the irrigation project.

A third area of complementarity involves irrigation planning. Local participation in the planning process is of critical importance to the performance of irrigation with respect to all the welfare effects identified. Procedures which bring the concerns of local participants into the planning process would make irrigation systems more successful in terms of both their production-based consequences, and their additional welfare effects.

3. Training. The final area of discussion was the role of training and education in overcoming some of the obstacles to a more integrated approach. There was general agreement regarding the need for training that

would increase awareness among those involved with irrigation systems, of the types of concerns raised in the workshop. Field experience in real irrigation systems is an important part of this training, along with an emphasis on interdisciplinary research. The need to train for this type of awareness exists for a broad range of disciplines. New and experimental approaches may be needed.

Summaries of the Papers Prepared for the Workshop

1. "Parasitic Hazards of Irrigation Projects" by Emmet A. Dennis, Associate Professor, Department of Biological Sciences, Faculty of Arts and Sciences, Rutgers University, New Brunswick, NJ.

Parasitic hazards of irrigation projects originate from the construction of reservoirs and extensive canals which become colonized by disease vectors, and from the concentration of human populations, including migrant workers, in the vicinity of irrigation systems. This concentration of population facilitates transmission of waste-related and other communicable diseases (hepatitis B, tuberculosis, cholera, amoebiases, hookworm, ascaris, strongyloides, pinworm, trichuris) and initiates or intensifies transmission of vector borne diseases (malaria, schistomiasis, onchocerciasis, filariasis, trypanosomiasis). The role of irrigation projects in the transmission, incidence, intensity and morbidity of diseases is not well established, and the effects of irrigation-related diseases on economic productivity remain unclear. Appropriate methodologies for predicting consequential disease transmission and the resulting health and economic impacts are wanting.

In many areas, preproject baseline data are lacking for irrigation projects, but subsequent investigations show a relatively large variety and combination of infections. This dramatizes the necessity for preproject epidemiological studies as a prerequisite to the decision for implementing irrigation projects in certain areas.

Schistosomiasis exemplifies the health impact of irrigation projects. Disease incidence and vector populations usually increase. A continguous canal system may destroy a patchy distribution of schistosome vectors and upset the delicate natural balance between the vector and its parasites. Engineering methods used to reduce or contain transmission of schistosomiais include vertical, concrete lined reservoirs and canals; high water velocity; desilting and weeding; closed conduits and sprinkler irrigation; and drainage to dispose of excess water.

2. "Sanitation and Water Supply" by Mark E. Singley, Professor, Department of Biological and Agricultural Engineering, Cook College, Rutgers University, New Brunswick, NJ.

Irrigation systems often invite their use as disposal systems for organic wastes which magnifies the threat of the spread of disease. The very costly types of sewage systems used in industrialized nations are not likely to be appropriate in developing countries. Composting, which is nature's way of mineralizing and sanitizing organic matter, can be effectively used to prevent the introduction of human organic wastes into potable water sources and thus contribute to the improvement of public health. It is simple, inexpensive, and may be used to produces a useful product that may be recycled

through the soil to produce new crops or be used as a food supplement for livestock.

3. "Irrigation Projects and Mosquito Vectors" by Joseph K. Shisler, Associate Research Professor, Mosquito Research and Control Unit, Cook College, Rutgers University, New Brunswick, NJ.

The alteration of natural habitats for increased food production to supply human needs creates an increase in disease transmission. Irrigation is one of the major reasons for the alterations of natural habitats for increased food production. Mosquito populations and species numbers increase with the development of irrigation systems. The major human diseases associated with mosquitoes are malaria, arbovirus (e.g. yellow fever, dengue, encephalitides) and filariasis.

Throughout most of the less developed countries, mosquito populations are controlled primarily to stop the transmission of human disease through the use of chemical control measures. Today, the availability of the chemical control methods is greatly decreasing because of resistance of the vectors and the costs of implementing a chemical control program. Mosquito vector problems become two-fold, especially in the tropics, with (1) the large volume of water required in the impoundment and (2) the consequences of irrigation on the surrounding area providing mosquito vector habitat.

Six major environmental changes associated with agricultural irrigation and which benefit vector mosquito populations have been identified: 1) simplification of the habitat; 2) increased acreage of above-ground water; 3) raised water table; 4) water flow; 5) modified microclimate; and 6)

associated urban development. Problems associated with the failure in vector control programs has been attributed to many factors: physiological and behavioristic resistance in the vector; resistance to chemothereapeutics in the parasite; lack of knowledge of the vector's biology; lack of leadership, trained personnel, funds and appropriate technology; changing government priorities; political instability; and public apathy, to name a few. The development of a comprehensive vector control program relies upon the expertise of trained personnel to implement effective programs. Funds to support the training of personnel in the various components of the comprehensive programs are rapidly decreasing and the 'magic bullet' is not available as it was in the DDT era.

4. "Agricultural Production Considerations in the Development and Management of Irrigation" by Leslie E. Small, Associate Professor of Agricultural Economics, Cook College, Rutgers Univsersity, New Brunswick, NJ.

Areas of concern related to the welfare effects of utilizing irrigation for agricultural production include the multiple roles of irrigation water in production; farmer involvement in irrigation projects; production externalities; and the distribution of benefits.

Irrigation water has many roles in agricultural production. In addition to increasing yields, it substitutes for other farm inputs or activities such as weed control, pest control, conveyance structures and land leveling. Failure by irrigation agencies to recognize these productive uses of water may lead to conflicts with the farmers. Obstacles to a more balanced consideration of the roles of water include technical training that focuses on

water requirements and water use efficiency, and planners' lack of knowledge both of the ways that farmers use water, and of its value in these uses.

Increasing farmer involvement can improve irrigation performance. Information from several case studies demonstrates that experiential knowledge of farmers is an important resource which can be utilized productively in irrigation planning and design. Obstacles to increasing farmer involvement include increased costs in the planning and design stages; institutional separation of planning and design activities from operation activities; technical biases in the planning process; and preoccupation by donor agencies with targets for fund disbursement and construction schedules.

Irrigation frequently encounters production externality problems associated with water allocation between the head and the tail sections of canals, with field channel maintenance, and with the siting of wells. Approaches to alleviating these externalities include institutional rationing of water to small groups of farmers, specialized structures to increase the difficulty or visibility of unauthorized tampering with the distribution system, and face-to-face confrontations among farmers.

Successful irrigation projects are likely to increase the returns to land, with direct benefits accruing to those who own land at the time that the irrigation development occurs. But through the labor market hired workers often receive substantial indirect benefits. By affecting prices, irrigation may also affect the well-being of farmers in nonirrigated areas.

Not all the objectives or desires of individuals in irrigation systems are consistent. Conflicting objectives need to be resolved in the process of

the development of individual projects. What is needed is not a "cookbook" that gives the ingredients for an ideal irrigation system, but rather the development of a process which allows a broad range of considerations to enter into the decision-making calculus in the various stages of irrigation project development and operation.

5. "Nutritional and Toxic Hazards to Households and Communities in Irrigation" by Robert W. Roundy, Assistant Professor of Human Ecology and Geography, Cook College, Rutgers University, New Brunswick, NJ.

The goal of irrigation agriculture is change. The resultant change can yield both improved and worsened situations. The objective of this paper is to discuss problems associated with constraints on human nutrition and with toxicological hazards. These overlapping problems are associated with changing biophysical and social/behavioral environments of irrigation and other agricultural developments. In this paper the multiple consequences of development acts are recognized and arguments are advanced that holistic, human ecologic considerations of development must be integrated into the planning and implementation stages of projects.

Human nutrition problems are described as consequent upon the disruption of local food supplies without adequate provision of purchasable provisions. The explanation is presented as fourfold and overlapping: 1) structural problems that reduce the efficiency of both food production and food trade in the irrigation area, including the difficulties of integrating export cropping with subsistence and local market cropping systems and the cash flow barriers to an immediately functioning commercial marketing system;

2) resource problems that limit food production, including competitive and potentially destructive demands for labor, land, water, and other productive inputs; 3) social problems, often at the family level, that lead to inefficient use of resources and funds even where they are available; and 4) class conflict problems, where societal structures result in poverty-stricken people pushed to higher degrees of dependency upon resources and systems they do not control.

Toxicological hazards in irrigation projects result both from the direct agricultural chemical inputs of pesticides and fertilizers, and from effluents generated by the processing of products of modern agriculture. Both agricultural sources may yield direct or long-term hazards to human health and to continued high environmental productivity.

In concluding remarks, it is argued that for any development act we must determine the real human well being opportunity costs generated by the act. To proceed with a development effort, we must first assess and justify the risks generated, and ameliorate those risks that are accepted. This is best done at the planning stage both because some hazards cannot be reversed once they convert to events and because controls often best integrate originally into a total system rather than when tacked on in an ad hoc fashion. Too often in the past when hazards of nutritional shortfalls or toxic stress have become a reality we have generated them not from ignorance, but rather from a willingness to postpone investment in human well being while allowing a segment of the population to bear the unrewarded risks. This is an inefficient and inexcusable use of scarce resources, be they human capital, time, cash, or local goodwill.

6. "Sociocultural Factors in Irrigation and Domestic Water Management" by Sheila Cosminsky, Associate Professor, Department of Sociology and Anthropology, Camden College of Arts and Sciences, Rutgers University, Camden, NJ.

Domestic water management success depends upon current local perceptions of water gathering and waste disposal methods and upon likely responses to changes in these methods. Many programs attempting to influence water use and sanitation have had limited impact because of non-use or misuse of facilities. This paper focuses on these factors as they relate both to non-agricultural, primarily domestic, uses of water and to waste disposal projects. The inclusion of women in the successful planning, implementation, use, and maintenance of domestic water management systems is emphasized.

Water is a key factor in economic and political power. Water rights and changes in those rights can influence the types of participation in a water scheme. Once a scheme is in place, its influence upon the division of labor and upon time and energy allocations may determine its success or failure. Improved water systems, if successful, should reduce some costs to consumers, so that time, energy, and finances are released for other uses.

In irrigation development the water in the system may be made available for multiple uses, although few projects have been designed with multiple water use purposes in mind. Water may be drawn from canals or shallow wells, reducing labor demands for domestic water procural, but perhaps increasing exposure to polluted and contaminated water. The opportunity for providing safe water for domestic purposes should be considered in irrigation projects. The question of safe water will more likely receive a full hearing

if women are allowed to plan and decide upon projects. The use of irrigation water for domestic purposes enters into the health debate regarding the importance of large quantities of domestic water vs. the need for water of high quality. Providing irrigation water for household use increases the quantities of water available, but not necessarily that water's quality.

Increased or improved water supplies and sanitary facilities do not necessarily mean they will be used. Users' desires and perceptions will influence this decision. Abundant nearby water is commonly appreciated by water users. High costs and competition for the use of the water are not appreciated. The appreciation and use of sanitary facilities depends upon beliefs and attitudes that vary by place and community, but adaptation to these beliefs and attitudes can yield increased hygiene and decreased environmental contamination.

For water and sanitation programs to be effective, local community participation is necessary. Local people, especially women, should be involved in all stages of a project, including its maintenance. Local beliefs and attitudes and their integration into a project are paramount to the project's success.

7. "Institutional Issues" by Baruch Boxer, Department of Human Ecology, Cook College, Rutgers University, New Brunswick, NJ.

Understanding of institutional obstacles to more effective multi-purpose water management in developing countries requires consideration of many factors. Problems posed by the failure of institutional procedures and

remedies to mediate conflicts between production and welfare goals in agricultural water use become ever more pressing and challenging. But there have been few attempts to explain why institutional factors may undermine the possibility of achieving balance in production, health, and environmentally-sound outcomes in water projects.

It is assumed that greater efficiency and equity in water development and use can be achieved by greater user involvement at each stage of development. Ideally, user input should result in better management since beneficiaries' concern and knowledge can be more directly reflected in the design and maintenance processes. Institutional factors often prevent consideration of users' views. Project planning and design are sometimes based on unfounded assumptions regarding discount terms, performance characteristics and social costs.

Institutional factors are difficult to categorize. Little consistency exists in the definition and use of concepts and terms. Furthermore, especially with regard to large water projects, interconnected institutional influences simultaneously operate at several levels. These influences link technical, engineering and economic criteria that primarily reflect international priorities, to the requirements for management decisions and design choices at the local level. National governments are intermediaries, but are seldom able to represent short or long term interests of project beneficiaries. There are thus overwhelming obstacles to rationalization of conflicts over who get what, for what purposes, for how long, and in what ways. Institutional rules and procedures that govern water development

activities in developing countries often have the effect of excluding user participation in project design, operation, and maintenance.

Failure to incorporate user perspectives on local implications of development projects as they relate to national or regional goals weakens possibilities for balancing local, regional, and national development objectives. Continuing emphasis on capital-intensive infrastructure projects to boost agricultural or energy output have had mixed results, reflected in the current debt situation of many developing countries. Rigidly-defined economic criteria for project development and lending required by multilateral agencies often retard attainment of maximum development potential and add to countries' economic woes. Finally, many institutional difficulties are encountered at national levels, where interests of planning and sectoral ministries in enhancing their own share of economic development largesse at others' expense often negates possibilities for equitable distribution of the benefits of increased production, improved quality of life and sound resource management.

Appendix A

Workshop Program

Monday, November 7

9:00 - 10:00 a.m. Session 1

Chairperson: Marie Siewierski, Rutgers University

9:00 a.m. Welcome

*Reed Hertford, Director of International Agricultural and Food Programs, Cook College, Rutgers University

*George Nieswand, Acting Dean, Cook College, Rutgers University

9:15 a.m. Overview of the Workshop

*Leslie Small, Coordinator, Working Group on Water and Human Welfare, Rutgers University

9:30 a.m. Summary of major issues raised in the papers prepared for the workshop

*Parasitic Hazards of Irrigation Projects
Emmet A. Dennis, Department of Biological Sciences, Faculty of Arts, and Sciences, Rutgers University

*Sanitation and Water Supply
Mark E. Singley, Department of Biological and Agricultural Engineering, Cook College, Rutgers University

*Irrigation Projects and Mosquito Vectors
Joseph K. Shisler, Center for Mosquito Research and Control, Cook College Rutgers University

*Agricultural Production Considerations in the Development and Management of Irrigation

Leslie E. Small, Department of
Agricultural Economics, Cook College
Rutgers University

10:30 - 12:30 p.m. Session 2

Chairperson, George Winnett, Rutgers University

10:30 a.m. Summary of major issues raised in the papers prepared for the workshop (continued)

*Nutritional and Toxic Hazards to Households and Communities in Irrigation
Robert Roundy, Department of Human Ecology, Cook College, Rutgers University

*Sociocultural Factors in Irrigation and Domestic Water Management
Sheila Cosminsky, Department of Sociology and Anthropology, Camden College of Arts and Sciences, Rutgers University

*Institutional Issues
Baruch Boxer, Department of Human Ecology, Cook College, Rutgers University

11:00 a.m. Comments on issues raised in the prepared papers

*Abe Weisblat, Rutgers University

*Dennis Warner, Water and Sanitation for Health Project

*Hammond Murray-Rust, Cornell University

12:00 General Discussion

1:30 - 4:30 p.m. Session 3

Small group discussions of the issues raised in the morning sessions. Workshop participants will be divided into groups each with a designated leader and recorder.

5:30 p.m. Reception

6:30 p.m. Dinner

Tuesday, November 8

9:00 a.m. - 12:00 Session 4

Chairperson: Roberto Lenton, The Ford Foundation

9:00 a.m. Presentation of the reports of the deliberations of the small discussion groups

Group 1: Don Taylor, South Dakota State University

Group 2: Ansen Bertrand, U.S. Agency for International Development

Group 3: Charles Gunnerson, The World Bank

Group 4: Abe Weisblat, Rutgers University

10:30 a.m. General Discussion

1:00 - 2:40 p.m. Session 5

Panel Discussion: Perspectives on Research and Training Priorities

Chairperson: Donald Taylor, South Dakota State University

*William Mashler, United Nations Development Program

*Ansen Bertrand, U.S. Agency for International Development

*Dennis Warner, Water and Sanitation for Health Project

*Paul Biron, UNICEF

*Roberto Lenton, The Ford Foundation

*Charles Gunnerson, The World Bank

3:00 - 4:00 p.m. Session 6

Synthesis and Summary of Workshop

Chairperson: Reed Hertford, Rutgers University

Appendix B

List of Participants

Ansen Bertrand
Office of Agriculture
Bureau of Science and Technology
U.S. Agency for International Development
Washington, D.C.

Paul Biron
UNICEF
New York, New York

Baruch Boxer
Department of Human Ecology
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