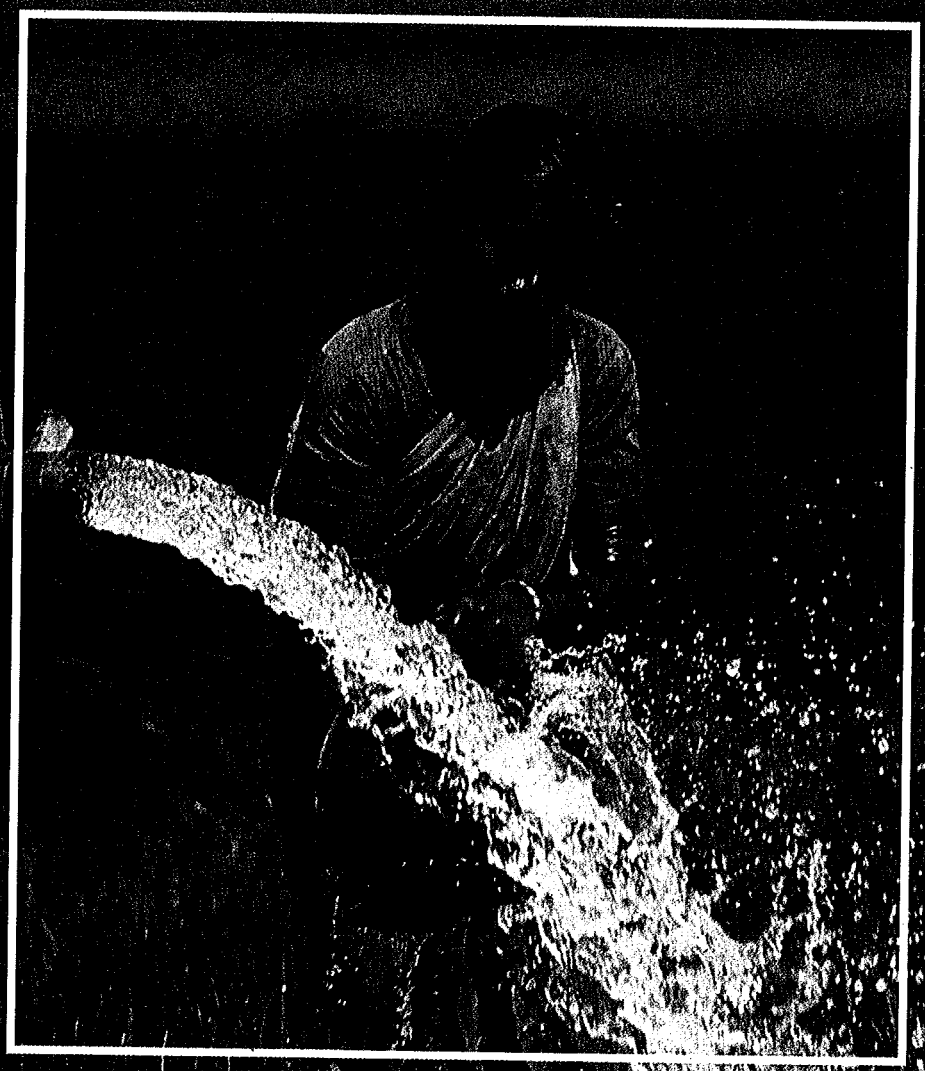
INTERNATIONAL IRRIGATION MANAGEMENT INSTITUTE

Vol. 4 No. 1 March 1990



INDIA LOOKS AT THE YEAR 2000: IS FOOD PRODUCTION ENOUGH?

PRELUDE

THE WORLD'S ENVIRONMENT OF WATER MANAGEMENT

Dr. Mostafa K. Tolba, Executive Director, United Nations Environment Programme (UNEP) talks to Francis O'Kelly, of the IIMI Review. Geneva, July 1989.

O'Kelly. UNEP has two priority areas which are of direct and indirect interest to us at IIMI, water management and the fight against desertification. Do you believe that current successes in other environmental areas will assist in making progress in these areas?

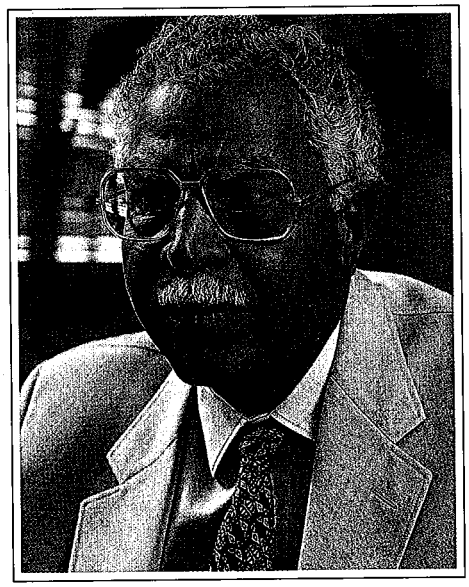
Tolba. Environment is now at the top of the international agenda, discussed by policy makers, heads of state and governments of the seven major industrialized countries; everybody is rushing to address this issue. This, I hope, will increase financial support for dealing with all environmental issues. And I believe that this will include henceforth those areas which have not hitherto been given sufficient attention such as desertification, deforestation and water management. All these issues will now come within the scope of environmental crises and issues to be faced. I look forward to a major change of heart in the foreseeable future.

O'Kelly. How do you view the question of food productivity and irrigation in the battle for self reliance?

Tolba. Food self reliance is principally a matter of independence, but I don't believe that any country can call itself independent today. However, co-operative efforts with neighboring countries to collectively produce according to their geographic and climatic conditions can be achieved.

The search for peace and prosperity through cooperation in proper management of natural resources is where our efforts are concentrated; in water resources, and shared water resources in particular, be they rivers, underground water aquifers, or lakes. Clearly in Africa two of the major issues are desertification and water resources.

O'Kelly. In many respects Asia represents less of a catastrophic



". . . the whole issue of famine arises from the lack of availability of water..."

challenge right now than Africa. However, Asia may suffer severe dangers of food sustainability risks coupled with environmental problems. What do you see as the priorities there?

Tolba. We have again the problem of cooperative water management, be it at the governmental level, for example the sharing of the Ganges' water between Bangladesh and India; at the farmer level in sharing the resource between those deforesting at the top of the mountain and those at the bottom of the hill who are suffering. In Asia we see population pressures on the natural resources and attendant financial resources. But Asia has a lower population growth rate than Africa, and efforts are being made to reduce it. Industrialization is advanced, especially in Malaysia, South Korea, Hong Kong, Singapore, Thailand, but their quick development is coupled with major destruction of natural resources. So Asia's problems are different from Africa, although there are elements of comparability.

O'Kelly. UNEP is currently working on climatic change. To what extent do your findings show any effects on rainfall and thus irrigation requirements?

Tolba. There is a large consensus within the scientific community that global temperatures will increase by between 1.0 and 3.0 degrees Celsius. This is a global average, there are as yet no clear indications as to regional differences, but one of the impacts will definitely be changing rain patterns. There are serious concerns that the green belt areas of the world, Canada, the USA will change as well as the more fragile areas of the developing world. Changes in rainfall would of necessity change the patterns of availability of water resources within irrigation schemes: for example, the Nile, the Congo, and the Ganges among others.

O'Kelly. You mention the Nile. As a former Minister of Egypt and as Executive Director of UNEP, do you have any views on the current reappraisal of the Aswan Dam?

Tolba. Indeed I do. In 1959 and 1960 I was involved in the studies that were carried out by the post-Aswan Dam Problems Committee. The problems were already clear – beach erosion, the lack of sedimentation for brick manufacture, small dam erosion from Aswan to Alexandria, embankments collapses – we were able to analyze the benefits and the disadvantages, and it was evident that

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REVIEW

Letter from the Editor

Telescoping current issues facing India's irrigation managers and scientists into ten pages is precipitous at best, foolhardy at worse. There are few countries where irrigation management research is more dynamic or active than in India. Still, that is what we have tried to do in this issue and in so doing apologize to the thousands of dedicated scientists, economists, and government officials who we couldn't contact and who are striving to improve the management of the country's vast water resources and thereby the livelihood of the equally vast pools of rural poor. We welcome your letters and comments.

At the same time we would like to thank the staff of Anna University's Centre for Water Resources and the Irrigation Management Training Institute in Madras, the Institute of Rural Management and the Water and the Land Management Institute (WALMI) in Anand, Roorkee University's Water Resources Development Training Centre, the Okhla WALMI in New Delhi, the Bihar WALMI and the Bihar College of Engineering's Centre of Water Studies in Patna, and the New Delhi offices of the Ford Foundation and the United States Agency for International Development. Without their assistance, these articles would not have been possible.

Request for Submissions

Beginning in 1990, we are requesting readers and journalists to submit articles for publication in the *IIMI Review*. Submissions should be of two types: short (500 to 1500 words) reports on irrigation management issues and research trends and results, providing a range of views and opinions from scientists, agency officials, and farmers; and condensed (1000 to 2000 words) academic research articles. Articles should relate to IIMI's seven research themes (write for a copy of the IIMI Strategy). Include color slides with captions if available (will be returned). Response on acceptance only. Text subject to editing. Fee negotiable. Query or submit completed typed manuscript to Editor, IIMI Review, P.O. Box 2075, Colombo, Sri Lanka.

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Photo Credits: Cover, pgs 2, 3, 5, 6, 7, 8, 9, 12, 14, 16, 20, 21, 22, J. Colmey; I.C., B. C., 19, UNEP; 10, H. Plusquellec; 18, Shaul Manor.
(Note: photos on pgs 4, 5, 6, 21 in Vol. 3 No. 1 were taken by Victor Oro, PCAARD.)

International Irrigation Management Institute. 1990. IIMI Review Vol. 4 No. 1. Colombo, Sri Lanka: IIMI. 28p.
DDC: 631.7 ISSN: 1012 8318X
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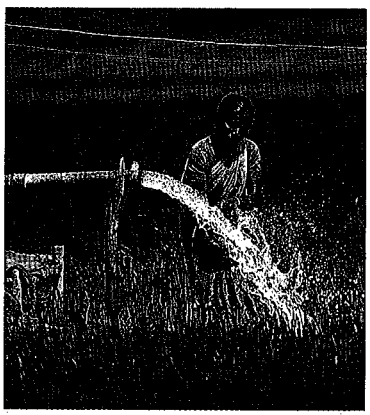


Little is known about conjunctive use of ground and surface water, despite its potential for alleviating poverty.

SPECIAL REPORT

INDIA LOOKS AT THE YEAR 2000 : IS FOOD PRODUCTION ENOUGH?

Within the next decade, the population of India will top one billion, with an increase roughly equivalent to the entire population of Indonesia —itself the fifth most populous country in the world. The majority of these people will be poor and rural and almost four-fifths, in one way or another, will depend on agriculture for their livelihood.

India is entering a period that Winrock International economist David Seckler calls, "the second Malthusian race" — a de facto marathon between the increase in labor force and the number of new jobs. The country has already won, for now at least, the first, more familiar "Malthusian race," which pitted population growth against food production. There is more than enough food to go around, but, says Seckler, "the 40 percent of the population who need and want this food are too poor to purchase it."

At issue now is "not a shortage of food, but a famine of work," says M.S. Swaminathan, former Director General of the International Rice Research Institute and a member of IIMI's Board of Governors.

The country will have to continue to look to agriculture for economic growth, because investments in agriculture generate three times the employment as an equivalent investment in industry, according to the central government's Planning Commission. However, the nature of agriculture, scientists say, must change. India can no longer attempt to expand what has become a limited resource base — land and water. The key now is to apply management strategies to intensify and sustain the use of those same resources. In short, India has to make less go further, particularly water.

"...the 40 percent of the population who need and want this food are too poor to purchase it."

Sixty percent of India's food production relies on irrigation. Since independence in 1947, almost 10 percent of the country's total public investment has been channelled into developing its surface irrigation resources. India's seventh Five-Year Plan invested more money in irrigation than in all rural anti-pòverty programs combined.

Today, India irrigates about 67 million hectares (Mha), more gross area than any other country in the world (some argue China is the first). Between now and 2010, the government will invest an additional US$ 50 billion to develop the remaining potential, which would irrigate roughly half of the country's agricultural land.

Scientists argue however, that too much attention is given to starting new irrigation projects with the goal of increasing food production and not enough paid to realizing the potential of existing irrigation systems. While the overall statistics are impressive, they illustrate little of the quality of irrigation. Many older systems are deteriorating rapidly and numerous new projects are performing far below their potential, usually at the cost of the poorest farmers.

"The biggest payoff is to manage what we already have, not to build new systems," says Gian N. Kathpalia, a consultant to the Ford Foundation in New Delhi who has written widely on Indian's irrigation systems. "We have to complete the projects in hand and improve the performance of those already constructed."

Experts, like Robert Chambers, author of *Managing Canal Irrigation,* argue the emphasis on increasing food production tends to influence investments in ways that don't necessarily alleviate poverty — a prime concern in current development

projects. Cost/benefit analyses, which policy makers use to evaluate investments, says Chambers, stress the value of production rather than employment or income distribution, which are more difficult to quantify. One result is that investments are directed toward prime agricultural areas and crops which yield the highest returns in bulk food supplies in the shortest period of time. States such as Haryana and Punjab, where nearly 50 percent of India's food surplus is produced, and crops such as rice and wheat, receive the most attention. States such as Bihar, where 60 percent of the population live below the official poverty line, utilize comparatively little investment.

"Whatever may have been the case in the past," Chambers writes, "the problem of poverty in South Asia at least is not now a problem of production, or food availability; it is a problem of who produces the food and of who has the power to obtain it."

A shift in policy from food production to poverty alleviation could affect, among other things, the mix of irrigated crops, according to P. Sakthivadivel, the former director of Anna University's Water Resource Centre in Tamil Nadu, and now a management specialist with IIMI. For example, less attention could be given to rice irrigation — world rice prices have fallen 40 percent since 1980 — and more attention paid to high-value crops and more intensive cropping, i.e., growing more than one crop per year on the same area of land.

"Labor requirement for cash crops like chili or ground nut is four times as high as that of rice," Sakthivadivel says, "and these crops require a lot less water."

Improving the management of India's irrigation systems to accommodate more intensive cropping patterns however, is no easy task. Needs change from state to state and even within states, with each need requiring a unique response. Rajasthan for example, suffers acute water scarcity, while Bihar suffers severe flooding. Crop yields in western Uttar Pradesh are almost double those in the eastern part of the state. The socioeconomic relationships that have developed around irrigation — some with centuries-old traditions — vary from village to village.

"The government needs more field tested information before they begin changing laws and implementing new programs," says Sakthivadivel. "We need more pilot studies to find out what works and what doesn't. And then we can start to implement changes."

The greatest challenge, says Sakthivadivel, lies in reversing trends begun by the British — particularly those that have influenced the way irrigation systems are planned and managed. That, he says, will require a "revolution in thinking."

(Continued on page 5)

IIMI IN INDIA

Beginning with initial discussions in 1988 and the signing of a Memorandum of Understanding in January 1989, IIMI embarked on a collaborative program of research on India's irrigation systems in four states - Tamil Nadu, Gujarat, Uttar Pradesh (UP) and Bihar - with an estimated cost of US $700,000 by the time activities are completed in 1991. This program is funded by the Ford Foundation and USAID, New Delhi.

In Tamil Nadu, IIMI is working in collaboration with Anna University, Madras, and the Irrigation Management Training Institute, Trichy on main system management and performance of the Sathanur Reservoir project, a World Bank funded National Water Management project. In Gujarat, IIMI is collaborating with the Institute of Rural Management, Anand and the Water and Land Management Institute, Gandhinagar on management processes in the main system of the Mahi project.

In UP, IIMI is interacting with Roorkee University, Roorkee and the Water and Land Management Institute, Okhla to carry out research on various issues related to conjunctive use management of surface and ground water for irrigation in the Madhya Ganga project area.

In Bihar, the collaborating research partners are the Bihar College of Engineering, Patna and the Water and Land Management Institute, Bihar. The proposed research is to analyze issues related to the management of a conjunctive irrigation system in the Eastern Gandak project aimed at evolving a management strategy which will be agriculturally productive, hydrologically sustainable and socially equitable.

In 1988, IIMI sponsored a doctoral fellow researching tank irrigation system diagnostics using the"Expert System Technique" in two villages in South India. The Institute has also participated in planning seminars on policy-making issues in Indian irrigation, a project sponsored by the International Food Policy Research Institute.

The rationale behind the research has several goals: IIMI hopes to help India strengthen institutional research and training capabilities of selected Indian institutions and to assist researchers to adopt a more interdisciplinary approach to research. IIMI hopes to assist in linking these same researchers to the larger world-wide irrigation management network.

MATTHEW DRISKILL

According to Sakthivadivel, the British management style "administered" the system as opposed to "managing" it. That style emphasized rules and regulations with accountability to higher-level administrators. "The top-down approach we inherited is lingering on," says Sakthivadivel. "It served its purpose then. But it doesn't suit the needs of cash crops or more intensive farming."

Viewed over time, the current challenge is yet one more hurdle in a 40-year saga of irrigation development, with the objectives evolving from protection (against famine) to production (for food self sufficiency) to intensification, its present stage. Having already expanded the system, the challenge is to expand access by the poor to the use of the system.

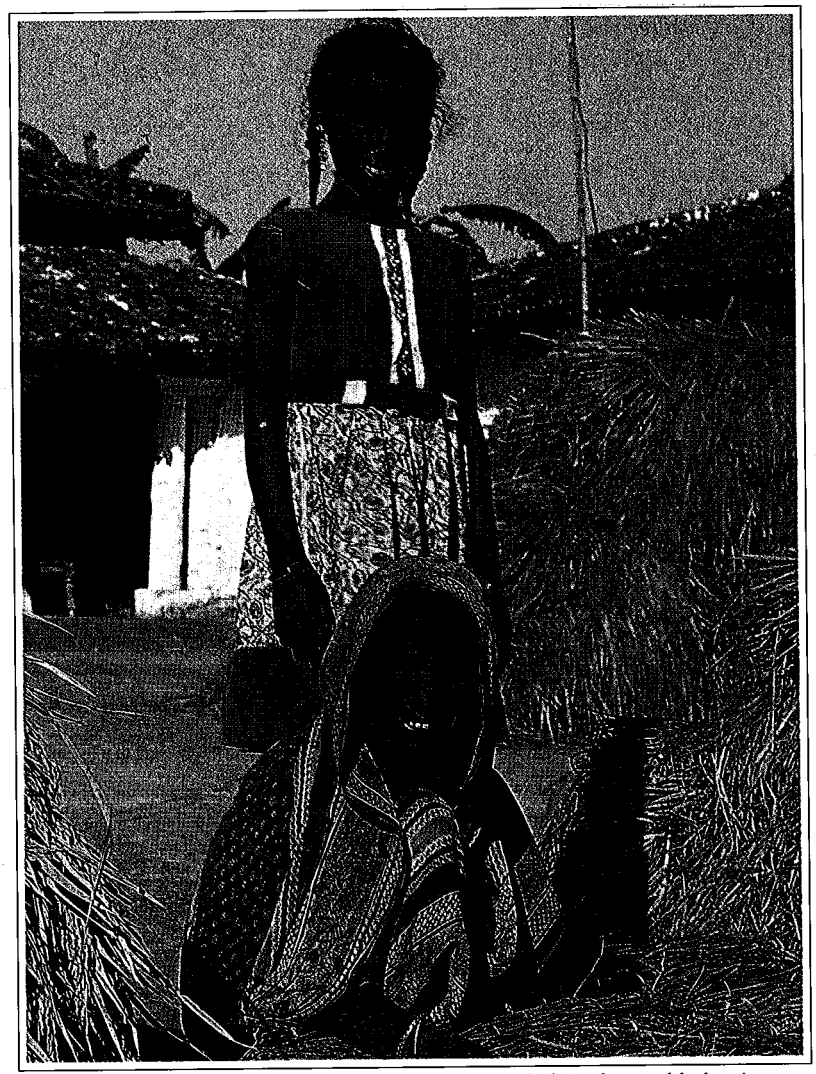
The critical factor to bear in mind when discussing cropping intensity, is that the remaining irrigation potential — estimated at 113 million ha — refers to the gross area, the number of irrigated crops grown on the same hectare of land in a year (as opposed to net area, which counts each new hectare irrigated). Thus, if a group of farmers change from irrigated rice to onion, which uses roughly one-third the water needed for rice, and they grow three crops with the same amount of water as a result, the area irrigated is trebled.

Another option to accomplish the same objective is to provide adequate water to farmers near the tailend of the system, where supply breaks down. This would allow them to switch to a high-yielding, fast-growing, Green Revolution rice variety. Often however, this entails convincing farmers near the system head to not waste water (a good crop of rice is still possible with extra water, so farmers in the head reach, who often have off farm enterprises, would rather use too much than spend the extra time trying to achieve exactness, but poorer farmers downstream suffer).

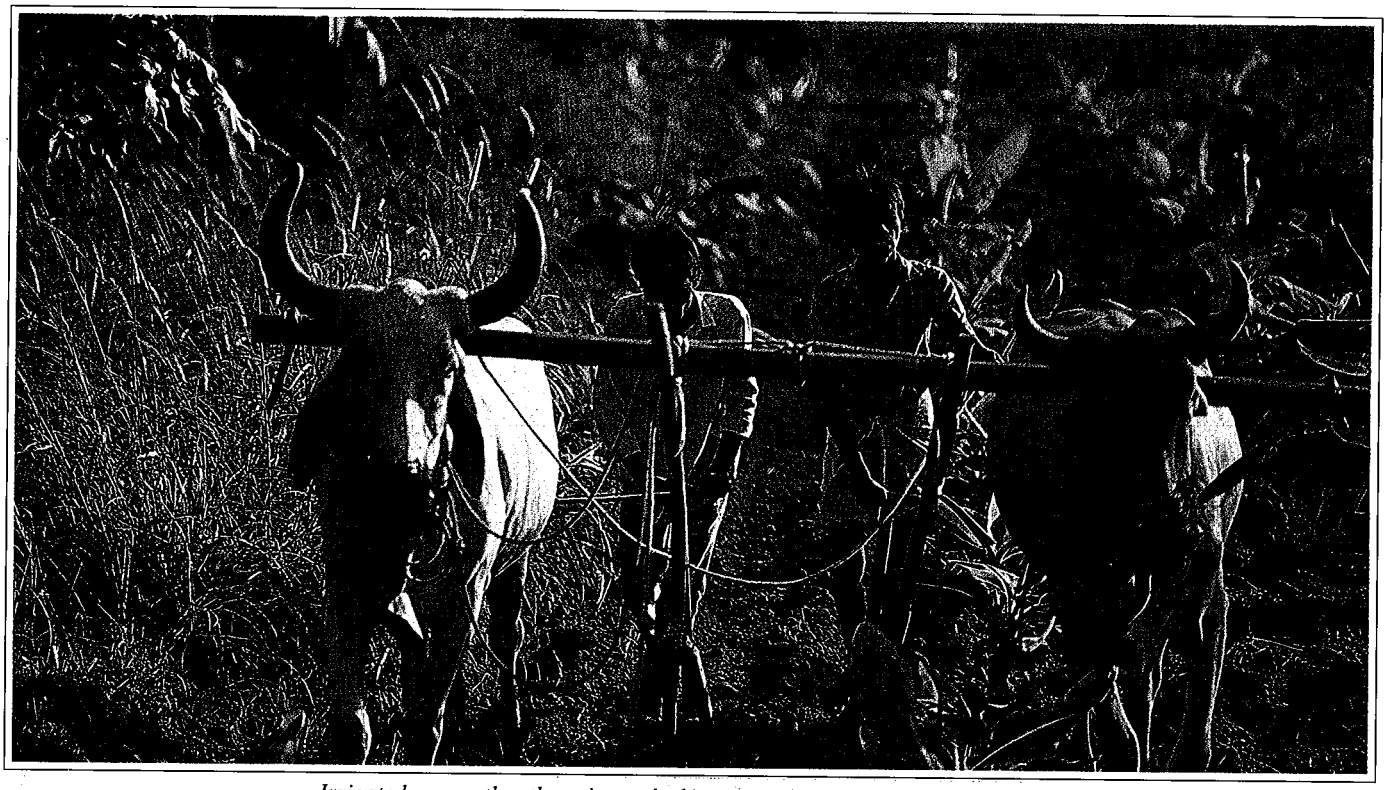
Making what seems like a simple switch from one irrigated crop to another however, can require vast amounts of information and more intensive water management. While chile requires less water, it has more acute water needs than rice — too much water at the wrong time can destroy the crop. Irrigation officers have to know what crops are being grown and their water needs, and farmers have to apply water more carefully. Irrigation structures often have to be redesigned. Environmental degradation can increase as farmers apply more chemicals. To make matters worse, farmers in one part of a system may choose to grow a water-loving cash crop like mango, while farmers in another part of the system choose to grow a water phobic crop like chile.

The one term used by scientists in explaining how to improve irrigation management in India is "flexibility." Irrigation managers need room to maneuver in the field, something which scientists say is currently lacking. "What has happened in the last 30 years," says Kathpalia, "is decision-making has become more centralized. That's why the lower man [official] can't make decisions."

There are several ways to introduce more flexibility, and thereby more decentralized management, say scientists. One way is to increase farmers' role in management, an innovation just beginning to appear in India. But irrigation officers tend to resist giving more power to farmers.



Northern Bihar is part of the second largest poverty belt in the world, despite vast natural resources.



Irrigated crops other than rice and wheat require 3 to 5 times as much labor.

"There is a feeling that they're [officers] going to have to serve these people," says G. N. Yoganarasimham director of the Water Resources Development Training Centre at the University of Roorkee. "Of course there's going to be resistance."

"The government cannot manage India's irrigation systems by themselves," adds Kathpalia. "But while everyone agrees this [farmer participation] has to happen, no one knows how to go about it. We have to convince the farmers as well as the government."

Another way is for India to continue to develop its huge groundwater reserves. "Wherever you have surface irrigation, the field efficiency can be as low as 50 percent and most of what remains, goes into the ground as a reserve," says IIMI's Sakthivadivel. Groundwater in the eastern Gangetic Plain, where India's poorest live, could potentially irrigate between 12 and 20 million gross ha, almost a third of the total land currently irrigated across the country.

"Groundwater has a unique quality," adds Sakthivadivel. "It provides a reliable water supply on demand. It is very efficient. But we have to find ways to integrate groundwater use with surface irrigation [also called conjunctive use]."

The government, say scientists, also has to change the way managers feel toward farmers. "Managers have to be accountable to farmers and not the other way around," says Sakthivadivel. Training will play an important role in this. Training will also play a vital part in redesigning and managing systems to adapt to more intensive use.

The government of India is moving forward on these and other suggestions. The eighth Five-Year Plan, according to officials, emphasizes improved management more than ever before. Millions of dollars are earmarked for groundwater development. The federal and state governments have established Water and Land Management Institutes (WALMIs) to train state irrigation staff. State universities are changing their curriculums in response to new demands and several state governments are experimenting with programs aimed at establishing farmer organizations.

"We've been talking about most of these things for years," says Sakthivadivel, "the important thing now is to get to it."

Because as the government knows, winning the "second Malthusian race," is paramount to winning the first. Food shortage and famine, gone for now, always looms in the shadows of poverty.

JOHN COLMEY

To learn more about these and other issues facing India's irrigation sector, the Review's editor recently visited four Indian states and spoke with scientists, irrigation officials, trainers and farmers, the rich and the poor. The articles that follow, while not providing definitive answers, attempt to reflect the current thinking on ways to improve the lives of the 500 million Indians who depend, directly or indirectly, on irrigated agriculture for their livelihood and future.

GROUNDWATER AND THE RURAL POOR

Poverty is no stranger to any country, least of all India. But Northern Bihar, part of the second-largest poverty belt in the world, according to the 1983 Brandt Commission Report, is home to the poorest of the poor. People there suffer low incomes (half of India's national average), too few hospital beds (12 per 100,000 people), and the majority — 60 percent according to the latest statistics — live below the poverty line; almost all of them depend on agriculture. The irony however, is that Northern Bihar, as well as other states of the Eastern Gangetic basin — eastern Uttar Pradesh and West Bengal — is blessed with good soils, a good climate and vast deposits of natural resources, including the largest underground water reservoir on the Indian subcontinent.

The menace chaining the region to poverty is water. Each year the area suffers through alternating calamities of floods and droughts. Between June and September, the seven great rivers of the Himalayas rage down from the mountains, with flow rates often 500 times the non-monsoon rates, and all headed to their master drainage channel — the Ganges. The river flow is further increased by monsoon rains, a veritable deluge of 130 centimeters in four months. The rampaging waters cause millions of dollars of damage each year and leave thousands of hectares flooded or otherwise too waterlogged to grow crops. For the rest of the year there is little rainfall and some areas even exhaust their drinking water supplies. As a result, farmers eke out one subsistence crop during the monsoon and are forced to remain idle through other cropping seasons.

"We have to find a way to control flooding and second, to supply water to farmers when they need it," says T. Prasad, director of the Water Resources Studies Programme at Patna University. "Water is sufficient, if managed properly to grow two to three crops per year."

Irrigation systems built in the 1950s and 1960s, says Prasad, have not always helped the situation. These systems, designed to supplement breaks in the monsoon, provide only enough water for little more than one crop a year; they are nearly dry for most of the year and at present, can irrigate only about 35 percent of what they were designed to

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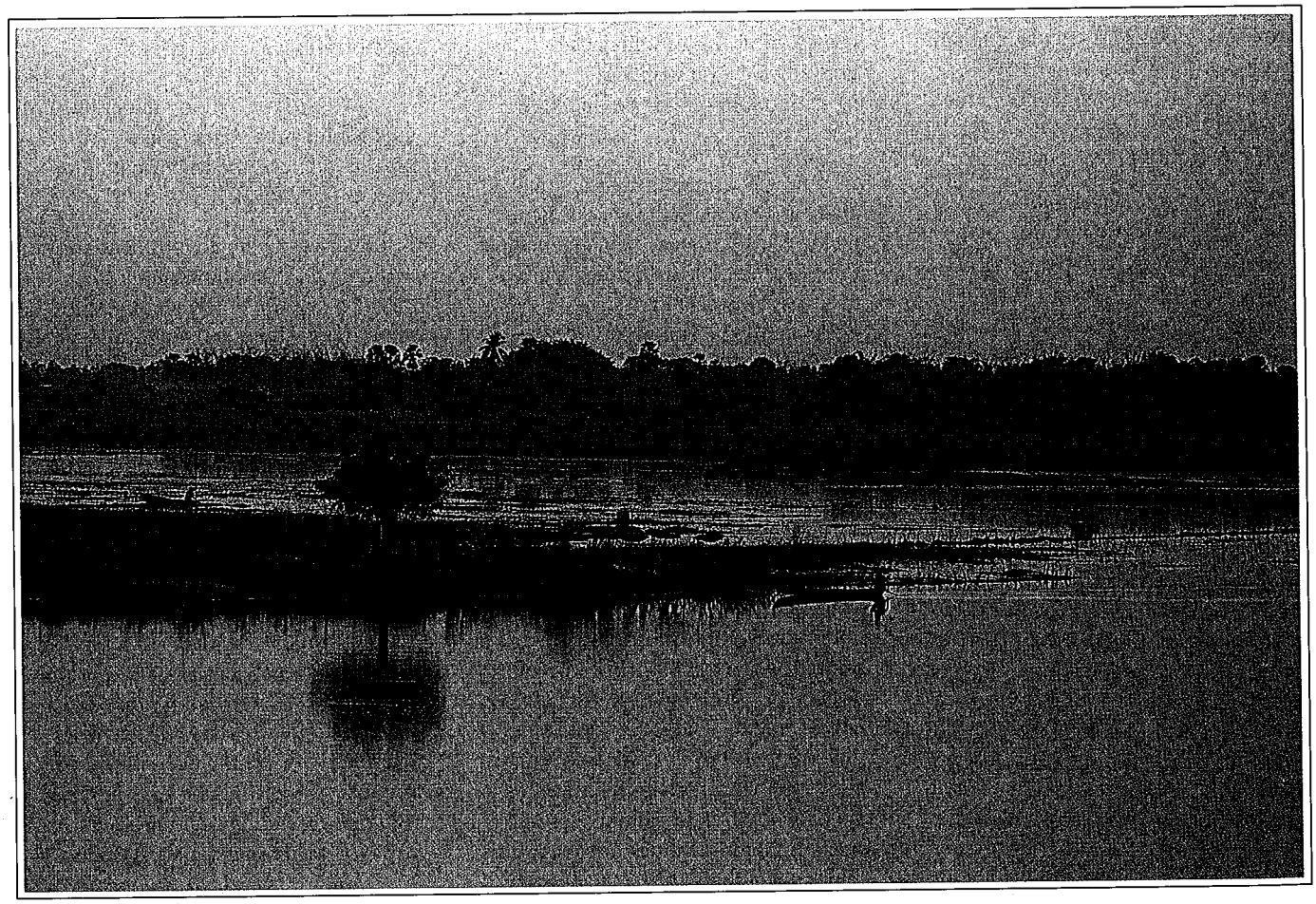


Rains and raging rivers leave thousands of hectares in the eastern Gangetic Plain under water. Yet many areas run short of drinking water.

do. Seepage from canals into the ground adds to rising water tables — climbing in some areas at some 50 centimeters annually. While drainage systems, now being constructed throughout the Ganges basin reduce flooding, they do little to ensure a reliable water supply.

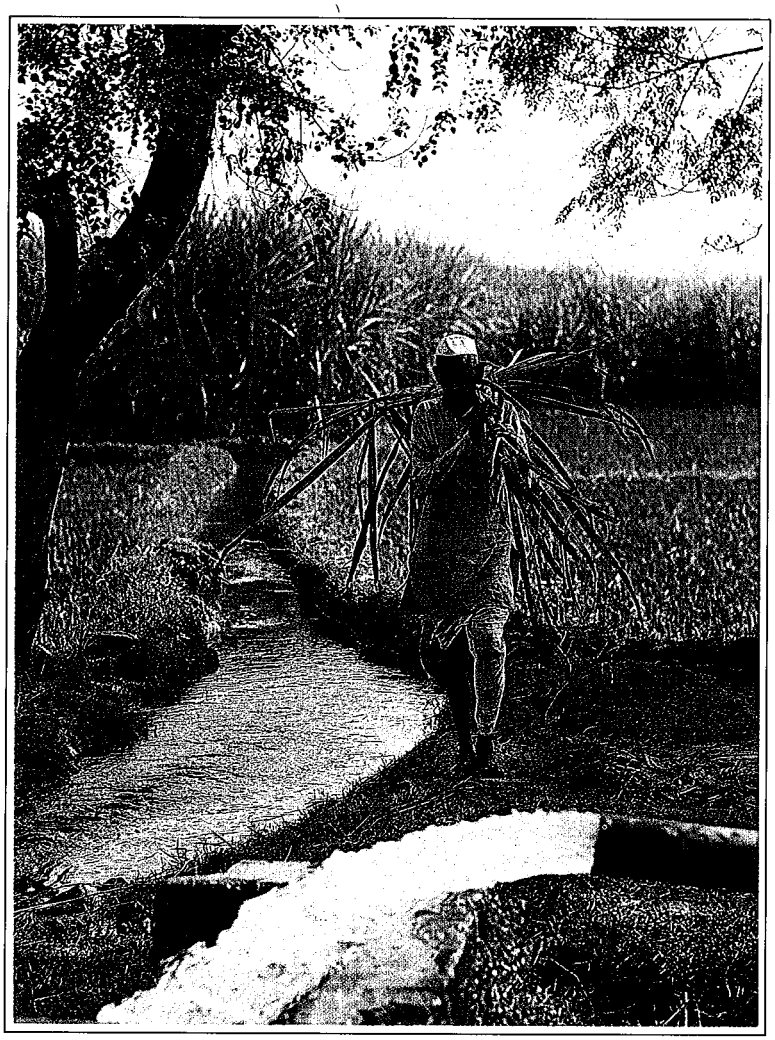
"Groundwater," says Prasad, "should have received a much greater emphasis than it has."

The Indian government estimates the Ganges basin has potential groundwater supplies of 15 million acre feet (MAF); others estimate the figure at double that. Prasad says the region has developed less than 15 percent of its total groundwater supply, as opposed to 80 percent developed in Punjab where farmers typically reap twice the yield of farmers in the Ganges basin.

Still, some scientists say groundwater is not enough in itself to alleviate the region's suffering. "You can't develop groundwater in isolation," says G. N. Yoganarasimhan, director of the Water Resources Development Training Centre at the University of Roorkee. "You must use surface systems to sustain it and to protect the land from flooding. The best idea is conjunctive use."

The idea behind conjunctive use is to establish a hydrological equilibrium between surface and groundwater supplies. Tubewells drain excess surface water, lower water tables and capture the 50 percent of canal water which seeps out of canals. More importantly, it provides farmers with reliable water supplies when they need it, particularly those farmers — usually the poorest — who farm the tail reaches of systems where water supplies are "like the weather," according to one farmer.

"Surface irrigation cannot provide high quality irrigation," says Tushar Shah, director of the Institute of Rural Management in Anand, Gujarat. "But, the contribution of irrigation to recharging tubewells, which in turn provide high-quality irrigation service, is significant. If you accepted that, you could design very efficient systems."



Tubewells supply water on demand, lower water tables, and increases wage rates. But is there enough control?

However, designing irrigation systems to be used in conjunction with tubewells has no precedent in India, or almost anywhere else in the Third World. Little is known about water exchange between the two sources. "Designing systems for conjunctive use," says Prasad," is outside the realm of professional engineers. It is not even mentioned in our textbooks."

Another problem, according to D. R. Arora, a water management consultant to the United States Agency for International Development in New Delhi, "is trying to integrate a user system with costs [tubewells] with public surface systems which are heavily subsidized."

Assuming such information could be learned along the way, there are several physical and economic constraints impeding tubewell development in the Ganges basin.

"Electricity is the key constraint," says Prasad. "Diesel tubewells are expensive and hard to maintain over time, but the generation of electricity throughout the region is unreliable and less than half [as low as 150 megawatts per year in Northern Bihar] the national average."

"The irregular supply of electricity is harmful to my well," says one Bihar farmer, "and the electricity fee is

fixed, so I have to pay whether it comes or not."

An additional constraint is the fragmentation of holdings in the region. Although it costs less than half as much to irrigate a hectare of land with an electric tubewell than with surface irrigation, the initial capital investment is beyond the reach of small farmers who stand to reap the greatest benefits. Numerous studies have shown that access to credit is limited to wealthier farmers who live near the head reaches of irrigation systems; but they already receive plenty of water.

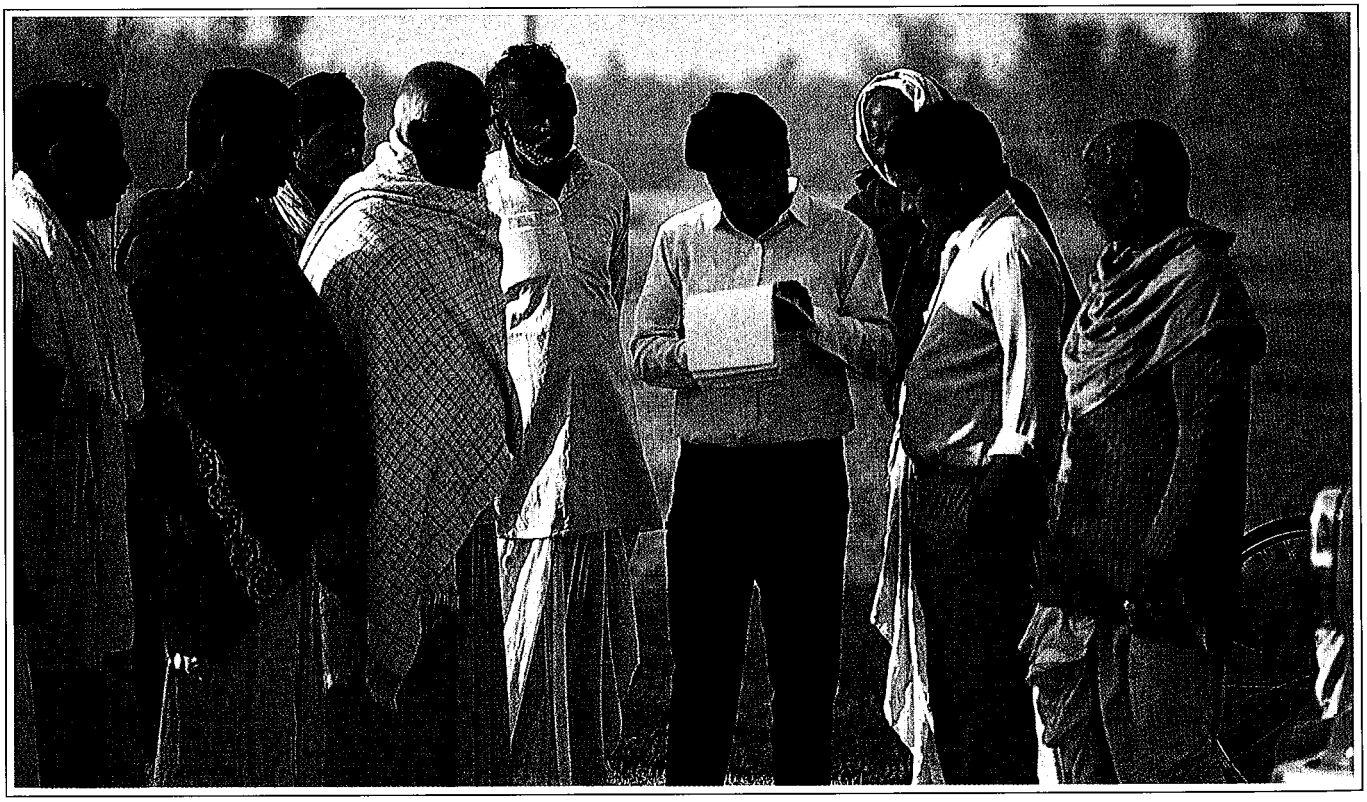
Water markets (see accompanying story), where one farmer or a group of farmers drill wells and sell water to nearby farmers, have been shown to benefit poor farmers. But markets have not yet taken hold in the Ganges basin, primarily because of the unreliability of electrical supplies and little understood social relationships.

"A good water market will minimize the harmful effects of land fragmentation," says Shah, who has written widely on beneficial effects of water markets in Gujarat. "Once you have good water markets, then land fragmentation is no longer an important issue in agricultural development."

There have been attempts by the public sector with support from international donors, notably the World Bank, to drill deep tubewells throughout the region with the intention of giving water to the poorest farmers. However, these efforts have been largely unsuccessful, say researchers. Out of 250 state-owned tubewells drilled in one district in Bihar, only 100 were working three years after their completion. Problems with maintenance and the irregular payment of salaries to operators were named as the principal causes. Hundreds of wells constructed with World Bank assistance, at a cost of more than US$ 200 million, have met similar fates for similar reasons. "Public sector involvement in managing tubewells has been uniformly disastrous," says a representative of one leading donor agency in New Delhi.

Researchers, including Prasad and others, are now carrying out several projects to alleviate these and other constraints to conjunctive use of water resources. "Our first job," says one, "is to find ways to develop the potential equitably. After that we can look for ways to train irrigation staff to utilize and sustain it."

JOHN COLMEY



"The government can't manage India's irrigation systems by themselves."

CONCLUSIONS

MORE THAN CANALS

A small Caribbean country takes the lead in the turnover of management of irrigation systems to small farmers' associations

by **Herve Plusquellec**

The Dominican Republic, which shares the Hispanolia Island with Haiti, is still unknown to the irrigation community, although with one-quarter of a million hectares it has the largest irrigated area among Caribbean and Central American countries. Development of irrigation in that country dates back only to the 1930s. Since 1986, the Dominican government has initiated a managerial innovation to free the farmers from dependence on weak public institutions and this may become a model for other developing countries where small farmers predominate. HERVE PLUSQUELLEC, Irrigation Engineer and Adviser to the World Bank, visited the Dominican Republic in early 1986 and in November 1988. He discussed the remarkable changes that have taken place between his two visits. The work described and views expressed are not attributable to IIMI but offer a revealing sidelight on farmer participation and management as general trends.

March 1986. Jose Luis, a Dominican farmer in the Azua project in the arid zone of the country, was yelling at a Bank sector review mission about this damned irrigation project. A few years ago, he was able to get a good crop of tomatoes of export quality on his 2.5 hectare (ha) farm. His land is now totally bare and in some places salt is shining. Luis now makes his living from the small shop he bought during the good years.

The situation in the Azua project is typical of many irrigation projects in arid zones. Inadequate drainage, combined with over watering of the project in the highlands, resulted progressively in the decrease of productivity and ultimately abandonment of the low lands.

INDHRI, the Dominican authority in charge of irrigation projects and dominated by civil engineers, was accused by international and bilateral institutions of taking more interest in constructing new large works than in developing irrigated areas. Canals were poorly maintained. Water distribution was anarchic and erratic for the tailenders. Needless to say, few farmers paid their water charges. The morale of the farmers and INDHRI staff was very low. To attempt to solve the situation, a team of eleven experts from Utah State University was called to work on a 250 ha pilot area. No result was yet apparent in early 1986.

A New Proposal

November 1988. I felt a breath of hope upon my arrival in Santo Domingo. Augustin Merea, a Peruvian consultant and a member of the team in charge of preparation of a World Bank project for the agricultural development of 28,000 irrigated ha briefed me on the new proposal. "The responsibility for management will be turned over to the "*Junta de Regantes,*" (irrigation associations). "The members of the Junta will be elected through a four-level process starting at the *nucleo,* a group of 10 to 15 farmers served by a common outlet.

Given that the areas are farmed by small farmers — 2 ha in average — many brought under an agrarian reform, I had some doubts on the chance of success of the proposed innovation. "The Junta de Regantes are already established in the Azua and Yaqu del Norte projects," added Merea, "and are progressively taking over responsibility for management."

I was told later that Merea was the author of new legislation on water charges and water users's associations in a number of Latin American countries. He was associated with the creation of a water-user association in Columbia which has managed the

"We met a farmer who was exultant at being able to cultivate his land for the first time since 1984."

30,000 ha Coello project remarkably well since 1976. However, farm size in Coello is on average fivefold the size of a holding in the Dominican Republic.

The next day I started the field visits.

"No Paga, No Agua"

"Half of the farmers have paid their water charges and we hope to reach 100 percent in 1989" said Leonidas Beltre, the President of the Azua Junta. The rule is "No paga, no agua." No pay, no water. The junta has recruited 13 employees so far and is progressively taking over the responsibilities of INDHRI. A. Reyes, an ex-INDHRI employee and now Project Manager, explained that videos, radio announcements and meetings were used to inform the farmers of their rights and responsibilities and to motivate them to pay water charges.

The results were apparent during the field visit. Canals were clean and all gates were in operable condition. Water losses had been substantially reduced and a drainage system was under construction in the lowlands. We met a farmer who was exultant at being able to cultivate his lands for the first time since 1984. The president, Beltre, a 2 ha agrarian reform farmer in the Utah State pilot area said "During the construction of the tertiary and quaternary canals, we realized the disadvantages of fragmented lands. We agreed within the group to consolidate and geometrize our plots."

The next day I visited the Yaque del Norte project in the north of the island. "We increased the water charges from RD 18 Pesos to 58 Pesos per hectare at the time of the creation of the Junta in 1981," said Romulo Cruz, Junta President. "We have collected 183,000 Pesos compared to 30,000 Pesos a year ago; those of us who abandoned their lands because of poor drainage are now back in the project."

"We have no problem in operating the irrigation system," said Andres Fernandez, the Junta Manager. "We have 300 automatic water level control gates in the system, which ensure a constant flow to the farm outlets."

"We receive the water in bulk," said one of the representatives of a nucleo," and we distribute it between ourselves, based on the priority requirements of the crops, not on a rigid or arbitrary rule."

Situation is More Complex

In the third area of the future World Bank project, Nizao, which is only an hour from Santo Domingo, the situation is more complex. Twice in 1982 and in 1986, INDHRI attempted to create water users associations. The project facilities were in poor condition and incomplete. The association was given only a consultative role without active participation. The water charges were still paid to INDHRI. Eustacio Zapata had the challenging task to re-establish a Junta de Regantes along the model of Azua and Yaque del Norte. Zapata decided to start organizing nucleos and groups at the tail end of the system where the water was the most unreliable and farmers would be easier to motivate.

One-fifth of the Nizao area is now organized in seven groups. "We hope to establish the Junta by the end of 1989," said Zapata. "Water distribution has been improved and has now reached the tail end part of the project."

The Dominican experience confirms that "developing an irrigation system means not only creating a network of canals, but also a network of social and institutional relationships between the water users of the system, who can jointly operate and manage it at lesser costs more effectively," according to Michael Cernea, the World Bank's sociology adviser.

The technical assistance provided by Utah University and the financing of drainage and levelling by the United States Agency for International Development contributed to the rapid take-off of the "Juntas de Regantes" in the Dominican Republic. Another key factor was the good condition of the infrastructure. Weeding and some desilting were the only works required before the transfer of facilities to the Juntas, a condition rarely found in most countries.

During the last two years, INDHRI has doubled its agricultural staff and created a rural development division. This institution is now taking a new orientation to develop irrigable lands in the country. A law on the organization of water users associations was approved in 1984. The government emphasizes reliance on the privatization of the irrigation sector. INDHRI is developing its own agricultural extension program to free itself from dependence on the Ministry of Agriculture and in the future will develop extension services in the Juntas of Regantes.

It may be too early to predict whether the experience of the Dominican Republic will be sustainable when present external aid comes to an end, but the chances of success seem good. It is an experience worthwhile to monitor since it may be a model for countries with weak public institutions to organize and support these associations at their early stages. A prerequisite to success is the good condition of physical facilities. Farmers will not take over a lousy system, poorly built and designed, inoperable and financially not viable!

Yaque del Norte

Another point of interest is the low intensity management of the Yaque del Norte. The designer took advantage of the relatively steep slope of lateral canals to install flap type automatic gates, which considerably ease the operation. Technical and managerial innovations are key to the success of this project. But the special design of Yaque del Norte was not replicated in any other project where similar conditions exist. Transfer of low intensity management technologies such as those seen in the Dominican Republic or those widely used in Mediterranean countries has proven to be incredibly slow.

SPECIAL REPORT

WATER MARKETS: SOLUTION OR THREAT

One of the fastest growing and least understood phenomenons appearing on the Indian irrigation scene is the indigenous development of water markets, where farmers alone or in groups sell groundwater to their neighbors.

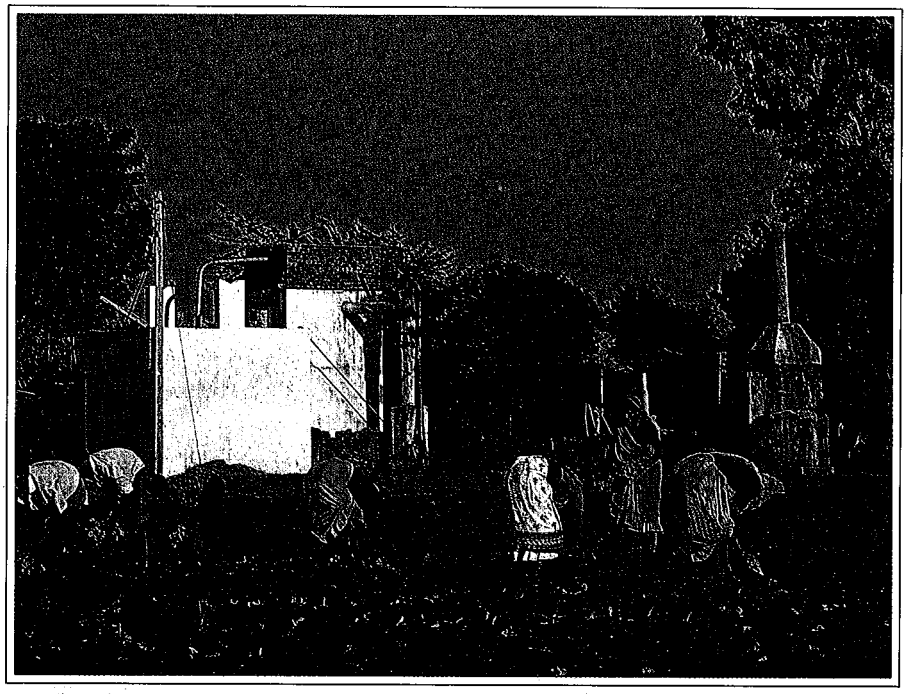
Despite their importance, water markets are largely ignored by policymakers and researchers, according to Tushar Shah, an economist and director of the Institute for Rural Management in Anand. "Nobody has done anything to create markets," says Shah. "They are an institution which has come out of nothing."

Several independent estimates, including Shah's, hypothesize that there is enough groundwater to ultimately provide 75 million acre-feet (MAF) of water — almost three times the present total. Over 95 percent of the area presently irrigated with groundwater comes from tubewells drilled by private farmers or groups, and nearly half of those sell whatever they don't use.

"The critical issue in groundwater, is water markets," says Shah.

Many international observers are deeply suspicious of the role of open markets in development. They assume water markets exploit poor farmers, and names like "water barons" appear. Recent studies however, have produced considerable evidence to the contrary. These studies have shown that where water markets are competitive the land value and cropping intensity of non-tubewell owners increases, as do wage rates for farmer laborers.

A typical tubewell, say 300-feet deep, with 1.5 km or so of underground pipe to convey water to farm plots, cost a well owner near Anand, Gujarat about US$ 10,500 including the electrical hook-up. He pays a flat rate of about US$ 600 a year for electricity (the rate is based on the horsepower of the pump). The well supplies water to 75 farms for about US$ 0.75 per hour and runs for a minimum of 12 hours a day. After irrigating 7 ha of land he reaps a net profit on water sales of US$ 600. The farms around his well generally produce three crops per year; wheat during the rainy season and cash crops, like tobacco, cabbage, cauliflower and tomatoes during the dry season.



Water markets, built around tubewells, are institutions which have "come out of nothing."

Water markets, says Shah, are extremely economical in getting water out of the ground, especially in states where electricity is charged on a flat rate instead of a pro rata basis. With a flat rate, the marginal cost (each additional unit) of water to the owner is zero, after the owner has recouped his one-time electricity investment. This partially explains why diesel is more expensive than electricity, because diesel costs act like a pro rata charge.

After Uttar Pradesh switched from pro rata charges to flat rates, average power consumption per well increased from about 2050 Kilowatt hours (kwh) to more than 6500 kwh. Water prices fell dramatically, and the amount of land irrigated with groundwater skyrocketed.

However, critics say, water markets are not always fair. In areas of scarcity, farmers must drill deeper for water at higher costs. In areas where farmers have very small holdings, as in the Ganges basin, only wealthier farmers can afford to drill wells. In both cases, monopolies can develop and poor farmers, lacking the necessary access to surface irrigation, pay exorbitant water rates.

The "Catch-22" of water markets is that they can be too efficient. The coastal area of Saurashtra in Gujarat is a case in point. After the government gave liberal loans to farmers to build tubewells in the 1960s, the amount of groundwater withdrawn by wells increased five-fold. Farmers switched

from traditional food crops to water-loving cash crops, and the area gained the name of "Lili Nagher," or Green Creeper. Eight years later, the groundwater table fell some ten meters, and salt water began to seep laterally into the aquifer from the coast.

The faster the salt water creeped in, the faster the owners drew water, until over 12,000 tubewells became saline, rendering the land useless. Mango yields fell from 40 to 2 metric tons, and land values fell from US$ 5,000 to US$ 1,000 per hectare. In several villages, families sold their livestock and migrated in search of work.

"There is the danger of overexploitation, particularly in hardrock areas," Shah admits, "and I don't think anyone understands it. In Haryana, which is an area of soft alluvial soils, the water table goes down at a rate of 5-7 feet every year. If you sink a tubewell this year, then the year after next you will have to spend another Rs. 25,000 (US$ 1,490) to drill deeper and chase the groundwater table. But one good year of rainfall means a 25-foot rise in the water table. This basically means better management of groundwater."

According to Anthony Bottrall, program officer for the Ford Foundation in New Delhi, "the whole center of India and most of the hardrock areas are vulnerable to overexploitation. Someone has to manage these aquifers." But," he says "it's too early to worry about overexploitation in the Ganges basin."

Presently though, there is little control over who drills a tubewell or how much water they pump; even the exact number of wells is an unknown. The only legislation proposed anywhere in the country has been awaiting passage in Gujarat for several years. Even in areas which are fast nearing overexploitation there is little the government can do to control owners.

"You have no legislation and even if you did, how do you monitor or stop pumping. The only control is electricity. But you can't stop diesel pumps," says one scientist.

There is also the problem of water rights, a complicated issue in even the most developed countries. "Surface water belongs to the government," says Bottrall, "but groundwater belongs to anyone who can afford to put a hole in the ground."

For now, water markets will continue to set the agenda. "The role of public institutions or policy makers is to understand how these markets work and how can you tinker around with them to get the optimum," says Shah.

JOHN COLMEY

ORGANIZING FARMERS: BREAKING NEW GROUND

On a rainy morning in December, V.S. Gandhinathan, a 25 year-old social worker-turned-farmer organizer, proudly leads a tour through a small, dimly-lit brick house in a rural section of the southern Indian state of Tamil Nadu. On the walls hang a series of posters with lists, handwritten in bright colors, that document a year and a-half effort by Gandhinathan and his two teammates to organize area farmers into a group with one voice.

Giandhinathan talks excitedly as he reads aloud his team's achievements to date. The list ranges from the seemingly mundane — "fixing of a new wooden plug in the existing sluice, utilizing farmers' efforts and resources," "group dining with villagers during festive occasions" — to the more obviously important — "cleaning and desilting the main canal and branch canal over a distance of 2,430 meters by mobilizing the services of over 40 families."

"The hardest part has been getting the farmers to accept us into the community," says Gandhinathan, as the village postman peers through the doorway at the visitors. "Our biggest break came when the technical assistant was stung by a scorpion. We ran to the village doctor who treated him using local medicine. Everything changed after that."

The house Gandhinathan uses performs double duty as the village post office and bank and the project office for what researchers believe is the most innovative attempt in India to interest farmers in managing the water that irrigates their fields.

The researchers came to this 400-farmer village as part of a three-year pilot study to promote community involvement in the restoration and management of the village irrigation tank, one of 39,000 ancient reservoirs in Tamil Nadu. The study, conducted by Anna University's Water Resource Centre in collaboration with the State's Public Water Department, is a small part of a US$ 16 million Indian government project, funded by the European Economic Community (EEC). The EEC project will rebuild 150 of these tanks, providing about US$ 100,000 to restore each one. The results of both studies will be used as models for the restoration of other tanks.

Despite their small size — most tanks irrigate about 200 ha — these small reservoirs provide irrigation water for 30 percent of Tamil Nadu's food supply. But most have been allowed to deteriorate because of the government's need to focus limited funds on maintaining the large surface

systems. With deforestation, many have fallen prey to siltation and, according to researchers, irrigate less than one-fifth of their potential. According to D. Chengaelvarayan, a consultant directing the pilot study, "even a 10 percent increase in efficiency would translate into an additional quarter million tons of food stocks."

The first step in the pilot study, says Chengaelvarayan, is to involve the farmers in the restoration work. The work itself involves lining canals, rebuilding structures and laying out new field channels. As part of the study, Anna University fielded a three-member team in two villages; the results of their work will be compared with two control villages, where restoration will proceed without farmer involvement.

Chengaelvarayan says they have a good idea of what to expect. An earlier study conducted by the university illustrated that government engineers tend to follow a "blueprint" approach, a process that fails to take into account farmers' knowledge of local conditions, like soils, or the political and economic role of tank irrigation in small villages.

"The tank is the center of the community," says one young social scientist. "Villagers bathe there, take their cattle to drink there, and meet to discuss the issues of the day. Improving water supply and delivery can change the whole economic structure of the village, because poor farmers at the tail end might get more water."

"When farmers are not consulted, they feel like the tank no longer belongs to them," says another scientist who worked on the earlier study. "If that happens, they won't take care of the system once it's rebuilt. In some cases, they even destroy the structures."

In order to avoid such destruction, Anna University, the Ford Foundation and Tamil Nadu's Public Works Department, put together the study now underway.

"We have basically taken the model from the National Irrigation Administration (NIA) in the Philippines of introducing an outside institutional organizer into a village," says Gian Kathpalia, a Ford Foundation consultant.

In the Philippines, the NIA is in the process of introducing institutional organizers into all or parts of 3,000 irrigation systems. The plan there is for the organizers to arrive six months prior to the beginning of restoration work; during and after restoration, the organizer works to develop contacts with the local community and inspire farmers to work with rather than against the irrigation agency.

"It's really a grassroots approach," says Gandhinathan.

(Continued on page 15)

Tamil Nadu's 39,000 irrigation tanks provide 30 percent of the states' food supply.

"This is the first systematic experiment in India to reverse the trend towards greater government involvement," says Anthony Bottrall, a Ford Foundation program officer in New Delhi who helped design the project. While the government has generally resisted the idea of farmer participation in irrigation, he says the tanks are unique.

"Tanks legally belong to the government," Bottrall says. "But they [the government] are more willing to give up control of them because their small scale and tendency to deteriorate quickly make them more of a liability than an asset." Tanks, he says, also have a history of community involvement which makes them an excellent place to test farmer participation.

The principal innovation introduced during the study is the second team member — the Process Documenter. (The third member of the team is the technical assistant, an engineer who advises farmers on technical aspects and monitors system performance.) The process documenter, usually an economist, maintains daily records of all events — from the first breakfast meeting the researchers had with farmers, to a community dispute over the sale of palm leaves to poor farmers.

"For the last few years, people have been talking about farmer participation," says P. Sakthivadivel, who, while director of Anna University's Water Resources Centre, conceived the project. "This is the first time we have tried to document the processes and problems."

To date, the project has been immensely successful, according to scientists. Although the normal "blueprint," of the restoration work calls for cement lining of all canals to stop seepage, farmers pointed out that parts of the canals did not leak, and convinced the government engineer to only line the worst sections. The farmers, with the help of the university, were able to convince the EEC to use the savings, about $13,000, to build a community well.

The farmer's organization now has over 40 members, each of whom contributed Rs 1000 (US$ 57.00). The organization has revolving committees to handle different irrigation tasks. Local wages for landless laborers have risen, which, according to one man, is why he decided not to move to Madras to look for work.

"The PWD [Public Works Department] listens to us much more now," says one farmer. Another says "individually our incomes are going up, because we are sure of getting water to the crops."

Despite the project's success, Bottrall and the other scientists admit, if the project is ever tried on a larger scale, it will be difficult to locate enough dedicated social workers willing to leave the bright lights of Madras to live in small rural villages for one to three years. However, as Bottrall says, "let's take one problem at a time."

JOHN COLMEY

INDIA'S TRAINERS ADAPT TO CHANGE

Ten years ago, India, pressed to meet rising food needs, was building irrigation systems as fast as funds and time would allow. Today, having harnessed the bulk of the country's surface water supplies, irrigation engineers are being asked to take a closer look at the systems they built.

"Before there was more emphasis on design and construction," says D. R. Arora, an irrigation engineer now with the United States Agency for International Development (USAID) in New Delhi. "These days there is a new feeling, 'Gentlemen this system must perform when you leave.'"

Across India, state governments and universities are finding new ways to prepare irrigation engineers for a rapidly changing water environment. Among the changes are, not only a nationwide effort to intensify irrigated agriculture, but a myriad of emerging trends like farmer involvement in operations and conjunctive use of ground and surface irrigation.

One example is USAID's seven year, 51 million dollar project with the government of India and the World Bank to establish state training centers for irrigation officials. According to Arora, the centers, called Water and Land Management Institutes (WALMIs), carry out short to medium term courses — ranging from one week for high level officers to six months for junior engineers — and action research on areas of concern to each state.

"Our role is to give training in those subjects which are not covered at the university level," says K.P. Jain, acting director of the Okla, New Delhi WALMI. He says India universities, with the exception of Anna University in Madras, do not provide degrees in irrigation water management, and most students do not want to reduce their chances of finding employment in other engineering fields by focusing on any one topic. Adds Arora, "It's not a workable proposal to put water management training into undergraduate studies. So the

WALMIs came into being."

Jain says his center is currently geared up to provide forty courses per year. "These courses," he says "first give trainees more input on irrigation engineering. The remaining courses are divided into three parts — irrigation management, upgrading technical know how, and administration."

"Our plan is train all of our [Bihar] engineers in about five years," says A.K. Varma, a teacher at the Bihar WALMI." He says some courses offered there teach officers how to interact with farmers, or how to develop irrigation rotation schedules during drought periods. "We even conducted one course where we brought farmers to the center to give them an understanding of how the department works."

Arora says the action research component is relatively new. "Action research was part of the WALMIs from beginning, but has been ignored until recently. It really is more of a action program to diagnose problems, design improvements and implement a few changes in state irrigation systems.

"Engineers are good implementors, but not good documenters," says Arora. "The idea is to bring universities together with WALMIs to get a mix of the theoretical and the practical.

However, some Indian researchers believe the WALMIs are expanding beyond what they are equipped to carry out. "The lack of dedicated faculty and well designed facilities, are impacting their effectiveness," says G. N. Yoganarasimhan, director of the Water Resources Development Training Centre at Roorkee University. "And I think people should be sent out of their region — they should be exposed to many types of thinking."

Yoganarasimhan's own center at Roorkee, one of the oldest Indian institutions dedicated to water resources, tries to do just that. The program accepts 70 Masters candidates from all over India and several Asian countries. Students are sponsored and initially selected by state or country irrigation departments. The government of India funds the program.

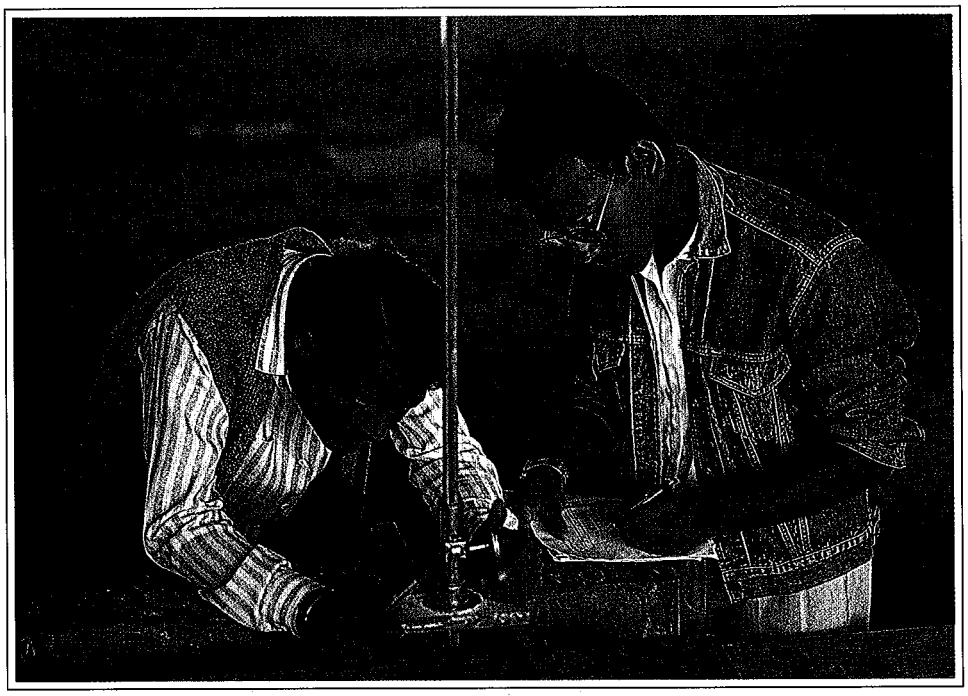
The program, says Yoganarasimhan, is in the process of being completely redesigned, with assistance from the Ford Foundation. "The M.Tech [Master's of Technology] programs were too discipline biased before; they didn't go into periphery subjects," he says. The new curriculum will be more multidiciplined and will generally "move away from theory and more into application." For example, the groundwater course, initially taught as a discipline, has been changed to groundwater management and will reflect a user bias. Agricultural economics will change to economic organization and include budget planning and project management. Irrigation policy management seminars will also be introduced.

Yoganarasimhan says the style of teaching will also change. "We are going to change from class room teaching to a more participatory style of teaching. By the time students reach the masters level, they're tired of reading notes off a chalk board."

While many innovations are starting to appear in training institutions, professors say training isn't always effective. "Training is a necessity, but training alone cannot deliver the goods," says P. Sakthivadivel, former director of Anna University's Centre for Water Resources in Madras. "If a department sends a fellow through training, he must be given the opportunity and facilities to use that knowledge when he gets back to the office. Normally, that opportunity isn't available."

Still, as many senior officers go through WALMI training there is a good possibility that will change.

JOHN COLMEY



"The M. tech programs were too discipline biased before."

TRAINING

TRAINING NEEDS ASSESSMENT TESTED IN MALAYSIA

A team of IIMI professionals recently joined counterparts in the Malaysia Department of Irrigation and Drainage (DID) for an experimental training needs assessment of irrigation staff. The 16-session program, held in Kuala Lumpur and Kota Bharu from 13 October to 11 November 1989 is the first of many such assessments IIMI hopes to conduct elsewhere.

Over 338 irrigation professionals attended the sessions, including system managers, trainers, and senior officials from the DID, the Muda Agricultural Authority and the Malaysian Agricultural Research and Development Institute.

Training needs assessments, says Zenete Franca, IIMI Training Specialist, are designed to determine the necessary knowledge, attitudes and skills to develop an effective personnel training program for irrigation departments. IIMI chose Malaysia as the first site, partly because of DID's enthusiasm for the project, and partly because of the department's wish to strengthen its capacity to manage Malaysia's nation-wide irrigation system.

Franca says needs assessments, generally have four parts:

* Presentation and discussion on irrigation management, physical and management dimensions;
* A job analysis to review duties and tasks performed, work conditions, responsibilities and skills required;
* A job description review aimed at giving individual participants an opportunity of improving it;
* Identification of requirements to perform managerial activities, gaps in skill proficiencies required to achieve specified performance standards.

Comments on survey forms ranged from "a totally new experience," to "the first time I was exposed to the irrigation management concept." Some criticized the effort as "too short," or "too tight a program" while others suggested courses be held more often.

Franca says information culled from lists, questionnaires and forms used in the exercise are now being compiled and a final assessment is due shortly. Results will then be presented to top management officials in a February workshop, where participants will consider policy implications and try to design a longterm training program for Malaysia.

NIMAL FERNANDO

(Continued from page 2)

the benefits outweighed by far the problems, as long as we accepted the problems and took prompt measures to mitigate them at the outset. And although the political and economic situation in Egypt did not always enable us to tackle these problems at an early stage, we are dealing with them now.

Let me give you one concrete example to answer those who say that the Aswan dam was a mistake. From 1980 to 1987, Africa faced a continuous drought and consequently extremely disastrous famines, for example in Ethiopia and Sudan, two Nile countries. Egypt could have been affected as badly, had it not been for the Aswan Dam and Lake Nasser, providing water into the Nile for irrigating crops, and for generating a stable supply of electricity year after year. Levels were low in 1988, but rains in Ethiopia which led to Sudan soon led to a renewal of reservoir water. We were saved from famine over this six to seven year period because of the Aswan High dam. So there is no way that I can accept any controversy over the dam's basic value to Egypt.

O'Kelly. What role would you see for an organization like IIMI in the development process?

Tolba. I expected or forecasted that water would take place after energy as the key environmental problem for the end of the eighties. From what I have seen now, the whole issue of famine arises from the lack of availability of water - rainwater, river water, lake water. I recently noted that the UN Committee on Development has asked that a special item, water resources, be included in the 1992 conference on environment and development; this is very revealing of how countries all over the world perceive water as a limiting factor to development.

It is a matter of almost a nation-by-nation exercise, with different ecological, social and economic conditions. In this type of exercise, when you tell me "let's go and price the water," how much will the peasants respect this? How much will it affect migration from rural to urban areas. What is the relation between today's agricultural technologies and techniques in the Third World and what is happening in the developed countries? What are the consequences for self reliance we discussed earlier? Shared water resource would be an ideal area of collaboration, in Asia in particular. Areas of cooperation for environmental and food sustainability must start today to prevent future conflicts.

IN BRIEF

EXTERNAL REVIEW VALIDATES NEED FOR IIMI OPERATIONS

A recently-concluded External Review of IIMI found the Institute to be "performing a vital function in promoting food security throughout the world."

The review, authorized by IIMI's (donor) Support Group, took some three months, during which the five-member panel of international experts visited several IIMI field operations throughout Asia and Africa. The panel also spoke with representatives of IIMI's donors and collaborating irrigation agencies in those countries.

IIMI's work to improve the lives of poverty-stricken farmers, alleviate environmental problems related to poor irrigation management and improve the sustainability of irrigation systems, was praised by the group. At the same time the panel made several recommendations which they felt would improve the Institute's operations.

"There is little doubt about the need to improve the management of irrigation systems at all levels," the panel said in its critique. "It is readily apparent that IIMI has done an effective job of initiating and carrying out various projects that should contribute significantly to the improved performance of irrigation systems in the developing world."

The review panel said IIMI was involved in an "impressive array of research projects for such a young organization" and that there "is considerable evidence of significant progress so far." The panel commended the Institute for its Strategy and five-year Workplan. The establishment of a Project Development Office and a recently introduced budgeting and monitoring system were also highly praised.

IIMI should however, the panel said, "give priority to achieving the highest possible quality of efforts in whatever it undertakes and not jeopardize its ability to do so by overextending itself – either geographically or in the size of its total enterprise." The organization should consolidate its operations and concentrate on current research projects, quality control and its organizational structure to "facilitate the design and execution of a cohesive, well-integrated Institute-wide program," the panel added.

IIMI is "making good progress" toward implementing a sound information program, but the reviewers said the institute should concentrate on improving its communications with collaborative agencies with which IIMI works. IIMI should also, the panel said, consider more strongly the role of women in developing country agriculture in the formation and implementation of future programs.

At a later press conference held to publicize the report, Chairman David Bell of IIMI's 13-member Board of Governors, said the Institute would probably become an even more effective organization if it continues to develop as it has the past five years. "The panel gave us good marks for the first five years," Bell told journalists.

IIMI will explore a long term presence in Nigeria.

An IIMI-sponsored national workshop recently determined a list of priority issues in Sudan.

Former World Bank President Robert McNamara, a member of IIMI's Board of Governors, stressed future needs and increasing strains on the world's food supply.

"The rate of population growth is going to decrease, but the absolute numbers of additional people will increase," McNamara said. "It was mentioned here that the world's population will double by the middle of the next century. There isn't going to be any increase in land and there isn't going to be an increase in the world's water supply. The achievement of the last 50 years of the world being able to feed itself is remarkable, but there is a tremendous requirement for utilizing existing cultivated land more productively and in particular utilizing irrigation investments more productively. Those are the issues that IIMI is working on."

Dr. Letitia Obeng, another Board member, said IIMI's work was intended not only to improve irrigation system management, but to help "people develop ways to protect the resource so that the environment and people in developing countries do not suffer, but gain from the activities of the irrigation schemes."

IIMI's Director General, Dr. Roberto Lenton, said the panel's observations "will undoubtedly assist IIMI in its work to strengthen the performance and effectiveness of national irrigation systems. Perhaps more importantly," Lenton added, "we are very proud of the impacts that our work has had on policies and policymakers."

IIMI Establishes Project Development Office

In November 1989, IIMI fully implemented its new organizational structure with the establishment of a Project Development Office. IIMI is one of only a few institutes to create such an office, which will be responsible for packaging all future project ideas and identifying new sources of funding, a critical need in light of IIMI's dependence on project specific funding. The establishment of the Office is expected to give other IIMI staff the necessary time for more substantial issues.

Agreements and New Country Initiatives

The Director General's office reports several new initiatives have been undertaken to formalize relations with countries where IIMI now operates, which in effect take those operations into a new phase of activities.

In Nepal a formal Memorandum of Understanding was signed with his Majesty's Government of *Nepal* for a further period of four years, on the expiry of the first Memorandum of Understanding signed in 1985 with the Water and Energy Commission Secretariat. In this country and in the *Philippines*, the mechanism of establishing a Consultative Committee, based on the Sri Lankan model, to coordinate overall program activities is now being pursued.

The Director, Field Operations, and Head, West Africa Field Operations, visited *Nigeria* in October to discuss with national agencies a possible collaborative program in that country. Further discussions at the Federal Government level will be held during 1990 to help establish a legal and operational basis for IIMI to initiate a long-term program there.

In *Bangladesh,* IIMI's office has now been established, equipped, and staffed. A newly established Consultative Committee held its first

meetings in June and November. A number of possible project activities have been discussed with national agencies and approved by the Committee.

In *Morocco*, IIMI has established its office in the Irrigation and Drainage Experimentation Services Office (SEHA), following the posting of the Head, Field Operations, in Rabat in October 1989. A Consultative Committee met for the first time in September 1989 with participation of IIMI's Director General and the Director, Field Operations. The Committee established a permanent Secretariat to facilitate interaction with IIMI, and identified several research topics for initial attention.

In *Sudan*, the Head, Sudan Field Operations, took up residence in July 1989. A national workshop held in October produced a list of research issues which will form the core of IIMI's collaborative research program during the next five years. A Consultative Committee, established after the workshop, will meet soon to determine specific research priorities.

Following the approval of IIMI's 1990-94 Workplan by its Board of Governors in July 1989, IIMI's management has taken initial steps toward explorations for future collaborative activities in Latin America and Egypt.

A joint workshop of IIMI and the International Congress on Irrigation and Drainage on irrigation management in Latin America will be held in May; several leading Latin American irrigation experts have prepared papers for discussion there.

At the invitation of the Egypt Mission of the United States Agency for International Development (USAID), the Director General and the Director, Programs, visited Cairo in early February for discussions with and the Water Research Center and USAID about a possible future program of collaborative research in that country.

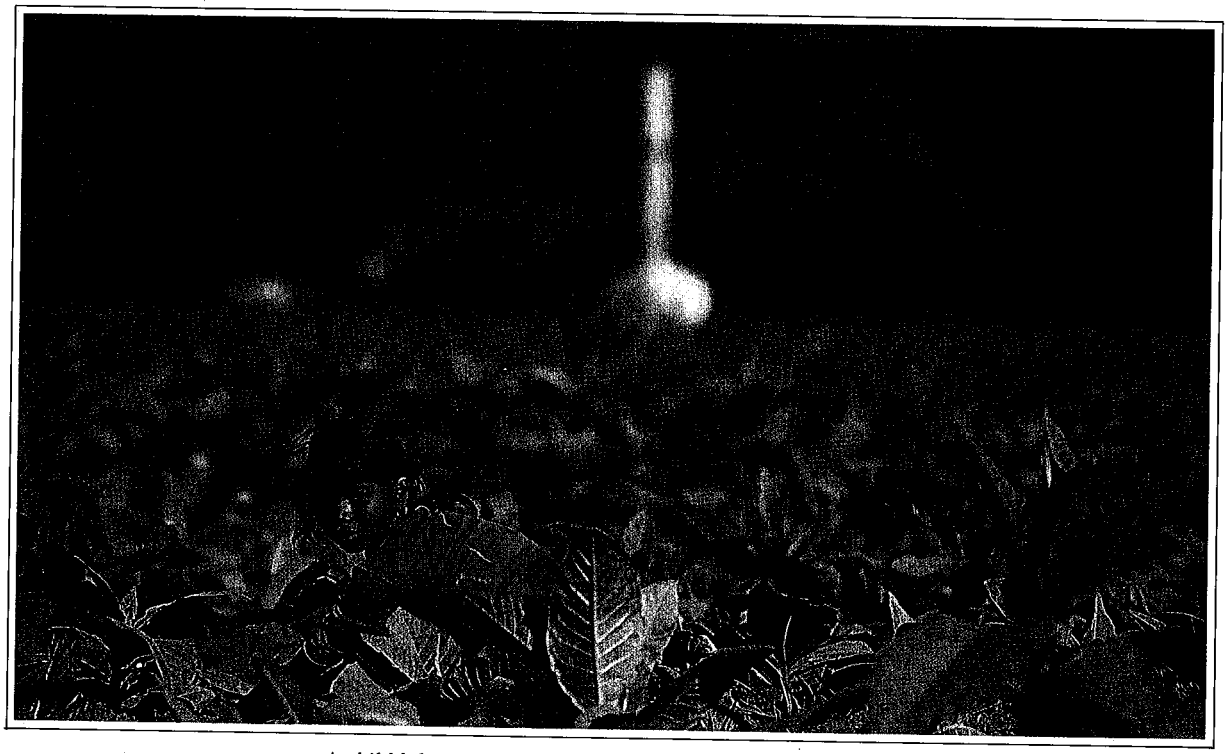
Staffing

Dr. Marian Fuchs-Carsch joined IIMI in late October as head of the Project Development Office. Dr. Fuchs-Carsch formerly served for five years as Project Design Specialist at the Office of Project Development and Monitoring of USAID in Pakistan, where she was centrally involved in the design and formulation of over 20 projects in a wide variety of sectors. She has a PhD in Linguistics, an MS in English and Education, and a BS in Sociology and Statistics. Dr. Fuchs-Carsch is an American citizen, and is fluent in German and conversant in French.

In January 1990, Dr. Hammond Murray-Rust, formerly Head of Field Operations, Indonesia, joined the Programs Division at headquarters to assist in irrigation engineering research; Dr. Fred Valera, formerly Head, Philippines Field Operations, has been reassigned to the Programs Division to assist IIMI's work in design/management interactions and in management training; and Dr. Douglas Vermillion, formerly Irrigation Specialist, Indonesia Field Operations, has also been reassigned to IIMI's headquarters, where he will assist in further developing IIMI's work in the area of irrigation institutions.

Two positions currently under recruitment include an Agricultural Economist for the Programs Division at headquarters, and Senior Water Management Advisor for the Institute's Sudan Office.

MATTHEW DRISKILL



A child laborer on a tubewell irrigated farm in Gujarat.

PUBLICATIONS

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Publications are distributed free of charge to selected audience groups. Certain publications are offered free on demand; others will normally be distributed, subject to availability, free of charge to institutions and individuals working in irrigation and related areas in the Third World. Publications are also available to readers on a sales basis; for these a dual-tier price system is applied. The cost of despatch will be added to the prices indicated; sea mail will be used unless orders specify air mail (for which there will be an additional charge). Prices may be subject to change.

Please note that free copies (apart from review copies) may only be obtained upon writing to the Institute.

Three new publications on Pakistan are now available.

Technical Publications

IIMI. 1989. *Research network on irrigation management for diversified cropping in rice-based systems.* x + 150. B5. Softcover. ISBN 92-9090-118-7.

Price US$17.50. US$9.50 (developing countries).

This book reports the proceedings of an organizational and planning workshop for a research network on the title subject in late 1988 in Bangkok, Thailand. In addition, eight papers on irrigating nonrice crops and discussions of each are included. Discussions leading to the establishment of a research network involving researchers from eight humid tropical Asian countries where irrigated rice predominates during wet season are presented in conclusion.

Technical Papers

Senen M. Miranda. 1989. *Irrigation management for crop diversification in Indonesia, the Philippines, and Sri Lanka: A synthesis of IIMI's research.* Technical Paper Number 1. xvi + 103p. B5. Softcover. ISBN 92-9090-106-3.

Price US$12.50. US$6 (developing countries).

This study of crop diversification in Indonesia, the Philippines and Sri Lanka provides conclusions and recommendations on the potentials and constraints to more intensive non-rice production during the dry season in irrigation systems originally developed for rice production.

Relevant secondary data other than that from research sites are provided to shed further insight in the synthesis.

Country Papers

Pamela Stanbury. 1989. *Land settlement planning issues for improved irrigation management: A case study of the Kirindi Oya irrigation and settlement project.* Sri Lanka Country Paper No 4. 80p. A5. Softcover. ISBN 92-9090-116-0.

Price US$13.50. US$8 (developing countries).

An analysis of the impact of settlement policies on irrigation management in a new irrigated settlement scheme in southern Sri Lanka, based on field research in 1988. It provides policy recommendations for improvements on this scheme and in future schemes.

Robert Johnson. 1989. *Private tube well development in Pakistan's Punjab: A review of past programs/ policies and relevant research.* Pakistan Country Paper No 1. ix + 24 p. A5. Stapled. ISBN 92-9090-151-9.

Price US$10. US$6 (developing countries).

Although Pakistan's has a long history of surface irrigation, the development of groundwater began only about 30 years ago. During the past decade, government policy has been reoriented towards private, instead of public tube wells. This paper examines the policies affecting tube well development and reviews past literature on the subject.

J.W. Kijne. 1989. *Irrigation management in relation to waterlogging and salinity: Precis for a research agenda in Pakistan.* Pakistan Country Paper No 2. vii + 13p. A5. Stapled. ISBN 92-9090-151-9.

Price US$6.50. US$4.50 (developing countries).

This paper presents an overview of current information on the relationship between irrigation management in Pakistan and the incidence of waterlogging and salinity. Key management questions are also highlighted.

E.J.V. Vander Velde. 1989. *Irrigation management in Pakistan mountain environments.* Pakistan Country Paper No 3. xiii + 33p. A5. Stapled. ISBN 92-9090-153-5.

Price US$8.50. US$5.75 (developing countries).

This paper is a first step in defining the extent of irrigation in Pakistan's mountain regions. Attention is given to some changes already begun in this environment through new irrigation development activities. Important knowledge gaps are also identified.

Prachandra Pradhan. 1990. *Patterns of irrigation organization in Nepal: A comparative study of 21 farmer-managed irrigation systems.* Nepal Country Paper No 1. xvi + 122p. A5. Softcover. ISBN 92-9090-109-8.

Price US$11.50. US$6 (developing countries).

The study identifies and describes the types of irrigation organizations found in farmer-managed systems, and examines the factors that stimulate farmers to organize for irrigation activities. The author suggests experience in farmer-managed systems can be applied to government-managed systems for improved performance. These aspects and key issues relevant to government policy for intervention and formulation of development strategy are also examined.

Prachandra Pradhan. 1990. *Increasing agricultural production in Nepal.* Nepal Country Paper No 2. xiv + 59p. A5. Softcover. ISBN 92-9020-142-X.

Price US$8. US$4 (developing countries).

The author contends Nepal irrigation policy directives and resources must be channeled to encourage the participation of beneficiaries and to focus the functions of the Irrigation Department on a management perspective. Three low cost approaches to this are presented: incorporating farmer participation in operation and management, considering lower cost structures in surface and groundwater irrigation, and improving the management of irrigation.

Periodicals, Newsletters and Serials

Annual Report 1988. 1989. vi + 58p. Softcover. ISBN 92-9090-107-1.

IIMI Review, Volume 3 Number 1. 1989. 24p.

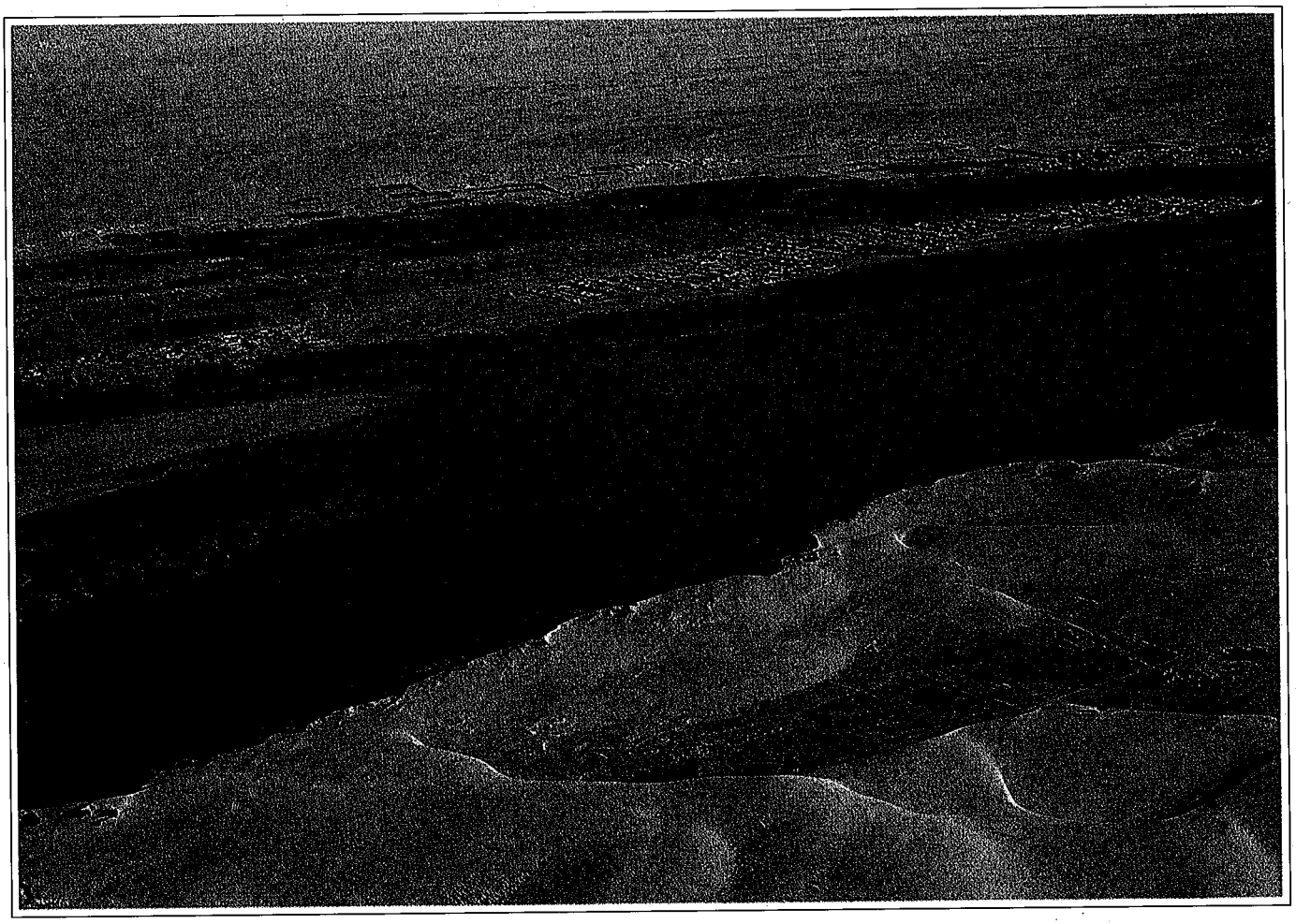
The Farmer-Managed Irrigation Systems Network Newsletter. 1989 (September). Number 6. 28 p. ISSN 1012 988 X.

Public Affairs

IIMI workplan 1990-94. 1988 (Draft). [2], 50 p.

The strategy of the International Irrigation Management Institute. 1990. viii + 48.

Two new publications investigate constraints and solutions to irrigating non-rice crops.



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Postal address: P.O.Box 2075, Colombo, Sri Lanka.

Printed at Stamford Press, Singapore