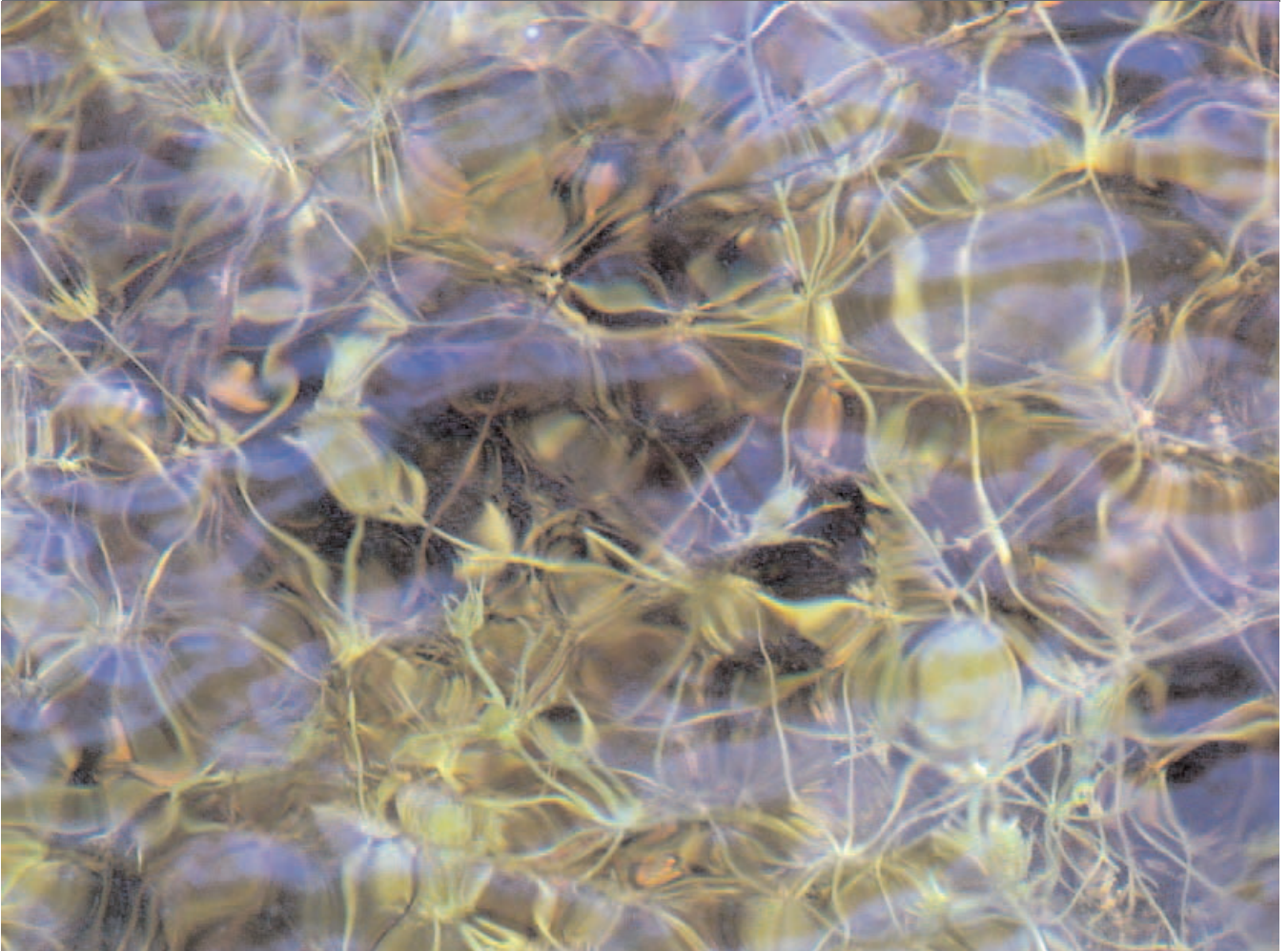


4.0 THE MARSHES OF IRAQ



Aquatic life in the marshes.

Iraq's Mesopotamian marshes were the "cradle of western civilization" according to many historians, and Muslims and Christians alike have referred to the area as the Garden of Eden. The word Mesopotamia means "between rivers", referring to the lands between the Tigris and the Euphrates. The marshes were once the largest wetlands in southwest Asia and covered over 15,000 square kilometers (km²), an area nearly twice the size of the original Everglades. However, by the year 2000 less than 10% of the area remained as functioning marshes due to a systematic plan by the Iraqi government to ditch, dike and drain the marshes.

The marshes were also famous for their biodiversity and cultural richness. They were the permanent habitat for millions of birds and a flyway for millions more migrating between Siberia and Africa. More than 80 bird species were found in the marshes in the last complete census in the 1970s. Populations of rare species like the marbled duck (*Marmaronetta marmaronetta*, 40%-60% of the world



population) and the Basrah reed warbler (*Acrocephalus griseldis*, more than 90% of the world population) were thought to be close to extinction but were recently seen in a winter bird survey. Coastal fish populations in the Persian Gulf used the marshlands for spawning migrations, and the marshes also served as nursery grounds for penaeid shrimp (*Metapenaeus affinis*) and numerous marine fish species. The marshlands also once served as a natural filter for waste and other pollutants in the Tigris and Euphrates Rivers, protecting the Persian Gulf, which has now become noticeably degraded along the coast of Kuwait.

The Iraqi marshlands were also the ancestral home of the so-called “Marsh dwellers,” better known in Iraq as the Ma’dan, an ethnic group unique in the Arab world for their cultural adaptation to the conditions of life in the flooded ecosystem. For five millennia, the Marsh dwellers have constructed a habitat on spotty dryland patches within the marshes, thriving on a combination of buffalo breeding, fishing, and cultivation of wetland-tolerant crops, most notably rice and dates. The Marsh dwellers used the tall reeds which cover the marshes as prime material for construction of their homes, their fishing boats, and mats for sale in urban centers. The Marsh dwellers, which numbered almost half a million people in the 1960s, saw both their ecosystemic and economic bases destroyed with the systematic draining of the marshes, mainly after 1991. Most of the inhabitants of the marshes migrated out, both to Iraqi cities as well as to refugee camps in Iran. At the present time there are only an estimated 20,000 to 30,000 Ma’dan living in the marshes, although others are returning with the destruction of dikes and the reflooding of much of the area.

The Iraqi marshlands, once one of the world's largest wetlands ecosystems, have been undergoing extensive restoration since 2003. This process was implemented to remedy the damage done between 1991 and 2003, when the marshes were drained and reduced to a-tenth of its original size. Re-flooding efforts after 2003 have now restored the marshlands to one-third the original size, making the marshlands now the largest wetland area in the Middle East, covering an area of 8000 square kilometers (UNEP, 2005).

These marshlands are both regionally and globally significant for cultural, political and economical resources. Through restoration activities, these marshes are, once again, rich in aquatic productivity and provide a natural refuge for aquatic organisms especially fish and birds. This area plays a vital role in the maintenance of biodiversity in the Middle East due to its unique ecosystem characteristics and isolation from other comparable systems. The restoration of the marshlands will also revitalize their important function as a filter for degraded waters entering the system from the upstream Tigris and Euphrates, before that water is released into the Persian Gulf. Additionally, many refugee and internally displaced families of Marsh dwellers are returning to their marsh homes due to the return of the conditions which supported their livelihood.

INTERNATIONAL ASSISTANCE TO RESTORE THE MARSHLANDS

Perhaps the most serious problem for the marshlands' inhabitants today is the lack of safe drinking water. However, they are beset by other serious problems, including lack of basic services (e.g., health and education), the loss of income generating opportunities, and inadequate nutrition.



(above and left) The *mudhif*, a barrel, vaulted, reed structure is indigenous to the marshlands of Iraq.

Donors from a broad spectrum of countries and institutions concluded that with appropriate development assistance, the marshlands could once again support rich biodiversity and offer its inhabitants new employment opportunities and the chance for a better life.

Since 2003, a number of donors have begun projects to restore the wetlands, and improve the health and livelihood of the population. USAID led an international effort for the sustainable management of the marshlands in close collaboration with the Ministry of Water Resources, other GOI ministries and other international donors. The projects were designed to balance economic and social development with hydrological and environmental monitoring and institutional capacity building.

TABLE 97 MAJOR PROJECTS TO RESTORE IRAQ’S MARSHLANDS

Donor	Focus
Canada	Biodiversity and wetland management
Italy	Water: marshlands, hydraulics, water assets Ecology: human impact management, ecosystem management Social-economy: land planning, infrastructure, culture and anthropology
UNEP/ Japan	Clean drinking water, sanitation and water quality management Marshlands information network and observation system
United Kingdom	Marshland restoration and management
USAID	IRMP: Livelihood improvements: (agricultural and agribusiness improvement, livestock and dairy production, date palm nurseries expansion, fish restocking) Environmental improvements: (hydrologic modeling, monitoring and data collection planning frameworks, capacity building) Equipping Ministry of Water Resources’ Soil and Water Laboratory Extending primary health care facilities Design of community-constructed wetlands Donor strategy development
	ARDI: Strategic planning, veterinary clinic rehabilitation, crop production, livestock improvement, brucellosis vaccinations, irrigation, monitoring

MAJOR PROJECTS TO RESTORE IRAQ’S MARSHLANDS

ARDI ASSISTANCE TO THE MARSHLANDS

ARDI’s work in the marshlands built on the USAID-sponsored Iraq Marshland Restoration Program (IMRP), which was implemented by Development Alternatives, Inc. From October, 2003 through September, 2006, IMRP sought to monitor the prime environmental indicators of marshlands restoration, expand economic opportunities and develop stakeholder and institutional capacities at the local, regional, and national levels. Its activities included:

MARSHLANDS ENVIRONMENTAL CONDITIONS IMPROVEMENT

- Hydrologic modeling
- Biological inventory, monitoring and data collection
- National and local frameworks for planning integrated marshland restoration efforts.
- Capacity building for stakeholders

LIVELIHOOD IMPROVEMENT

- Expansion of agriculture and agribusinesses to diversify production
- Livestock and dairy production improvement
- Expansion of date palm nurseries
- Fish restocking

ARDI's activities to restore Iraq's marshlands continued many of the activities initiated under IMRP, including the repopulation and restocking of fish, buffalo breeding, and wheat, sorghum, and barley cultivation. The program's main goals were to:

- Improve the productive capacity of the marsh dwellers (one of the poorest groups in Iraq) through improved technical practices and greater marketing opportunities
- Assist the Iraqi government in formulating policies and decisions to promote a sustainable water resources management strategy
- Build the capacity of Iraqis in natural resources management through an emphasis on advanced information systems and stakeholder involvement.

TABLE 98 ARDI MARSHLAND PROJECTS

Activity	Number of Projects	Projects Primary Beneficiaries
Planning	2	1 Strategy for water and land resources in Iraq 1 Marsh monitoring systems
Animal Health and Production	6	4 Rehabilitation of veterinary clinics 1 Improved nutrition for buffalo 1 Restock fisheries
Crop Production	4	1 Improve sorghum, alfalfa, sunflower, maize, and okra production 1 Establish government date palm nurseries 1 Establish government date palm mother orchards 1 Establish private date palm orchards
Irrigation	4	1 Distribute family drip irrigation kits and train farmers 3 Canal cleaning projects





PLANNING ACTIVITIES

STRATEGY FOR WATER AND LAND RESOURCES IN IRAQ

Although significant restoration activities have occurred, the future of the marshlands is not certain. First, much of the area was reflooded in an unplanned, haphazard way, by local residents who breached many of the dikes after the fall of the old regime. Second, the scale and degree of recovery is largely dependent on the amount and quality of water that is available for the area. This in turn depends on decisions made outside the region, upstream along the Tigris and Euphrates rivers. Iraq must make strategic decisions at a national level, and enforce them at regional and local levels, in order to ensure the health of the marshes as well as maximize the benefits from the available water resources.

In order to help the Ministry of Water Resources and other agencies of the government provide informed stewardship of Iraq's water resources, ARDI implemented the Strategic Water and Land Resource Initiative, discussed in Chapter 3.7. The data collection and water usage models developed during the first phase of the Water Strategy program will give policy-makers the tools they need to make informed, practical decisions about water usage and how to care for the needs of both the marshes and the marsh dwelling population.

MARSHLANDS MONITORING

Measuring aquatic productivity in Suq al Sha marsh

Monitoring team sampling at Huwayza marsh

ACTIVITIES

Monitoring teams from ARDI and a southern governorate university worked intensively within the marshlands to gain an accurate picture of the progress of wetlands restoration efforts and to establish baseline information on water, soil, wildlife, and socio-economic activities. Their activities included monitoring and data collection on:

- Water quality (e.g., temperature, depth, salinity, pH, velocity of flow)
- Ecological indicators of plant and algal productivity (e.g., sampling phytoplankton and zooplankton for analysis, sampling aquatic plants and cattails for chemical analysis)
- Populations of macro-invertebrates (insects, spiders, fish species, and shrimp)
- Populations of water birds (pygmy cormorant, little gereb, moorhen, storks), including observing any changes in bird health that could signal the presence of avian flu.
- Activities of marsh dwellers (number of settlers, amount of fishing, other economic activities, etc.).

After each monitoring expedition, the teams recorded the collected data in a Marsh Monitoring Database. This tool was developed under IMRP in 2003, and thus contains a record of information collected over a three-year period.

(opposite page) Testing salinity of the water by measuring its electrical conductivity.



The monitoring team on a collection and measurement mission.



RESULTS

Over a three-year period, the teams observed positive results with respect to the regeneration of flora and fauna in the marshlands. For example, increasing numbers of mature shrimp in the East Hammar marshes, larger catches of indigenous fish, and the greater observed number of water bird species all indicate that environmental restoration is underway. The monitors also had observed many positive economic indicators by mid-2006, including increased fishing activities, collection of reeds for cattle food, and canal cleaning for agriculture.

The data collected by the monitoring teams will help the Ministries of Agriculture and Water Resources to design interventions to help restore the marshlands and the marshland economy. A better knowledge of the current state of environmental and biological development that the database provides will inform the designs of programs to restore biodiversity, improve economic conditions for marsh dwellers, and ensure the sustainability of the marshlands' resources.

ECONOMIC DEVELOPMENT IN THE MARSHLANDS.

The culture of the marshlands is one of the oldest in the world. Though they were not wealthy relative to their dryland neighbors, the marsh dwellers were famously well-adapted to their environment, which differed radically from the surrounding region. Their communities were built around and lived off of the marshes, which provided food, clean water, fodder for animals, and construction materials.

The tragic story of the ruined marshes and persecuted and displaced marsh dwellers has been told many times during the Saddam regime and since its fall. Although the ecological basis for sustainable livelihood in the marshes had degenerated almost to the point of crisis, people are returning to the area and beginning to rebuild their lives.

Complete restoration of the marshes to their former size and biological diversity is unlikely. Even if it were possible, the marsh communities would not be able to completely recreate their traditional lifestyle. In fact, some people want desiccated areas that have become farmland to remain drained. The degree of marsh restoration, and the number of the tribal marsh dwellers who return will in part determine how much of the old marsh culture is preserved, and how local lifestyles will adapt to new social and economic conditions. Now that many people have been exposed to different standards of living in other parts of the country, as well as new technologies and ideas, economic and social change in the region is inevitable.

ARDI implemented several projects in the marshlands that were targeted at economic development in what has long been one of the poorest and most isolated regions in Iraq. Animal production, especially of water buffalo, was a familiar activity for marsh dwellers, but the traditional food sources for animals disappeared when the waters receded. ARDI helped farmers find new ways to raise healthier and more productive animals. Farming is a new frontier for many marsh dwellers. ARDI introduced simple improvements for common crops such as okra and alfalfa. ARDI also helped rebuild the irrigation infrastructure,

and introduced low-cost, water-saving irrigation equipment to farm families across the region.

ANIMAL HEALTH

REHABILITATING VETERINARY CLINICS

ACTIVITIES

Livestock production has historically been an important source of food, materials, and income for marsh dwellers. Water buffalo are especially important to their economy, providing dairy products, meat and hides.. Buffalo dung is a major source of fuel for cooking. Although numbers of water buffalo are much smaller than sheep in the marshes, buffalo are particularly important animals in the marshlands culture. A single buffalo can be a marsh family's most important possession, and the animal's health critical to the family's ability to thrive.

ARDI rehabilitated four government-operated veterinary clinics in the marshlands that had fallen into disrepair. Such clinics are often the only source of veterinary care for breeders who cannot afford or do not have access to private clinics. In addition, these clinics coordinate national vaccination campaigns and provide treatment during disease outbreaks. The renovations were carried out by local construction companies that were selected through a competitive bidding process. Two of the clinics are located on the edges of the Basrah marshlands, and two are located in Thi-Qar.

RESULTS

Rehabilitation of the Shatrah Veterinary Clinic in Thi-Qar and the Al-Qurnah Veterinary Clinic in Basrah were complete by October 2004. The Al Dair Clinic in Basrah and Thi-Qar Veterinary Hospital were completed in 2006. The clinics treat large numbers of sheep and cattle as well as water buffalo. ARDI surveys in the region showed the number of breeders served by the two clinics increased by 38 percent, and the number of animals treated by the clinics went up by 33 percent. The rehabilitation projects helped raise the profile of the clinics with breeders in the area, as well as improve the quality and kinds of services provided by the clinics.

IMPROVING BUFFALO NUTRITION AND RATES OF REPRODUCTION

ACTIVITIES

In the marshlands, adult water buffalo are not usually slaughtered for their meat, but instead provide milk, butter, yogurt, cheese and other dairy products. Males are often used in agricultural activities and as draft animals. In the past, dairy products were sold outside the marshes and throughout the country. Today, water buffalo in the marshlands remain a primary source of protein for marsh dwellers, and as such are a major source of income for many families. The buffalo's value is largely dependent on the reproductive cycle of the animal, which determines calf and milk production.

Most buffalo owners nourish their animals on wheat bran and cotton seeds, and





in most cases on only small amounts of nutritious green roughages. This poor diet is one of the main causes of delays in puberty and long inter-calving period. This results in low calving rates and low milk production. Improvement of nutrition in female buffalo, both prior to mating and during the late gestation period, increases growth rates, ovulation rates (estrus) and calving.

ARDI's activities in this area focused on improving the health of female water buffalo to increase calf and milk production and reduce mortality rates, thereby increasing economic returns to breeders. ARDI selected some of the poorest breeders in the Basrah marshlands to participate in the program. These breeders fed their buffalo only low quality roughages and wheat bran, resulting in long inter-calving periods, delays in the onset of puberty, low calving rate, and general poor health.

Another intervention which ARDI demonstrated in the marshes used HGH (human growth hormone) to induce estrus and ovulation. Prolonged periods of high heat coupled with poor diet prevent the onset of ovulation without the HGH treatment. This lack of conception prevents pregnancy and lactation. With calving the female buffalo is not providing an income stream to the family through the sale of milk and milk products.

ARDI distributed a highly nutritious diet concentrate to the breeders to feed to their pre-mating and pregnant buffalo. One hundred pre-mating buffalo received the diet concentrate until mating, in order to stimulate ovarian activity and improve the chances of successful conception. One hundred pregnant buffalo received the diet during the last two months of gestation, in order to improve the birth-weight and health of the calves and increase their growth rate. ARDI technical staff monitored the progress of the activity.

RESULTS

Subsequent evaluation of the high-nutrition diet found that improved nutrition in pre-mating buffalo increased the percentage of buffalo that entered estrus and mated. The pregnant buffalo that received the concentrate diet also gave birth to heavier calves and are producing more milk than buffalo that did not participate in the program.

For an investment of \$86 in nutritional supplements, there is an expected increase in income of \$174 per calved buffalo, which includes increases in milk production and market weight of the calf. One hundred and five breeders participated in the buffalo nutrition program in the marshlands, and a number of field days extended the demonstration to other area breeders.

RESTOCKING FISHERIES

ACTIVITIES

Before the near-desiccation of the marshlands, fish was the primary source of food for the majority of marsh dwellers, and an essential part of their income. Daily fish catches are now only a fraction of earlier yields (3-8 kg vs. the pre-drainage average of 150-400 kg). Marsh families have been forced to seek other sources of income and food supply. This was a principal reason for migration out of the marshlands.

ARDI purchased nearly one million fish fingerlings from private hatcheries in Basrah and Babylon for release in the Basrah and Thi-Qar marshes. The first batch was released on July 3, 2006 to the Al-Hammar marsh in Basrah; it consisted of about 225,000 fingerlings of two major carp species, the common carp and the grass carp. Both are indigenous to the marshes and are in high demand by consumers. Four subsequent batches were released in July, including two additional indigenous species.

The bags of fingerlings were kept cool for the long journey to the release areas, where they were subsequently placed unopened in the water of the marshes to allow for a gradual adjustment to the warmer water temperature. The fingerlings were then released into shallow areas with protective aquatic vegetation supporting abundant food supplies. To avoid excess food competition and concentrated predation, the fingerlings were divided into small groups and distributed over a large area.

RESULTS

The releases were a success, with a high survival rate throughout both the transportation and distribution stages. As the restocking continued, ARDI conducted workshop and training activities for local populations to encourage proper management of the fish stocks. Increased awareness of harmful fishing methods will help ensure a stable future income for marshland fishermen. With this program, ARDI helped contribute to the return of marsh families who had been forced to migrate, in addition to helping improve their nutrition and income. An important part of the project was also to support private hatcheries, to encourage the production of cheap stocks of fish in the future.

CROP PRODUCTION

IMPROVING SORGHUM, ALFALFA, SUNFLOWER, MAIZE, AND OKRA PRODUCTION

ACTIVITIES

Historically, farming was not a major economic activity for most marsh dwellers. However, after their lands were drained, many marsh dwellers turned to agriculture in an attempt to earn a living. But there were few, if any, government extension services in the marshlands, resulting in a poor knowledge base for proper cultivation methods. In addition, agricultural productivity in these areas is poor, even where crops have been cultivated for a longer period of time. ARDI worked directly with farmers to introduce them to modern techniques for the proper cultivation of sorghum, alfalfa, okra, maize, and sunflowers, which are more commonly grown in the region and can be easily marketed during the summer months.

This project began with the collection and analysis of soil and water samples in the marshlands and using these data to select areas more suitable for production. ARDI then worked with farmers to establish 60 production plots (26 in Basrah, 16 in Thi-Qar and 18 in Missan) to demonstrate proper techniques of planting, cultivation, and harvesting to improve production both for income, as cash crops, and food supply as subsistence crops. For each of the five crops selected for demonstration, 12 one-acre plots were established. All of the





crops were planted during the spring, and throughout the growing season ARDI provided technical assistance on fertilization, weed control and harvesting.

Field days were held to demonstrate the effects of the improved cultivation techniques to other farmers in the marshlands. Area farmers observed the increased production obtained from improved practices, learned about the techniques to replicate those results, and became acquainted with agricultural specialists in the area with whom they can discuss the issues they face with crop production.

RESULTS

For all five crops, the introduced technology package demonstrated significant yield increases over traditional methods. Income increases, taking into account increased costs of production, ranged from 25% for maize to 80% for sorghum. The most promising results were seen with alfalfa. Alfalfa has proven to be a very economical crop in the marshland areas. It is possible to get 12 cuttings of alfalfa per year if the farmers are careful with plot leveling and the correct applications of fertilizers. Demonstration plots produced 12 cuttings a year as compared to only 6 cuttings taken with traditional methods. Each cutting produced in an average of 38 ton/hectare green fodder or 5.8 mt/ha dry fodder. The demonstration plots produced average annual yields of alfalfa of 456 mt/ha green fodder or 69.6 mt/ha dry fodder.

The gross revenue of farmers participating in the alfalfa demos was \$25,536 per hectare for green alfalfa and \$22,272 per hectare for dry alfalfa. This can be compared to average revenues of \$12,768 per hectare for green harvest and \$11,136 for dry harvest under normal conditions. Participating farmers experienced more than a 100% increase in revenue. Marshland livestock breeders will also benefit greatly from the increased production of alfalfa, which will serve as a source of fodder to improve the health and production of their animals.

ESTABLISHING AND RESTORING MOA DATE PALM MOTHER ORCHARDS AND NURSERIES

ACTIVITIES

Date production is a key component of stabilizing future income and employment opportunities for marsh dwellers and internally displaced people who were returning to the marshlands. ARDI assisted the Ministry of Agriculture's date palm production program by establishing 22.5 hectares of mother orchards and 10 hectares of nurseries in the Basrah and Missan marshlands area in 2005. During the previous year, ARDI established an additional 17.5 hectares of mother orchards in the two governorates, for a total of 38 hectares.

Date palm production in the marshlands has declined by half over the past decade as trees have gone out of production due to the general neglect of the orchards due to sustained military conflicts, draining of the marshes and lack of new stock to replace dead and aging trees. Many farmers were forced to abandon their lands to pursue other employment and those who stayed to cultivate date palms experienced declining productivity and income as existing







(above) Traditional reed structures in the marshes.

trees suffered damage from changing water regimes, or simply aged beyond their productive utility.

Beginning in 2004, ARDI contributed 83,000 offshoots to restock MOA mother orchards around the country. 16,000 of these offshoots went to mother orchards in the marshland region in the two governorates of Basrah and Missan. The MOA mother orchards will supply some offshoots directly to the farmers, though most will go to the nurseries for one year of further cultivation to increase their value and the likelihood of successful transplant. These will also be available to area farmers as they are moved out of the nurseries and replaced by new offshoots from mother orchards. The marshland mother orchards will have a capacity of approximately 48,000 offshoots per year, all of which will move to farmers fields either by direct transplant or through the nurseries.

To assure maximum productivity of the facilities, ARDI also rehabilitated the infrastructure of the mother orchards and nurseries, furnishing modern drip irrigation systems, pumps, pumphouses and water reservoirs.

RESULTS

ARDI's project to assist the Ministry of Agriculture to supply new date palm seedlings to farmers provides growers in the marshlands access to commercially desirable, high-value stock within a short distance of their groves. The productive capacity of Ministry mother orchards and nurseries will enable 2,400 date growers each year to replenish or increase their stock with 50 new trees.

REHABILITATING PRIVATE DATE PALM ORCHARDS

To promote date palm cultivation in the marshlands, ARDI worked with a local NGO to help 50 date palm farmers in Basrah replenish their existing orchards with high-quality, commercially desirable offshoots. The grant provided 40 offshoots to each farmer, which will enable each farmer to produce an additional 2,000 kg. of high-value fruit each year from the initial new stock. Technical specialists from the NGO worked with farmers to plant the offshoots using preferred methods, including the use of a rooting hormone to promote growth and fungicides to prevent disease. The NGO also held a workshop for farmers

(opposite page) Renewing the waterproofing on the longboat.



Date palm offshoots awaiting planting in marshland areas.



to learn proper care for the offshoots, date palm orchard maintenance, and the benefit of interplanting other crops (particularly pomegranate) among date palm trees to further increase agricultural production and income.

This project was intended to complement ARDI's work with the Ministry of Agriculture to build up the government's stock of high-value date palm planting material in mother orchards and nurseries. With the government providing a reliable source for high-value offshoots, farmers can begin to reinvest in their orchards.

RESULTS

The improved production of date palms in the marshlands will benefit the participating farmers, who can expect each of their offshoots to produce an average of 3.5 additional offshoots in the second year, or 140 per orchard. The farmers can either replant these offshoots on their own lands, or sell them to neighboring farmers for an average price of \$12 per offshoot. If the farmer has the available land, and replants the offshoots, each farmer would have 180 productive trees producing a minimum of 50 kg. of high-value fruit each year. Thus, in four years, each farmer could produce about 9,000 kg of dates per year, which would provide a gross annual income of \$5,000 to \$7,000. The farmer, of course, can continue to sell offshoots from mature trees, and provide neighboring farmers with new high-quality date palm varieties as well.

IRRIGATION

DISTRIBUTING FAMILY DRIP IRRIGATION KITS AND TRAINING FARMERS

ACTIVITIES

As with the rest of the country, efficient water use is one of the primary challenges facing farmers in the marshlands. To address this obstacle, ARDI introduced high efficiency family drip irrigation systems (FDIS). The systems work at very low pressure and can be gravity-operated, with no external power or electricity needed, making them ideal for rural and small-scale agricultural production. No specialized skill is needed to manage the low-tech FDIS, and they afford the farmer the same advantages as more sophisticated irrigation systems.

Thirty-three marshland farmers in Basrah, Missan and Thi-Qar received the systems and participated in the demonstration program. The farmers grow high-value horticultural crops such as okra and sunflower, which offer a larger return per hectare than typical dryland crops such as wheat. The drip system allows farmers to use the land for two cropping seasons in a year, which also increases their income.

RESULTS

With a modest investment for each FDIS system, which was equalled by the dramatic increases in production during the first year alone generates additional income for farm families. Growing interest in the FDIS generated by the initial demonstration projects motivated local entrepreneurs to produce their own systems at a lower cost of \$100 to \$120. These merchants also provide repair

services, helping ensure the long-term return from the farmer's investment. The distribution of these drip kits and the training of extension agents to provide irrigation scheduling assistance will significantly improve the productivity and income of small-scale farmers throughout the marshlands.

CLEANING CANALS

ACTIVITIES

Irrigation systems for adequate water supply and proper drainage are critical for farmers in the southern part of the country. Over the last fifteen years, government neglect has left many irrigation systems in advanced states of disrepair. Irrigation canals are often full of silt and weeds, which reduces or completely blocks the flow of water to the fields.

ARDI rehabilitated three tertiary canal systems blocked by silt and weeds, providing instant, tangible results to marshland farmers who cultivated lands fed by the network of canals. Two of the systems were in Basrah, and were meant to provide irrigation water to 3950 hectares and 1 624 farmers. The third system was in Thi-Qar, and affected 1,688 hectares and 280 farmers. The farmers in these areas grow mainly high-value, but irrigation-dependent horticulture crops such as tomato, okra and sunflower. The rehabilitation of the irrigation systems enabled farmers to return lands to cultivation that had been left idle for lack of water.



