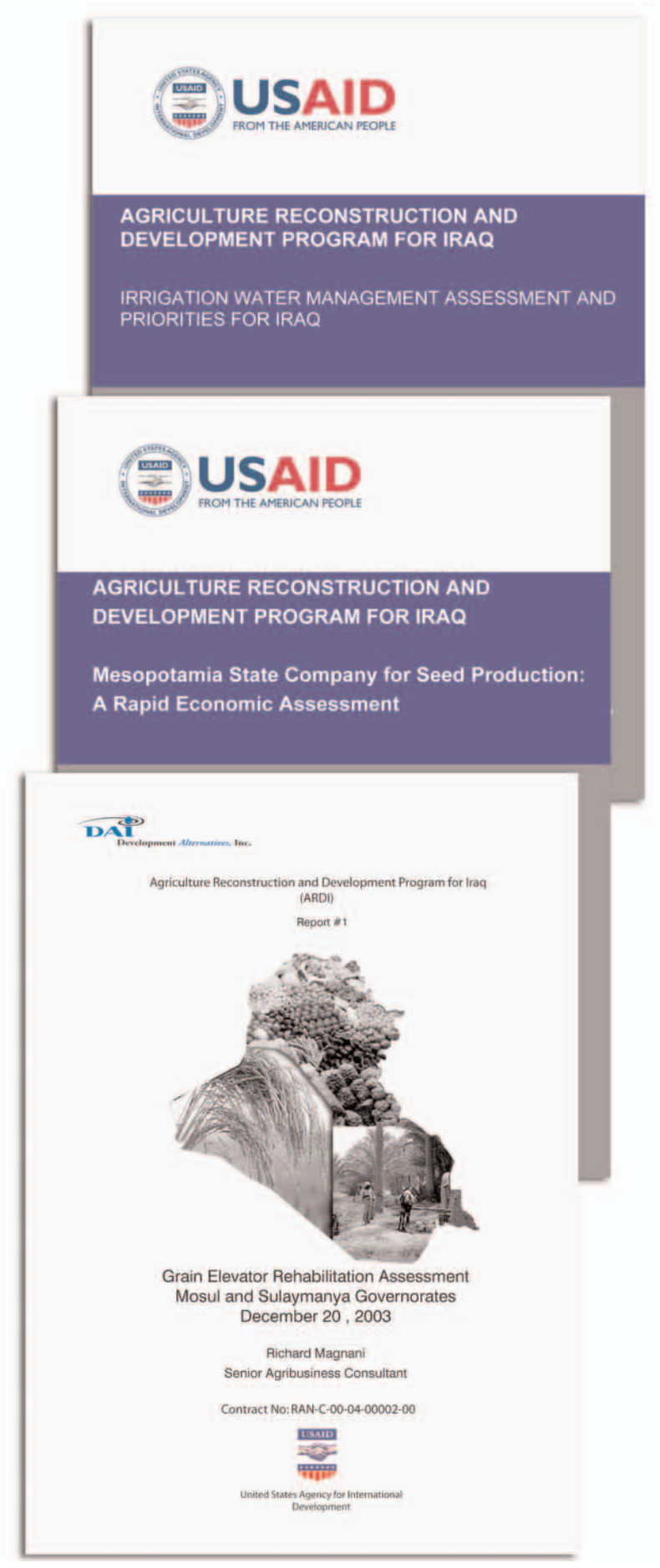
3.0 INSTITUTIONAL AND ORGANIZATIONAL IMPROVEMENTS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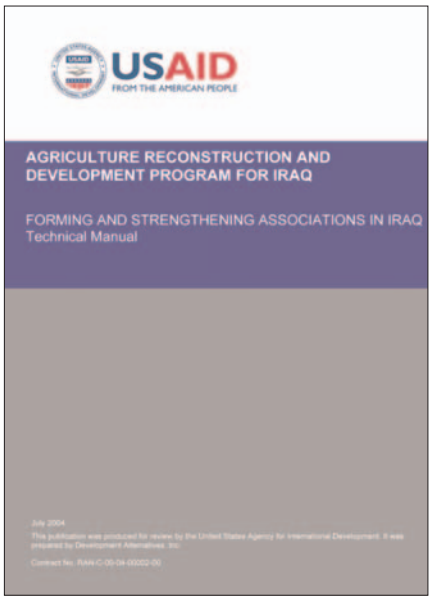
AGRICULTURE RECONSTRUCTION AND DEVELOPMENT PROGRAM FOR IRAQ
Mesopotamia State Company for Seed Production: A Rapid Economic Assessment
DAI
Development Alternatives, Inc.
Agriculture Reconstruction and Development Program for Iraq (ARDI)
Report #1
Grain Elevator Rehabilitation Assessment
Mosul and Sulaymanya Governorates
December 20 , 2003
Richard Magnani
Senior Agribusiness Consultant
Contract No: RAN-C-00-04-00002-00
USAID
United States Agency for International Development

3.1 CAPACITY DEVELOPMENT IN THE AGRICULTURE SECTOR

Seasonal fruits and vegetables in a typical market stall.

Iraq's transition from a centrally-planned to a market-based economy has changed the Government's role in the economy. The Government is reducing its direct intervention in commercial activity, and instead is working to promote private enterprise through the creation of an environment that will permit the growth of stable and transparent markets. The role of individual economic agents (producers, buyers, and sellers) is also changing. Instead of following directions sent from the Government to conform to a central economic plan, producers, buyers, and sellers must make business decisions based on economic factors that most directly affect their activities.

Although the Government has reduced significantly its direct intervention in commercial activity, it nonetheless has an important role to play to ensure the general health of the various economic sectors, including agriculture. In order to promote the agriculture sector, the Government must support an efficient



market in which private business, including farming, can flourish; provide assistance to economic agents, including producers and consumers of agricultural products, to help them make good business decisions based on economic factors; and provide assistance to the agricultural sector to promote and support agricultural production when necessary.

As the Government is shedding its direct production and marketing activities, a vibrant and enthusiastic private agribusiness sector is developing to take over leadership in these areas. This emerging private sector, though still weak, has great potential to provide the foundation for growth and development of agriculture.

ARDI implemented a variety of programs to assist both the Government of Iraq and the private sector to make the transition to a market-based economy, in order to strengthen the agricultural sector. We provided assistance to build capacity within the Government to support efficient market mechanisms, with an emphasis on collection and dissemination of production and marketing information. We also worked with private sector groups, including NGOs, cooperatives, and associations to strengthen their capacity to contribute to reconstruction and development of the agriculture sector.

ARDI implemented private sector development activities in coordination with projects to improve agricultural production of agronomic crops, high-value agriculture, and livestock production. This section contains references to other parts of this report, where those activities are discussed.

AGRICULTURAL INFORMATION

Crop cutting to estimate wheat yields in Sulaymaniyah governorate

The wide dissemination of market data to all economic agents is an essential element of a stable, efficient market. Asymmetrical possession of market information by those who have the means to collect it through private networks leads to market distortions and failures. A public system of collection and dissemination promotes broad participation in market activities, and also reduces the cost of multiple private networks for data collection.

In the agricultural sector, information on market prices and production levels is useful to farmers, consumers, and traders making business decisions. A public system of data collection and dissemination ensures that all economic agents have access to these data, so that the market works efficiently.

A public system of information dissemination also provides the Government with the data necessary to assess the health of economic subsectors and plan assistance programs. In the agricultural sector, the collection of data about prices,

production, land use, crop suitability, and other factors that affect agricultural production are useful in planning efficient and effective assistance programs, whether through extension activities or targeted support projects.

To increase the ability of the GOI to improve the efficiency of the market though agricultural information and dissemination, ARDI provided technical support, tools, and capacity-building programs in surveys and statistics, agro-ecological zone mapping data collection, agro-meteorological networks, cadastral land mapping, and a strategy for water and land management. In addition, ARDI implemented a separate program, through the private sector, for wholesale market price data collection and dissemination.

Precise cuttings and measurements are essential for accurate crop forecasts.

ESTABLISHING STATISTICS UNITS IN THE MINISTRY OF AGRICULTURE

When ARDI began working with the Ministry of Agriculture in late 2003, the responsibility for collecting, analyzing, and disseminating data for all of Iraq's economic sectors rested with the Ministry of Planning. This ministry conducted agricultural surveys for winter and summer crops each year. Accompanied by a staff member from the MOA, surveyors traveled to nearly every village in the country, where they gathered data from on-farm interviews. Because of the labor intensity of this collection method, survey results were often issued two or three years late and thus had little direct benefit for planners or farmers.

The Ministry of Agriculture's own statistical capabilities were constrained by a lack of staff, facilities, and expertise. Its head statistical office in Baghdad did not have enough staff for field visits, so it would request estimates from MOA subdistrict offices, the staffs of which would go to the field and talk directly with farmers. This method of collecting data was piecemeal, and did not produce reliable or comprehensive results.

Within the GOI, ARDI assisted the MOA to establish a main Statistics Unit office in Baghdad, to assume the main responsibility for collecting, analyzing, and disseminating data for the agricultural sector which is now staffed by approximately 25 trained employees. The Statistics Unit also maintains branch staffs, with approximately 5 employees in each governorate. We supplied these governorate offices, which had been looted or destroyed in 2003, with computing equipment, internet connectivity, telephones, software, and reference materials.

The transfer of methodologies and training were two other important components of establishing these units. The MOA's traditional method of collecting data consisted of village-level surveys, which often yielded scattered data, and complicated the process of drawing meaningful results or conclusions. Beginning with the 2004 crop surveys in Babylon and Diyala, ARDI introduced new sampling methodologies to the Statistics Units. We also provided assistance in the design of survey tools and questionnaires, the provision of equipment, and logistical support for data collection. Most frequently this took the form of vehicles to carry enumerators to the fields. Some MOA offices had no vehicles at all, while in areas, cars recognized as belonging to the Government would be targeted for violence.

In 2005/2006 ARDI presented the MOA with a more sophisticated sampling technique: Area Frame Sampling. This sampling method, which was developed by the US Department of Agriculture, uses both high-resolution satellite imagery and field surveys. It is currently a standard method for collecting agricultural statistics in the US

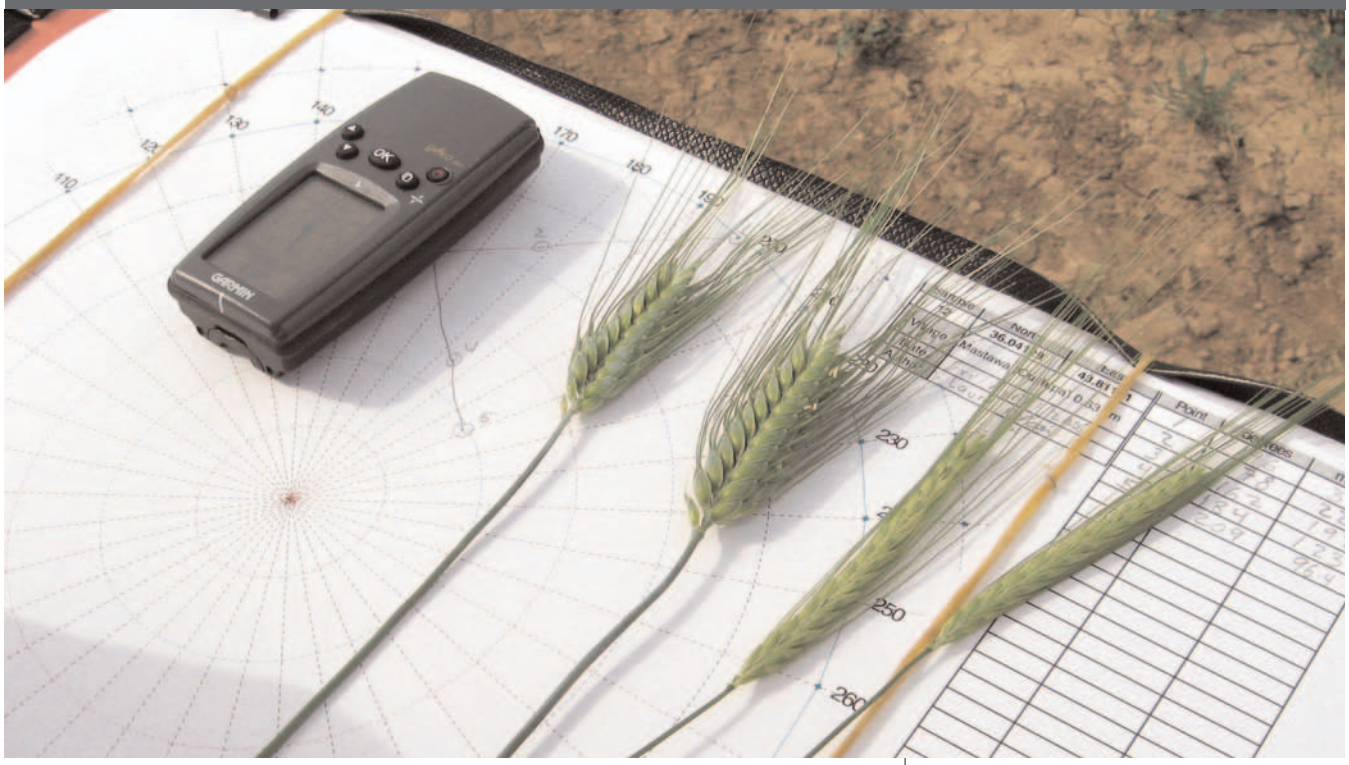
As part of ARDI's technical assistance to the Statistics Unit, we trained about 425 individuals from MOA offices in six governorates in survey enumeration techniques. Training included such subjects as survey methodology, random sampling procedures, and survey administration. Staff involved with data processing tasks received training in Excel, Access, and other data management software programs.

RESULTS

MOA Statistics Units from all of Iraq's governorates are now furnished with basic equipment, have been assigned additional staff, and are fully functional. Armed with new survey methodologies, appropriate tools, and better-trained staff, these units are able to provide timely, good-quality data to both public and private decision makers throughout the country.

In its published reports, the MOA's Baghdad Statistics Unit publicly acknowledges ARDI assistance in building its survey and statistical capabilities. The unit prefaces its reports with an announcement of its intention to conduct annual surveys for all agricultural activities in all of Iraq's governorates beginning in 2007.

CONDUCTING AGRICULTURAL SURVEYS



Surveys involved actual field crop sampling, measuring, and georeferencing.

AGRICULTURAL SURVEYS

ARDI sponsored 14 agricultural surveys for both crops and livestock, which were conducted by MOA personnel. We also introduced a statistical procedure known as Area Frame Sampling to improve the accuracy of winter crop estimates.

TABLE 77 AGRICULTURAL SURVEYS

Activity	Number of Projects	Projects Primary Beneficiaries
Winter Crops	4	3 in Dahuk, Erbil, and Sulaymaniyah governorates for the 2004/2005 planting season 1 in Dahuk, Erbil, and Sulaymaniyah for the 2005/2006 planting season
Agricultural Production	2	2 in Babylon and Diyala for 2003/2004 and 2004/2005
Area Frame Sampling	1	1 Introduction of Area Frame Sampling
Summer Crops	1	1 in Sulaymaniyah for the 2005 crop season
Sunn Pests	2	2 in Dahuk and Erbil for 2005
Poultry Production	3	2 in Erbil, Dahuk and Sulaymaniyah for 2005 1 in Baghdad for 2005
Livestock and Dairy Production	1	1 in Sulaymaniyah for 2005
Beekeepers	1	1 in Diyala for 2005

WINTER CROP SURVEYS

BACKGROUND

The demand for wheat, which has long been the mainstay of the agricultural sector, has fallen dramatically in the past decade, primarily as a result of the Oil-for-Food Program, which distributed imported wheat free of charge to the entire population of Iraq through the PDS. The lowered profitability of wheat in the form of bread flour, in turn, has led to deteriorated grain quality. As farmers' income plummeted, fertilizer and herbicide use declined, resulting in the proliferation of weeds and poor-quality grain. This reduced yields further, and led to large areas being left fallow.

Winter Crop Surveys of wheat and barley can determine area planted to crops, gather information on production methods and variables, and measure crop yields. This information can assist the Ministry, traders, and private farmers to take effective steps to reverse the decline in grain quality and yields

ACTIVITIES

MOA staff conducted three surveys to examine the trends in winter crops (primarily wheat and barley) for the 2004/2005 planting season in Dahuk, Erbil, and Sulaymaniyah governorates. In 2006, they resurveyed winter crops in the same governorates for the 2005/2006 planting season.

The surveys collected data on cropland area and planting trends, output, and

production costs of wheat, barley, and other important staples such as chickpeas, lentils, and winter vegetables. The focus was on wheat and barley because of their dominant role in Iraq as a food source for both humans and livestock. These two crops are also a major source of cash for farmers, and generate additional income and employment in the manufacturing sector.

RESULTS

The principal findings of the surveys included:

Cropland areas. Almost 880,000 hectares were planted to winter crops in the three northern governorates in 2004/2005. Barley was the main crop in terms of area planted, accounting for 49% of the region's cultivated land. This was a somewhat surprising result because wheat (42% of cultivated land) has long been considered to be the region's principal source of food. The survey also revealed that 39% of the governorates' total arable land was not planted during the winter season. The 2005/2006 survey showed little change in cropping patterns, with 48% of the region's land planted to barley and 42% planted to wheat.

There are several reasons that may explain this trend toward increased barley planting. First, barley is more drought-tolerant than wheat, which is sensitive to water stress. As the 2005/2006 survey showed, the ratio of barley to wheat increases in districts with less rainfall. Second, barley is also more resistant to Sunn pest and diseases such as smut. Third, the production costs of barley are lower because this crop requires less fertilizer and inputs. Last, although the price for barley is less than the price of Grade 1 wheat, it is about the same price as Grade 3 wheat. At most, one-third of the wheat produced in Iraq is Grade 1 or 2; the rest is used for poultry or livestock feed.

Planting trends. The areas planted to wheat and barley in the three northern governorates changed a great deal between 1990 and 2005, which may be largely attributable to overall economic and policy conditions. The area dedicated to wheat increased rapidly in 1990/91 following the threat of economic sanctions against Iraq. During sanctions, the government kept production in this area at nearly double the prewar levels, while barley continued to decline.

Under the UN Oil-for-Food Program, which began in 1997, wheat was imported and distributed free in the form of bread flour to the entire population through the PDS. The reduced demand for domestic wheat was followed by reduced wheat plantings, while areas planted to barley, chickpeas, and other crops increased. By the 2004/2005 MOA/ARDI survey of winter crops, barley cultivation had increased to 431,914 hectares, slightly exceeding the total area planted to wheat in the three governorates.

By 2005/2006, however, the areas planted to both wheat and barley declined. For wheat, this was the continuation of a decade-long decline, while for barley, it was the reversal of an upward trend that began in the 1996-1997 season. The reduction in area planted reflects the increased competition faced by farmers as the government withdrew subsidies, and a trend toward migration to urban areas.

Wheat harvesting in Erbil governorate

Yields and production. On average, the yields for barley in 2004/2005 (665 kg/ha) were lower than those for wheat (803 kg/ha), because of multiple reasons: barley is grown in areas of less rainfall, less fertilizer and pesticide are applied, improved varieties have not received as much attention, and farmers usually save barley seed from their previous harvest rather than purchasing more vigorous seed.

The 2005/2006 survey found that wheat and barley yields increased substantially from the previous year: to 1,160 kg/ha for wheat and 832 kg/ha for barley. The probable reasons for these increases include better distribution of rainfall, improved seeds as a result of ARDI's seed cleaning program (see Section 2.1), and increased access to such inputs as pesticides, fungicides, and fertilizers.

TABLE 78 WHEAT AND BARLEY PLANTED AREAS IN DAHUK, ERBIL AND SULAYMANIYAH 1989/1990 - 2004/2005

Period	Crop Years	Wheat (ha)	Barley (ha)
Baseline Year	1989/1990	295,579	278,611
Kuwait Invasion	1990/1991	806,359	168,337
Economic Sanctions – Trade Embargo	1991/1992	473,550	175,362
	1992/1993	562,519	122,898
	1993/1994	536,664	145,366
	1994/1995	563,739	147,378
	1995/1996	455,777	112,234
Oil for Food Program	1996/1997	363,439	94,426
	1997/1998	327,419	138,177
	2000/2001	305,002	227,269
	2001/2002	417,687	264,069
Regime Change	2004/2005	372,170	431,914
	2005/2006	337,500	391,493

Ministry of Agriculture for the years 1989/1990 to 1994/1995; UN-FAO for 1995/1996 to 2001/2002; and ARDI and Ministry of Agriculture for 2004-2006.

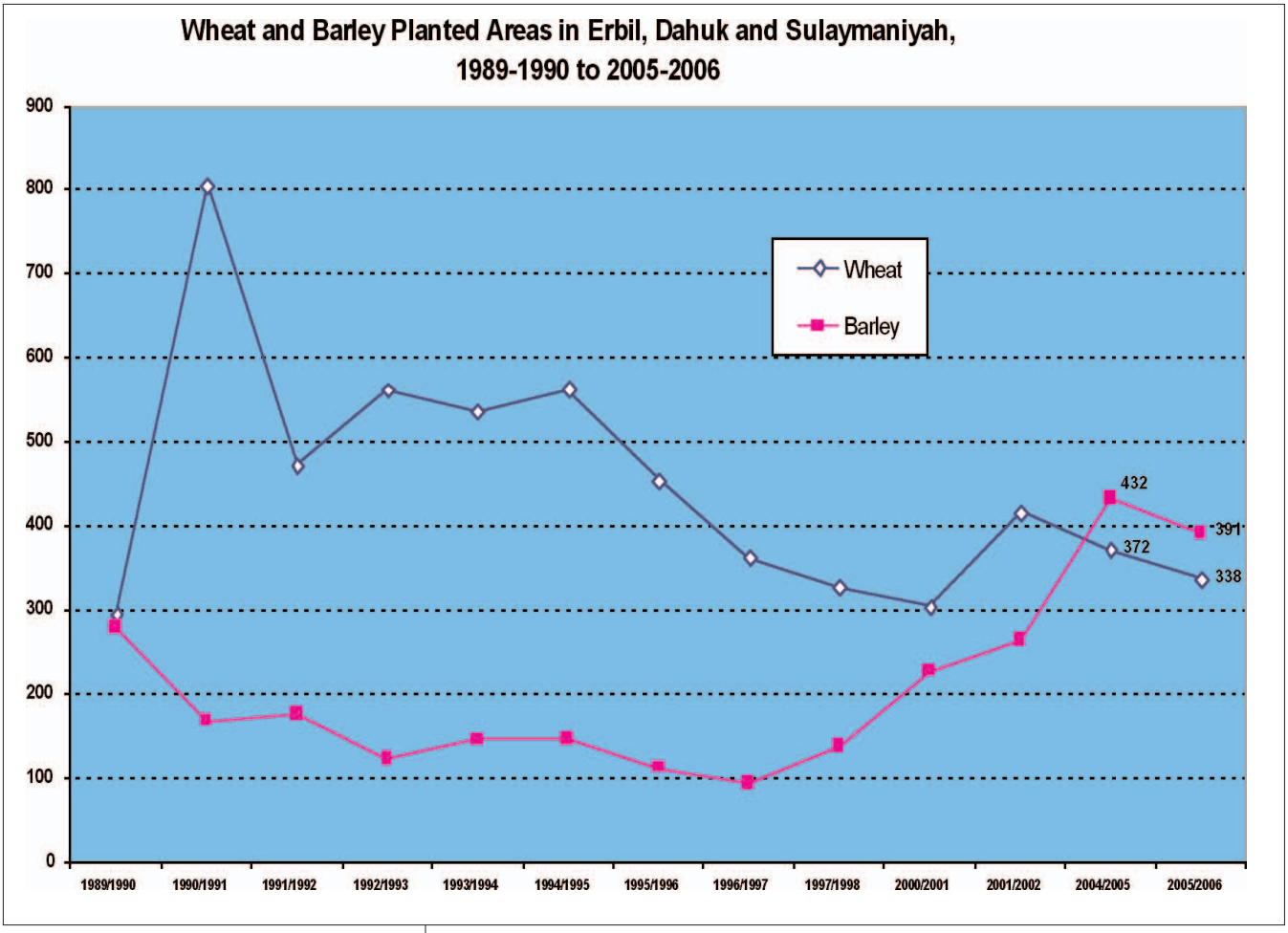
Estimating the yield for wheat in Sulaymaniyah during the 2005/2006 winter crop survey

Production costs. In a survey subset of the northern governorates' villages and fields, farmers were asked to provide information on production costs. Those costs included cash spent for services (e.g., machinery rental, transportation, and marketing activities) and inputs (e.g., seed, fertilizer, pesticides, labor). Wheat was reported as having the highest production costs in all three governorates.

Harvesting was the largest component of production costs in all three governorates, with hand harvesting being at least three times the cost of mechanical harvesting. The amount spent on fertilizers (urea and DAP) and pesticides, on the other hand, was remarkably low; farmers use only small amounts due to their high cost. 42% of the region's wheat farmers and 84% of its barley farmers do not use any fertilizers.

TABLE 79 WHEAT AND BARLEY PRODUCTION COSTS, NORTHERN GOVERNORATES, 2004/2005 (IRAQI DINARS PER HECTARE)

	Dohuk		Erbil		Sulayminayah	
Cost	**Wheat**	**Barley**	**Wheat**	**Barley**	**Wheat**	**Barley**
Plowing and Seeding	27,816	26,800	25,168	24,864	24,572	24,536
Seed	28,928	24,868	28,108	24,132	30,072	22,620
Fertilizer	14,736	1,060	17,240	6,820	13,812	4,764
Harvesting	23,768	44,792	43,916	53,148	48,676	44,168
Weed and Pest Control	2,412	236	1,240	952	2,348	568
Other Costs	18,924	4,748	28,504	14,328	25,584	10,388
Total Costs	114,172	107,980	144,176	124,244	153,064	107,044



Destination of crop production. The survey questioned farmers about their main uses of production, both on and off the farm. They reported that 64% of wheat is marketed, and 15% is kept as seed for the next planting season. Only 5% is kept for family consumption (farmers also receive free flour under the PDS), while around 4% is kept for animal feed. In contrast, around 25% of the barley crop is used for fodder or feed grain, while 20% is kept as seed and 46% is sold. An even smaller fraction (0.2%) is consumed by families.

TABLE 80 CHANGES IN CULTIVATED AREAS, BABYLON, AND DIYALA 2003/2004 TO 2004/2005

Governorate	Available Area (hectares)	Cultivated Area (hectares)		Available Area Cultivated (percent)	
		2003/2004	2004/2005	2003/2004	2004/2005
Diyala	475,964	181,392	192,002	38.1	40.3
Babylon	227,033	n/a	117,152	n/a	51.6

Sunn pest incidence. During the 2004/2005 survey, enumerators took samples of wheat grain from farms they visited in the three northern governorates. On average, about 17.2% of the wheat was found to be damaged by Sunn pests. This has important economic consequences, as a rate of only 3% Sunn pest infestation can render wheat unsuitable for making flour (see Section 2.1 for discussion of ARDI Sunn pest control activities).

AGRICULTURAL PRODUCTION SURVEYS

In view of the large differences among crop estimates from different sources and from year to year in Babylon and Diyala, policy makers and private sector decision makers needed earlier and more accurate estimates of area planted to the main cereal crops in these two important grain-producing governorates. To achieve this, ARDI helped the MOA Statistics Unit staff to conduct a pilot survey in Babylon and Diyala for the 2003/2004 cropping season. In late 2004, they re-surveyed the same locations. In Diyala, field crops (wheat, barley, rice, cotton, sunflower, potatoes, tobacco, groundnuts, and sesame) predominated, while fruits and vegetables (broad beans, tomatoes, cucumbers, etc.) for the Baghdad market are mainly grown in Babylon.

ARDI helped the MOA design a questionnaire to capture information from farmers on crops, varieties, types of irrigation, month and area planted, area harvested, total production, yield per hectare, quantity sold, and average price. The questionnaire also included queries on the area planted to different types of crop as well as the area left fallow during the past year and the reasons it was left uncultivated.

Both surveys adopted a straightforward approach to the problem of collecting crop data quickly and accurately. Ten percent of the farmers in each governorate (about 6,000) were selected as the sample population. Samples were drawn from the same population in both surveys to ensure that the results were comparable.

RESULTS

The results for the 2003/2004 survey are tentative for two reasons. First, when the Iraqi government changed hands in the summer of 2004, government-owned estates on which many of the industrial crops in the country's irrigated areas were produced (e.g., cotton, sunflowers, maize) were abandoned. This had serious negative consequences for the production of these crops. Second, the survey was a retrospective one (it was conducted in late 2004), and asked farmers to recall what they had planted nearly a year earlier. This likely affected the accuracy of the estimates.

The results reveal that slightly more land was under cultivation in the 2004/2005 planting season. However, the percentage of land cultivated was still lower than expected. When asked why they left their land fallow, farmers gave the responses as appearing on the followng page:

FARMERS' REASONS FOR NOT PLANTING WINTER CROPS

BABYLON

Reason	Percent
Lack of Fertilizer	66.9
Low Prices in the Market	41.9
Lack of Pesticides	35.5
Area Planted to Summer Crops	32.7
Machinery Problems	31.8
Soil Problems (e.g., salinity)	30.7
Lack of Irrigation Water	44.8
Seed Problems	22.8
Other (e.g., input costs)	11.2

DIYALA

Reason	Percent
Area Planted to Summer Crops	52.6
Lack of Irrigation Water	45.6
Lack of Fertilizer	19.6
Soil Problems (e.g., salinity)	13.1
Lack of Pesticides	7.2
Machinery Problems	4.7
Seed Problems	4.4
Low Prices in the Market	3.0
Other (e.g., input costs)	11.1

Several of the reasons cited for lack of inputs (e.g., fertilizer, pesticides, irrigation) apparently stemmed from farmers' inability to pay for them. For example, farmers did not have the money (or did not find it cost-effective) to pay for the fuel required to pump irrigation water.

MONITORING WHOLESALE MARKET PRICES

Dahuk wholesale market

BACKGROUND

Farmers make decisions about the types and amounts of crops they grow based on the prices they expect to earn for their products, against what they must pay for their inputs. Knowledge of market prices is also critical for traders to make decisions about when and where to buy and sell their products. Public officials also need price information for policy analyses and decisions.

Before 2005, Iraq had no mechanism for determining prices in the markets and disseminating this information to the public. ARDI instituted a simple yet effective system for collecting price information on a wide variety of wholesale market products and disseminating it to Iraqi producers and consumers. The daily and weekly reports that the ARDI Wholesale Market Price Project produces on fruits and vegetables, animal products, dry goods, and agricultural inputs are the only such reports published in Iraq, and they have received wide attention throughout the country.

Wholesale markets were monitored in all governorates.

ACTIVITIES

This project began when ARDI representatives visited several markets in northern Iraq to get a picture of their structure, the produce available and its quality, and commodity prices and their determinants. They first visited the Erbil wholesale produce market, a warehouse-type facility that houses about 100 stalls that wholesalers rent for a fixed price. Importers and local farmers bring produce to the wholesalers, who in turn sell it to local distributors and supermarkets. The volume of fresh produce sold through these markets in the summer months is about twice the volume sold in the winter months.

WHOLESALE MARKET MONITORING

Like many markets in Iraq, the Erbil market is jointly managed by the Ministries of Agriculture and Municipalities. A committee from these institutions is charged with setting and adjusting daily prices according to perceived market value.

ARDI technical staff next visited a similar central market in Sulaymaniyah governorate and privately owned and managed greengrocer market in Dahuk governorate. They found that the infrastructure in all three markets was weak, with inadequate sanitation, refrigeration, sorting and packing facilities, and storage space. For these reasons, it is not uncommon for wholesalers to throw away about a quarter of the produce that enters the market.

Farmers in all three markets deliver their produce directly to the wholesalers, who sell it on a commission basis. Farmers bear all price and sales risk, and the wholesalers in the public markets typically charge a 5% commission for all produce sold.

The team also visited the largest greengrocer facility in Dahuk, which houses 196 grocers under one roof. Although the facility is old and has limited space, its market area is clean and virtually all of the produce on display is of high quality. Mid- and low-quality produce is not displayed, but is available to consumers. The typical grocer margins are 25% of the wholesale price.

With a good picture of these markets' pricing and structure, ARDI price monitors began visiting wholesale markets at 6 a.m. every day, when retail vendors are purchasing their stock. They consulted five to ten principal vendors at each market and collected data on selected produce, including its origin and price per kilogram. They then sent the price information electronically to the ARDI project office, where it was organized into a daily price bulletin which was, in turn, sent out to subscribers throughout the country.

In May 2005, ARDI issued its first daily report on wholesale market prices for fruits and vegetables. Available in both Arabic and English, the report provided the high and low prices paid that day for 42 fruits and vegetables in the three northern governorates of Dahuk, Erbil, and Sulaymaniyah. The daily reports, which are issued by 12 p.m. on Sunday through Thursday, are consolidated into monthly reports of average prices. By January 2006, the reporting system has been greatly enlarged to cover major markets in all 18 governorates.

The monitoring system continued to expand, and reports on wholesale prices for dry goods, animal products, and agricultural inputs became available in October 2005. These reports are issued on Saturdays because the prices for the

products tend to be less variable than those for fruits and vegetables.

Prices for several varieties of fruits and vegetables (e.g., red, green and yellow apples) were reported. In addition to local prices, those for imports (e.g., apples from Chile, Iran, Lebanon, Morocco, South Africa, Syria, Turkey, and the USA) were reported for the purpose of comparison.

The daily and weekly reports were first distributed to wholesalers, retailer and farmers in two forms. The project disseminated reports via e-mail to hundreds of people who subscribed to this free service, and ARDI monitors brought hard copies of the previous day's reports to the wholesale market each day.

But as the word of this service spread, growing numbers of traders were requesting price information, and most of them did not have easy or quick access to e-mail. The next step was to work with television and radio stations to broadcast the price reports to a wider audience. On December 19, 2005, Basrah

TABLE 81 AGRICULTURAL PRODUCTS MONITORED BY ARDI

Fruits	Fruits	Dry Goods	Animal Products	Agricultural Inputs
Apples	Beets	Barley	Beef	DAP
Apricots	Broad Beans	Chickpeas	Chickens	Phosphates
Bananas	Cabbage	Cooking oil*	Eggs	Urea
Cherries	Carrots	Flour*	Fish	
Coconut	Cauliflower	Lentils	Milk	
Dates	Cucumbers	Maize	Mutton	
Figs	Eggplants	Rice*		
Grapefruits	Garlic	Sugar		
Grapes	Green beans	Wheat		
Kiwi	Lettuce			
Limes	Okra			
Loquat	Onions			
Oranges	Peas			
Melons	Peppers			
Olives	Potatoes			
Peaches	Spinach			
Pineapple	Squash			
Pears	Swiss Chard			
Plums	Potatoes			
Pomegranates				
Strawberries				
Tomatoes				
Watermelon				

* Cooking oil, flour, and rice are part of the public distribution system's food basket; ARDI monitors their prices in both this system and the commercial market.

Radio, which reaches from Basrah to just south of Baghdad, made the first radio broadcast of the daily price bulletin. It reports prices every morning at intervals during its 10 a.m. news program.

The wholesale price program was able to expand its coverage again in January 2006, when it began sending price information to traders by short message service (SMS) via mobile phones. The SMS service allows traders to receive information targeted to their specific needs without having to be at the market daily or near a radio or television at a specific time. Traders simply gave ARDI their mobile phone numbers and the main products they trade. The project then sends a message to their mobile phones with price information on these crops from all 15 governorates.

SUCCESS STORY

WHOLESALE PRICE REPORTS INFLUENCE MARKET BEHAVIOR

Peach and apricot orchards are common in the Dahuk governorate, and during the peak harvest season farmers need to develop additional market outlets for their production. ARDI's wholesale market price reports give early warning signals to interested traders throughout Iraq when local supplies in a region exceed consumption.

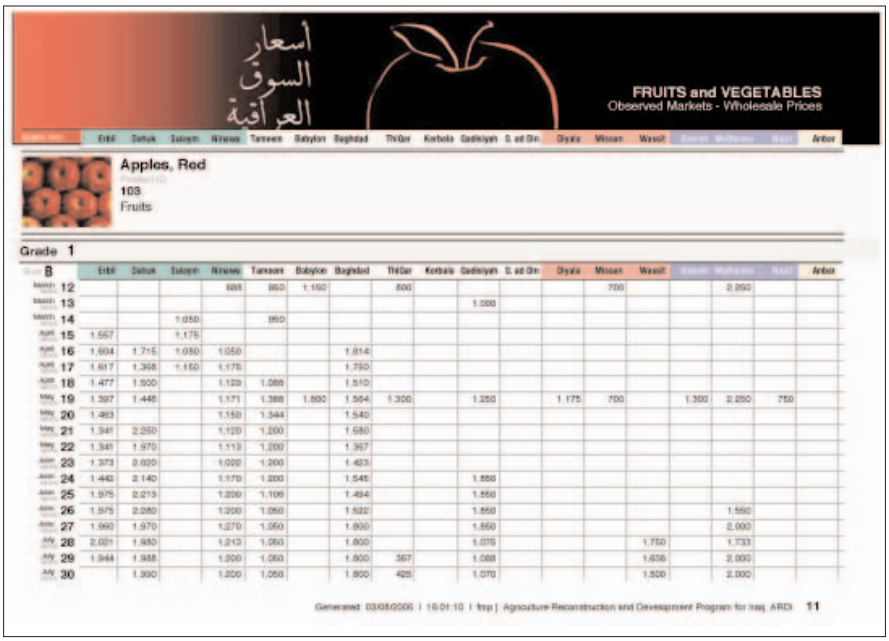
Traders in Dahuk reported that a Baghdad trader came to their market in July 2005. The trader had learned from ARDI's daily price reports that wholesale prices for peaches and apricots were lower in Dahuk than other markets.

Dahuk traders, in turn, noticed that banana prices in their city were consistently higher than those reported in Mosul, even for the same bananas imported from Ecuador. After some investigation, they switched from their Baghdad-based supplier to an agent in Syria, who was supplying Mosul markets at lower cost.

RESULTS

For the first time, Iraq's traders and farmers have access to agricultural price data that helps them make informed decisions about buying and selling produce. The number of people subscribing to ARDI's pricing reports grew to over 200 e-mail subscribers and 280 SMS subscribers by September 2006.

This program formed the foundation of a nationwide price information system for traders and farmers in Iraq. Recently, the MOA indicated that it would like to begin distributing the prices through its Media Unit and publish the reports in weekly newspapers.



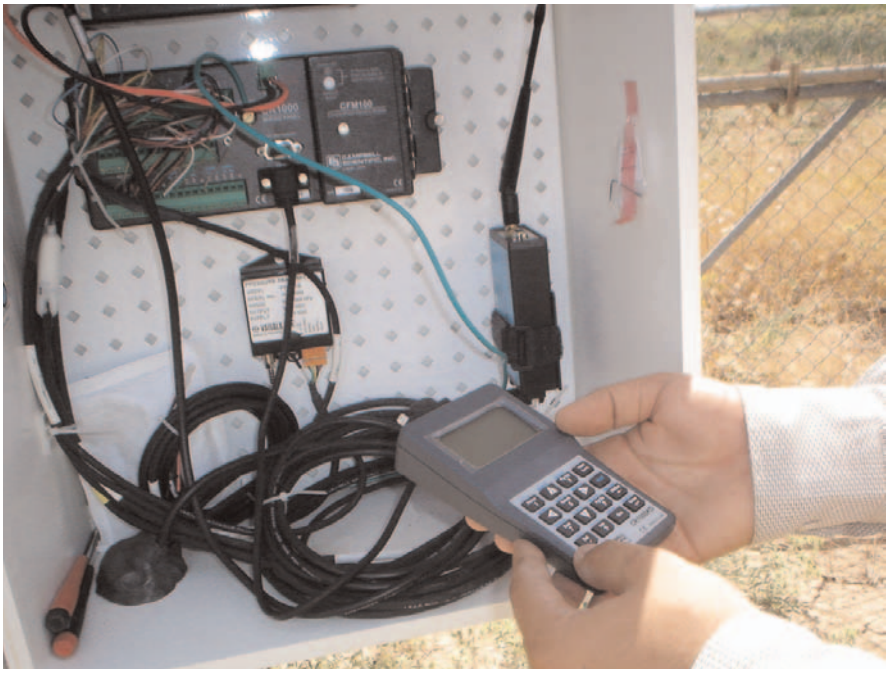
Sample page from a weekly wholesale price monitoring price report, available via web, email, or SMS.

AGRO-METEOROLOGICAL NETWORK

Assembly of a control box for the automated weather stations.

Iraq has extensive arable lands suitable for irrigation, but also a long history of irrigation-related problems and increasing competition for limited water resources, so Iraqi farmers must improve practices for irrigation agriculture and water management. In order to do this, the GOI needs improved data on water use, water demands by crop, and relevant environmental factors. ARDI assisted the GOI to implement a national-scale agro-meteorology program to improve their capacity to collect this data and implement improved water management practices.

Reconstruction and modernization of the existing meteorological monitoring programs was a key element in the establishment of Iraq's agro-meteorology program. Previously, Iraqi meteorological data providers lacked sufficient capacity to collect, manage, analyze, and disseminate data needed to support an agro-meteorology program. GOI staff required training and experience operating



An automatic weather station control box with data logger.

automated data acquisition instrumentation, processing electronic data, analyzing meteorological data and agro-meteorological applications. In addition, the existing network of weather stations and other data collection instruments needed to be updated with modern equipment.

In 2005, ARDI conducted an assessment of the existing agro-meteorological network in Iraq, to determine the status of existing networks, local needs for weather information and weather-based products for agricultural management, internal capability, and potential benefits of this program to Iraq and national interest. Based on this assessment, ARDI determined needs for hardware and for staff training.

An automatic weather station with a solar collector which provides power in remote locations.

One of the main accomplishments of the agro-meteorology project was the establishment of the National Agro-meteorological Steering and Coordination Committee, which included a designated representative from each participating ministry and institution: Minister of Agriculture- Baghdad (State Board of Extension); Minister of Transportation- Baghdad (Iraqi Meteorological Organization); Minister of Environment- Baghdad (Director General of Planning and Technology); Minister of Water Resources- Baghdad (Director General of Management); Minister of Water Resources- North (Director General of Irrigation and Water Resources); Minister of Agriculture-North (General Director of Agro-meteorological Programs); Iraqi Meteorological Organization-North; Minister of Environment- North; and the University of Baghdad.

The purpose of the Committee is to coordinate weather data collection for agro-meteorology; coordinate weather data exchange between the various ministries as well as other organizations; develop an agro-meteorological information program; support training and education; and guide agro-meteorological research. It was especially important that the steering committee take ownership of the National Agro-meteorology Program, so that it can continue to coordinate all agro-meteorological efforts in Iraq. The objectives of the committee can only be met if there is close collaboration between agricultural, hydrological, and meteorological interests.

Extensive hands on training exercises introduced participants to the practical aspects of database management for weather data.

In addition to forming a Steering and Coordination Committee, training was an important element of the Agro-meteorology program. ARDI carried out the following training program:

- Introduction to automated data acquisition. This was a preliminary workshop that introduced the concepts and equipment used for automated data acquisition. Two, two-day sessions were completed in November 2005. Attendees included 58 trainees from the Iraq Ministry of Agriculture, Iraq Ministry of Transportation, Kurdistan Regional Government (KRG)-Ministry of Water Resources and KRG-Ministry of Agriculture and Irrigation.
- Introduction to database processing. This was a preliminary training workshop that introduced concepts of using databases for data management focusing on Microsoft Access database software. Two four-day training sessions were completed in March 2006 and included 59 trainees from the Iraq Ministry of Agriculture, Iraq Ministry of Transportation, Iraq Ministry of Water Resources Kurdistan Regional Government (KRG)-Ministry of Water Resources and KRG-Ministry of Agriculture and Irrigation.
- Database processing and automated meteorological data acquisition. This was a follow-up workshop to the database processing workshop. The training focused on using database processing for management of meteorological data, including generation of reports and preparing data for analysis with other applications, including spreadsheets. There were two workshops, of two and one-half days each, for the 59 trainees who attended the previous database processing session.
- Operation and maintenance of automated weather stations. This workshop provided operation and maintenance training for the 19

automated weather stations provided by ARDI. Two workshops of five and one-half days each were conducted, with 15 participants per workshop. The training reviewed support software, installation, maintenance, data retrieval and review and programming. The workshop included both in classroom computer training and field installation activities.

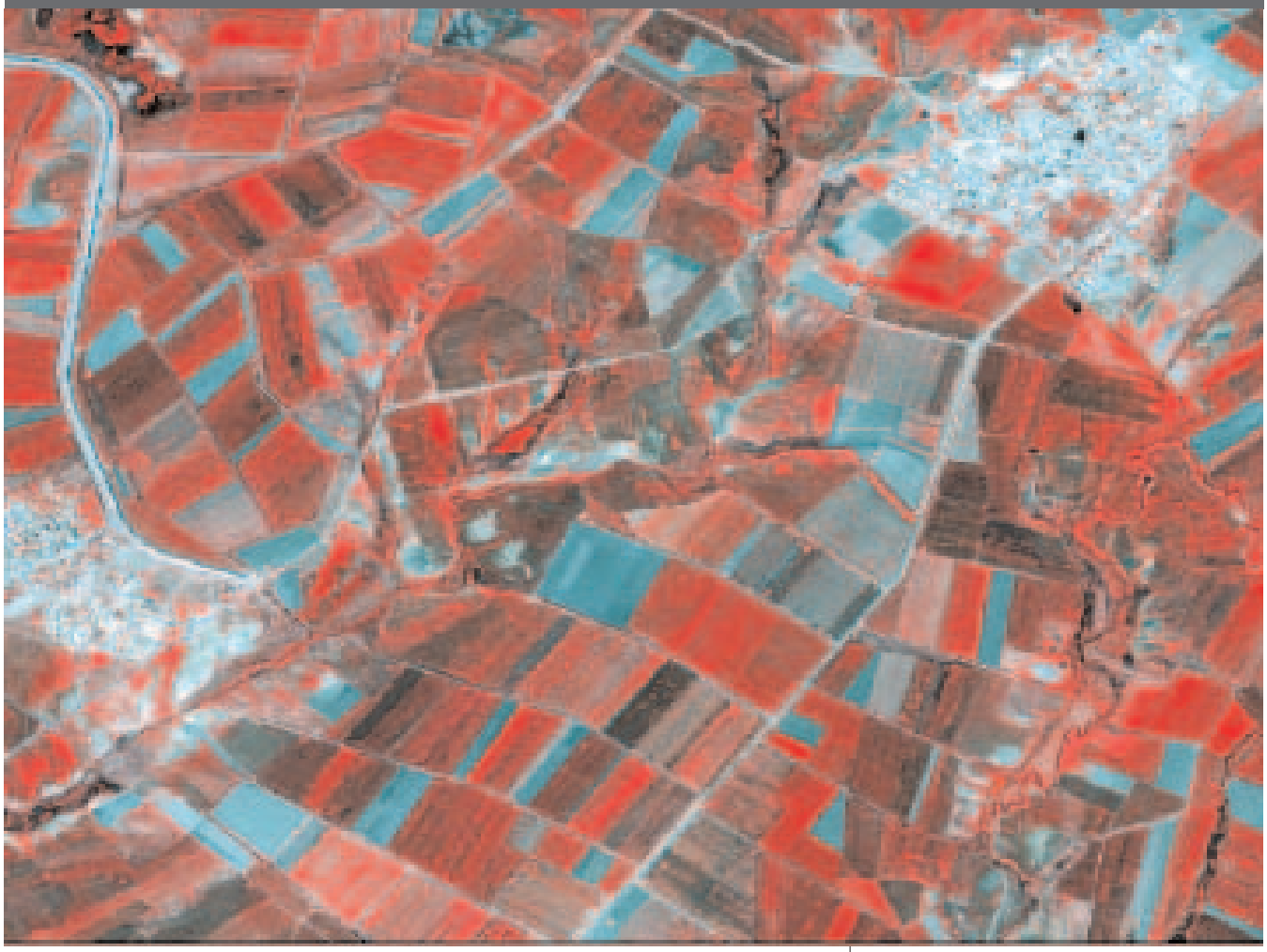
- Follow-up to Operation and Maintenance Workshop. This workshop provided additional training to automated weather station operators to assist in the improved operation of the equipment. The workshop additionally provided a forum for troubleshooting and resolving questions regarding the operation of the Automated Weather Stations.

The final step of the Agro-Meteorological program was the procurement and installation of 19 Automatic Weather Stations, which are modern data collection instruments that enable researchers to record information relevant to agricultural planning, including air temperature, relative humidity, precipitation, solar radiation, wind speed, and soil temperature. These weather stations will be integrated into the existing network to improve data collection capabilities. Three of the stations were installed in the drainage pilot areas of Al Wahda, Al Dujailah, and Al Raied. Five stations are part of a prototype network in Samawa because that area represents the conditions of the southern zone Iraqi irrigated areas. Five stations were installed in Erbil (Erbil Prototype Network), to complement other ARDI on-farm irrigation activities such the installation of drip and center pivot irrigation systems and associated training on irrigation management. The remaining six weather stations were distributed to the other stakeholders, keeping in mind that all of them are part of the National Agro-meteorological Network.

The prototype networks provide a model of an automated data acquisition network that will generate products to support agricultural management decision making, including irrigation scheduling. The lack of experience in Iraq with this technology is a substantial hindrance to effectively utilizing automated meteorological equipment and electronic data processing. The proposed networks are scalable and would provide a model for evaluation and potential expansion into a national agro-meteorological program. The prototype networks would demonstrate many automated capabilities necessary for efficient irrigation scheduling including:

- Real-time data acquisition;
- Improved data quality checking;
- Localized agro-meteorological analysis;
- Centralized electronic data processing and automated network operation;
- Electronic data access and sharing between users;
- Timely dissemination of advisory products.

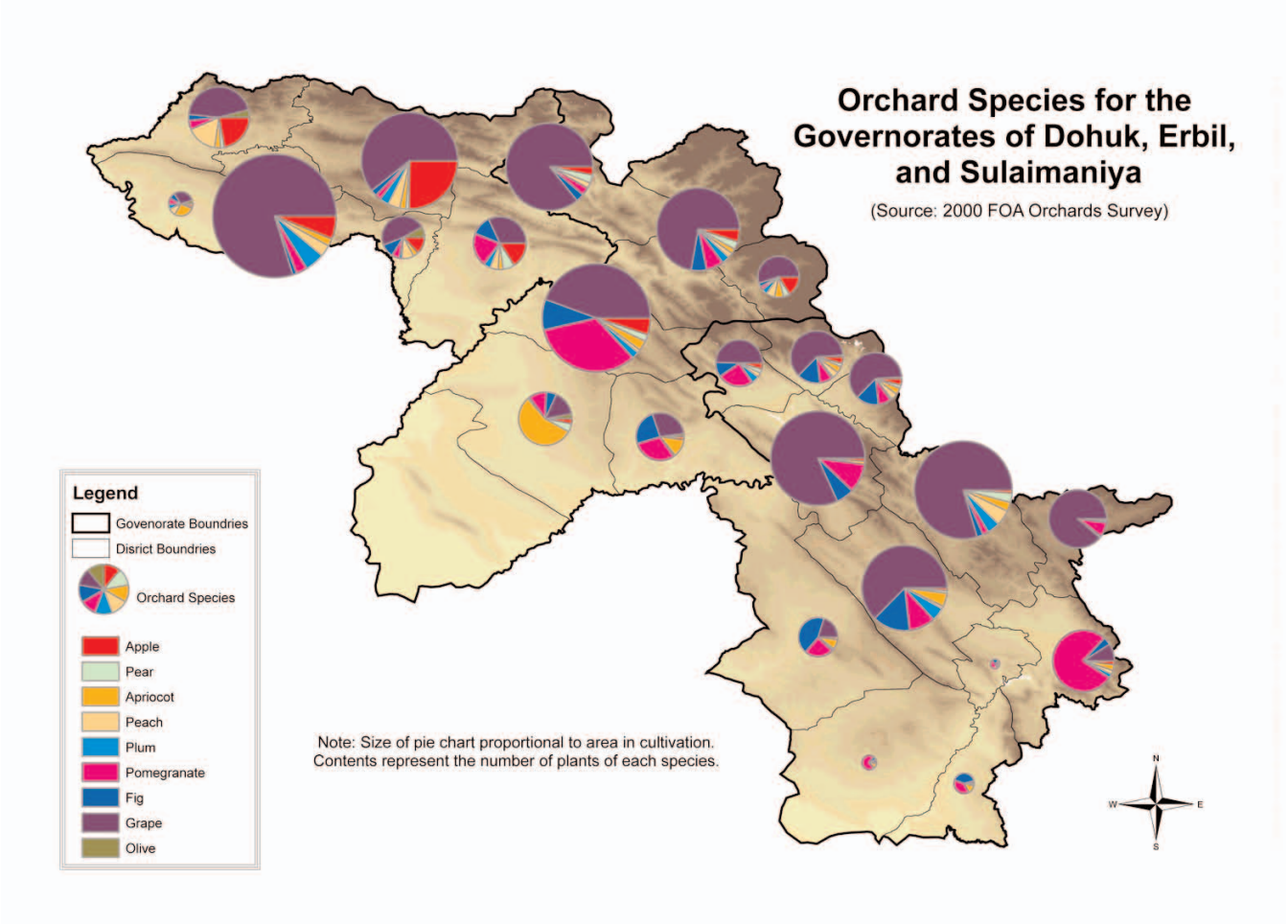
MAPPING AGRO-ECOLOGICAL ZONES



An enhanced photometric graphic used in remote sensing applications.

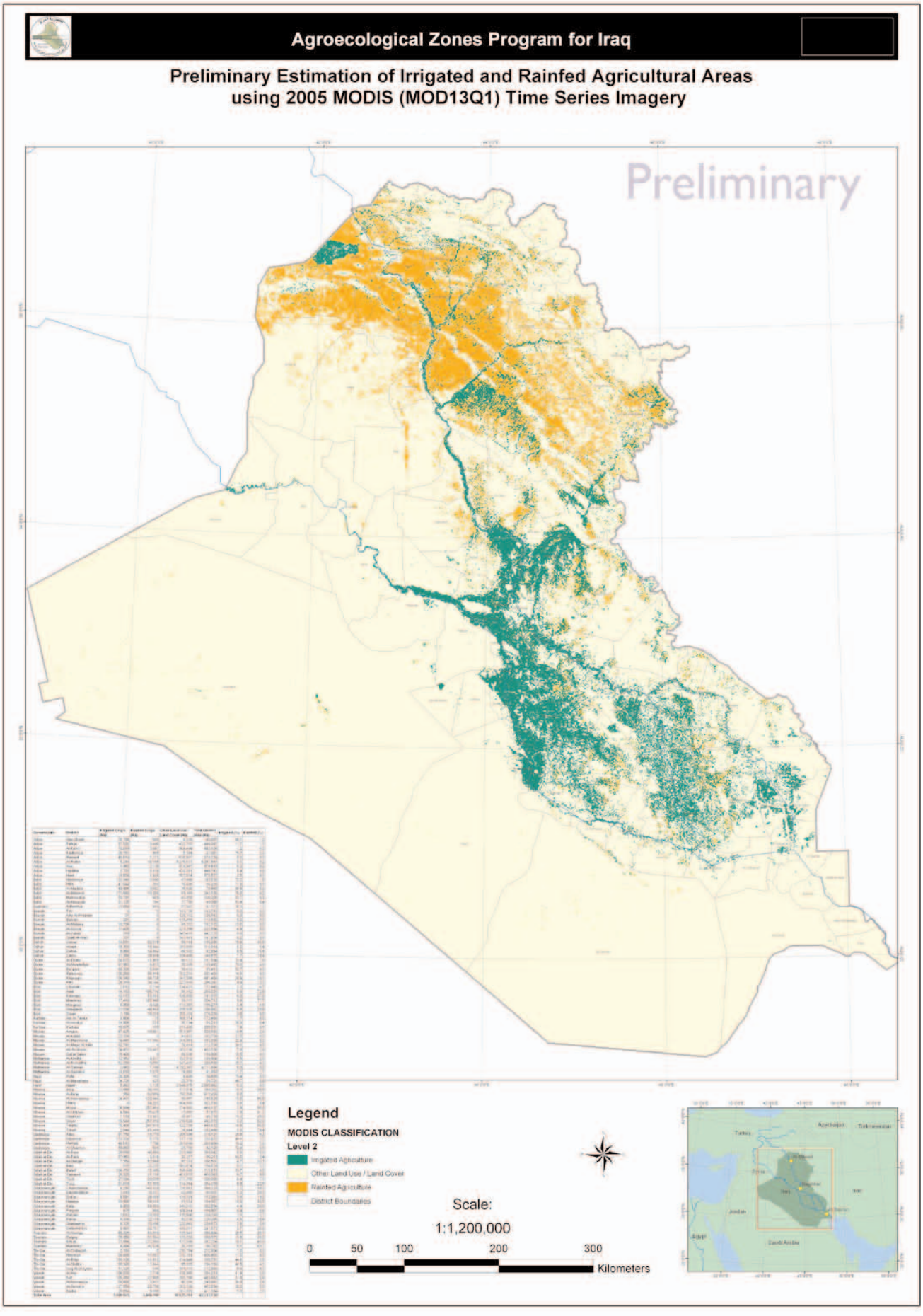
In order to maximize its capacity to assess the health of the agricultural sector and plan and allocate assistance resources to support that sector, the Government of Iraq (GOI) must utilize advanced technologies such as remote sensing and Geographical Information Systems (GIS) for data collection, presentation and analysis. The GOI has initiated a new program for Agro-Ecological Zone (AEZ) mapping, which utilizes these technologies for the collection and manipulation of data relevant to agricultural production. The program is an interministerial effort involving the Ministries of Agriculture, Water Resources, Planning, and Transportation.

The Ministries are in possession of satellite imagery showing areas of agricultural production in Iraq. Two pilot areas have been selected for initial program activities (Al-Jezzira and Middle Tigris areas). Using AEZ technology, this satellite imagery is combined with such inputs of raw data as soil, climate, and socio-



economic data to generate multilayered views, or maps, that illustrate ecological conditions, land use, and other factors that impact agricultural productivity. This information is valuable for agricultural planners, who can use the data to make assessments of the agricultural sector in Iraq, including crop suitability for different agro-ecological zones; water management and use; and water and soil requirements for different crops. These types of assessments will help the Ministry of Agriculture allocate assistance resources and design effective support for farmers, including advising on proper cultivation methods and other practices to help farmers maximize yields and income from agricultural production.

ARDI cooperated with the Ministries to provide support for the Agro-Ecological Zone program, including an advanced AEZ training facility, located in Erbil, equipped with both laboratory and classroom space, along with the hardware and software necessary to create AEZ maps. Ministry and private sector personnel received extensive on-the-job training in all aspects of data treatment to prepare Ministry officials to implement the program and give basic technical expertise to the private sector for civil applications. A team of AEZ professionals, including staff from the GOI and ARDI, worked full-time for over a year at the MOA/ARDI AEZ facilities in Erbil, and a second facility in Baghdad, to create AEZ models and collect the necessary data to produce land use and crop suitability maps.


Agroecological Zones Program for Iraq
Preliminary Estimation of Irrigated and Rainfed Agricultural Areas
using 2005 MODIS (MOD13Q1) Time Series Imagery
Preliminary
Legend
MODIS CLASSIFICATION
Level 2
Irrigated Agriculture
Other Land Use / Land Cover
Rainfed Agriculture
District Boundaries
Scale:
1:1,200,000
0 50 100 200 300
Kilometers

DATA COLLECTION

Systematic and detailed data collection is the basis for an agro-ecological zone mapping program. The extent of AEZ characterization analyses and modeling activities depends on the availability and quality of data collected. The MOA/ARDI AEZ program data collection activities were organized by data production lines corresponding to: climate data, water resources, soils and terrain, land utilization types and farm cropping systems, agricultural statistics, crop parameterization, additional GIS data, and remote sensing data. Each data production line was the responsibility of one or more of the individual AEZ program personnel designated to work in AEZ facilities in Erbil and Baghdad.

AEZ personnel assigned to do this work coordinated these activities with senior level officials at the Ministries that are members of the AEZ Technical Committee. Data obtained by the project constituted the input for the development of AEZ data management tools and database development. These data were complemented with more detailed information to be provided by the MOA and obtained from the field.

Two key components of data collection are land usage and crop modeling. Land usage evaluation is a primary tool to determine if a particular region or area is suitable for growing one or more crops based on land characteristics, climate, and socioeconomic activity. An ARDI land usage specialist worked with the AEZ team to determine the types of information required for the AEZ database, and strategies for collecting that information at the village level, within the current security environment.

Once an area has been deemed suitable for growing a crop, models can be used to simulate or "predict" yield as a function of local weather and soil conditions and crop management regimes. Under the guidance of a crop modeling specialist, AEZ staff created crop requirement tables for five major crops, and began developing calendars that show the cultivation cycle for those crops in the two pilot agro-ecological zones: the Middle Tigris region and the Al-Jezzira region.

With the conclusion of ARDI assistance, the MOA AEZ program has assumed responsibility for the continued development and application of the system, and taken possession of all equipment, satellite imagery, and software necessary to continue the work of the project in Baghdad. Information generated by the system will assist the MOA in the development of agricultural policies that reflect the emerging demands of government and private sector actors in a vibrant agricultural economy.

Upon the conclusion of ARDI, all of the equipment in the AEZ training facility in Erbil was transferred to a purpose built facility of the MOA in Baghdad.

3.2 CADASTRAL MAPPING AND LAND ADMINISTRATION PROJECT: SECURITY OF TENURE

BACKGROUND

Clear definition of land occupancy and use is important for the success of the emerging private agriculture sector in Iraq. At present, most agricultural land in Iraq is government-owned, and these areas are under long-term leases the terms of which generally parallel the kind of tenure found in the West. The leases are established under laws that govern the registration of use rights, inherited rights, and the right, in rare cases, to rent out the lands to others. Thus, Iraqi cadastral maps and registration records maintain, and update, much the same information as western-style plat maps and title or deed records.

Initially (in 2003), the general belief [1] was that Iraq had "no land system." This was

[1] Material from the World Bank and the U.N. indicated that there was no land administration system in Iraq.

*A **cadastre** is a public record, survey, or map of the boundaries, extent, and occupancy of land, and related details. In the West, such records are used as a basis for planning, transfers, and taxation. In Iraq, the first two uses also apply. Cadastral mapping, therefore, is required for (and complementary to) accurate records of land use and occupation throughout a country or other political unit.*

markedly untrue. Iraq has had, in one form or another, a system of land-records and administration for hundreds of years. Since 1958, two central GOI directorates in Baghdad in fact have been responsible for registering and maintaining all records of a cadastral nature. Directorates at the governorate level also maintain the records for their own territories.

Adjudication: *the legal process of establishing boundaries, occupancy, and/or use for areas or parcels of land. Generally done through a general court or special lands commission which judges, or "adjudicates" the status of the lands under question.*

HISTORY OF LAND SYSTEMS IN IRAQ

ANCIENT REGIMES

The Egyptians, Persians, and Arabs developed sophisticated mathematical systems that included linear and square measurements of territory. References to these can also be found in the Bible and the Koran. A 9th century Arab mathematician, Shuqr n Ibn Ali, specialized in calculation and the science of inheritance, and wrote a book on the partitioning of successions, which included means for measuring land extent. Linear measurement terms such as "digit" and "cubit" may be familiar today, "remen," "kos," and "zebo" less so. The Persian/Arab/Indian empire had a system of land-area recording and land tax collection called "tehsil," a word which has echoes in the later Iraqi-Arabic term "tesswiya".

THE OTTOMAN EMPIRE

During the Ottoman Empire, the Turkish system of land recording was established in Iraq. It essentially registered private ownership of land by recording land in the names of male heads of household. All owners were issued deeds, called tapus, for each parcel they owned. Thus, the Ottoman Empire established a head-of-household-based land-recording system. The records were used both for taxation and to register transfers, whether by sale or inheritance.

BRITISH RULE / IRAQI MONARCHY

The British trained many map makers and surveyors, and from 1932 to 1938 mapped, surveyed, and adjudicated approximately 90% of Iraq, excepting tribal and desert areas over which they had no control, and which were too dangerous to enter. It was during this time that a parcel-based system was introduced with, normally, one 1:10,000 cadastral map per section.[2] Many of the maps created during this era are still in use and being updated into the 21st century. They were supplemented by handwritten registries, also continuously updated.

1958 BA'ATHIST REVOLUTION

The Ba'athists overthrew the monarchy in 1958, and established, under Law 117-1958, an Agrarian Reform on the model of Nasser's 1952 reforms in Egypt. Much agricultural land became the property of the state. (Certain properties, including residential and urban properties, remained in private ownership, and tapus continued to be issued and updated for the private properties by the Ministry of Justice [MOJ]. Privately held agricultural land was limited to 1500 donums per owner.

Government (or publicly owned) agricultural lands came under the

[2] Iraq is divided into 18 governorates. subdivisions of governorates are as follows: districts, sub-districts, sections.

administration of the State Board for Agricultural Lands (SBAL), one of eleven directorates of the Ministry of Agriculture in Baghdad. Agricultural lands were distributed in two ways. Poor farmers and villages received rent-free distributions. Individual farmers received up to 50 donums or 12.5 hectares. Groups or villages that held the land in common received approximately 120 donums, or 30 hectares per 10 farmers. Distributions to wealthier farmers or villages were made on a lease basis. The Government continued to own the lands but permitted long-term occupation, as long as the land was being properly used. However, these distributions and leaseholds had many characteristics of ownership as long as the land was used properly and rent (where applicable) was paid, the distributions were transferable on petition to the SBAL, had limited subdivision rights, and had inheritance rights. Limited subletting was allowed with permission from the SBAL. These and all other changes in the status of state-owned land were subject to approval by the SBAL office in the area in which the change was requested, with a final decision rendered by the SBAL in Baghdad. The particulars of these distributed holdings were maintained, as before the Reform, in record books, and also on the handdrawn 1:10,000 cadastral maps archived by the SBAL in Baghdad. Copies of these maps were held in the land offices of the Agricultural Directorates of every Governorate and in local land offices. The SBAL also participated in other activities, such as settlement of disputes over rights, and easements.

1970: THE RECLAMATION PROGRAM

New legislation in 1970 decreed that all further distributions of agricultural land would be made as leaseholds. There was very little, if any, rainfed agricultural land available for distribution, and the country needed more agricultural production. A large-scale reclamation program began. Generally, this meant building canals and other irrigation infrastructure to make these areas arable as irrigated (as opposed to rainfed) agricultural property. These leasehold distributions had, subject to approval by the SBAL, the same characteristics as older distributions. They were transferable, had limited subdivision rights, and had inheritance rights. Payments from land leases were a significant source of revenue for the Government.

1990-2003

By the early 1990s, the SBAL was backing up many of its paper records on microfilm, using equipment housed in its Baghdad offices.

New restrictions on the areas of leaseholds were set by the Presidential Council in 1997. They were designed to limit the amounts of the more valuable land that any one individual or group could hold. For instance, middle Euphrates rice land is among the most valuable, and therefore has the lowest allotments. The restrictions are shown in Table 82.

During the "Embargo" period of 1990-2003, when sanctions began having a serious effect on agricultural production, the GOI began a new program, giving land allotments free of rent for five years. The requirement for these free distributions was that the new landholders grow certain crops that had been embargoed. After five years, these allocations could become permanent leaseholds, if the possessor agreed then to pay the rent allocated for that type

TABLE 82 RESTRICTIONS ON AREAS OF LEASEHOLDS

	Individual Lessee	Corporate (group) lessee	Amount of rental per donum before 2005 *
Riverside Land	1,000 donums	2,000 donums	1,000 dinar
Irrigated Lands (with drainage and all services)	2,000 donums	4,000 donums	800 dinar
Semi-reclaimed Lands (soil canals)	4,000 donums	8,000 donums	600 dinar
Unreclaimed Land (old irrigation systems)			500 dinar
Rain-Fed Lands, guaranteed 400 mm/year	10,000 donums	20,000 donums	500 dinar
Rain-Fed Lands, semi-guaranteed under 400 mm/year	10,000 donums	20,000 donums	300 dinar
Rain-Fed Lands, unguaranteed (planting every 2-3 years)	10,000 donums	20,000 donums	100 dinar
Desert Areas	30,000 donums	70,000 donums	----
2.5 donums = 1 hectare			
* These amounts are as of March, 2004. Rental rates were raised in 2005			

of land. When reviewing these allocations during the database activities in 2006, the project discovered that every one of these allocations had been successfully planted, and had become full leaseholds. [3]

In 2004, the computer department of the SBAL in Baghdad began entering all agricultural land information into an Access® database. Prior to this activity, no one in the MOA had any acquaintance with computer based work. In 2005, the database effort switched from Access® software to Excel®.

AFTERMATH OF THE AMERICAN INVASION

After the overthrow of the Ba'ath government, there was much destruction and looting of government property. The Baghdad SBAL suffered damage to its archived records and loss of equipment, including its microfilm processing equipment. The microfilm itself was rescued and hidden in the home of one of the staff members. The project proposed providing another layer of security for the records by continuing and expanding them in digital format.

ARDI BECOMES INVOLVED IN LAND ISSUES

SPRING AND SUMMER, 2004

ARDI's Land Administration project director visited the Baghdad SBAL in April, 2004. There he met the Director General of the SBAL and other senior staff people, who were welcoming and eager to discuss the nature of their work. The senior members of the SBAL all had 30 or more years of experience. For several days, this group discussed the history of lands records and land tenure in Iraq, its current situation, and the meaning of various terms.[4]

The SBAL staff showed the ARDI project director their 1:10,000 maps and record books. He photocopied sample records to study them, and saw that

[3] In 1995, when it was recognized that the sanctions were having serious effects on the health of Iraqis, the so-called "Oil for Food" program was established. This permitted the import of grain, cooking oil, and other essentials from abroad. It also allowed purchase of agricultural equipment which, however, was not utilized or installed until after the American invasion.

Old cadastral maps.

entries had been made up until the March 2003 invasion and subsequent looting. There was no question that a good record system for public agricultural lands had been in place for generations, and further that the staff people maintaining them were highly trained, capable, and committed to their work.

Project personnel then visited district SBAL offices in the Baghdad governorate, as well as the Babil (Babylon) governorate SBLA office in Hilla District, and saw similar records and maps. Later they viewed such records in various governorate, district, and section offices.

By late 2004, ARDI personnel had reached a decision to scan all available maps, some of them 70 years old, and to obtain supporting information with newly introduced GPS equipment. Other decisions about technological assistance followed. The project began to introduce existing surveyors to GPS technology, leading to a field day in July 2004, when 40 surveyors were introduced to the technology in Rashdiya, Baghdad governorate.

FALL 2004

The decision was made to scan the maps available from the SBAL and MOJ. This was not implemented until October, 2005 (see below). Security in Baghdad became a critical consideration, and ARDI personnel could no longer travel outside their guarded compound. SBAL personnel instead visited with ARDI staff members in neutral safe houses for continued consultation. The project purchased 23 computers along with internet access and office furniture help the SBAL with the proposed effort to enter their records into database format.

The entire cooperation had to be interrupted when ARDI personnel were abruptly removed to Erbil, Kurdistan. Furthermore, because of the deteriorated situation and inability to conduct field work, the Project Coordinator was not asked to return for further work until a year later, in October 2005.

[4]This concerned in particular, the term 'tesswiya'. Once the project director understood that this term meant "adjudication," that is, the process of deciding and labeling land occupancy and usage rights, it became clear that an entire, well-organized land system was in place in Iraq. because there is no point in adjudicating land unless there is an organized legal structure for land management.

OCTOBER-DECEMBER 2005

The SBAL made a formal request the ARDI support more field work by their surveyors. The component head was then asked to return to Erbil and assess the likelihood of continuing the work that had been discussed in 2004.

The Director General of the SBAL and other senior government staff began to visit and consult with the Director of the Lands Project in Erbil. In addition, delegates from the Baghdad offices of the Ministry of Water Resources (MOWR), the MOA and MOJ came to Erbil for meetings to set up a formal committee to run active field work, and to establish policies for a continuing program. It was agreed that the SBAL's records for agricultural land would be available to the project, and any further field work in all 18 governorates would be handled by the SBAL. A pilot survey training area was designated in a wheat growing village, Jezhnikhan Effendi, north of Erbil. In addition to this area, the project hoped to start two other pilot surveying areas, one in Baghdad governorate and another in Basra but security issues prevented use of these two as pilot areas.

The project purchased 10 new Dell® desktops and Xion® drives for the renewed effort. All were supplied to the Baghdad SBAL office, so that it could move more quickly to enter the land records into the database. At the start, few of the people entering data were computer literate. All learned quickly after some training and are now fully capable.

ARDI purchased two large format HP plotter/scanners and the necessary software. A short-term outside expert assisted the project in setting up the Training House offices. He also provided a sample map with coordinates in place. Project staff again met with officials from MOWR and SBAL, and helped confirm the direction of the overall project. In addition, the local project manager, along with an outside employee, designed a database for the land administration system, on the model provided in ARC-GIS 2014®. The SBAL provided, or obtained, the required data from 11 of 18 Governorates.

An extremely important item in the map database will be the eventual introduction of Unique Parcel Registration Numbers (UPRNs), permitting each separate parcel to have its own identification. The UPRN will also serve as an instant cross-reference between the cadastral maps and the agricultural and private land records database. All governorates, districts, subdistricts, and sections already have assigned numbers, though some of these are inconsistent. The project expected to regularize the numbering of the first four UPRN categories, and also to assign numbers to all the parcels once they were available on the digitized maps (see Table 83).

It is proposed, for the future, that when a parcel is subdivided, the old parcel number be struck from the record (but retained in another section for reference) and new numbers be assigned to each new parcel.

[5] The three northern governorates, Erbil, Dahuk, and Sulaymaniyah, constitute the semi-autonomous Kurdish region of Iraq, but these three have had two Ministries of Agriculture: one in Erbil which also covered Dahuk, and another for Sulaymaniyah. Further, there are political divisions within the three Kurdish governorates which have influenced varying levels of cooperation with the project. Thus, for some time, the project has had good cooperation with the Sulaymaniyah MOA, but none with the Erbil MOA. This changed in the summer of 2006 when the Kurdish MOAs were consolidated into one in Erbil, and the new Minister there ordered full cooperation.

TABLE 83 A SAMPLE UNIQUE PARCEL REGISTRATION NUMBER (UPRN): 01-10-21-156-12345

1	10	21	156	1234 (or as many digits as necessary)
Governorate Number	10th District within Governorate	21st Subdistrict within District	156th Section within Subdistrict	1234th Parcel No. within the Section (these are yet to be assigned)

PROPOSED SYSTEM FOR REGISTERING PARCEL SUBDIVISION: A SAMPLE CASE

Ali Mohammed leases and farms parcel number 07-01-76-543-21. The number -21 represents his parcel; all the preceding numbers indicate the parcel's location (governorate-district-subdistrict-section). Ali Mohammed has three children, Ibrahim Ali, Saida Ali, and Ahmed Ali. The father wishes to divide his parcel into three parts, and transfer them to his children. He appeals to the SBAL of his district which approves his request for subdivision. The boundaries and new possessors (or lessees) of the three new parcels are entered into the lease registration database, in both the governorate and the central Baghdad computers. The new parcel information is also indicated on the appropriate cadastral map and its database. The old parcel number, -21, is retired from the records. The "543" section has 274 parcels already on the record. The three new parcels are numbered following the last parcel number in the record, as follows: Ibrahim Ali, -275; Saida Ali, -276; and Ahmed Ali, -277.

During a visit to Erbil by the Director General of the SBAL and others in December 2005, the group made its first contact with the Director General of Lands in the Erbil Ministry of Agriculture. Together, they looked at one of Erbil's cadastral maps and agreed to a surveying field trip to Jezhnikan Effendi. The group also explained the ARDI Lands project to the DG and her staff. They, however chose not to cooperate with the project, insisting that Kurdish data had to be handled separately from all other Iraqi data. Not until the three Kurdish Ministries of Agriculture were consolidated in August 2006, was cooperation possible with the Erbil MOA's Lands staff.

JANUARY-FEBRUARY 2006 SHAKLAWA MEETING

In the early months of 2006, an important breakthrough occurred. The project held a workshop for about 40 people from the SBAL offices in Baghdad, including the Director General, representatives from the Surveys Department of the MOWR, the Land Registry Office of the MOJ, and others. Members of the directorates of the Erbil and Sulaymaniyah Ministries also attended. At the meeting, the plans for databasing records and scanning maps were presented and discussed.

Following this, cooperation increased, especially in the form of offers to send or bring maps from all over Iraq to Erbil for processing. The Director General of the Tapu Office of the Baghdad MOJ assisted the scanning effort with many of the "sleeping tapus,"—old maps—from the MOJ archives, without fee, in exchange for copies of the scanned maps on CD. A new Director General of the Survey Department of the MOWR offered to continue cooperation, but wanted to

receive payment for inputs to the project. The personal advisor to the MOJ Minister intervened on behalf of the ARDI project, but it became evident that the project already had a more extensive collection of maps than MOWR. This incident led to a termination of cooperation with the MOJ. Because of the full cooperation received from the SBAL and MOJ, the project now has the only nearly complete set of cadastral maps in Iraq.

The project manager and coordinator visited Sulaymaniyah, where the governorate's Director General of Lands promised full support, asking for training for his personnel in the database and map scanning components of the project, and offering to share his department's maps and data. At this point, the MOA of Erbil did not wish to cooperate with the project (see footnote 4).

The project people learned that the Sulaymaniyah directorate had begun, on its own, to adjudicate the Mt. Azimar area south of their city (see "British Rule/Monarchy" section). These lands had not been previously adjudicated. The Directorate has been recognizing occupiers and issuing lease contracts to them, (or, in some cases, recognizing them as outright owners when they had held the land since before the 1958 Agrarian Reform). In this respect, Sulaymaniyah has made moves that anticipated the long-term goal of the present GOI: security of tenure for all land holdings. In any case, these adjudications have helped avoid a number of disputes that had been threatening.

MARCH 2006

GIS training efforts began at this time. (See details under the section on training.) The project also did a test scan of the SBAL's microfilmed records, which was successful. A plan to digitize all the microfilmed records came to nothing, however, because the Minister of Agriculture in Baghdad could not locate a safe way to duplicate the microfilm in Baghdad, and for security reasons was unwilling to ship its only copies elsewhere.

By late March, there was a steady stream of people visiting Erbil from Baghdad and Sulaymaniyah to scan maps. They also developed an index of all the maps that had been scanned.

MAY, 2006, PROGRESS APACE

The Sulaymaniyah MOA's Director General brought himself and 4 staff members to Erbil in May for a two-day training and observation session. They brought with them 600 of their cadastral maps, many fragile, to be scanned. Two of these staffers learned map scanning (and scanned half of their own maps), and map index making. Two others learned database entry. They have continued entering Sulaymaniyah data into the database at the Training House office. At the time, they were the first of the three northern (Kurdish) governorates to have actively cooperated with the project.

May also saw a 12-day GIS/GPS training program held in Erbil, at which 8 staff members from Baghdad and 2 from Sulaymaniyah MOA learned the basics of georeferencing, digitalizing, and editing scanned maps. Additional field surveying at the pilot site in Jezhnikan Effendi backed up the work done in the lab setting.

Finally, May was the month when the project took on an important new

Coordinator. The newly retired Director General of the Baghdad MOA became the formal Baghdad-based Project Coordinator, responsible for cooperative efforts with the Tapu Office of the MOJ, with the Ministry of Water Resources (MOWR), and with the various governorate MOA offices. In particular, he visited areas of Iraq which were unsafe for project personnel, in order to seek hosts for field surveys, etc.

JUNE, JULY, AND AUGUST 2006

Approximately ten thousand (10,000) maps have been scanned, and 110,000 records of agricultural land holdings entered. Maps from Erbil and Dahuk remain to be scanned. In addition, tapu (private holding) information from the Land Registry of the MOJ will be databased at a later date. By the end of August 2006, the vectorization process was proceeding. This involves matching (layering) sections of the scanned maps to the same section coordinates in 8,500 5-meter satellite images, creating a third, completely searchable, version.

ADMINISTRATIVE BACKGROUND: GOI MINISTRIES WHICH COOPERATED WITH THE LANDS PROJECT

THE STATE BOARD FOR AGRICULTURAL LANDS: STATE-OWNED AGRICULTURAL LAND

Iraq's central Ministry of Agriculture (MOA) houses the SBAL, responsible for maintaining a system of land administration in order to enforce the laws related to state-owned agricultural land.

ARDI's Land Administration project has been working with both the Baghdad SBAL and the MOJ's Land Registry (Tapu Office, see below) to update Iraq's land administration system and create secure, digital land registration records. Until this effort began, the SBAL had kept registry (leasehold) records and their handdrawn cadastral maps on paper with microfilm backup. Many paper records and all the microfilm equipment were damaged or looted in 2003. Restoring and recording all data in digital form is essential to allow the Government to meet contractual agreements, register occupants' rights, allocate land for state projects, provide documentation for legal disputes, monitor payments for leases of state land, and conserve historic sites in accordance with existing law.

Further into the future, this standardized, parcel-based registration system will provide the records and stability necessary should the GOI choose to move toward a system of private agricultural land ownership.

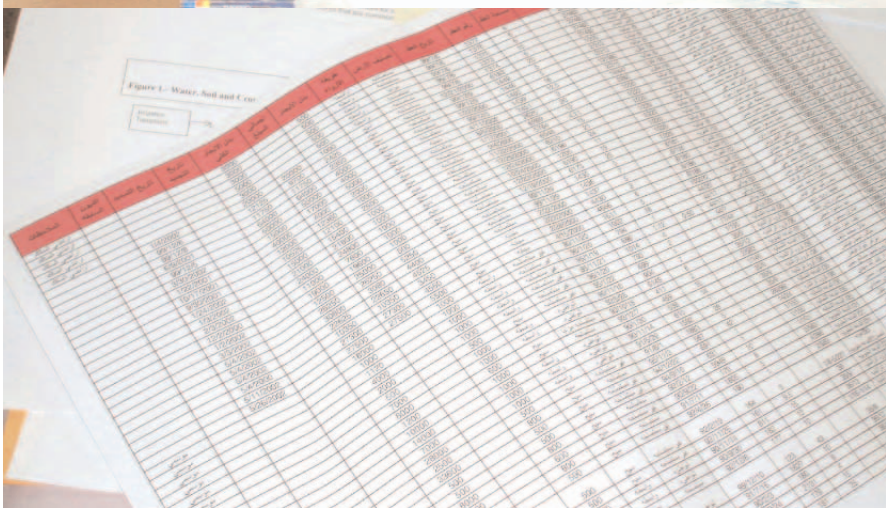
THE LAND REGISTRY (TAPU) DIRECTORATE: PRIVATELY-OWNED LAND

Since the 19th century, the Ottoman system of privately owned land has involved issuing and registering tapus, or deeds. The Land Registry Directorate, housed in the Ministry of Justice (MOJ), administers the tapu system. Like the registry books for state-owned land, the tapus are on paper, and not secure. Eventually, tapu information will also be digitized, and the Land Registry Directorate will continue to hold official, paper copies of tapus while the electronic records will be held by the SBAL in Baghdad. The database format for private land entries will be identical to that for agricultural lands, and indeed tapus will eventually be issued for agricultural lands as well. Part of the need for a security system for the

entire database results from the fact that the MOJ will access its records from the same computer files as the SBAL's records.

MINISTRY OF WATER RESOURCES: SURVEYING DEPARTMENT

The Survey Department of the Ministry of Water Resources (MOWR) keeps a complete "bank" of cadastral and survey maps. Initially, they promised to share these with the project. However, when the project requested access to the material, the Survey Department chose to ask for payment. Consequently, other resources were used. The MOWR did send personnel to various project meetings, but cooperation fell off after the demand for payments.



MOA personnel from Baghdad entering State Land information into the Excel® database. Each computer case contains a massive Xion® drive used to store the data and work with the high-powered GIS software. Right: a page of the database. The database columns are (right to left) : Entry number / sector / relevant law or regulation / name of renter / district / plot number / area unit ("olek") / area of plot / lease number / initial date of lease / category of land (e.g., irrigated, rainfed, etc) / irrigation process if any / rate of rent per unit / total owed per annum / total paid over the life of the lease / date of lease renewal / date of rent payment / previous rental arrears / further notes (e.g. seasonal; railroad easement; within municipal boundaries, etc).

CREATING DIGITIZED INFORMATION FOR STATE LAND: THE DATABASE

Information about leases of agricultural land at the SBAL, and ownership of private land at the MOJ, were kept by hand and the historical paper records were kept on microfilm. During the looting in 2003 many records were damaged, and the microfilm equipment stolen. The microfilm itself was rescued by a staff member who kept it in his home.

While the SBAL in Baghdad begun some work to place its records in database format, the effort was redirected in 2005. The database categories were refined, and the SBAL began to reenter all their public land records into Excel®. To date, more than 109,000 records from 12 governorates (11 in Iraq proper, and one in Kurdistani Iraq) have been recorded in this database, representing records through 2002. Newer records (following 2002) have been difficult to obtain, but will be gathered. This work will continue until SBAL (i.e., government held agricultural) land from all 15 southern governorates is entered and updated. Records from Sulaymaniyah began to be entered in March of 2006. (The records from the other two northern [Kurdish] governorates, Erbil, and Dahuk, were not obtained until August of 2006, and are being handled post project by the Erbil MOA.) Following completion of the entries, the database will be continually updated as leases change, transfers are made, and so forth.

Security is a significant issue in this process. Procedures have been worked out to create rules about access to the registration material, to prevent unauthorized access and alteration of the records. Initially, all the data will be held centrally, at the Baghdad office for the 15 southern governorates in Iraq. The three Kurdish governorates will most likely keep their own data from the beginning. Eventually, each governorate will have secure access to its own information. The security system was only in a "talking stage" at the termination of the project.

A final goal will be to create tapus for all the state-owned land. Normally, that would not be done, but for several reasons, we felt that tapus would be the best means of providing possessors with security. Tapus for agricultural land will indicate that the land is state-owned, but would be helpful if the GOI opts to go through a process of reform. The stage will be set to change ownership from "state" to the name of the person who is becoming owner. In the meantime, the tapus will show the legal status of possessors of the parcels, use of the land, its boundaries and extent, and other information. They will be a significant step in providing heightened security of tenure.

CREATING DIGITIZED INFORMATION FOR STATE LANDS: THE MAPS

Within the SBAL sits a technical department which oversees mapping activities, and has had an astounding record: for more than 70 years, a succession of dedicated mapmakers had been making, and maintaining by hand, competent maps of property in the country, accompanied by the handwritten books recording property lease holdings, revenue (e.g. rent and other payment) records, and transfers of leases to other parties. Such transfers were sometimes by inheritance, and sometimes made for consideration.

Most of the maps were indexed, also by hand. Certainly the map numbers and land records were cross-referenced. However, a good many of them were

Above: Preparing to scan an original map.

damaged by age, long use, or poor storage conditions. In any case, the system was still one based on predigital technology.

Discovering these maps, and the SBAL workers who had maintained them, was the first step to a digitized cadastral records system for the country. Without such maps, and the data they represent, there can be little or no modern organization of land records, or the stability and security of tenure that creates productive use of land.

Below: Repairing one of the original maps before scanning.

To accomplish the work, the project obtained satellite images at 5-meter resolution. We also obtained satellite images at 1-meter resolution, which were not used. They will be useful when urban areas are remapped, but are not needed for areas that are devoted primarily to agriculture.

Beyond that, the digitized versions of these maps will serve numerous aspects of development. The AEZ effort—the program to provide comprehensive data for agricultural planning—cannot go forward without digital mapping data. Indeed, the lands project serves the entire agricultural infrastructure rehabilitation program which is the ARDI program's core goal.

THE PROCESS

At the time of writing this report, approximately 10,000 maps representing more than a million parcels of agricultural and urban land have been scanned. This includes the maps from the SBAL and maps from other Governorates which are now being processed. The process of layering them with matching areas of the 5-meter satellite images of Iraq has begun. Furthermore, the land records data and other transfer records (at present approximately 109,000) which have been entered into Excel® format will be cross-referenced to the digitized maps. The procedure is as follows:

- Scan the original, handdrawn cadastral map.
- Locate two or more known coordinates on the scanned map (for instance, a fixed boundary, or a natural feature with coordinates well identified).
- Find corresponding coordinates on the relevant 5-meter resolution satellite image.
- Layer the two images: match features on the two maps, and find from the satellite image the boundaries of usage and other characteristics to be included on a third map layer.
- On the third layer, change vectors so that lines on the old map coincide with boundaries or chosen features on the satellite image.
- Vectorize: this is the creation of the edited third layer, essentially an editing of the old cadastral map to reflect features present in the newer satellite map. The digitized version has been created.
- Place individual parcels into proper coordinate areas.
- Features or parcel boundaries and extents on the digitized map will be checked for accuracy by surveyors in a field survey.
- Records are brought up to date and entered into the Excel® database of land records by preparing or updating a uniform registration record for each parcel, based on the field checks by the surveyors.
- Parcels are assigned numbers, permitting creation of the complete UPRN.
- The digitized maps and the database are linked; alterations of the map may be easily made to reflect changes in the database, and vice versa.

The digitized versions of these maps will serve the AEZ effort—the program to provide comprehensive data for agricultural planning—and therefore has direct and indirect impact on the entire agri-cultural-infrastructure rehabilitation program that is the ARDI Program's core goal.

A surveying field day. SBAL staff members hold 3 versions (original, scanned, digitized) of the map of the area which is being surveyed in order to check the map accuracy.

THE DATABASE

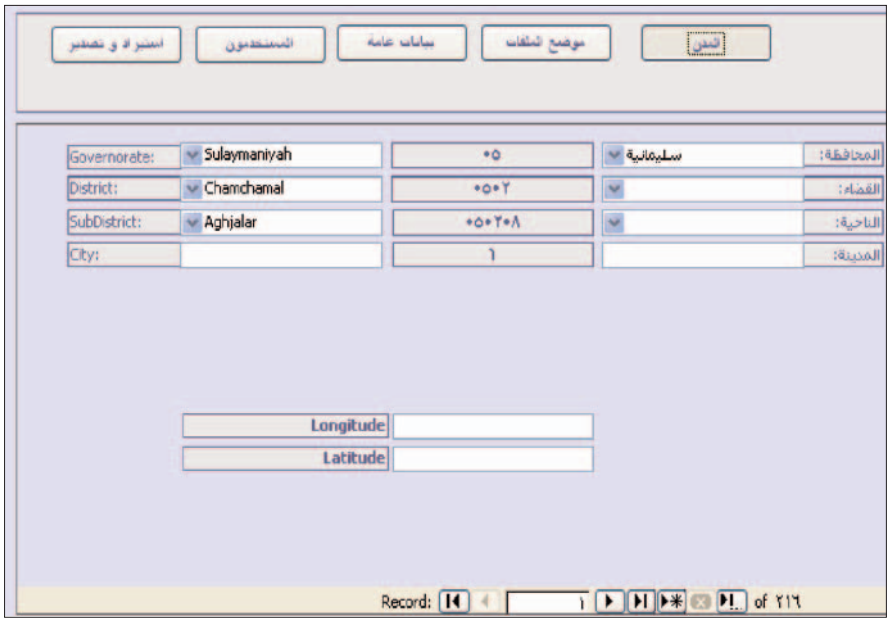
This form is used for entry of data. (see image at right)

The information entered is as follows:

- Governorates, districts, subdistricts and sections or villages in both Arabic and English.
- Location (link) for attached files (images and maps) relevant to this entry.
- General lookup data (land description, rights, irrigation method, etc.)
- Possessors: name(s) of users and their locations.
- Import and export: a function that collects data from other locations—exports entered data and imports the exported data.

DIRECT IMPACT

Every farmer in Iraq, whether a landowner or possessor, will benefit directly from having an accurate and legally binding delineation of property. Easily accessible, secure property records form the most important criterion for determining the rights to exploit that property. Therefore, the number of direct beneficiaries is equal to the number of farms (defined as a discrete parcel of agricultural land farmed by a single family or entity) in the country. The total number of farms in Iraq is estimated by the SBAL at 1.25 million.



Input screen for the cadastral database.

CAPACITY BUILDING AND TRAINING:

- Numerous staffers at the SBAL and Ministries in Sulaymaniyah and Erbil have become computer literate, especially in database skills.
- A full map scanning and vectorizing system, with trained personnel and equipment, will be left in Iraq, to be fully housed in the Baghdad SBAL offices when security permits. This will allow continuation of an extremely sophisticated land registration and management system in all 15 southern governorates. Similar equipment is being left at the Erbil and Sulaymaniyah MOA for management of the same system for the 3 northern (Kurdish) governorates.

Much on-the-job training went on at the Training Center in Erbil, especially in the realm of data entry. Thus, data entry people from Baghdad, Sulaymaniyah, Erbil, and other areas came to the Training House to learn the database structure and to enter the information from their own governorates' records. (The Baghdad material covered many governorates as well.) When the Sulaymaniyah Ministry sent their maps to be scanned, they also sent two of their personnel to learn both scanning (while scanning their own maps) and database management.

Formal training sessions at the Training House took place as well:

- Two GPS training courses
- Workshop, March 2006: Forty officials from the SBAL, the Land Registry Directorate, and the Survey Directorate came together to discuss the progress of the plans for the updated land administration system. Representatives from the SBAL, the primary users of cadastral maps, came from Baghdad, Sulaymaniyah, and Erbil. The project worked with the participants to create a common understanding of the future system and demonstrate prototype digital records. The participants also saw demonstrations of the GIS and GPS technology essential to modern cadastral mapping.

A surveying field day, used to check a newly vectorized map against an actual survey in the agricultural area represented on the map.

A surveying field day, used to check a newly vectorized map against an actual survey in the agricultural area represented on the map.

- Two-Week GIS Training Program, May 27 to June 8 2006: Eight trainees from SBAL in Baghdad joined 2 from Sulaymaniyah to learn to administer the digitized parcel-based land administration system. Five were men and 5 women. They learned to georeference, digitize maps, and edit the scanned maps. In addition, they did field work in Jezhnikhan Effendi, near Erbil, to learn to check map coordinates by surveying in the field.
- 30 surveyors have been trained in the latest GPS surveying technology. MOA offices at all levels, with few exceptions, have cooperated enthusiastically with this effort, and requested training for their personnel. Their expectations about the way to organize and use land information have changed accordingly.
- Training was given to scanner operators, especially in how to judge when to make color scans of particularly faded or damaged originals.

Perhaps as important as technical training has been the style in which instruction is delivered by our training staff. Used to receiving information passively, and passing it on authoritatively, our trainees are instead encouraged to interact with instructors. They learn quite specifically to ask questions of our trainers. They also learned to interact in an empowering, less authoritarian manner with those whom they will train. Above all, they learn to listen to the people affected by their policies, and to take that information into account in planning and policy making.

TABLE 85 TRAINING AND SUPERVISED ON-THE-JOB WORK

Data Entry Specialists, Baghdad, Training and long-term ongoing work	*Data Entry Specialists, Sulaymania, Training and short-term work*	Map Scanning Training and short-term work, Baghdad, Koysanjaq, Sulaymaniyah
2	2	18

TABLE 86 PROFESSIONALS FROM SBAL AND AGRICULTURAL DIRECTORATE, BAGHDAD

Orientation to Digital Cadastral Lands Project	*GIS Training*	*GPS training*
21	8	4

TABLE 87 PROFESSIONALS FROM OTHER GOVERNORATES WHO RECEIVED TRAINING

Professionals, Agricultural Directorate, Kwisinjak, GPS training	Professionals, Agric Directorate Babylon, GPS training	*Professionals Agric. Lands Directorate Qadissiya, GPS training*	*Professionals, Agric. Lands Directorate Wasit, GPS training*	*Professionals, Agric. Directorate Muthanna, GPS training*	*Professionals, Agric. Directorate Diyala, GPS training*
4	2	2	8	2	2

TABLE 88 PROFESSIONALS FROM OTHER GOVERNORATES WHO RECEIVED TRAINING

Professionals, Sulaymaniyah Agric. Lands Directorate, GPS / GIS training	Professionals, Sulaymaniyah Agric. Lands Directorate, GIS training	Professionals, Agric. Directorate Najaf, GPS training	Professionals, Agric. Directorate Kerbala, GPS training	Professionals, Agric. Directorate Kerbala, GPS training
19	2	2	3	3

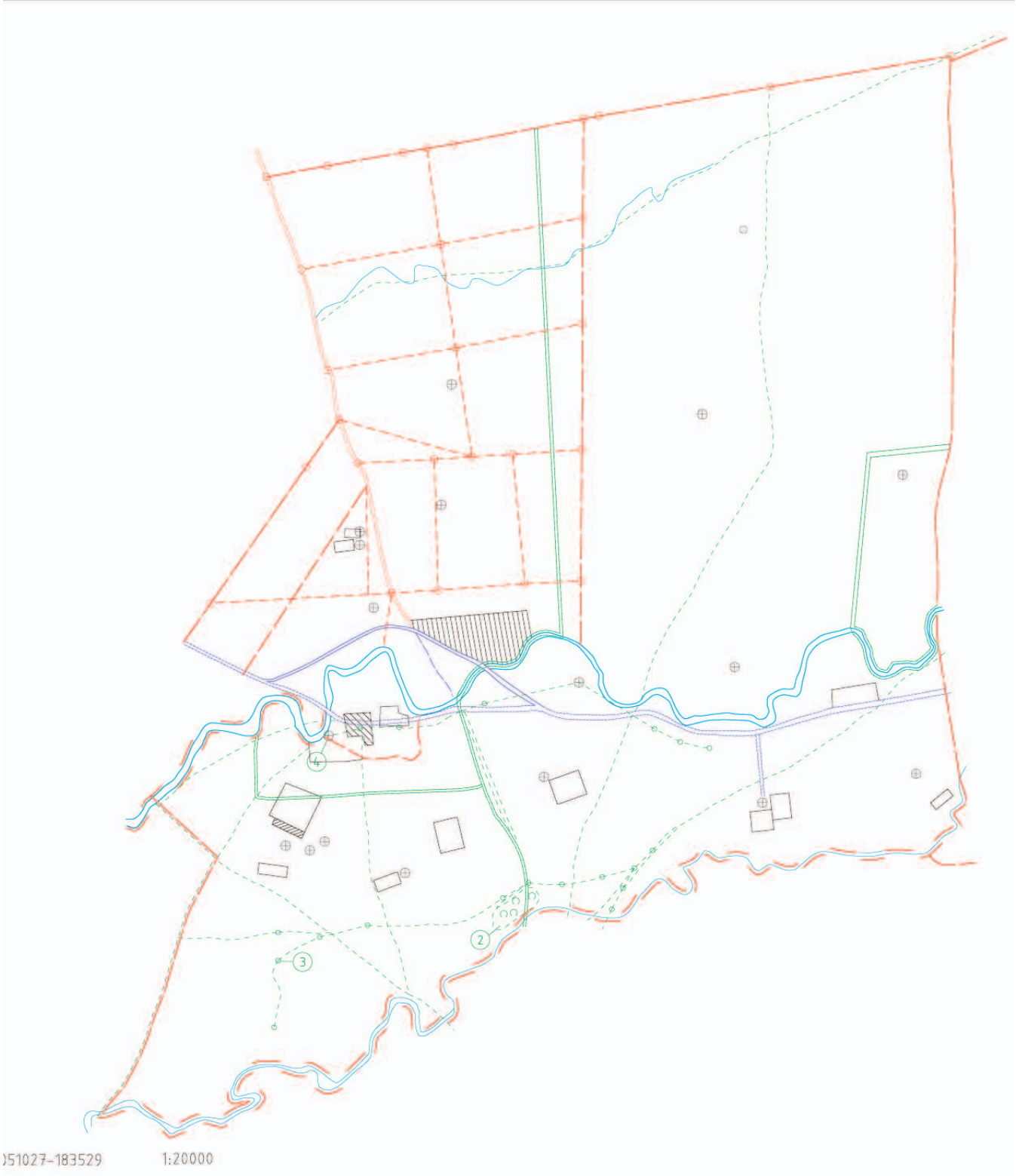
TABLE 89 PROJECT EMPLOYMENT OF IRAQIS

Long term: Project Coordinator	*Short term: Trainer*	*Short term: Programmer*
1	1	1

TABLE 90 TOTAL TRAINEES

Men	*Women*
42	19

Original, pre-digitized map.



Post-digitized map.

- **The most immediate impact** of this project is the restoration and modernization of Iraq's entire land records system. What follows is its use by all landowners, possessors of government land, and planners in government and other sectors. One of the Project's goals was to move toward issuance of tapus for all holdings, whether in possession or privately owned. Ultimately, should the GOI choose to permit direct ownership of agricultural land that is now under lease, it will be a simple matter to change distribution and lease records to reflect that.

- **Every farmer in Iraq,** whether an owner or possessor, will benefit directly from having a sound, accurately administered property registration system, with secure property rights. Therefore, the number of direct beneficiaries is equal to the number of farms (defined as a discrete parcel of agricultural land farmed by a single family or entity) in the country. The total number of such land holdings is estimated by the SBAL at 1.25 million.

- **Adjudication and dispute resolution:** A countrywide, secure, and trustworthy system of registration of property holdings is essential both for security of tenure and for resolution of disputes in the courts. It is also vital to the GOI as it collects revenue from leased agricultural land and tax from private holdings, as well as to conserve historic sites in accordance with the laws in place for those areas.

OTHER AREAS RELATED TO THE LANDS PROJECT

AGRO-ECOLOGICAL ZONE (AEZ) MAPPING

Agro-Ecological Zone mapping is essential to and involved in all aspects of agricultural planning. AEZ compiles, in map and database form, the information about agricultural potential in various parts of the country. The complete scanning and vectorizing of all Iraqi territory which this project accomplished provides a perfect 'base' for mapping of all kinds, including AEZ purposes. A data base which records the use and legal status of every parcel in Iraq also may be adapted to show such matters as soil quality, rotation needs, production per-hectare capacity, and many other kinds of information. Indeed, the existing distribution and lease lands database already provides information about rainfall and irrigation status for agricultural land; expanding that is a simple matter. Already within the project, the AEZ component shares scanners and other soft and hardware with the Lands component.

HIGH-VALUE CROPPING AND EFFICIENT WATER USE

For all the reasons outlined above, the need to make efficient use of the best land in Iraq is served by the Lands project's maps. Planning for irrigation and use of scarce water resources is essential to production of valuable crops, both for internal consumption and export.

STILL TO BE DONE: MAPS SCANNING

The scanning of the cadastral maps started by the SBAL in Baghdad is complete. They have completed the full set of maps for all of the 15 Governorates of Iraq proper. In addition, the full set of maps for Sulaymaniyah was completed by a

team provided by that Ministry of Agriculture when it was a separate entity in Kurdistan. The cadastral maps from the area of Kwisinjak was also completed by a team of individuals provided by the Agricultural Office in that subdistrict. Kwisinjak was treated separately because even though its geographical location was within in Erbil governorate, for political purposes it was allied with the political party giving allegiance to Sulaymaniyah, and therefore administered by that Ministry of Agriculture.

Scanning of the maps for Erbil and Dahuk governorates has not been started. However, members of the SBAL in Baghdad have agreed to assist by providing the cadastral maps of the two governorates for scanning at a time after the project terminates. It is not clear that it will happen, but the hope is that there will be follow-through and the maps will be moved from the source in Baghdad to the Ministry in Erbil, where one of the large map scanners will be located for the postproject.

DIGITIZING THE MAPS

While all available maps have been scanned, the process of vectorizing them—layering them with the 5-meter satellite images—is far from complete. Clearly, they will not be of use as a searchable tool until this job is done.

When notice was received that the project would be terminating, all activities were switched to the digitizing of the maps. Eight of the ten people who went through the GIS training returned to the Training House and worked with the trainer practicing the digitizing process.[7] They layered the scanned cadastral maps with the appropriate five-meter satellite images and created new boundaries on a third layer. It takes a lot of practice to be able to digitize properly. It can only be hoped that the team has had enough practice and will be able to continue on their own.

It was planned, of course, to work on the digitizing, together with the necessary follow-up in the field to check the social and other realities of each parcel, where necessary through the local surveyors. We never got to that stage.

SURVEYING

Random sample on-the-ground surveys must continue, in order to check accuracy of parcel coordinates entered into the database from Ministry records.

UPRNS

Since section mapping exists on all the existing handdrawn cadastral maps, the sections are now being vectorized. Individual parcels will be mappable following the vectorization, because finding coordinates for parcels will be a simple matter of entering the coordinates and "drawing" the parcel boundaries. Following this, district administrators will be able to assign parcel numbers, completing the UPRNs.

DATABASE

The database structure is virtually completed and ready for data to be entered into it. However, there are still many records that have not been prepared and

[7] One was in London pursuing an M, Sc, course and would be gone for approximately two years; and one had health problems and was unable to join us.

entered. There may be problems encountered on the more recent data, and the data from both Erbil and Dahuk have to be watched very closely. It is unclear that the members of SBAL or the teams from the Ministry in Erbil (and Sulaymaniyah) can handle the processing of the data in the database without continued assistance.

There are potential new categories of entries, or additional fields in those that have already been entered, which have not yet been encountered, yet since there have been many changes is Government policy recently. There would need to be changes added to the database when these new categories are encountered. The team members will have to deal with this on their own. It would have been better if the ARDI project could have continued the oversight of the implementation of the database until it was completed properly.

It was anticipated that a Kurdish version of the completed database would be produced. This has not been done.

The SBAL in Baghdad has 154 rolls of microfilmed registration records. Each roll has an average of 2,700 images. Those images have to be converted into a digital form and the database needs to be adjusted in order for this data to be entered in the proper place. The data on the microfilm represents some of the history of each parcel of land which is in the database. Historical factors are considered regularly when looking into questions that arise concerning the individual parcels throughout Iraq. This in not now available for the SBAL, or the Erbil Ministry teams, as part of the database. We hope that the conversion of the rolls of microfilm will take place and the data will be entered eventually in the database.

It was planned to enter the adjudication records for each parcel of land as part of the historical record. This was to go in to the database, but it is not there. There are paper records in Baghdad of the historical factors that should be entered into the database. With the termination of the project, it is not clear that this vital information will be included.

TRAINING

There should be continued training. Additional people should be trained in the GIS process and many additional surveyors should be trained in the operation of the GPS units. The burden is now on the members of the SBAL and the Ministry in Erbil to continue the training process.

Although it is not crucial to continue the GPS training at this time, it will be crucial once the database is operating and there is an attempt to expand it into the registration of all lands, public and private. At present, there has been nothing done about the addition of the private lands to the database. In addition, tapus (the actual record of ownership/possession) have not been prepared (revised to take into consideration the many changes that have occurred over the years). These need to be developed and added to the database. The SBAL members know that this needs to be done, but do not have the skills to do so function at this time. Training will be necessary to prepare people to create the new tapus.

CREATION OF TAPUS FOR STATE-OWNED LAND

It is a goal of this project to create tapus for all the state-owned land. Normally, that would not be done but, for several reasons, we felt that tapus would be the best means of providing possessors with security of tenure now and of making any transition to other forms of possession in the future easier.

ADJUDICATION OF UNADJUDICATED LANDS

There remain a substantial number of parcels that were not adjudicated during the British/Indian systematic adjudication of the 1930s. Some governorates (e.g. Sulaymaniyah) have begun to adjudicate those lands on their own. It was felt that the ARDI project could develop an instrument for general use throughout the country (one compatible with the manner in which data have been entered), and follow through to complete the adjudication process. A visit was made to an area of unadjudicated land in Sulaymaniyah governorate, and all the officials agreed that the process could now be completed. The project terminated before any of this activity could be commenced.

DATA ENTRY

The data entry is not completed, as noted above. It is also relevant to look back at the final section dealing with the database to appreciate that there is a significant number of different categories of data that need to go into the database in order to make it effective, and that these categories are not yet all defined.

The teams were told through lectures how they should function, but there was not time to give them practical experience in the field.

MODIFYING COORDINATES ON THE CADASTRAL MAPS

There are coordinates on the original cadastral maps but they are part of a system of internal coordinates. It was decided by the project that we would use one of the accepted international coordinate systems. The training in how to convert to, and use, the international system never took place. The persons trained in the GIS program understood this was a crucial part of the modernization process, but they were never formally trained in the new system.

SECURITY OF THE SYSTEM

Security is fundamental to maintain the integrity of the computerized land registration system. We had planned to deal with issues of system security in detail. However, time did not allow us to review alternative methodologies for putting a security system into place. This was discussed in the training program, seminars, workshops and whenever an opening allowed. However, nothing concrete was ever proposed to the SBAL or Erbil (Sulaymaniyah) Ministry teams. The issues were explored in some detail with the database developers and the other computer specialists who were assisting with the ARDI project activities. We hope that there will be an attempt to create a security system for the database and all the data.

COUNTRYWIDE COORDINATION

It had been planned that surveyors from the 3 Kurdish governorates would join surveyors from the other 15 Iraqi governorates, at the Erbil project, to coordinate both database entries and field checks on maps. This must be a countrywide effort, in order to make a consistent and accessible structure for a land administration system. Such meetings must now be organized at another venue, perhaps still in Erbil, but in the absence of the Project Coordinator since the project has closed.

The instructor is explaining the use of a GPS positioning device in how it can be used to locate a point on the earth.

"Where are we?" Surveyor and technical staff from the SBAL practicing the use of GPS devices to locate a physical position on a map.