

Sustainable Development of Drylands Project

<http://ag.arizona.edu/OALS/susdev/>

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Cooperative Agreement

USAID and the IALC
(2002 – 2010)

Final Project Report

September 30, 2010



Figure 1 – Ein Ghazal Septage Receiving Station

Introduction

The Sustainable Development of Drylands Project in Asia and the Middle East was initiated in October 1, 2002 as a Cooperative Agreement between the International Arid Lands Consortium (IALC), headquartered at the University of Arizona (UofA), and the US Agency for International Development (USAID). Following eight years of continuous activity, the Project has accomplished its principal goals and will now close as of September 30, 2010.

In closure, the Project website <http://ag.arizona.edu/OALS/susdev/> will be maintained by the IALC at the Office of Arid Lands, School of Natural Resources & Environment, College of Agriculture and Life Sciences at the UofA. This final summary report is linked to the website, and designed to provide an outline to the actual reports and publications on the website to, hopefully, provide smooth access to the individual reports of interest. Additionally, physical copies of all the reports on the website have been transmitted to USAID Washington and to the individual USAID Missions which had operational project Components.

Project Components were sustained across a number of countries, Afghanistan and Pakistan (jointly), Jordan (project duration), and Yemen (briefly). More focused activities were undertaken in Afghanistan for Libraries Rebuilding and the West Bank (briefly) and attempted to work with Yemen (Libraries Rebuilding) and India (exploratory). This report covers highlights and the sustained activities with the hypertext links provided at the head of each major component, in summaries (either as a Table or List).

Three interdependent objectives were implemented:

- (1) Improve wise use and re-use of water, treated wastewater and soil resources at the farm, community and regional levels;
- (2) Support human and institutional capacity development in arid lands agricultural development and conservation by partnering with educational and other institutions of host country nations,
- (3) Apply appropriate technology, especially information technology, to support sustainable arid lands development.

This project addressed directly the twin threats of desertification and drought which represent enormous obstacles to sustainable development and that threaten the lives and livelihoods of millions of men, women and children in Asia and the Middle East with unbridled competition for resources, and could increase the likelihood of armed conflicts. The methodologies employed in this project were well tested, replicable and showed considerable success.

The Cooperative Agreement, began as a one-year demonstration that showcased IALC capabilities. It was judged to merit two funded extensions that totaled six years following the

initial year, and then the Project was provided with a one year no-cost extension of time to allow for an orderly completion of activities.

This project resulted in leveraging of resources, and encouraged the use of scientific methods and modern technologies to provide solutions to some extremely difficult resource and social challenges. Most of these accomplishments are highlighted in the following pages as having a beginning and an end, but the “soft power” of training and capacity building provides on-going support and encouragement of the moderate elements in society by giving them a stake in the future.

By reaching across the miles that divide countries and by diminishing the cultural and language barriers of separation, while difficult to measure and quantify (although there is a serious attempt made in the summary tables), remain real. These improvements in our respective societies understandings of each other and those improvements within each community will likely last far beyond any material designs or physical equipment supplied by this Project. In the final analysis, sustainability is about increasing a society’s human capacity to self-renew within the resource base of the region and globe, while leaving a better future for the next generation.

Acknowledgements

It is common to characterize sustained efforts as successful by simply lasting a sufficient amount of time, but this project not only lasted through two major wars in the region (Iraq and Afghanistan), and a serious armed incursion (Israel-Lebanon), that displaced hundreds of thousands of people throughout the region and stressing all the neighboring countries’ social nets, as well as the US government’s focus and funding. This project was able to sustain its efforts through dedicated teamwork by its US university faculty and staff members, and by the support and commitment of members of each of the host country institutions.

Due for special recognition is the IALC, headed first by Dr. Ken Foster and then Dr. Colin Kaltenbach, the IALC-Technical Advisory Committee (TAC) Chairs, Dr. Earl Kellogg and Dr. LeRoy Daugherty and the participating TAC members, Dr. Jeff Dawson, Dr. Peter Ffolliott, Dr. Jim Norwine, Dr. Dwayne Beck, Gill Atsmon, Dr. Dave Rhode, and Dr. Mohammad Smairan.

The very dedicated Project Component Leaders were Dr. John Santas (University of Chicago at Urbana-Champaign (UIUC) for Afghanistan-Pakistan Human Capacity Development), Dr. Saad Al-Ayyash, Dr. Mohammad Smairan (Badia Research and Development Centre (BRDC) for Jordan Water & Environment) and Dr. Akrum Tamimi (University of Arizona as Jordan Component Coordinator), Dr. Octavio Ramirez and Dr. Bill Gorman (New Mexico State University (NMSU) for Yemen, then Jordan Agri-Business), and Dr. Atifa Rawan and Dr. Nasrat Wassimi (UofA for Afghanistan Libraries Rebuilding).

Within each one of these Components there were numerous significant contributors and two from the Afghanistan-Pakistan Component, Dr. Abdul Qayyum Khan and Dr. Oval Myers (deceased) bear special mention. Participating fully in the training was the Northwest Province Agricultural University (NWFP AU), Peshawar, Pakistan.

The Jordan Water & Environment Component had, in the course of its work, participation by 25 UofA faculty members (a bit too numerous to mention individually), but three of the most steadfast were Dr. Chuck Gerba, Dr. Janick Artiola and Dr. Jim Field. The work could not have been accomplished without the partnership with IALC member, BRDC, Amman, Jordan, headed by its President, Mohammad Shahbaz. Key participating Jordanian institutions were the Royal Scientific Society, Jordan University of Science and Technology (JUST), University of Jordan, Water Authority of Jordan (WAJ), Ministry of Water and Irrigation, and the Aqaba Special Economic Zone Authority (ASEZA).

The Jordan Agri-Business Component was ably assisted by NMSU's Dr. Jim Libbin, Rich Phillips, and Dr. Derrick Bailey, with co-direction provided by the BRDC leadership and staff. The Afghan Libraries Component had dedicated administration, faculty and staff from the University of Kabul, and the University of Nangarhar.

A special thank you goes to IALC Board member and Managing Director, respectively, Dr. Chuck Hutchinson and Dr. Jim Chamie, and a big thanks to Project Admin Assistant, Esther Miklofsky for accomplishing all with good cheer.

We acknowledge the tremendous financial support provided by USAID Washington and the individual Missions, especially Jordan, Pakistan and Yemen that provided matching funds to the "core" funds from Washington. Of the Missions, the Jordan Mission must be recognized for its years of support, and special recognition goes to Jim Franckiewicz, Dr. Amal Hijazi, and Dr. Ross Hagan.

Without the guidance, intervention, mid-course corrections, and support by Cooperative Agreement USAID Project Managers ("CTOs" and "ATORS" in AID parlance), Dr John Wilson and Dr. Scott Christiansen, this Project would have ended far earlier, and with far few accomplishments. Thank you, gentlemen!

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Afghanistan-Pakistan Activities

Sustainable Development of Drylands Project

IALC-University of Illinois at Urbana-Champaign

Component Final Report Summary

Introduction – University of Illinois at Urbana-Champaign, Southern Illinois, University and Northwest Province Agricultural University

Led by the University of Illinois at Urbana-Champaign, UIUC, (with Southern Illinois University (SIU), Northwest Frontier Province Agricultural University, Peshawar, Pakistan, and Kabul University, Nangarhar University, Balkh University and Ministry of Agriculture, Afghanistan):



topics.

The Afghanistan-Pakistan Component has operated on three tiers in its human capacity building effort, the first being short-term high impact training of more than 400 farm leaders, (**Figure 1**) NGOs and agricultural officers in 21 technical courses, ranging from soils management, orchard management, irrigation practices, extension methodology, post-harvest management and food preservation, and animal nutrition to name but a few of the training

The UIUC-SIU team, operating in close collaboration with the faculty of the Northwest Frontier Province Agricultural University (NWFP-AU), has re-trained 24 agricultural scientists in a “twinning” program which matches the Afghan discipline counterpart with a Pakistani agricultural scientist. This has proven very successful as a train-the-trainer methodology while building bridges for future collaborative efforts between neighboring scientists.



The third tier is the training of the next generation of agricultural teachers by enrolling 10 Afghan teachers in a Master of Science program at NWFP-AU (**Figure 2**). All 10 teachers are on par to graduate and be able to turn their skills to training the lost generation of agricultural students.

In addition to the multi-level trainings, the UIUC team, drawing upon the work of their previous comprehensive USAID-funded project (TIPAN), has provided more than 10,000 text books in English and Dari for Pakistan and Afghanistan students of agriculture. Currently an Agricultural Extension text and English Enhancement Center are under development.

Project Summary of Accomplishments

Our final quarterly report in the life of this project will deal with the timing and chronology of our efforts to develop human capacity for the agriculture sector in Afghanistan, and secondly, will place on record the actual number of Afghans reached through these training programs.

The numbers are straightforward and tell an impressive story. Through the technical short courses, which were the central feature of training efforts, we reached a total of 501 individuals who play key roles in Afghanistan's agriculture sector. Twenty-six courses on at least 16 different topics were conducted in both Pakistan and Afghanistan, with groups of about 20 in each course. These groups were a blend of participants representing universities, various Afghan ministries and an assortment of NGO's. Most courses were one month in duration, allowing for sufficient networking and interaction within the group and for detailed in-depth coverage of the topic being studied. This total number of short course participants includes 44 women. Course outlines and other details can be found at: www.aces.uiuc.edu/Global/Afghanistan/ .

Research collaboration led to 24 Afghans, from Darul Amaan (Kabul) and Sheshambagh (Jalalabad), being sent in small groups to stations and institutes in the Northwest Frontier Province of Pakistan for specialized short term training. Scientists at the Cereal Crops Research Institute in Nowshera, Pakistan played a central role in these efforts to strengthen research capacity in Afghanistan's Ministry of Agriculture, Irrigation and Livestock (MAIL) and to establish "twinning" relationships between Afghan and Pakistani research stations.

Long term degree training was provided to 20 Afghans who completed M.Sc. degrees at the NWFP Agricultural University in Peshawar, Pakistan. Masters degrees in a wide range of disciplines were awarded to five from the Faculty of Agriculture at Kabul University, five from the Faculty of Agriculture at Nangarhar University (Jalalabad) and ten from the MAIL Extension Department. Their degree programs included intensive English training and heavy emphasis on individualized and customized enrichment experiences, as well as thesis research conducted in Afghanistan on problems and issues that confront their agriculture sector.

These training activities were supported by the purchase, production and distribution of large quantities of reference and printed materials. These materials were placed in university libraries in both Afghanistan and Pakistan. Field offices of the MAIL Extension Department also received reference materials. Training manuals that were produced for the technical short courses were carried back to duty stations by participations in these courses.

Numbers from the financial side of this component are also worth mentioning. Illinois received \$1,320,672 in “core funds” that passed through the Cooperative Agreement between the IALC and USAID. Core funds were managed and “leveraged” to attract an additional \$1,515,363 in supplemental funding. This came from sources such as: Chemonics’ RAMP project, USAID-Islamabad, MAIL-Afghanistan, USDA-FAS, ALO-HED, and FAO of the UN.

The evolution and chronology of this component provides valuable perspective as we reflect on events of the past seven years. During the first half of CY2002 the development community

(including U.S. universities) became interested in Afghanistan’s recovery process, as that country emerged from a generation of chaos. Illinois had established a presence in the region through a ten year period (1984-1994) spent upgrading the NWFP Agricultural University in Peshawar, Pakistan. This USAID-funded university development project had left a well qualified faculty with more than 150 professors and research scientists holding advanced degrees from U.S. universities. After gauging interest at our partner institution in Pakistan and receiving a positive response, Illinois prepared a plan that would use the resources of this Peshawar-based university to assist their neighbors in the recovery process. We reasoned that our Pakistani colleagues could combine their U.S. educational qualifications, with their knowledge of local agro-climatic conditions and region-specific agricultural practices, to help the agriculture sector get back on its feet. Afghanistan’s most obvious need, having been isolated for a generation and their entire educational system shut down, was for intensified training that would introduce Afghans to the technology they had missed during the 1980’s and 90’s.

Our response to this need consisted of a series of “early impact” short courses that would be conducted on the Agricultural University campus in Peshawar. We felt we could have an early impact on the recovery process by using our Pakistani colleagues as short course instructors, while the security situation improved in Afghanistan and the in-country development process began to gather momentum. Arrangements were made for the first courses (one on Water Management, one on Enterprise Development and another on Post-Harvest Handling) to be held during August and September 2003. As we moved ahead with these plans, an August 12, 2003 meeting of the IALC Technical Advisory Committee (TAC) became a pivotal event. The TAC

group was not in favor of the Illinois plan and did not support our proposed approach to assisting Afghanistan in its recovery. Cooperation with the NWFP Agricultural University was not acceptable to the TAC group and strong concerns were expressed about the potential for damage to the IALC reputation. Given this situation, it became necessary for the Afghanistan-Pakistan component to be managed in such a way that the blame for any problems (or the credit for any successes) would come to rest on the University of Illinois and not on the IALC.

Because we had confidence in our Pakistani partners, Illinois moved ahead with the plan that we developed in 2002/2003. During the intervening years we have made significant contributions to development of human capacity for the agriculture sector in Afghanistan. And during these intervening years, the development process in Afghanistan has gathered momentum. The “early impact” phase has passed. At the early stages of the recovery process, the resources of our partner institution in Pakistan were appropriate and sufficient to meet the development needs of Afghanistan’s agriculture sector. An impressive array of development resources has been assembled over the past seven years and is now available to the Afghans. The NWFP Agricultural University is part of that “array of development resources”. That university has a definite role to play in the development process and a sincere interest in assisting their neighbors. The partnership with Illinois has brought them to the point where they can independently apply the resources of their university to the continuing and unfolding development needs in Afghanistan during the years ahead.

Chronology of Technical Short Courses delivered through IALC/UIUC Afghanistan-Pakistan Component.

Most courses were one month duration, with 20 Afghan participants enrolled in each course. Except as footnoted, courses were held at the NWFP Agricultural University in Peshawar, Pakistan. AU-P Faculty were responsible for all instruction. Participant lists for all courses are on file at UIUC. These train-the-trainer courses reached a total of 501 individuals who play key roles in Afghanistan’s agriculture sector.

*Please note that the following links go to quarterly reports on the Project Website

August 2003	Irrigation and Water Management Practices
August 2003	Enterprise Development and Management Skills
September 2003	Post Harvest Management and Marketing Skills
February 2004	Sustainable Use of Water Resources for Engineers
February 2004	Orchard and Nursery Management
April 2004	Women's Enterprises (Funded by Mercy Corps)
May 2004	Enterprise Development and Management Skills (1)
May 2004	Extension Methodology and Technology Transfer (1)
June 2004	Integrated Pest Management
June 2004	Animal Nutrition
July 2004	Post Harvest Management and Marketing Skills
July 2004	Preservation of Fruits and Vegetables
February 2005	Poultry Husbandry
February 2005	Animal Health
March 2005	Soil Management
March 2005	Teaching Methodology and Communication Skills
April 2005	Irrigation and Water Management Practices
April 2005	Post Harvest Management and Marketing Skills
May 2005	Mushroom Training (Funded by Mercy Corps)
February 2006	Animal Nutrition
February 2006	Extension Methodology and Technology Transfer
July 2007	Soil and Water Analysis (Funded by FAS/USDA) (2)
August 2007	Home-Based Food Processing (Funded by UN/FAO)

April 2009

Research and Demonstration Methodology and Interpretation (3)

Conducted at Kabul University

Conducted at Shesham Bagh Agricultural Research Station in Jalalabad, Afghanistan.

Conducted in Kabul as three separate six-day courses. Participants in group one/course one came from the northern and western provinces, group two came from the southern and eastern regions, and group three was made up of individuals whose duty stations were in the Kabul vicinity.



Figure 2 -Students walking on Kabul University



Figure 3 - Enterprise Development and Management Skills Classroom



Figure 4 - Northwest Frontier Province Agricultural University in Peshawar, Pakistan



Figure 5 - Northwest Frontier Province Agricultural University in Peshawar, Pakistan



Figure 6 - Northwest Frontier Province Research Station

Jordan Activities

Sustainable Development of Drylands Project

**IALC-University of Arizona and Badia Research and Development
Centre**

Component Final Report Summary

Introduction – The University of Arizona and the Badia Research and Development Centre

This component was led by the University of Arizona (UofA) and Badia Research and Development Centre (BRDC), with participation by Royal Scientific Society (RSS), University of Jordan (UJ), Jordan University of Science and Technology, Water Authority of Jordan (WAJ), National Center for Agricultural Research and Training (NCARTT), and Hashemite University.

The Jordan Water and Environment Component has focused on providing USAID-Jordan and the government of Jordan key expertise in the safe re-use of treated wastewater and bio-solids that are principally destined for application to farmlands. The UofA worked closely with its Jordanian partners to tackle one of Jordan's critical problems, that of water scarcity, by:

1. re-using water,
2. using water more efficiently, and by
3. improving soil resources through the use of treated bio-solids.

Management Practices of Sludge and Biosolids in Jordan

Considerable efforts were made to provide substantive assistance in the form of operations and user manuals for the safe use of treated Biosolids. These were organized as:

Volume I: Management of Biosolids in drying beds at the wastewater treatment plants. The manual was begun by the Royal Scientific Society and completed by the UofA.

Volume II: Management of Practices of Biosolids on-farm application. This manual was written by JUST with input by BRDC and the UofA. It was provided in both English and Arabic to facilitate use by extension personnel and farm leaders.

Volume III: Laboratory Procedures for Biosolids. This effort was an outcome of the numerous trainings provided by the UofA Microbiology faculty, headed by Dr. Gerba and by the RSS staff, in particular, Dr. Nisreen Al-Hamood. It was designed to be used by laboratories in Jordan testing Biosolids, in particular those of the Water Authority of Jordan.

The Development of Anaerobic Wastewater Treatment Technology for Jordan:

WERSC at the University of Jordan was responsible for the adaptation and development of an anaerobic wastewater treatment method advanced in the Netherlands and subsequently brought to developing countries with Egypt being the lead regional country in its adaptation. Following

an extensive workshop and visit to Egypt, the University of Jordan engaged in a series of three related activities examining the potential of UASB for Jordan.

1. UASB Adaptation to low temperatures,
2. Characterization of solids at Salt, and
3. Characterization of Septage at Ein Ghazal

While promising, considerable work remains to be done, especially in the lower winter temperatures found in the Jordanian plateau to insure that anaerobic treatment continues at the high rates necessary for the uninterrupted pathogen removal and inactivation.

Biosolids Application to Farm and Rangelands

Begun in the early stages of the project, there were three distinct applied research and monitoring efforts made to characterize, monitor and measure the effects of the applications of Biosolids to dryland farmland (NCARTT/NCAR Experimental Station, Al-Ramtha), to irrigated farmland (Water Authority of Jordan at Madaba Wastewater Treatment Plant) and to Rangelands (at Hashemite University rangeland)

Results were positive for each of the applications efforts and are reported in the summary table and in reports on the website. In short, the application of Biosolids showed no residual pathogen activity, there were no adverse health incidents reported, and there was no detection of any adverse chemical reactions in the soils examined. These activities were incorporated into the field and laboratory training exercises and benefited from the full participation of the Royal Scientific Society as a lead institution, the BRDC in its supervisory roles, the Water Authority of Jordan as the operating entity and the National Center for Agricultural Research.

Additional workshops were developed as outcomes of the research, among those were: A workshop dealing with the effect of applying biosolids to rangeland was held on July 22, 2009. Mohammed Shahbaz gave a talk on “Stopping Soil Erosion in the Desert”. This was followed by Dr Odeh Almeshan who talked about “Preliminary Work and Site Characterization at Hashemite University”. Dr. Nisreen Al-Hmoud talked about “Application of Biosolids to land planted with Fodder”, and Dr. Odeh, with “Hashemite University Pilot Project: Site Preparation, Characterization and Initial Seasons Results”, Dr. Radhi Al-Hashimi discussed “Hashemite University Pilot Project: Application of biosolids to Rangeland Soil and Chemical Results” and Dr. Tamimi provided an international perspective of “Application of Biosolids to Mine Tailings: The Arizona Experiment”.

Regulatory Standards Revisions

An early and sustained effort was made to successfully revise the Jordanian Standard for Biosolids Regulation. This was the result of the concerned Jordanian institutions coming together in an *ad hoc* committee, comprised of RSS, BRDC, WAJ, Ministry of Health, Ministry

of the Environment, and Ministry of Metrology. The committee's efforts were funded and provided technical assistance by this Project, resulting in modeling the revisions to the JS on USEPA regulations and then further modifying and adapting the Jordan Standard to local conditions and capabilities (including laboratory analysis capabilities). This effort both benefited from the Project's technical assistance and, in turn, guided the technical assistance direction. It was truly a collaborative effort that resulted in knowledge gained by both Jordanian and US researchers.

As this type of work is always on-going and subject to new tests and analysis techniques, the project revisited the early work and concluded that additional revisions are merited and that the Standard should be revised again, especially for the requirement of testing all microbiological parameters even if Fecal Coliform counts proved to be less than 1000 MPN. In addition, it was felt that one or more methods (Aging, Solarization etc.) should be certified to produce Type I Biosolids.

Development of Biosolids Treatment Methods

Initially pursued under the joint efforts by RSS and the UofA at the Wadi Hassan WWTP, detailed examinations of Biosolids treatment in drying beds were performed by Dr. Chris Choi and with assistance by Susan O'Shannessey of the UofA and supervised by Dr. Bassem Hayek with substantial staff involvement by RSS. This work was the precursor to later efforts made at the Madaba WWTP, again by RSS with Dr. Bassam Hayek and then by Dr. Nisreen Al-Hmoud at RSS/ERC with considerable assistance by Dr. Tamimi, Dr. Gerba and Dr. Artiola of the UofA. An enhanced Aging Method, based upon findings of the Chicago Wastewater Sanitary District, was researched. Thickened sludge was placed in the modified drying beds and left for greater than 90 days while intensive instrumentation and sampling occurred. This effort was followed by an additional season of monitoring and modifications to the drying beds at the WWTP.

As a adjunct to the physical research, Dr. Tamimi undertook to model the resulting behavior of the Biosolids. This modeling was then examined statistically by the UofA's Statistical Consulting Laboratory, under the guidance of Dr. Dean Billenheimer. The results show that the Biosolids readily reach Type II standards, but Type I is more difficult to reach particularly in the winter time. Additional efforts are needed to insure the safe use of Biosolids and this is likely a combination of extended aging times and to restricting the release of Biosolids materials to the warmer summer months for application for use in fodder, fiber or non-directly human consumed crops. Type I classification was reached in the summer months, but the winter weather with lower temperatures and increased rainfall proved challenging. USAID Amman is encouraged to continue this work to find an economical and safe method of consistently achieving Type I classification of treated Biosolids. Biosolids are an important and necessary resource to enhance degraded soils, increase agricultural productivity and decrease water use.

**Table 1 - Sustainable Development of Drylands Project
Retrospective Activities Summary (October 2002 – 2010)**

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
1	The Essential Electronic Agricultural Library – UofA & Cornell U	Researchers, Proposal Quality	500		3 years: used by 500 students and researchers at JUST, UofJ, & BRDC. Improved the quality of proposals submitted to funding agencies – Likely large impact but difficult to quantify beyond direct users	2003, 2004, 2005 and 2006

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
2	Technical Study Tour. Wastewater Treatment and Reuse Technologies – UofA and BRDC	Training the trainers	6	240	Expertise and Skills: the 6 participants trained and improved quality work for two professors trained at least 200 students; four agency professional at least 40 colleagues	December 200
3	Laboratories Study Tour: Biosolids Analysis and Applications – UofA	Training the trainers	4	40	Expertise and Skills: the 4 Participants trained and influenced the quality of work for at least 40 people and improved own work quality	May, 2004
4	Short Course Training: Dendochronology Applications to Sustainability of Wastewater Reuse – UofA	Training the trainers	2	200	Two faculty members from Hashemite University spent 3 weeks at the tree ring lab at UofA.	Summer, 2004

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
5	Recycling of Wastewater and Biosolids Maximizing Benefits and Safety Workshop – UofA & BRDC	Training the trainers	15	420	3 faculty teaching at least 300 students; 12 graduate students and agency personnel improving work of 120 persons. Held at NCART	June, 2004
6	Sustainable Water Resources Management , the Role of Proxy Records in Understanding Drought and its influence on Reclaimed Water Resources Workshop – UofA, Hashemite U & BRDC	Training the trainers	15	510	4 professors teaching at least 400 students. 11 participants impacted work of 110 other persons	July, 2004

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
7	In Support of WEPIA , partially funding and participating in Water Demand Management Conference – Reuse Track – UofA	Conference Assistance	46	250	Supported 40 attendees; 6 UofA faculty and staff presented and contributed to 6 papers to the conference impacting 250 persons	May, 2004
8	In support of WEPIA , Delivering the Alternative Water Supply Course to JUST – UofA	Education	29	650	4 Jordanian university faculty members teaching at least 400 students, 25 graduate students impacting 250 persons	August, 2004
9	Design of Water Conserving Garden in Aqaba – UofA & ASEZA	Training	13	400	Training ASEZA staff in xeriscape design ideas and concepts. 3 designers trained, impacting 300 persons, 10 other employees influenced impacting 100 persons	2004-2005

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
10	Design of Irrigation System for WCG – UofA	Technical Assistance	3		Improved ASEZA irrigation design methodologies to save water	2004-2005
11	Training ASEZA staff – UofA	Training the trainer, improve work quality	3	300	Trained 3 irrigation system designers from ASEZA and CDM. Impact potentially very high	Summer 2004
12	Characterization of Biosolids at three WWTP's	Standards, people and improve work quality	18	60	Updating standards, see below. Improved Research skill for 6 researchers at RSS, impacting 60 other persons. Formed biosolids Ad hoc committee of 12 members to improve inter-agency cooperation.	2005 thru Feb 2007

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
13	Reclaimed Water Supply and Demand Study to ASEZA - UofA	Knowledge	15	250	Improved knowledge thru technical report to ASEZA and paper publication	2004
14	Standards development for the reuse of biosolids in agriculture	Standards	10	100	Updating standards. Ad hoc committee members RSS, BRDC, UofJ, JUST, JISM, NCARTT, M of Environ, M of Health, M of Agriculture, USAID and technical assistance from UofA	2004-2009
15	Developing Improved Technology for Biosolids Treatment – UofA, RSS	Standards	10	100	Updated standards and improved research skills for 6 researchers at RSS and 4 at NCARTT	2004, 2005, 2006

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
16	Wadi Mousa Landscape Design – UofA & BRDC	People	20	1000	Will affect visitors to the Park: around 1000 visitors per year when implemented	2004 and 2005
17	Real-time interactive video conferencing learning course: Irrigation Management of Reclaimed Water (special emphasis on salinity) UofA & JUST	Faculty and students	17	300	In addition to directly impacting the 17 graduate engr. Students, faculty members have produced additional courses. Course evaluation at end of semester showed positive response from students to the use of technology	2005 thru Feb 2007
18	Biosolids Application to grow barley at Ramtha – RSS, NCARTT & WAJ	Standards, People and knowledge	12		Improved Research Skill for researchers at RSS and NCARTT. Biosolids ad hoc inter-agency committee of 12 improved communications, cooperation and knowledge	2005

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
19	Biosolids Application residual study at Ramtha – RSS, NCARTT & WAJ	Standards, people and knowledge	12		Improved Research Skill for researchers at RSS and NCARTT. Biosolids ad hoc inter-agency committee of 12 improved communications, cooperation and knowledge	2006
20	Modeling Biosolids Treatment in Jordan – Wadi Hassan, Wadi Mousa – UofA & RSS	Health and knowledge	10	48	Developed model for the improved biosolids treatment operation at WWTP	2005thru 2007
21	Management of sludge and Biosolids in Jordan	Health	18		Initial work: RSS, Ad hoc committee, UofA, See item 18	2005 and 2006

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
22	Biosolids Risk Assessment and Standards Development Methods: A Workshop and Seminar	Health, economics and environmental	46	460	See item 18 in reducing health risks of biosolids to 5000+ users while encouraging the reuse of biosolids. Reduce, then eliminate the dumping of biosolids into the environment. In Amman – UofA, RSS, BRDC, & Ad hoc Committee	December 2005
23	Anaerobic Low Cost, Low Energy Technology for Wastewater Treatment Workshop, UofA, BRDC, and NRC, Cairo, Egypt	Knowledge on alternative treatment options	12	120	12 decision makers from Jordan	March 2006

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
24	Anaerobic Technology Development UASB Technology Development	Economic , health, environmental, and knowledge	6	22	Reduce operational cost by 60 to 70%. Reduce biosolid quantities by 50%. Potential to produce biogas for more efficient treatment. Very large potential impact. Reduce biosolids dumping in dumping sites. Developing UASB for Jordan's winter low temperatures.	2006 thru 2009
25	Linkages for On-Farm Applications and Technology Extension Project – JUST	Farmers	20	500	500 farmers and 20 extension agents	2006 thru 2008

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
26	Advanced Biosolids Laboratory Training including virus detection at Microbiology lab – UofA	Health	2	4000	Lab training for senior RSS staff. Reduce health risks of biosolids to 4000+ users. This training assisted the detection and isolation of a <i>Cyptosporidium</i> outbreak in water supply in Mafrq region.	November 2006
27	Required Biosolids Laboratory Training – RSS & UofA	Health, economics and environment	20	5000	Reduce health risks of biosolids to users by improving testing for pathogens. Also, reducing dumping of biosolids to the environment.	Summer 2007

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
28	Development of Drying Bed Sludge Treatment Method to arrive at a permitted “Process to Further Reduce Pathogens” (PFRP) (Madaba) Applied Research and Demonstration, UofA, RSS, & WAJ	Health, economics and environment	10	5000	Reduce health risks of biosolids to users. Reduce the cost of testing biosolids and encourage biosolids reuse.	2006
29	Manual for Management of Biosolids in the Drying Beds at the WWTP Level (Volume I) Ad hoc Committee & RSS	Health and economic	50	150	Improve the health and performance of 200 WWTP operators. Initiated 2005 in revision 2009	2005, 2009

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
30	Management Practices of On-farm Biosolids Application Manual (Volume II) – JUST, RSS, & Ad hoc committee	Health, economics, farmers and training	125	5000	Improves 5000 biosolids users part II. Encourages the reuse of biosolids for the 5000 users. Extension effort targeting safe use of treated effluent and treated biosolids. Manual was developed thru local workshops with agencies and farm leaders participation,	2006 thru 2009
31	Biosolids Laboratory Procedure Manual (Volume III)	Health and training	18	30	Standardized methods for biosolids physical, chemical, and microbiological parameters. RSS and Ad hoc committee. Used at Hashemite University. WAJ and RSS labs. Under revision for a new version.	2006 thru 2009

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
32	Septage Characteristics at Ein Ghazal -U. of Jordan	Economic, health, and technical	4	5000	Give options to reduce the cost of treating high loads of BOD by Samra WWTP – Potential impact very large but difficult to accurately quantify. Assist WAJ in determining source of high organic load in Samra influent	2007 thru 2009
33	Application of Treated Biosolids to land irrigated with effluent (Madaba – Fodder Maize) RSS & UofA	Economics, ag economics and environmental	10		Reduce the dumping of liquid sludge at Ein Ghazal: 5000 cubic meters per day times 7 treatment plants during the 6 months with cold weather. Reduce dumping of biosolids to dumping sites. Increase agricultural fodder production to farmers	Spring 2007

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
34	Application of treated biosolids to land irrigated with effluent (Madaba – Alfalfa) RSS & UofA	Economics, ag economics and environmental	10		Reduce the dumping of liquid sludge at Ein Ghazal: 5000 cubic meters per day times 7 treatment plants during the 6 months with cold weather. Reduce dumping of biosolids to dumping sites. Increase agricultural fodder production to farmers	Summer – Fall 2007
35	Development of sludge treatment techniques to arrive at Type I biosolids under greenhouse cover	Health, knowledge, and environment	10		Reduce health risks of biosolids to users. Improve biosolids quality and safety and encourage biosolids reuse.	2007-2008

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
36	Characterization and outreach of rangeland responses under biosolids application. Project Planning Phase – Hashemite U & BRDC	Environmental, health, and economics	75	5000	Three local workshops were held to assess cultural attitudes towards the application of biosolids to rangeland. Site physical parameters performed including soil nutrient content. Work would affect 5% of Jordan population through improved rangeland productivity	2005 thru 2008

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
37	Modeling biosolids treatment in Jordan – Madaba WWTP – UofA & RSS	Health and knowledge	10	48	Improve the operational treatment process by the WWTP	
38	Biosolids treatment using the aging technology	Environmental, health, Knowledge	10	48	Developing a treatment method with low energy/low cost/low labor requirement. Reduce health risks of biosolids to users, improve biosolids quality and safety, and encourage biosolids reuse.	2008-2009

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
39	Application of biosolids as a soil enhancer and fertilizer to rangeland – BRDC and HU	Knowledge, economics, environmental and health	30		Research and demo project at HU at experimental rangeland plot. Local workshop to present results and to inform ad hoc committee and USAID. Hands-on training for lab technicians at RSS.	2008-2009
	Total Persons impacted		1,246			



Figure 7 - Real-Time Distance Learning



Figure 8 - Capacity Building: Virology Training



Figure 9 - Biosolids *ad hoc* Committee Technical Session



Figure 10 - Biosolids Technology Monitoring



Figure 11 - Reuse of Treated Wastewater and Biosolids



Figure 12 - Rangeland Restoration with Biosolids



Figure 13 - Implementation of Xeriscape Design Elements

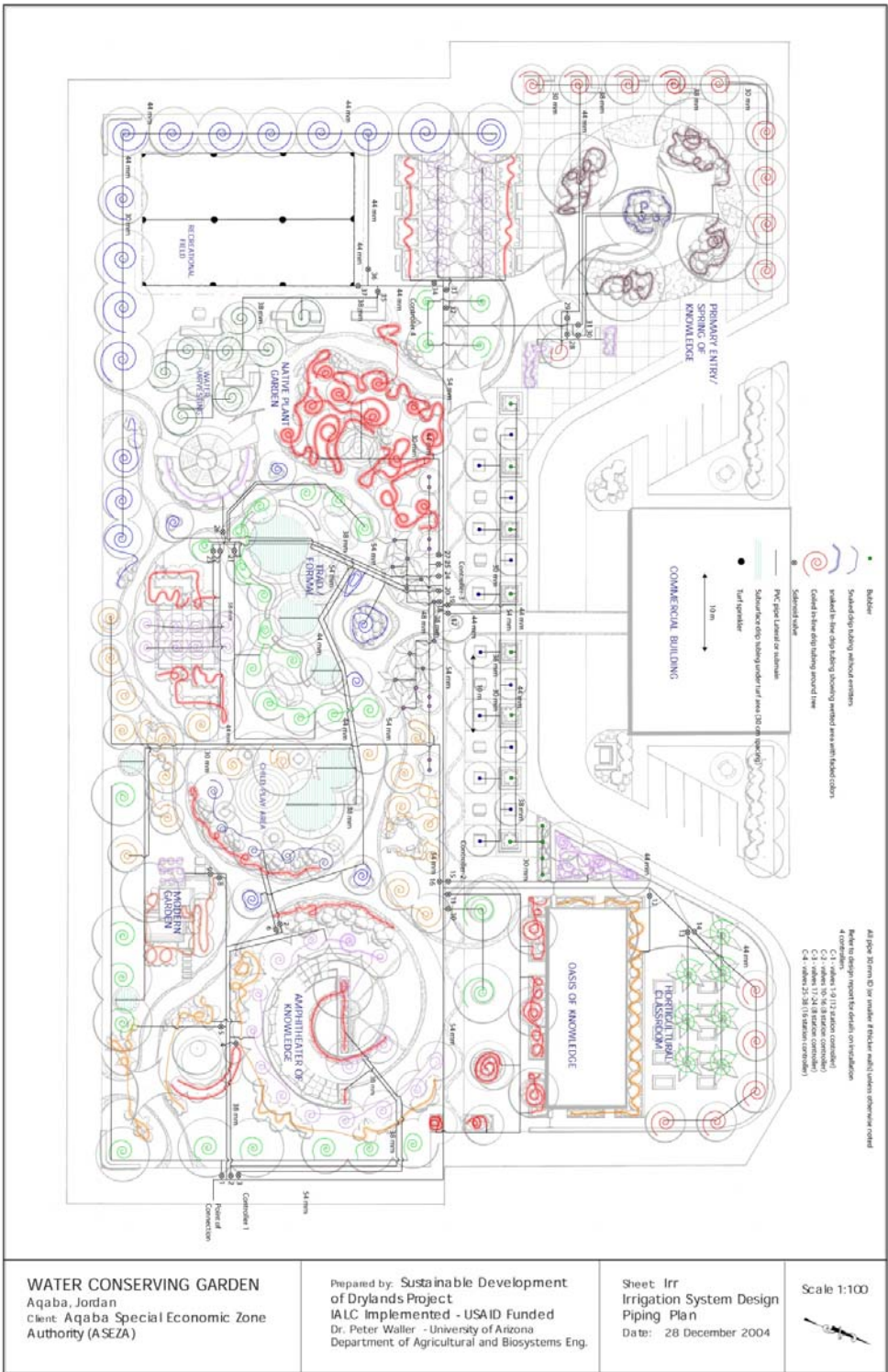


Figure 14 - Master Plan Xeriscape Irrigation Design

Jordan Agri-Business and Rangeland Activities

Sustainable Development of Drylands Project
IALC-New Mexico State University

Component Final Report Summary

Introduction – New Mexico State University and the Badia Research and Development Centre

IALC members New Mexico State University and the Badia Research and Development Centre are implementing the project “Business and Socioeconomic Assessment of Water and Products for Community-Based Projects in the Badia Region.” This project provides technical assistance to Jordanian government-sponsored, but privately run cooperatives on economic feasibility analysis of various cooperative business, business planning (including development of business plans to enable the cooperatives to seek outside funding), management and marketing of produce.

Rangeland Restoration

Research

A study conducted in collaboration with BRDC at Tal Rimah during 2004 through 2009 demonstrated that the combination of shrub plantings, water harvesting techniques (contour furrows, micro-catchments, and low rock walls) and proper grazing management practices may have the potential for increasing the range carrying capacity by three to six fold as compared to non improved rangeland under present management practices. This demonstration used relatively high cost construction alternatives for building the water catchments and planted comparatively expensive shrubs. Even under these conditions the concept appears to be economically feasibility with investment payback period ranging from 4 to 17 years depending up assumptions of the sustainable level of grazing and average rainfall.

A second study conducted by BRDC, NMSU and USDA-ARS was conducted in Qurain and Tal Rimah to evaluate the potential for forage kochia (*Kochia prostrata*) and perennial grasses for rangeland restoration in the Badia. Forage kochia appears to be an excellent forage resource for restoring perennial vegetation in arid rangelands of Jordan. Forage kochia emerged and survived the summer in drought conditions (70 to 110 mm of annual precipitation).

However, in conditions where annual precipitation is less than 70 mm, forage kochia may not survive.

Forage kochia can be broadcast seeded with minimal soil preparation, which will dramatically reduce restoration costs compared to transplanting nursery raised stock. Many of Jordanian rangelands are remote, and operation of machinery can be difficult because of rugged terrain or large rocks on the soil surface. The Sahro-select and Otavny-select varieties performed better than the other forage kochia varieties in the drought conditions of 2008 and 2009. However, at present, these varieties have not been released as commercially available cultivars. The commercially available Immigrant variety also performed reasonably well.

Perennial grass varieties evaluated in this study originated from Eurasia and were selected for arid and semi-arid conditions in the western United States. These grass varieties also have potential to be used in reseeded Jordanian rangelands, especially in areas receiving more than 100 mm of precipitation. The Kazak and Vavilov Siberian wheatgrass varieties may be slightly more productive than Hycrest crested wheatgrass and Bozoisky Russian wildrye in the arid conditions of Jordan.

A third study was conducted to determine if water harvesting and limited tillage was needed to establish forage kochia (Immigrant variety) and perennial grasses (Siberian wheatgrass and crested wheatgrass). Simple broadcast seeding with no soil tillage did not result in successful seedling establishment of forage kochia or perennial grasses. However, seeding with minimal soil disturbance and only light raking was successful. Water harvesting may not be economical in drought conditions when there is no surface water runoff. Contour plowing did not improve seedling establishment during a drought year.

Outreach

Two workshops were conducted to train local livestock producers on the value of rangeland restoration and low-input methods for establishing perennial forage. One workshop was conducted at Tal Rimah (40 participants) and the second in Qurain (30 participants).

Two presentations of the research conducted at Tal Rimah and Qurain were presented at the International Farm Managers Association conference in Bloomington, Illinois (July 2009) and the Society for Range Management (February 2010).

A manuscript summarizing the evaluation for the forage kochia and perennial grass varieties in Jordan will be submitted to *Rangeland Ecology and Management* (an international peer-reviewed scientific journal). The title of the paper is: “Potential of *Kochia Prostrata* and Perennial Grasses for Rangeland Rehabilitation in Jordan.”

In July 2009, Sheikh Hussein from Qurain, Jordan and Ahmad Al-Qadi (BRDC) visited NMSU in Las Cruces for training in grazing management, livestock husbandry and women’s issues.

Table 2 - Summary of NMSU Rangeland Restoration Activities in Jordan

Item	Description of Activity	Factors	Number of People		Measure	Remark
			Direct	Indirect		
1	Shrub planting demonstration at Tal Rimah (BRDC & NMSU)	Environmental, Economic, Community	70	500	Improve rangeland productivity by 3 to 6 fold	2004 through 2009
2	Economic analyses of Tal Rimah shrub planting demonstration (NMSU & BRDC)	Environmental, Economic Livestock	10	500	Payback period for rangeland restoration from transplanting shrubs is 4 to 17 years	2006 through 2007
3	Rangeland restoration workshop (BRDC & NMSU)	Environmental, Economic, Community	40	80	Conduct workshop explaining economic returns from planting shrubs on rangeland	December 2007
4	Grazing behavior research study (BRDC)	Environmental, Livestock	10	50	Conduct grazing behavior study	2006 through 2007
5	Germplasm – forage kochia and grass variety evaluation study (USDA-ARS, NMSU, BRDC)	Environmental, Livestock	20	500	Identify adapted and palatable forage species for reseeding rangelands in Jordan	2007 through 2009

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
6	Seeding and water harvesting practices evaluation (NMSU, BRDC, USDA-ARS)	Environmental, Economic, Livestock	20	300	Determine extent of tillage and or water harvesting practices needed for seed establishment	2008 through 2009
7	Use of forage kochia and perennial grasses for rangeland restoration with minimal tillage (BRDC, NMSU)	Environmental, Economic, Livestock, Community	30	100	Train livestock producers how to use forage kochia and Siberian wheatgrass for rangeland restoration. 1 day workshop.	June 2009
8	Grazing management, livestock husbandry, and women's issues (NMSU, BRDC)	Environmental, Economic, Livestock, Social, and Health	2	100	Training for Sheikh Hussein and BRDC technician during visit to NMSU	July 2009
9	Rangeland restoration practices evaluation (NMSU, BRDC)	Environmental, Economic	30	100	Scientific presentation at International Farm Managers Association conference in Bloomington, Illinois	July 2009

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
10	Evaluation of forage kochia and grass varieties (NMSU, BRDC, USDA-ARS)	Environmental	5	500	Manuscript submitted to international scientific journal, Rangeland Ecology and Management	December 2009
11	Use of forage kochia and perennial grasses for rangeland restoration with minimal tillage (NMSU, BRDC, USDA-ARS)	Environmental, Livestock, Economic	5	100	Scientific presentation at the Society for Range management meetings (international rangeland management society)	February 2010
	Total People Helped		192	2830		

Business and Socioeconomic Analysis of Water Use by Farmers

Water Use Surveys

The surveys of water use by 150 farmers in the South Jordan Disi aquifer and 105 farmers in the North Mafraq basin showed that:

On average, farmers used significantly more water than what was agronomically recommended for the crops grown.

Farmers living on the lands they farmed tended to use less water and obtained almost twice the yields per unit of water than owners living off-farm.

The vast majority of farmers don't use outside experts to assist in efficient water use.

Installation of meters to measure water use, charging a fee based on the amount of water used, education on crop water needs would reduce the amount of water used in agriculture and slow the depletion of aquifers without negatively impacting total production.

Assessments of Community Based Projects in the Badia Region

Community Based Agricultural Projects

Financial analysis of the agricultural enterprises on the Anaqeed Cooperative indicated that the production of honey, sheep, and sundried tomatoes had the potential of being profitable enterprises assuming good management and more effective marketing. The non-agricultural enterprise of concrete block manufacturing shows promise of being profitable. Feasibility analysis was not done for the crop and livestock enterprises prior to beginning production and the cash based government accounting system being used was not adequate to properly measure profitability.

The financial analysis of the Tal-Rimah sheep milk cheese processing plant, which was performed after the second year of operations, showed that there was no viable strategy for making the factory a long-term economically viable enterprise. The plant was built with funds from the government without the benefit of a detailed feasibility assessment. Had a feasibility assessment been required, it is likely the plant would not have been built.

The financial analyses of the Anaqeed and Tal-Rimah are situations often seen where well intended government funding is made available for projects to create much needed income and employment opportunities for Bedouins in the Badia region. However, neither of these projects had a competitive advantage in the market place to be self sustaining projects – projects that had a reasonable probably of continuing operations without substantial infusing of government funds annually. Hopefully more government agencies, non-profit donor agencies, community leaders will recognize the need to perform a feasibility analysis and prepare a business plan prior to investing social and private capital into future projects.

Fiber Arts Feasibility and Training Project

In late 2006, the NMSU economics team began to explore the feasibility of a financially self-sustaining community based project in the Badia that would produce high quality woven wool products from native sheep for sale primarily on the Internet and in international markets. The project would utilize two abundant resources in the Badia; wool from their native sheep and

labor provided by women in need of income opportunities. This effort would build on the currently well established craft industries but would focus on a niche international market for everyday useful high quality premium handmade products using native wool, historical designs, and some natural dyes. The products would be produced under conditions that would allow the use of “Fair Trade” labels.

Several cooperatives or associations involved in the production of crafts were visited in 2008. The Jordanian Women’s Qualifying and Training Society in Udreh was selected as an attractive site for a pilot project. This society’s members were receiving training in weaving rugs using a simple floor loom, training in sewing of clothing and related items, had a well equipped sewing room with a large number of machines and possessed a larger number of women interested in such a venture.

Their labor practices were very time consuming because of inadequate equipment and training. To effectively create a product that could be competitive in the designated niche market, spinning wheels, drum carders, weaving looms and other tools were purchased and delivered to the Society in June of 2009.

In July of 2009, Kimberly Shifflett, a highly experience commercial artist with over 20 years of experience in fiber crafts, conducted a several day preliminary orientation and training session for 19 women. The women were very interested and eager to learn. However, considerably more training and experience is needed before they are ready to produce high quality premium products for the international market. A demonstrating was conducted on dying their native wool using solar drying techniques as opposed to using expensive propane fuel.

A feasibility assessment was completed in the fall of 2009. The assessment indicated that it was possible to development a financially self sufficient fiber arts business along the ideas discussed above but it would require government upfront funds for startup expenses, the purchase of additional equipment, substantial additional training in spinning weaving, sewing and business practices, development of a brand name, additional products and designs and developing the international market distribution net work.

The NMSU team believes a fiber arts company can be successful and create a large number jobs for women and provide a higher value use for their native wool and is worthy of further development.

Table 3 - Summary of NMSU AgriBusiness and Marketing Activities in Jordan

Item	Description of Activity	Factors	Number of People		Measure	Remark
			Direct	Indirect		
1	Seminars on developing marketing plans and feasibility studies to BRDC staff	Improved economic performance	11	300	Trained BRDC staff to assist Bedouin to make better economic decisions on resource use	May 2006
2	Economic analysis of Anaqeed Al-Khair Cooperative agricultural activities	Economic, marketing, employment, crops ,livestock	170	1,259 households	Identify which crops and livestock activities were financially sustainable	2006 through 2007
3	Economic analysis of Tal-Rimah sheep cheese factory	Economic, marketing, Community	40	2,784 persons or 460 households	Feasibility analysis of the factory as currently operated and suggest way to improve financial performance	2006 through 2007
4	Agricultural water use survey of 105 farmers in the North Jordan aquifer	Water use , water conservation environment, economic	105	Several thousand in Amman	Information for water conservation policies including water pricing and future use in Amman	2006 through 2007
5	Agricultural water use survey of 150 farmers in the South Disi basin	Water use , water conservation environment, economic	150	More than 1,000	Information for conservation policies including water pricing and future urban and industrial uses	2006 through 2008

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
6	One week seminar on understanding accrual accounting and feasibility studies for BRDC staff in NM	Economic, marketing, financial analysis, community development	2	300	Trained BRDC staff to perform feasibility studies on projects before investing funds to avoid projects that will not be sustainable	September 2006
7	Presented seminar to members of Anaqeed and Tal-Rimah cooperatives on their financial performance	Economics, community development, effective use of resources	11	210	Demonstrated which agricultural enterprises were or could be profitable with better management and which were not sustainable	July 2007
8	Development of a sweet onion enterprise on Sheikh Khalid farms in Al Mudawwara	Economics, Marketing, economic development	5	50	Assistance given on seed selection, planting and harvest dates, cultural practices and marketing	2007 through 2009
9	One week seminar with BRDC staff how to conduct feasibility studies in New Mexico	Economics, effective use of financial resources	1	50	Trained BRDC staff to perform feasibility studies on projects before investing funds in non projects	December 2007

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
10	Seminar at Al Al-Bayt University on financial results of feasibility studies of Anaqeed and Tal-Rimah projects	Economics, sustainable use of financial resources, marketing	35	350	Discussion to demonstrate that feasibility studies including marketing plans need to be done before investing in projects	June 2008
11	Preformed financial analysis of concrete block manufacturing , Anaqeed Cooperative	Financial feasibility, community development	170	8,000	The financial analysis results indicated that the concrete block enterprise can be profitable and provide jobs	2009
12	Research on the feasibility of a fiber arts industry that would provide jobs to women	Economic development, jobs creation use of local resources	40	120	Research indicated that a self-sustaining business is possible using native wool for products sold internationally	2008 through 2009

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
13	Conducted training session for women on spinning and weaving, Women's Training Society in Udah	Job creation, income for women use of local wool resources	19	60	Trained women on how to use spinning wheels looms, carding machines, dyeing wool and local designs	July 2009
	People Served		609	Many Thousands		

NMSU publications from the IALC project, USAID Jordan Series

Report # 1: Profitability Assessment of the Enterprises of the Anaqeed Cooperative Community-Based Project, Badia Region, Jordan, March 2007

Report # 2: Profitability Assessment of the [Tal-Rimah Dairy Processing Factory](#) Badia Region, Jordan, March 2007

Report # 3: [Profitability of Anaqeed](#) Cooperative Enterprises (FY07) and the Financial Feasibility a Concrete Block Enterprise, Badia Region, Jordan, June 2008

Report # 4: Tal Rimah [Range Rehabilitation](#) – Recreating a Valuable Resource, June 2008

Report # 5: [Fall Planted Onions on a Bedouin Farm](#) in Al-Mudawara, Jordan Applied Economic Development, July 2008

Report # 6: [Water Management in the Disi Basin](#) in Jordan, July 2008

Report # 7: Factors Affecting Agriculture Water Use in the [Mafraq Basin of Jordan](#): Quantitative Analyses and Policy Implications, September 2008

Report # 8: Potential of Kochia Prostrata and Perennial Grasses for [Rangeland Rehabilitation](#) in Jordan, December 2009

Report # 9: Feasibility Assessment of [Job Creation for Jordanian Women](#) in Fiber Art Crafts, December 2009



Figure 15 - Rangeland restoration activities of New Mexico State University and BRDC in Jordan: Evaluation of seeding and water harvesting practices in Qurain.



Figure 16 - Community involvement of rangeland research restoration research and demonstration with NMSU and BRDC.



Figure 17 - Tour of Qurain cooperative research NMSU and BRDC rangeland restoration site by Prince Hussain.



Figure 18 - Tent for field day presentations and participants examining rangeland.



Figure 19 - Very promising varieties of forage kochia (*Kochia prostrata*) and Siberian wheatgrass (*Agropyron fragile*). Two year's growth from seed with less than 100 mm of annual precipitation.



Figure 20 - NMSU & BRDC assessed the financial performance of the agricultural business ventures of the Anaheed Cooperative



Figure 21 - NMSU & BRDC assessed the financial performance of the sheep milk cheese processing plant at the Tal-Rimah Cooperative



Figure 22 - Financial performance seminar for members of Anaqeed and Tal-Rimah cooperatives



Figure 23 - NMSU & BRDC assessed the feasibility of block manufacturing at the Anaqeed Cooperative



Figure 24 - Seminar at Al Al-Bayt University on financial results of feasibility studies of Anaqeed and Tal-Rimah projects



Figure 25 - Sweet onion trials on Sheikh Khalid farms in Al Mudawwara



Figure 26 - Training conducted at the Jordanian Women's Qualifying and Training Society in Udreh



Figure 27 - Representative products that might be produced by Jordanian fiber artists

Yemen Activities

Sustainable Development of Drylands Project

IALC- New Mexico State University

Component Final Report Summary

[New Mexico – Yemen Component of Sustainable Development Website](#)

Introduction – New Mexico State University and Yemen Ministry of Agriculture

The main objectives New Mexico State University wanted to accomplish in Yemen were as follows: To assess the quality and qualifications of the Faculty of Agriculture of the University of Sana'a; to learn what their role is and how they relate to the Ministry of Agriculture, the Regional Agricultural Development Authorities and the private sector; and to understand how they conduct and share applied research, provide outreach and extension, train students, and help farmers have a better life.

The goal of this assessment of the status and role(s) of the Faculty of Agriculture of the University of Sana'a (UOS), was to help USAID/Yemen decide if and how to best help strengthen the Faculty of Agriculture so that they can better support the development of the Agricultural Sector in this country and become a more productive partner with other governmental institutions related to agriculture. Particular attention was paid to what they might specifically do to improve agriculture in the USAID/Yemen target governorates.

Table 4 - Summary of NMSU Yemen Activities in Jordan

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
1	USAID Sponsored Agricultural Assistance Workshop	Agricultural teaching, research and extension	42		Provided a PowerPoint presentation overview of the USAID/IALC/NMSU Faculty of Agriculture Support Program to Yemeni government and NGO agricultural leaders. The presentation emphasized the project's focus on long-term infrastructure development for Yemeni agricultural teaching, research, and Extension programs	October 2004

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
2	Yemen Project Management Training	Instruction to members of University Sana'a	16		Two-day project management workshop at the University of Sana's was based on Franklin Covey's "Project Management an In-Depth Approach." Certified instruction was provided on the project management environment and the project management process. This included project initiation, planning, executing, and closing. As part of the workshop, participants selected and planned a project that was a priority for their respective organizations.	Oct. 2004

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
3	Yemen Project Management Training	Instruction to members of University of Aden	17		Two-day project management workshop at the University of Sana's was based on Franklin Covey's "Project Management an In-Depth Approach." Certified instruction was provided on the project management environment and the project management process. This included project initiation, planning, executing, and closing. As part of the workshop, participants selected and planned a project that was a priority for their respective organizations.	Oct. 04

Item	Description of Activity	Factors Considered	Direct	Indirect	Measure	Remarks
6	Project Proposal Development Workshop (Sana'a U and Thamar	Farmers, marketing goods	23		Seminars were presented on 1) planning techniques, 2) how to do market research and prepare marketing plans, 3) feasibility analysis, and 4) effective extension strategies. There was considerable discussion regarding each of these topics	Jan. 05
	Total Persons Impacted		113			

Afghanistan Libraries Rebuilding Project

**Sustainable Development of Drylands Project
IALC- University of Arizona**

Component Final Report Summary

Introduction – University of Arizona and College of Agriculture at Kabul

The University of Arizona has been involved in the creation and development of an agriculture electronic library for the College of Agriculture at Kabul University since spring of 2004. This involved refurbishing a facility in the College to provide an appropriate learning environment for faculty and student research and education.

Project Overview

Afghanistan:

With the strong continuous support of USAID and the IALC Drylands Project TAC members the ongoing efforts toward the revitalization of the agricultural education program in higher education institutions in Afghanistan has achieved significant progress through the establishment of two Agriculture Electronic Libraries (AEL) in the Faculties of Agriculture at Kabul and Nangarhar Universities in 2004 and 2006 respectively. The foundation of distant teaching and learning has been established and in due time it could be expanded to link major US universities with these institutions for the advancement of science based education systems in Afghanistan. The extension of these facilities to other colleges of agriculture will strengthen the higher education institutions in Afghanistan. A well-educated youth can serve the country and contribute to peace and security in the region.

Yemen:

The agricultural education and information system in Yemen requires similar attention. However, the security and infrastructure situation of Yemen compared to Afghanistan is much better. The Yemeni universities have expressed interest in AEL. The USAID mission in Yemen has been very supportive of the initiatives to extend the agricultural electronic library and distant learning technology into their universities.

OVERALL PROJECT GOALS:

Afghanistan:

The objective was to establish an information resource center for the development of modern agriculture in Eastern Afghanistan. This was accomplished by creating a fully-equipped and operational Agriculture Electronic Library and technology teaching and learning center at Nangarhar University in Jalalabad, Afghanistan. The center is housed and managed by the faculty of Agriculture.

Yemen:

The goal is to open a teaching and learning technology center in two Colleges of Agriculture (Aden and Ibb) in Yemeni universities in 2008 to support faculty and students' learning and teaching activities. New Mexico State University and the University of Arizona have established contact with these universities and are working on sorting the details out for project implementation.

Afghanistan:

The higher education system in Afghanistan is in need of continued support to train young Afghans and the farming community in market oriented agricultural production. The IALC Sustainable Development of Drylands in Asia and the Middle East has focused on extension and education in the agricultural sector in Afghanistan. The attention to this important sector will help more than 85% of the Afghan population who are directly involved in agriculture and the whole population that need food and food assistance from the international community.

Observation:

Another major concern is the lack of communication networking throughout the university. The computer facility still lacks internet capabilities, inhibiting university staff access to online databases (AGORA, HENARI), e-mails, etc.

Currently the faculty does not have a library, and there are no resources of any kind (primary, secondary, or tertiary) available at this time. The students rely completely on verbal dictation and notes provided by faculty members. There is no way for determining the validity of information or possibilities for updating educational levels. Lack of such vital resources inhibits free thinking capabilities, spirit of investigation, and experimental studies. What we have achieved in a short period with a modest budget is very efficient and effective, but needs to be further expanded and provided with the necessary support for continuity.

ACHIEVEMENTS

Afghanistan:

The training of faculty members in the college of agriculture.

Two hundred ten students have been trained in the use of TEEAL.

Contacted the president of Nangarhar University and discussed with him the sustainability of the center and the other resources for distant learning notes

Communicated with the dean of the college of agriculture at Nangarhar University to get a letter of support for our efforts to find funding for the expansion of the center.

Arranged for the continuous maintenance of the center.

Wrote a concept proposal for the establishment of Agricultural Electronic Library (AEL) in six colleges of agriculture in Afghanistan as part of a proposal, “Afghanistan Water, Agriculture and Technology Transfer (AWWATT)” that Texas A & M present to USAID.

A second proposal was submitted to CREES/USDA/ISE for the upgrade of the current facility.

Contacted colleagues to advance funds for salary support for the coordinator and security guard and maintenance of operations at the center.

It was suggested that the use of solar panels for electricity generation be investigated in order to overcome the dependency upon unreliable electric power. This option was investigated, but due to budgetary limitation no further action was taken.

TRAINING

Afghanistan:

Training was continued by AEL coordinator in the college of agriculture in Nangarhar University and 125 students were trained in the use of TEEAL.

Yemen:

Prepared concept note, budget, and scope of work for the extension of this activity to two universities in Yemen.

New Mexico State University and the University of Arizona were in contact with Yemen to establish AEL centers in two universities, but was discontinued due to security reasons in the area.



Figure 28 - Students of the college of agriculture in Nangarhar University in training to use TEEAL made available through the initial work at the Technology Training and Learning Center late in 2007.



Figure 29- Another group of students of the college of agriculture in Nangarhar University in training to use TEEAL made available through the initial work at the Technology Training and Learning Center late in 2007.