ICARDA's Integrated Research at Benchmark Sites

Background

ICARDA and its NARES partners have fully committed themselves to tackle the challenges of the dry areas through scientific research and capacity building. These challenges include converging trends of

- scarce and variable water resources
- increasing desertification and loss of biodiversity
- increasing out-migration of adult males resulting in loss of traditional farming systems and greater reliance on women as heads of households,
- high population growth rate and pockets of poverty
- increasing dependence of countries on grain imports for food security
- problems of access to international markets as a result of trade policies and subsidies

The conventional approach to agricultural research is not well equipped to address poverty and sustainability as its often single-disciplinary and single-scale focus fails to deal with the complexity of natural resource management, human behavior, and policy issues. Furthermore, the increasing demand for research with diminishing resources requires that more efficient modalities be adopted to effectively conduct the research and out scale the results.

To deal with the multi-faceted problems of rural poverty, ICARDA has joined other CGIAR Centers in the development of an integrated natural resource management (INRM) approach. Promising INRM strategies must be easily transferable to and applicable at other sites to be of value towards the CGIAR goal of poverty reduction, food security, and resource sustainability. This calls for the selection of representative benchmarks that most closely characterize (i.e., resemble) the broader agro ecological zone of interest representing the major agricultural, environmental, and human elements. The INRM approach is now implemented by ICARDA and NARES partners at benchmark sites in the dry areas. These benchmark sites are used to develop, test, adapt, and evaluate improved genetic and natural resources management technologies under real-life conditions and not in research stations. As INRM requires multiple stakeholders, these sites bring together farmers, research and extension agencies and policy makers to address

- the gap between research and development,
- the non-linear social processes of rural development,
- the development of better monitoring and evaluation methods and,
- the representation of a range of biophysical and socio-economic conditions.

Selection of Benchmark Sites

The choice of a benchmark site is always a compromise between being truly representative of all the major problems and trends of drylands and logistical considerations such as accessibility, range of suitable partners, similarity of edapho-climatic factors, representativeness of the predominant production systems, policy considerations, etc. In all cases, however, analysis is done to indicate the potential of scaling out of the results at a national, regional and international level using GIS-based agro-ecological characterization and similarity analysis.

A first approach for testing representiveness and possible outscaling of best-bet options is by quantifying climatic similarity. In this approach the value of a climatic parameter or index at one location (the 'match' location) is compared with other ('target') locations using simple distance functions for monthly temperature and precipitation between match and target locations (De Pauw, 2003). Socioeconomic conditions were approximated by assessing similarity in land use/land cover as a proxy for farming systems.

A more comprehensive approach to outscaling is by classifying areas into agroecological zones (AEZ). An internal study by the ICARDA GIS Unit (De Pauw, 2006) indicates that the CWANA and northern Mediterranean region can be subdivided into 677 agroecological zones, using climate, land use/land cover, terrain and soils as differentiating criteria. Outscaling from the benchmark site to 'similar' environments is then simply a matter of 'rounding up' the AEZs inside the benchmark site and locate the areas in CWANA or other dryland areas where the same AEZs exist. This approach has the advantage of incorporating the most relevant biophysical factors for land management but is in a way more restrictive than the approach based on similarity mapping, because it is based on 'homogeneity' rather than 'similarity', and therefore in fewer areas the biophysical environments will match each other.

Ideally outscaling requires knowledge about both biophysical and socioeconomic environments. A major bottleneck remains the characterization and mapping of farming systems as an entry point to livelihood systems. A first attempt at mapping farming systems at global level (Dixon et al., 2000), is spatially too tentative for use at the regional scale. Now that the biophysical environments are well characterized and mapped in CWANA, ICARDA can dedicate more resources to the identification of major farming systems typologies, the characterization of their relationship to livelihood systems, and their mapping.

Developing livelihoods base line data

One objective of the benchmark approach is to improve research relevance and ultimately improve the livelihoods of the rural people and the environment. This requires in depth understanding of rural livelihoods in terms of their assets (human, natural, physical, social and financial) using the sustainable livelihood framework. The establishment of baseline data on the livelihoods of rural households provides the means to assess the impact of research on poverty reduction and on the environment. ICARDA has developed a framework for such analysis as part of the benchmark model (Aw-Hassan, Mazid and La Rovere, 2002, Aw-Hassan, Mazid and La Rovere, 2003, Buerli and Aw-Hassan, 2004, La Rovere et al., 2005, La Rovere et al., 2006). The livelihood analysis is now carried out as an integral component of the benchmark model in different agro-ecological and resource endowment conditions for drawing global lessons for dry areas development.

Transferring the Results ('Outscaling')

Theoretically, research findings and technologies developed and tested at a given benchmark site should apply across the entire agro ecological zone that encompasses the benchmark site as well as other similar agro ecological zones in other regions and countries (i.e., target sites). The identification of distinct agro ecological zones and the subsequent selection of benchmarks within each zone eliminates the need to conduct agricultural research at multiple sites, thus saving cost, labor, and time while increasing the likelihood of successful adoption. Benchmark sites and their teams serve as a hub for capacity building and technology transfer.

Exchanges of farmers and researchers help to catapult the improved techniques and technologies and policy recommendations into the wider dry areas.

Examples of ICARDA's Integrated Research at Benchmark Sites

Perhaps ICARDA's best known benchmark site is the Khanasser Valley in Syria. This area was selected by ICARDA's now defunct NRM program as an integrated research site to address typical problems of the marginal dryland environments of Central and West Asia and North Africa (CWANA). These problems include diverse and dynamic livelihoods, the occurrence of natural resources degradation, poverty, erratic and low rainfall and limited water resources. Technologies that were tested and improved with the farming communities and in cooperation with selected NARES partners included participatory barley breeding, cumin management, vetch varieties and management, phosphogypsum use, Atriplex-barley alley-cropping, water harvesting and saving technologies for olive trees, and improved feeding for sheep fattening systems. Policy recommendations were developed and presented through a range of different stakeholder and policy meetings.

In addition to the Khanasser site, three important benchmark sites have been developed within the framework of ICARDA's 'Water Benchmarks of WANA' Project. This project explicitly defines benchmark sites for water management research across West Asia and North Africa and cooperates with communities and NARES partners in the development, testing and adaptation of improved water management options at the farm, irrigation scheme, and watershed level. Taking into consideration the different agro-ecologies and levels of water scarcity in the region, The benchmark sites have been established in Jordan, Morocco, and Egypt to represent the marginal drylands with range-livestock system, the rainfed environment with and the conventional fully irrigated environment respectively.

Whereas the benchmark sites represent the majority of the conditions in the above three agro-ecologies, some conditions and issues in the region related to the natural resources, the environment and/or the socioeconomics can not be fully represented in the benchmark sites and need to be addressed at other locations. Examples include policies and institutions and socioeconomics. Specific research associated with these conditions and issues is conducted in so-called 'satellite sites'. Research results and experiences are exchanged between the benchmark and satellite sites. The satellite sites also provide a venue for the transfer of technologies from the benchmark sites and to enhance the regional dimension of the project.

The Muhareb watershed in the Jordan *badia* is representative of the vast drier rangeland environments in WANA. Overgrazing and ensuing land degradation processes have prompted the people to improve these marginal dry areas by integrating appropriate rainwater harvesting techniques in the dominant range-livestock system. The concept and process for the selection of the site is fully described in the document "Badia water benchmark site selection and characterization, in ICARDA press 2006". Satellite sites in *badia* environments are located in Saudi Arabia and Libya.

The Tadla basin in Morocco represents the rainfed agricultural systems in semi-arid regions with access to limited water resources. These rainfed environments are susceptible to droughts and are often suffering from severe water scarcity. The Water benchmark site was selected to optimize the use of the limited surface and groundwater resources conjunctively with rainwater in supplemental irrigation systems. The benchmark site tries to improve water productivity at the field, farm and basin level. Satellite sites in rainfed cultivation

environments are located in Tunisia, Algeria, and Syria where varying socioeconomic conditions exist.

The Nile valley is the largest intensively irrigated area in the region. Egypt is expanding irrigated areas while its water resources are not increasing. Sustainability is being threatened by excessive pressure and changing land use. Benchmark irrigation communities have been selected within the fertile lands of the delta, the new lands, and saline areas in Egypt. The benchmark site was selected to research at the community level ways to sustain high water productivity under the three situations indicated earlier. Each sub sites was selected along a canal with varying upstream-downstream socioeconomic and biophysical conditions. Water user associations' policy links are important components of this site. In addition, satellite sites to address different policy and socioeconomic conditions are located in Iraq and Sudan, which represent the two other major irrigated areas of the region.

Other integrated benchmark research sites have been established within the Challenge Program on Water and Food in the Karkheh River Basin in Iran. Honam and Merek, two watersheds in the upper catchment represent the prevailing rainfed crop, range and forest environments with different water resources for supplemental irrigation. In the downstream irrigated environment, two sites have been identified, one representing farm communities with access to fresh water, from the irrigation network and wells, for irrigation and the other with different levels of salinity and water logging problems. The benchmark site attempts to maximize water productivity at all scales from plant to basin, to improve livelihoods resilience of the communities and to ensure environmental sustainability as a result of increasing productivity at the river basin.

The approach of integrated research was also applied with research partners in Boykozan in Central Asia, within the Mountain Terrace Project in Yemen, the Mountain Project in North Africa, and the Barani and Balochistan Development Projects in Pakistan. The approach has brought the NARES partners much closer to the problems of resource poor communities in the dry areas.

Future Developments

The concept of benchmark site is not interpreted across the CGIAR in a uniform way. For example, IITA uses it in the context of broader geographical entities at the level of agroecological zones.

Also within the different research themes of ICARDA the concept has not been applied using the same methodology and selection processes. The water benchmark sites were automatically representative since their outscaling potential was defined at the level of broad agro-ecoregions/ land use systems (irrigated, rainfed, rangelands) within CWANA, and with internal variability assessed through satellite sites. The integrated research site of Khanasser essentially covered a single agroecological zone. In the Karkheh River Basin an ex-ante study of the agroecological zones (De Pauw et al. 2005) already defines the biophysical domains for outscaling from the integrated research sites in Merek and Honam before research was undertaken. Also in the context of agrobiodiversity projects the concept of benchmark site is used differently.

Basically the current approaches in applying the benchmark site concept and outscaling have been ad-hoc, depending on specific project needs, resources and timelines, and will in future need to be backed up by a comprehensive methodology.

There are operational challenges arising from the need to be both representative and practical. A key question in operationalizing the INRM approach is to what extent different disciplinary themes should work in the same geographically confined area, or can somehow link up their activities through GIS. Another question concerns outscaling the research from an 'ideal' benchmark site, which presents some average image of typical dryland conditions, to a large proportion of drylands which are more location-specific and therefore 'a-typical'. To what extent is internal variability within a benchmark site to be avoided or instead to be pursued as a way to increase representation? To answer these and other questions, the concept of 'benchmark site' will need to evolve and to be fine-tuned as experience increases.

Financing benchmark sites

Currently the benchmark sites are financed from special projects fund and contributions from NARS institutes participating in the research. The Khanasser site was funded by the BMZ, the water benchmarks by IFAD, AFESD and OPEC Fund and the Karkheh basin by the CPWF. This mode of operation will continue as future project proposals are developed around these benchmarks and additional benchmark sites to be selected as needed. The center core fund may supplement the benchmarks soft money in areas where special project funds are not easily obtained in order to maintain the sustainability and integrative nature of the benchmarks. As NARS adopt the concept they become committed to provide mainly in kind support to the benchmark. The role of NARS is crucial in maintaining the research site viable and productive. This is why the agreement with NARS from the beginning to use such sites for their research in addition that in cooperation with ICARDA is very important.

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