

SUSTAINABLE LAND MANAGEMENT AND CLIMATE CHANGE ADAPTATION IN CENTRAL ASIA

Growing Returns from ADB-ICARDA Partnership



Photo: ADB/ICARDA

The challenge

Central Asian countries are highly agrarian, with 60% of the population living in rural areas. The agricultural sector accounts for over 45% of the regional labor markets and nearly 25% of GDP on average. The land in Central Asia consists mostly of desert and mountain pastures with only 10% of the land arable. The sustainable use of the limited arable land is, therefore, essential to economic growth, human well-being, and ecosystem services. However, salinization, soil erosion, and desertification cause severe land degradation which, in turn, is degrading ecosystem services in Central Asia.

The population in the region has increased by almost 10 million since 2000, creating pressure on the already scarce land and water resources, especially in Kyrgyzstan, Tajikistan and Uzbekistan. Over use of land and outdated farming methods are declining soil and water quality, and pushing croplands and pastures to marginal areas, threatening the livelihoods of the vast majority of the rural poor who rely on farming and livestock to make a living.

Further, the effects of climate change are immediately felt in Central Asia's fragile agroecosystems as farmers are facing more extreme temperatures, erratic precipitation and more frequent droughts. Yet there is a lack of awareness and action on climate change. With dwindling state-run programs and resources transferring in the region, farmers are left severely ill-equipped to address these challenges and continue to rely on outdated technologies and land management practices.



LAND DEGRADATION

An expensive and increasing challenge in Central Asia

Over 50% of the land in the region is affected by salinization as a result of land degradation and poor farming practices.¹

The annual cost of land degradation in the region due to land use and cover change between 2001 and 2009 is estimated at about 4 billion USD.²

¹ The State of Land, 2015 Main Report, September 2015

² Estimates of Land Degradation in Central Asia (2001-2009): Estimation of Land Degradation and Impacts on a Global Assessment for Sustainable Development, Springer International Publishing, 2014

Developing SLM solutions: ICARDA and ADB partnership

In 2007, the Asian Development Bank (ADB) partnered with ICARDA, to develop new Sustainable Land Management (SLM) technologies in Central Asia as part of **Central Asian Countries Initiative for Land Management (CACILM)** (Phase I: 2007-2009). ICARDA's scientists worked with the National Agricultural Research Systems (NARS) of all five countries in the region, interlinking land and water management methods with improved crop technologies to successfully deliver on the combined vital functions and services of productive ecosystems: well-being of the population dependent on them, conserving biodiversity, and preserving environment.

Among the many outcomes of the ADB-funded SLM research, conservation agriculture technologies using zero tillage presented the most promising opportunity as a strategic entry-point for combating land degradation and revitalizing local production systems in the region. It was successfully introduced and established in both irrigated and rain-fed systems, as well as flat and sloping lands. Other beneficial interventions included laser-assisted land leveling, irrigation with plastic mulch and reduced use of drainage and irrigation water, which demonstrated an increase in water productivity by 15-25% in Kyrgyzstan, Turkmenistan and Uzbekistan.

In particular, zero-till farming with direct seeding, raised-bed planting, and laser-assisted land leveling play a significant role in retaining organic matter in the soil and reducing the energy needs of farmers for ploughing and irrigation. These aspects reduce fossil fuel use and greenhouse gas emissions through reduced disturbance of soils, contributing to mitigation of climate change.

Use of raised-bed planting with rice resulted in input saving by improving seed germination and crop establishment, requiring half of the seed rates used in conventional flat-bed method. Raised bed also significantly increased wheat and barley yields, while reducing water use by 10% and allowed for diversifying the cropping geometry in Kazakhstan, Kyrgyzstan and Uzbekistan.

Conservation Agriculture a high return climate change adaptation & mitigation strategy

Conservation agriculture (including zero till farming) has been core to ICARDA's SLM research in Central Asia. Research outcomes offer optimized farming options with zero till for main cereals systems - both for conserving soil and improving agricultural productivity over the long term.



Raised bed planting: producing more with less

Raised-bed planting demonstrated significant benefits over conventional flat-bed planting:

- Reduced water use by 10%
- Increased yield of winter barley 3.7 times and that of winter wheat by 1.2 times

Intercropping of cereal crops with legumes proved highly profitable and tripled the net return for farmers in Kyrgyzstan, Tajikistan and Uzbekistan. In addition, planting into standing stubble and applying mulch were tested, which proved beneficial especially in the mountainous regions of Kyrgyzstan and Tajikistan where residues on sloped land and terraces successfully reduced soil erosion and increased moisture content in the topsoil.

ICARDA and its partners combined its research on crop rotation and crop diversification with genetic-enhancement and breeding of crop varieties (barley and wheat for cereals and chickpeas and mungbeans for legumes) that are more resistant to climate change-related stresses such as heat, drought, salinity, and frost, which has resulted in several productive and resilient cropping systems.

Dissemination of SLM technologies

50 most promising SLM technologies and approaches have been compiled and 4 of them prioritized for dissemination under CGIAR Research Program on Dryland Systems to effectively target the challenges in the four agroecosystems in Central Asia: rain-fed, rangelands, irrigated, mountain.

Outscaling promising SLM technologies

The approaches developed for SLM during CACILM I had clearly demonstrated the potential in restoring ecosystem services and enhancing productivity for the good of both people and the environment in Central Asia. In the following years, ICARDA focused on disseminating these outcomes through varied initiatives to unlock their potential.

Through CGIAR's Global Research Program on Dryland Systems, an ICARDA-led program, a farmer participatory research approach was put in place at benchmark sites in Aral Sea Region and Fergana Valley representing the major production systems in Central Asia, with funding support from Kazakh, ICARDA and partners also developed a regional meta-database for the dynamic assessment of land degradation and rehabilitation prospects, which has formed the basis for outscaling of the CACILM I approaches to a wider region. The effort integrates GIS-based technologies which help identify potential applications of SLM technologies in regions with similar agroecosystems and land use.

As a major focus, a comprehensive knowledge management hub was put in place to consolidate the SLM research outcomes from CACILM and facilitate their widespread dissemination to stakeholders in a meaningful way. The resource synthesizes and packages information, fills knowledge gaps, builds capacity and communicates on SLM technologies and practices to farmers, extension workers, local development organizations and decision makers through the integrated use of website, databases, advisory services, trainings, video materials and blogging. The initiative, funded by IFAD, makes these resources available in English and Russian ([URL: http://www.cacilm.org](http://www.cacilm.org)).



Intercropping of maize with mung bean, crops greater returns from farms and improves soil health.

Informing and steering national agendas on SLM

Today ICARDA is also directing its efforts to establish policy dialogues for SLM by combining evidence-based interventions with in-depth policy analyses with the aim to engage decision makers in national and sub-national level, workshops, roundtable meetings, and science-policy dialogue meetings.

In a crucial policy-shaping endeavor, funded by ADB, ICARDA and NARS researchers scientifically measured the impact of climate change on agroecosystems and farm incomes. The study, conducted in partnership with CGIAR's International Food Policy Research Institute and completed in 2014, filled an important knowledge gap, providing insights for adaptive policy measures that can safeguard the lives of both the farmers and agricultural economies. Scientists used bio-economic farm models to analyze climate change scenarios and their impact on three main crops (cotton, potatoes, and wheat) which are crucial for rural economies and food security in Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan. The study concluded impact of climate change to be positive in the semi-arid and humid zones of Tajikistan, but producers in the arid regions may suffer from losses under climate change scenarios. It also concluded that more open economic policies and less rigid trade policies can be effective adaptation strategies to allow farmers to shift to more profitable crops with changing climate.

A milestone was reached with the Presidential Decree in Uzbekistan on agriculture reform and development for the period 2018-2020 targeting lower land leveling for up to 240, 000/ha of land. This decision is informed by the research evidence developed by ICARDA and its partners within the SLM research supported by ADB, Russia, IFAD and World Bank.

Asia, in Tajikistan and Uzbekistan, the agenda is set for crop diversification and the use of legumes in crop rotation for the improvement of soil health and production of healthy food, based on SLM research outcomes.

Moving forward on SLM

The SLM technologies developed during CAGIIM and the subsequent knowledge packaging and dissemination of select technologies by ICARDA and its partners have charted a distinctive path for establishing regional land management strategies that can improve rural livelihoods and promote sustainable environment in Central Asia. Fully achieving the benefits of the efforts will, however, require the agroecological perspectives of natural resource management to be combined with socio-economic perspectives to derive wider uptake of SLM technologies.

ICARDA's scientists are partnering with other CGIAR research centers, advanced research institutes and diverse practitioners in the region to bring interdisciplinary approach to promote and implement SLM technologies. The partnership, implemented under **Regional Program for Sustainable Agricultural Development in Central Asia and Caucasus**, cooperates with players from associations, initiatives, governments, businesses, and landowners to generate application-oriented strategies with ready-to-implement SLM measures. The objective is to equip local people with capacity and climate-resilient solutions for sustainable future that can also be realized in other regions.



Laser-assisted land leveling, an innovative technique saving water up to 25-35%, forms a part of Uzbekistan's national agriculture development plan for 2014-2020, deriving from SLM research of ICARDA and its partners, and funded in part by ADB.

ICARDA's International Research Partners for SLM in Central Asia

Bioversity International, CIMMYT, International Potato Center (CIP), International Center for Biosaline Agriculture, International Water Management Institute, The World Vegetable Center

Donors

Asian Development Bank, Australian Center for International Agricultural Research, BMZ/IZZ (Germany), CGIAR Research Program on Dryland Systems, The Food and Agriculture Organization (FAO), The International Fund for Agriculture Development (IFAD), Swiss

About The Regional Program for Sustainable Agricultural Development in Central Asia and Caucasus

The Program, coordinated and led by the International Center for Agricultural Research in the Dry Areas (ICARDA), is a consortium of eight National Agricultural Research Organizations, eight CGIAR Centers and three advanced research institutions. The Program, initiated in 1998, is the collective functioning body of these 19 organizations, delivering multidisciplinary research toward better livelihoods and sustainable management of natural resources in the region. For more information, visit icac-program.org.

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