

## Knowledge Management in CACILM Phase II

### Regional Workshop on SLM prioritization

25-27 February 2014, Almaty, Kazakhstan

#### Meeting minutes

According to the workplan, the project team, particularly of the Component 1, has been collecting and synthesizing Sustainable Land Management (SLM) technologies and approaches utilizing various sources. This regional level workshop was preceded by the national level workshops in each of the countries where SLM collected and found fit for the environmental conditions of particular country were evaluated and preliminarily shortlisted. The purpose of this regional workshop was (i) to prioritize collected SLM; (ii) to develop criteria to generate similarity maps where selected SLM can be applied; and (iii) to identify demonstration sites in each target agroecosystem. Meeting program is included in Appendix A.

Project team from each participating country (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan) as well as from ICARDA headquarters and regional office for CAC participated in this workshop. The list of participants is included in Appendix B. This document provides a brief report of the meeting.

The event was opened by Dr. Saparov, Director General of Kazakh Research Institute of Soil Science and Agrochemistry, Dr. Ziadat and Dr. Aw-Hassan, ICARDA. Introductory round introduced participants. This round was followed by brief presentation by Dr. Akramkhanov explaining objectives and expected outputs from this workshop.

#### **Session 1 - Country Presentations about Collected SLM Technologies and Approaches, and Sharing Results of Prioritization at National Level**

Country presentations informed about the component 1 team formation, sources of information used to collect SLM, brief descriptions of each technology or approach. Presenters also shared about the national level prioritization workshop results including the list of involved organizations to discuss jointly all of the collected SLM and the shortlisted SLM selected for the regional level discussion. The list of the all collected SLM by each country is presented in Appendix C. Number of technologies and approaches are mentioned several times in the list since sources of the information used by country teams were similar and the country teams found them also applicable to environmental conditions of their countries. In the shortlisted list those duplicated SLM were joined for further discussion.

The following table summarizes SLM technologies and approaches prioritized and selected during the national level workshop. Further discussion was devoted to finding consensus in selecting 1 SLM per target agroecosystem (irrigated, mountain, rainfed, rangelands). This was difficult task to agree among 5 country teams.

<b>Irrigated agroecosystem</b>
New technology of developing saline lands (NTOZ 1), (NTOZ 2)
Technology of raised bed planting of crops
Application of nano-agro- ameliorative measures of increasing crop productivity on degraded soils
Contour irrigation

Agrotechnology to improve soil fertility, enriching soil organic matter under irrigation by crop rotation "cotton - winter wheat" with repeated and intermediate crops
Resource conservation innovative technology of irrigation for growing agricultural crops with minimum tillage
Water-saving irrigation technology for cotton production on screened furrow perforated polyethylene film
Establishment of dense intensive fruit tree plantations with regulated pruning and drip irrigation
Subsoil irrigation system with near root moistening for garden crops on saline soils
Conservation-biogas technology and the use of organic waste for biogas production to improve soil fertility and crop yields in farmer households
Agrotechnology to prevent secondary salinity on reclaimed slightly saline soils in irrigated agriculture
Technology to increase the fertility of eroded irrigated soils
New method of planting of crops on beds/ridges in saline conditions of irrigated areas
A method for improving the quality of cotton by irrigation furrow on land damaged by irrigation erosion
Mulching the soil with plastic film
Water saving technology of irrigation
Technology of growing vegetables in greenhouse conditions
Planting of crops into irrigation furrow bottom
Planting of crops between former bottom and ridge of the furrow
Innovative technology of furrow irrigation for to grow agricultural crops
Method of growing own-root sapplings of fruit trees and vineyard
Using artesian saline water for irrigation farming in the Kyzyl Kum
<b>Mountain agroecosystem</b>
Growing sainfoin in mountainous agriculture
Growing fodder crops on steep slopes of arid highlands
Irrigation of gardens, vegetables using inexpensive drip irrigation technology
Agroforestry on the basis of gardens (establishment of gardens)
Community based forestry
Improvement of land in arid conditions through the development of high-quality pistachio plantations
Method of irrigation of young garden using bottles
Irrigation of garden crops with the use of local irrigation installations in extreme conditions
Increasing soil fertility considering local resources
Technology of establishment of agroforestry meliorative strips with diagonal-grouped method
<b>Rainfed agroecosystem</b>
Holistic Conservation agriculture (zero tillage)
Resource conservation technology of growing cereals in rainfed conditions
Soil conservation minimum soil tillage technology and planting
Growing crops based on minimum and zero tillage on rainfed areas
Zero and minimum tillage of degraded rainfed and irrigated soils, restoration and conservation of soil fertility for crop production
New technology of minimum tillage for growing crops
New method of soil slotting to grow winter wheat
Agrotechnology to optimize the properties of low fertility soils and production of organic fertilizers based on secondary resources
Resource saving technologies for improving the fertility of degraded soils
Crop diversification in rainfed conditions
Technology of ensuring high yields of oil and legume crops on rainfed areas
Methodology of planting with deep soil ripping in rainfed conditions to grow agri crops
<b>Rangeland agroecosystem</b>
Technology of space and ground monitoring of ecological-meliorative state of rangelands
Establishment of perennial grass seed plots (Improvement of pastures by subseeding perennial legumes and grasses and establishment of seed plots)
Autumn and early-spring irrigation as a mechanism for pasture improvement in climate change conditions
Technology of growing pasture crops in arid conditions
Rotation of pastures in the desert regions

Since there were several SLM technologies from country teams that had similarities (for instance minimizing mechanical disturbance of the soil, field level irrigation water saving, improvement of soil conditions, integration of agroforestry, pasture improvement etc.) and addressed specific issues within certain technology it was decided to form a package for each agroecosystem. Each package has a core technology (i.e. raised bed in irrigated agroecosystem) and other prioritized technologies that could be attributed to core technology can be integrated (i.e. seed treatment or soil additive, integration of plastic lining for irrigation in the furrow or placement of the seeding row on the raised bed to overcome damage from soil salinity accumulation).

Core technology	Technology options to integrate into core technology
<b>Irrigated agroecosystem</b>	
<p>Raised bed technology associated with one or more of the listed technologies to improve irrigation and water saving, soil fertility, reduce soil salinity and control soil erosion on sloped irrigated fields</p>	<ul style="list-style-type: none"> <li>• New technology of developing saline lands (NTOZ 1), (NTOZ 2)</li> <li>• Contour irrigation</li> <li>• Agrotechnology to improve soil fertility, enriching soil organic matter under irrigation by crop rotation "cotton - winter wheat" with repeated and intermediate crops</li> <li>• Water-saving irrigation technology for cotton production on screened furrow perforated polyethylene film</li> <li>• Agrotechnology to prevent secondary salinity on reclaimed slightly saline soils in irrigated agriculture</li> <li>• New method of planting of crops on beds/ridges in saline conditions of irrigated areas</li> <li>• A method for improving the quality of cotton by irrigation furrow on land damaged by irrigation erosion</li> <li>• Mulching the soil with plastic film</li> <li>• Water saving technology of irrigation</li> <li>• Planting of crops into irrigation furrow bottom</li> <li>• Planting of crops between former bottom and ridge of the furrow</li> <li>• Innovative technology of furrow irrigation for to grow agricultural crops</li> </ul>
<b>Mountain agroecosystem</b>	
<p>Agroforestry and afforestation through the implementation of structural interventions, such as terraces and stone bunds and intercropping of orchard crop with cover crops, such as Sainfoin and Fodder crops, with minimum tillage, and one or more of the listed technologies to improve productivity, empower the local community, improve soil fertility and reduce land degradation</p>	<ul style="list-style-type: none"> <li>• Growing sainfoin in mountainous agriculture</li> <li>• Growing fodder crops on steep slopes of arid highlands</li> <li>• Agroforestry on the basis of gardens (establishment of gardens)</li> <li>• Community based forestry</li> <li>• Improvement of land in arid conditions through the development of high-quality pistachio plantations</li> <li>• Method of irrigation of young garden using bottles</li> <li>• Irrigation of garden crops with the use of local irrigation installations in extreme conditions</li> <li>• Increasing soil fertility considering local resources</li> <li>• Technology of establishment of agroforestry meliorative strips with diagonal-grouped method</li> </ul>
<b>Rainfed agroecosystem</b>	

<p>Conservation agriculture by implementing minimum and zero tillage and associated with one or more of the listed technologies to improve productivity, optimize resources' use, improve soil fertility and crop diversification</p>	<ul style="list-style-type: none"> <li>• Holistic Conservation agriculture (zero tillage)</li> <li>• Resource conservation technology of growing cereals in rainfed conditions</li> <li>• Soil conservation minimum soil tillage technology and planting</li> <li>• Growing crops based on minimum and zero tillage on rainfed areas</li> <li>• New technology of minimum tillage for growing crops</li> <li>• New method of soil slotting to grow winter wheat</li> <li>• Agrotechnology to optimize the properties of low fertility soils and production of organic fertilizers based on secondary resources</li> <li>• Resource saving technologies for improving the fertility of degraded soils</li> <li>• Crop diversification in rainfed conditions</li> <li>• Technology of ensuring high yields of oil and legume crops on rainfed areas</li> </ul>
<p><b>Rangeland agroecosystem</b></p>	
<p>Pasture improvement through the implementation of one or more of the listed technologies to improve the vegetation cover, carrying capacity and reduce degradation and the use of geoinformatics to monitor the status and improvement of rangelands</p>	<ul style="list-style-type: none"> <li>• Establishment of perennial grass seed plots (Improvement of pastures by sub-seeding perennial legumes and grasses and establishment of seed plots)</li> <li>• Autumn and early-spring irrigation as a mechanism for pasture improvement in climate change conditions</li> <li>• Technology of growing pasture crops in arid conditions</li> <li>• Rotation of pastures in the desert regions</li> <li>• Technology of space and ground monitoring of ecological-meliorative state of rangelands</li> </ul>

## Session 2 - Criteria Development for Similarity Index and Demo Sites

Based on the formulated packages, the participants suggested criteria that can be used to develop similarity maps. The similarity maps will be used to identify target areas to disseminate the SLM packages in the four agro-ecosystems. These areas will be also targeted for knowledge management and dissemination campaigns to be designed and implemented by component II. A presentation by Feras Ziadat was delivered to explain the similarity analysis and criteria undertaken in the West Asia and North Africa (WANA) region to facilitate and direct the discussion toward generating the anticipated output. This brainstorming round identified sets of criteria and indicators that will be used to generate preliminary similarity maps on regional level. The purpose of this regional level similarity map generation exercise is to present data and procedure for fine-tuning at country level. This exercise will be used to organize GIS training to allow country teams to apply new skills for particular deliverable. The following sets of similarity criteria were identified by the national teams from the five countries for the four agro-ecosystems.

Irrigated agroecosystem	Similarity criteria
Land use	Irrigated land
Slope, degree	0-5
Water availability/source	Sufficient
Soil (texture), clay content, %	10-75 physical clay
Soil salinity, %	to be clarified

Rainfed agroecosystem	Similarity criteria
Precipitation	300-600
Slope, degree	<7
Land use	Cropland
Soil (texture), clay content, %	20-75 physical clay

Mountain agroecosystem	Similarity criteria
Slope, degree	>7
Precipitation	>500
Altitude, m	>800
Land use	exclude inconvenient areas (rocks, gullies etc.)
Soil depth, cm	>50

Rangelands agroecosystem	Similarity criteria
Land use	rangelands, pasture
Slope, degree	>12
Precipitation	to be clarified
Degradation degree	to be clarified
Livestock density per ha	to be clarified
Watering points/ha	to be clarified

This discussion was followed by identification of demonstration sites. Initially, the project planned to support establishment of 1 demo-site per country that would cover particular selected technology. Project managed to attract additional resources to support more demonstration sites. Additional resources are part of Dryland Systems CRP. This requires that additional demo-sites are established in target areas of the CRP program in Central Asia.

Tentatively, the following demonstration site locations were identified. Further discussions are planned to integrate CACILM-KM project demonstration site activities with the Dryland Systems CRP.

Agroeco-system	Technology package	Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
Irrigated	Raised bed*	1. Almaty province; 2. South Kazakhstan province	Chuy valley	Central Tajikistan	1. Ahat province; 2. Dashauz province	1. Yakkabog district; 2. Bayavut district
Mountain	Agroforestry and afforestation*		Djalalabad province	Rasht valley		
Rainfed	Conservation agriculture*	South Kazakhstan province, Sayram district	Chuy province	Kuliab zone	Lebap province	1. Ahangaran or 2. Middle-Chirchik district
Rangeland	Pasture improvement*	Almaty province	Naryn province	Sogd province	Ahat province	Navoi province

\*This is the main technology but it is associated with one or more of other sub-technologies to achieve fine-tuning of the main technology to suit local conditions within the agroecosystem

### Session 3 - Review and Planning by Components and Conclusions/Closure

This session included presentations dealing with collaboration with other initiatives on knowledge management. Presentation from Natalia Mitiakova, GIZ regional program, informed about IT based

Knowledge Hub initiative that planned to link separate and individual knowledge management databases into one network, with innovative search and display possibility of information from those who join this network.

Gulniso Nekushoeva shared experience of WOCAT (CDE, Switzerland) in linking local community and donor to solve particular problem in one of the districts of Tajikistan where SLM technologies were put into use. This experience was interesting to learn in order to implement collected SLM within or outside of the project timeframe. This is linked with component II.

The rest of the session was devoted to group work by components to revise workplan activities and plan further works.

For component I, the following steps were identified:

- Fill out the simplified template for each SLM technology that were selected from the national workshops for the five countries.
- Arrange a separate report for each country to summarize the process of collecting the SLM and sources of information, the criteria to select SLM at national level and the finally selected criteria.
- Continue the collection of information about more SLM, especially indigenous SLM.
- Packaging of the selected SLM (main SLM technology and sub-technologies) as developed above and send those for the national teams for review.
- Identify SLM that are particularly useful to adapt to the climate change in the four agro-ecosystems.
- Select the team who will participate in the climate change workshop (the team is preferably composed of SLM specialist, GIS and meteorologist).
- Arrange GIS training (ArcGIS) and similarity analysis for regional and national levels.
- Select and start implementation of the demonstration plots (sites), located within the CRP-DS target/action sites.
- Identify and demonstrate gender-related SLM.

Project team on Component II agreed on the following activities:

- **Collected experience was analyzed** to develop the web sites for land and water resources management. It was noted that today the information sharing on best practices through the Internet is a "bottleneck" for all countries in the region. There is an international list of WOCAT. However, many practices of the CA are not included in the list for a number of reasons, particularly because of the strict criteria for including of practices in WOCAT.
- Web site of ICARDA project on "Knowledge Management" has great potential **to reach a large number of best practices** that can be used in all five countries of CA.
- Different farmer innovations, examples of sustainable management of water, land and forest resources, sustainable farming methods, pasture management, methods of improving of livestock and crop production, perspective research developments can be included in that list.
- **Proposals on the structure.** Materials are placed into categories (headings). Texts that are relevant to different areas, such as water and pastures, are arranged in parallel in their respective categories, making it easier for users to search required text.

**Categories:**

**Soil** (information (text) and photos on best practices for soil treatment and use of fertilizers)

**Crop production** (new varieties and products, IPM, time of planting and harvesting, cultivation of fodder crops)

**Water** (advanced irrigation methods, water distribution, groundwater and saline water utilization, water measuring methods, associations of water management)

**Forestry** (practices on forest slopes enhancing, cultivation of pistachio, walnut and other forest crops to increase the profitability of agriculture, forests on marginal lands)

**Livestock** (pasture improvement, production of fodder crops, improving the quality of livestock through breeding, rotation of pastures, food choppers and veterinary)

**Climate** (adaptation to climate change in different climatic zones - from mountains to deserts)

**Science** (scientists propose new proven technologies in all of these areas)

**Personality** (stories about people who have/had outstanding skills/experience in the areas mentioned above)

**Projects** (project information)

**Legislation** (information on legislative acts)

**Countries** (*subcategories that will be visible in this heading: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. All materials placed at the web site will be placed in parallel with the category of countries. Thus, the user will be convenient to get acquainted with the advanced practices and the best practices in a particular country).*

**Best practice of the world** (examples from other countries).

Panelists raised many questions on how to complement this web- site with information.

- **Informational content** - this is the main difficulty in developing and maintaining website. The site was developed for the international information from five countries. At the first stage, this information can be derived from international projects implemented in the Central Asian countries (ICARDA, IWMI, IWRM - Fergana, CACILM, UNDP, GEF SGP, FAO, etc.). This will require contact with government officials and executives. Typically, project information is scientifically expressed and not easy for understanding by non-scientific people. Therefore, editing of these texts and selection of useful information for readers are required. Readability of text is an important aspect for the perception of best practices and their widespread introduction. Also, it will be useful to use publication in the media of the five countries in the adapted form.

Database on existing technologies and approaches developed by scientists and farmers of the five countries will be useful after completion of the project ("Knowledge Management.")

Prospects of longevity of web-site: As a rule, with the end of projects and financing, developed web-sites stop their existence too. Several options were considered for further support:

- Opportunity to add information by other stakeholders (as being done at Wikipedia web-site, Facebook page (SPARE). Concerning the dissemination of best practices in Central Asian countries there are very few chances that this approach will work. Farmers, breeders, foresters do not have particular interest to share their experiences and do not have required experience in writing texts for a wide audience.
- Uniting of the web- site with another ICARDA project and keep doing this from project to project

- Development of NGO with the organizational charter implicating the informational interpretation of all topics mentioned above. As is known, the activities of NGOs in Uzbekistan supported by the state grant funds, including from the State Environmental Fund. There may be other grants.

The project team of Component III agreed on the following activities:

- Finalize the template for survey on agricultural extension services in Central Asia
- Conduct quick survey of farmer advisory service providers in CA countries
- Collect the very final list of the selected SLM technology packages from Component I for cost-benefit analysis
- Conduct training of the NARS partners on cost-benefit analysis of the shortlisted SLM technologies
- Conduct the cost-benefit analysis using the template and qualitative indicators provided in Appendix D

### **Conclusions, closure, and actions to follow up**

- Prepare packages - title, brief description, pictures, individual technologies that can be integrated with the practices
- Continue with collection of indigenous and other SLM technologies
- Student involvement - foster engagement of students of various levels of study, follow-up, ask teams to nominate and topics assigned for each student (consider possibility for each relevant component)
- Encourage to select demo-sites within CRP DS target/action areas
- Check the budget of implementing demonstration sites for the five countries to proceed with budget allocation
- Select and nominate people/students (2-3) for GIS and CC model downscaling - with background in SLM, computers, GIS application, meteorology etc.
- Demo-sites - follow-up regarding where, what technology to demonstrate, visits to the sites, discuss with partners
- Gender related activity - follow-up with Dr. Aw-Hassan regarding new staff member with gender specialization to strengthen this activity and to cover this topic from professional point of view
- Share information about GIZ's and CAREC initiatives to establish Knowledge HUB with CODIS unit Michael Devlin

## Appendix A - Workshop program

### Day-1, Tuesday, 25 February 2014

09:00–09:30	Registration	
09:30–09:40	Welcome statements, introduction of participants	Abdulla Saparov, Feras Ziadat, Aden Aw-Hassan
09:40 –10:00	Objectives and expected outputs from this workshop	Feras Ziadat, Akmal Akramkhanov
<b>Session 1</b>	<b>Country Presentations about Collected SLM Technologies and Approaches, and Sharing Results of Prioritization at National Level</b>	
10:00–11:00	Kazakhstan: (i) presentation about collected SLM; (ii) presentation about prioritization during national workshop	Abdulla Saparov, GulnaraTokseyitova
11:00–11:30	<i>Group photo; coffee/tea break</i>	
11:00–12:00	Kyrgyzstan: (i) presentation about collected SLM; (ii) presentation about prioritization during national workshop	GulmiraElemanova, Malik Bekenov
12:00–13:00	Tajikistan: (i) presentation about collected SLM; (ii) presentation about prioritization during national workshop	Tosh Narzulloev
13:00–14:00	<i>Lunch break</i>	
14:00–15:00	Turkmenistan: (i) presentation about collected SLM; (ii) presentation about prioritization during national workshop	AhirSaparmuradov
15:00–16:00	Uzbekistan: (i) presentation about collected SLM; (ii) presentation about prioritization during national workshop	RamazonKuziev MarufTashquziev
16:00–16:30	<i>Coffee/tea break</i>	
16:30–17:30	Discussion to select SLM from each national presentation (country presentations will demonstrate collected SLM, rank them and suggest several to shortlist. During this discussion participants will look at possible SLM that were not shortlisted and then make final shortlist)	Feras Ziadat, Akmal Akramkhanov

### Day-2, Wednesday, 26 February 2014

08:30–10:00	General discussion to shortlist and select SLM for each agroecosystem - Irrigated - Rainfed - Mountain - Rangeland	
<b>Session 2</b>	<b>Criteria Development for Similarity Index and Demo Sites</b>	
10:00–10:30	Definition and quantification of environmental criteria for selected SLM	
10:30–11:00	<i>Coffee/tea break</i>	
11:00–13:00	Definition and quantification of environmental criteria for SLM	
13:00–14:00	<i>Lunch break</i>	
14:00–15:30	Definition and quantification of environmental criteria for SLM	
15:30–16:00	<i>Coffee/tea break</i>	
16:00–17:30	Identification of demonstration sites for selected SLM in each country	
19:00	<i>Social dinner</i>	

### Day-3, Thursday, 27 February 2014

09:00–09:15	“Knowledge Hub” for Natural Resources Management	Natalia Mitiakova
09:15–10:00	Selection of local level innovative SLM and ways and tools for dissemination	GulnisoNekushoeva
10:00–10:30	Country presentations on extension services	Country teams
10:30–11:00	<i>Coffee/tea break</i>	
<b>Session 3</b>	<b>Review and Planning by Components and Conclusions/Closure</b>	
11:00–13:00	Concurrent working groups (by Components) will review activities and plan the next steps, including trainings to be conducted in GIS/CC, project website content provision, cost-benefit analysis of SLM	Feras Ziadat Aden Aw-Hassan
13:00–14:00	<i>Lunch break</i>	
14:00–15:00	Plenary, presentation of working groups immediate plans	
15:00–16:00	Next steps; Workshop evaluation; Closing remarks	

## Appendix B - List of participants

#	Full Name	Component	Organization	Country	Position	Contacts
1	Dr. Abdulla Saparov	Focal point	Kazakh RI of Soil Science and Agrochemistry named after U.U.Uspanov (KazNIIPA)	Kazakhstan	Director General	Tel: +727 269-47-49; <a href="mailto:ab.saparov@mail.ru">ab.saparov@mail.ru</a>
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9	Mr. Karim Khudayberdiev		Farm (peasant) "NurAgro"	Kazakhstan	Head of the farm	
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14	Dr. Natalia Mitiakova		GIZ, Regional Programme for Sustainable Use of Natural Resources in Central Asia	Kyrgyz Republic	Knowledge management specialist	Tel.: + 996 312 90 93 40 (111) <a href="mailto:natalia.mitiakova@giz.de">natalia.mitiakova@giz.de</a>

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## Appendix C

nn	#	SLM technology and approach	Country
1	1	Biotechnological method for producing bio-fertilizers based on zeolite (follow-up revision)	KZ
2	2	Reclamation of highly saline solonchic and alkaline soils for rice sowing without pre-leaching to obtain crop yield in the first year of reclamation (NTOZ 1)	KZ
3	3	New technology to increase rice yield on saline soils (NTOZ 2)	KZ
4	4	Application of nano-agro -ameliorative methods of increasing crop productivity on degraded soils in Kazakhstan	KZ
5	5	Conservation technology of cultivation of cereal and grain crops in rainfed conditions of southern Kazakhstan (Recommended for south and south-eastern regions of Kazakhstan)	KZ
6	6	Conservation technology of cultivation of winter wheat in irrigated conditions of southern Kazakhstan (Recommended for south and south-eastern regions of Kazakhstan)	KZ
7	7	Direct seeding of alfalfa under rainfed and irrigated conditions in southern Kazakhstan (Recommended for south and south-eastern regions of Kazakhstan)	KZ
8	8	Technology for establishment of agroforestry strips through the diagonal grouping method	KZ
9	9	Conservation technology for permanent raised bed planting	KZ
10	10	Conservation technology for increasing the fertility of degraded irrigated lands	KZ
11	11	The technology of remote sensing and ground monitoring of ecological and reclamation status of pastures	KZ
12	12	Holistic conservation agriculture (zero tillage technology of Kazakhstan)	KZ
13	13	Using the remote sensing technologies in assessment of productivity of grain crops, timing and scope of the main agricultural activities in Northern Kazakhstan	KZ
14	14	Autumn and early spring irrigation as a mechanism to improve pastures under the climate change conditions in southern Kazakhstan	KZ
15	15	Development of seed plot of perennial grasses (pasture improvement by overseeding of perennial legumes and grasses and seed plots development)	KZ
16	16	Soil-protective minimal technology of the tillage and sowing	KZ
17	17	Technology of fastening Aral sea's drained bottom' s soil	KZ
18	18	Technology for production and application of vermicompost	KZ
19	19	Minimum tillage in grain crop production	KZ
20	20	Growing of sainfoin in mountain agriculture - Susamy Valley (CACILM)	KZ
21	21	Technology of raised bed planting	KZ
22	22	Spring cleaning technology and construction of water points for animals	KZ
23	23	Monitoring of rangeland	KZ
24	24	Saxaul plantation for stabilisation of sandy soils	KZ
25	25	Mulching of rainfed vineyards on terraces in loess hilly areas	KZ
26	26	Development of forest shelterbelts for protection from wind erosion on sandy-gravelly arrays	KZ
27	27	Drip irrigation using polyethylene under field and greenhouse conditions	KZ
28	28	Buffer strip of arable land on steep slopes	KZ
29	29	Terrace with tree barriers	KZ
30	30	Restoration of rangelands by seeds of perennial shrubs	KZ
31	31	Pasture rotation supported by additional watering points	KZ
32	32	Growing fodder crops on steep slopes of arid highlands.	KZ
33	33	The solar greenhouses. Growing crops in greenhouses.Crop yield year round	KZ
34	34	Phyto-pesticides	KZ
35	35	Rotation of pastures in the desert regions of Uzbekistan (CACILM)	KZ
36	1	Disposition field using a laser leveler Kyrgyzstan ICARDA (CACILM)	KG
37	2	Raised bed planting Technology Kyrgyzstan ICARDA (CACILM), Kyrgyzstan SIDA	KG
38	3	Growing cereals by using minimum tillage (CACILM) Kyrgyzstan	KG

nn	#	SLM technology and approach	Country
39	4	Soil-protective minimal technology of the tillage and sowing (Kazakhstan - Soil-protective system of agriculture)	KG
40	5	Zero Tillage, China - No Tillage; Kyrgyzstan, ICARDA (CACILM) Zero Tillage	KG
41	6	Drip irrigation Kyrgyzstan	KG
42	7	Irrigation of orchards by using low cost drip irrigation technique Tajikistan	KG
43	8	Bottle irrigation of a newly planted orchard Tajikistan	KG
44	9	Water-conservation technology at cultivation of the cotton in south	KG
45	10	Water-conservation technology (ICARDA)	KG
46	11	Contour irrigation (Kyrgyzstan, Uzbekistan, ICARDA, CACILM)	KG
47	12	Cultivation of sainfoin on high mountain pastures Kyrgyzstan	KG
48	13	Off-season irrigation of fields and pastures as a mechanism for pasture improvement under climate change conditions in Southern Kazakhstan (CACILM)	KG
49	14	Orchard-based Agroforestry (intercropping) Tajikistan	KG
50	15	Orchard-based Agroforestry (establishment of orchard) Tajikistan	KG
51	16	Recovery of soil through agroforestry Tajikistan (CACILM)	KG
52	17	Afforestation for rehabilitation of degraded irrigated croplands (CACILM) Uzbekistan	KG
53	18	Poplar trees for bio-drainage (Kyrgyzstan - bio-drainage, reduce salinity, favorable microclimate for plant growth Kyrgyzstan)	KG
54	19	Short rotation under irrigation (Kyrgyzstan, ICARDA)	KG
55	20	Crop diversification in rainfed conditions (Kyrgyzstan, ICARDA)	KG
56	21	Solar greenhouses Tajikistan	KG
57	22	Biocotton production technology (Kyrgyzstan, Tajikistan, Helvetas)	KG
58	23	Production technology and application of vermicompost (Kyrgyzstan)	KG
59	24	Cross autumn plowing Kyrgyzstan	KG
60	25	Irrigation on seeded furrows	KG
61	26	Irrigation of crops, as the key element of effective regulation of the major factors of plant life	KG
62	27	Preparation of irrigated field for vegetation season	KG
63	28	Enhanced elements of techniques and technology of surface irrigation	KG
64	29	Optimization of the thermal regime	KG
65	30	Optimization of the nutrient regime	KG
66	31	Determination of irrigation dates of crops	KG
67	32	Equipment for normalized water distribution	KG
68	33	Regimes of vegetation irrigation of agricultural crops	KG
69	34	Experience of using sub-irrigation in Kyrgyzstan	KG
70	35	Drip irrigation system in Kyrgyzstan	KG
71	1	Development of feed supply through Lucerne production on dry-land grounds saturated with rainfall in mountainous areas in Tajikistan	TJ
72	2	Bed cereal farming on irrigated grounds of Central Tajikistan	TJ
73	3	Reduction of fuel and energy expenditures by means of dual-purpose machine-tractor aggregates	TJ
74	4	High yield on irrigated lands in Tajikistan	TJ
75	5	Implementation of crop rotation on irrigated and rainfed lands of Tajikistan	TJ
76	6	Impact of irrigation conditions on crop capacity of various varieties of wheat against the background of Central Tajikistan	TJ
77	8	Influence of mineral fertilizers on growth and development of medium fibrous cotton varieties in the context of stone lands of Northern Tajikistan	TJ
78	9	Biological methods of pest and crops disease control	TJ
79	11	Legume crops seed production under dryland conditions of Tajikistan	TJ

nn	#	SLM technology and approach	Country
80	12	Intercrops are the most important factor of increase of the soil fertility and livestock animal breeding development	TJ
81	13	Principles of increasing of rice crop by transplanting method in Zeravshan valley of Tajikistan	TJ
82	15	Cultivation of cotton by precision planting method using denuded seeds	TJ
83	16	Honeycraft in mountainous regions of Tajikistan	TJ
84	17	Improvement awareness of rural households on production techniques of crops and their processing	TJ
85	19	Diversification of agricultural crops under market economy conditions of Tajikistan	TJ
86	21	Lucerne seeds production under dryland conditions of Tajikistan	TJ
87	23	Study and selection of salt tolerant varieties of sorghum and millet for cultivation under the conditions of salinized soils of Vakhsh valley	TJ
88	24	Production of new technologies of mulberry planting under conditions of Northern Tajikistan	TJ
89	25	Production of sunflower seeds under conditions of Tajikistan	TJ
90	27	Buckwheat cultivation technology in case of reseeding	TJ
91	28	Increasing the yield of chick-pea under conditions of foothill, mountain and highlands based on new technologies	TJ
92	29	Application of new technologies for cultivation of oil flax under conditions of dry lands in Tajikistan	TJ
93	33	Irrigation and meadow formation of the high mountain semi-desert pastures (WOCAT)	TJ
94	34	Irrigated hayfield (utilization of discharged water for irrigation of hayfield) in arid highlands	TJ
95	38	Establishment of buffer strips from native grasses between arable lands, located on steep slopes (WOCAT)	TJ
96	41	Agroforestry in gardens (WOCAT)	TJ
97	42	Conversion of near village degraded pastures on steep slopes into terraced gardens with forage crops between tree lines	TJ
98	47	Gradual development of step terraces via contour drainage ditches (WOCAT)	TJ
99	50	Establishment of nurseries for testing adaptation degree of different fruit tree species (WOCAT)	TJ
100	51	Growing of poplar forests in floodplains of highland rivers (WOCAT)	TJ
101	54	Rational use of narrow empty/free land strips along the roads, as well as heavily stony areas of river floodplains through plantations of willow trees, in conditions of land scarcity (WOCAT)	TJ
102	56	Bed planting technology of cereals in irrigated lands of Central Tajikistan	TJ
103	57	The technology of high yield of oil-bearing and leguminous crops in rainfed conditions of Tajikistan	TJ
104	58	Cultivation of pasture crops in arid conditions of North Tajikistan	TJ
105	59	Creation of compact intensive fruit plants with the application of adjusting cutting-back and drip-irrigation	TJ
106	60	Production of potato with the application of drip irrigation	TJ
107	61	The vegetable growing technology in greenhouses	TJ
108	62	The cultivation of agricultural crops in the basis of no-till technology in the rainfed of Tajikistan	TJ
109	63	Increasing of soil fertility with accordance of local resource usage	TJ
110	66	Develop of IPM of the wheat, legumes, oil-bearing and forage crops from main pest and diseases in Tajikistan	TJ
111	67	The compost preparing technology and methods of application	TJ
112	68	Develop of innovated fruit garden with planting of alfalfa between rows in the mountain-stoned desert	TJ
113	69	Planting of fruit trees for stabilization of ascents	TJ
114	70	Progressive technologies of usage of the irrigated lands	TJ
115	71	Improvement of meliorative conditions of the soil by deep ripping in rainfed areas of Tajikistan	TJ
116	73	Production of alfalfa seeds in the rainfed of Tajikistan	TJ
117	74	Salt stable varieties of sorghum and millet for cultivation in the salted areas of Vakhsh valley	TJ
118	75	The broom growing technology in North Tajikistan	TJ
119	76	Dissemination of soybean in irrigated lands of Tajikistan	TJ
120	78	Growing of forage in ascents in the condition of arid mountains (Wocat)	TJ

nn	#	SLM technology and approach	Country
121	79	Usage of perennial forages for creation of clampe plant cover (Wocat)	TJ
122	80	Restoration of pastures by planting of longstandingbrushwood- izen (Wocat)	TJ
123	81	Joint planting of cereals and legumes - traditional technology of less-lands of the Pamir region (Wocat)	TJ
124	82	Reclaiming of stoned lands for irrigated apricot gardens (Wocat)	TJ
125	83	Develop of irrigated sea-buchthorn forests in condition of high-mountain desert zones (Wocat)	TJ
126	84	Develop of saksaul plantations for stabilization of sandy soils (Wocat)	TJ
127	85	Develop of forest field-conservation lines for protection of soil from wind erosion (Wocat)	TJ
128	86	Develop of transversal water rejection drains in rainfed (Wocat)	TJ
129	87	Stone picking - necessary provision for reclaiminf of stoned lands in mountain areas (Wocat)	TJ
130	88	The grape cultivation in high-mountain stoned and sanded desert	TJ
131	89	Restoration of marginal lands by agroforesty (Wocat)	TJ
132	90	Application of integrated technologies in the farmlands (Wocat)	TJ
133	91	Alternate using of pasture (rotation) in combination with establishment of watering points (Wocat)	TJ
134	1	Resource conserving innovative technology of irrigation and minimum tillage seedbed preparation for cultivation of agricultural crops	TK
135	2	New method of winter wheat growing	TK
136	3	Innovative technology of furrow irrigation in growing agricultural crops	TK
137	4	Planting of cotton onto the furrow bottom	TK
138	5	Planting of cotton onto the raised bed in saline conditions of irrigated areas	TK
139	6	Planting of cotton between former furrow bottom and top of the raised bed	TK
140	7	Furrow irrigation method on flat land	TK
141	8	Method for growing of ungrafted vine and own-rooted fruit tree sapplings	TK
142	9	Method for growing wheat	TK
143	10	Near root soil moistening system for gardens on saline lands	TK
144	11	Method of sowing crops in deep soil loosening/ripping	TK
145	12	Method of preparation of fields for crops	TK
146	13	Sowing of cotton under the former bottom of the ridges	TK
147	14	Local irrigation installation for irrigation of horticultural crops in extreme conditions	TK
148	15	Adjustable irrigation tubes and un-pressurised siphones	TK
149	16	Closed irrigation system with adjustable nozzles	TK
150	17	Portable subsoil moistening system	TK
151	18	Drip irrigation with nozzles	TK
152	19	Method for soil leaching	TK
153	20	Innovative way of cotton planting	TK
154	1	Resource-biogas technology and the use of organic waste for biogas production increase soil fertility and crop yields in farms	UZ
155	2	Agrotehnologiya improve soil fertility, organic matter enrichment it under irrigation by changing cultures "cotton - winter wheat," Crop repeated and intermediate.	UZ
156	3	Technology for producing organo-mineral fertilizers from poultry waste combined with the organic materials and minerals by aerobic biothermal fermentation	UZ
157	4	Agrotechnology for optimizing the properties of the low-fertile soils and producing organo-mineral fertilizers based on secondary resources	UZ
158	5	New bio-fertilizers to improve soil fertility and crop productivity	UZ
159	6	Conservation technologies to improving the fertility of degraded soils	UZ
160	7	Water-saving irrigation technology for cotton on shielded perforated polyethylene film furrow	UZ
161	8	Mulching the soil with polyethylene film (Plastic mulch)	UZ

nn	#	SLM technology and approach	Country
162	9	Technology to increase the fertility of eroded soils under the irrigation	UZ
163	10	A method for improving the quality of furrow irrigation for cotton under the irrigation erosion conditions	UZ
164	11	Zero and minimum tillage degraded rainfed and irrigated soils, restoration and preservation of fertility in crop production	UZ
165	12	Technology on mapping of mobile forms of phosphorus and potassium in irrigated soils	UZ
166	13	Development of "Soil salinity map" under the irrigated on-farm conditions	UZ
167	14	Agrotechnology on preventing secondary salinity on reclaiming slightly saline soils in irrigated agriculture	UZ
168	15	New technology of minimum tillage for crop production	UZ
169	16	Technology of direct sowing of solanaceous crops	UZ
170	17	Technology of production and application of nontraditional fertilizers	UZ
171	18	Fertilizer application system for producing of 50-70 q/ha grain yield of winter wheat	UZ
172	19	Technology for soil management to ensure high-quality of soil in greenhouse vegetable production	UZ
173	20	Rotation of pastures in the desert regions of Uzbekistan (CACILM)	UZ
174	21	Use of artesian saline water for irrigation farming management in the Kyzylkum desert, Uzbekistan (CACILM)	UZ
175	22	Improvement of land conditions in arid regions by planting of high-quality pistachio plantations (CACILM). Uzbekistan	UZ
176	23	Agroforestry land reclamation for the rehabilitation of degraded irrigated lands (CACILM). Uzbekistan	UZ
177	24	Development of seed plots for perennial grasses (CACILM). Kazakhstan	UZ
178	25	Autumn and early spring irrigation as a mechanism to improve pastures in the context of climate change in southern Kazakhstan (CACILM)	UZ
179	26	Monitoring of pastures (CACILM). Kazakhstan	UZ
180	27	Growing bamboo reed (Arundo donax L.) as the shelterbelts around farmer households to protect from hot winds and for other economic purposes. (CACILM) Turkmenistan	UZ
181	28	Growing sainfoin in mountain agriculture – Susamyr valley (CACILM). Kyrgyzstan	UZ
182	29	Minimum tillage in grain crop production. (CACILM) Turkmenistan	UZ
183	30	Technology on production and application of bio-compost. Kyrgyzstan	UZ
184	31	Forest farming on the mountain slopes using moisture-accumulating trenches. (CACILM) Turkmenistan	UZ
185	32	Perennial forage grasses for untouched forest cover. Tajikistan	UZ
186	33	Drainage ditches on the steep slopes of arable land. Tajikistan	UZ
187	34	Recovering poor soil through agroforestry. Tajikistan (CACILM)	UZ
188	35	Drip irrigation using a polyethylene film. Tajikistan	UZ
189	36	Agroforestry (Forest Gardening). Tajikistan	UZ
190	37	Transition from grazing land to fruit and fodder plots. Tajikistan	UZ
191	38	Agroforestry (Forest Gardening). Intercropping. Tajikistan	UZ
192	39	Mulching rainfed vineyards on terraces in loessial hilly areas. Tajikistan	UZ
193	40	Dune fixation and reforestation on drift sands around settlements in the Karakum desert. (CACILM) Turkmenistan	UZ
194	41	Farmer Field Schools in irrigated areas.	UZ
195	42	Joint - pasture -use planning. Kyrgyzstan – CACILM	UZ
196	43	Community - based forestry in Karakalpakstan. Uzbekistan - CACILM	UZ
197	44	Joint- pasture management. Kyrgyzstan – CACILM	UZ
198	45	Organization of the forestry units at school to involve youth into the environment conservation activity. Kazakhstan – CACILM	UZ
199	46	Pasture management through the restoration of transhumance system and radical improvement of pastures. Kazakhstan	UZ
200	47	Farmer Field Schools. Tajikistan	UZ
201	48	Mapping in pasture -use planning. Kyrgyzstan - CACILM	UZ

<b>nn</b>	<b>#</b>	<b>SLM technology and approach</b>	<b>Country</b>
202	49	Involving villagers to joint planning activities aimed at ensuring of agricultural sustainable development and effective land management. Tajikistan	UZ
203	50	Sustainable land management support at sub-district ("jamoat") level. Tajikistan	UZ
204	51	Voluntary support in the form of labor services. Tajikistan	UZ
205	52	A joint initiative of the land users. Tajikistan	UZ
206	53	Choosing of SLM technologies to reduce the risk of natural disasters. Tajikistan - CAMP Kuhiston	UZ
207	54	Establishment of rural farmer schools andSupport. Tajikistan	UZ

## Appendix D. Table for Assessment of Net Change from the Selected SLM Technology Packages

### I. With applied new SLM-package

Category	Items	Unit and Unit Price	Quantity of inputs per ha required for this technology	Cost, USD per ha
Capital	Machinery (incl. rented)	Hour		
Labor	By different operations (land preparation, planting, weeding, etc)	Man/woman days (discuss possibility of involving women)		
Agr Inputs	Fertilizers	kg		
	Pesticides	kg		
	Seeds	kg		
	Water	cbm		
		<b>Yield Unit</b>	<b>Yield per ha</b>	<b>Net Gain, USD per ha</b>
Produced Output		tons per ha		

### II. Without new SLMs (traditional technologies)

Category	Items	Unit and Unit Price	Quantity of inputs per ha required for this technology	Cost, USD per ha
Capital	Machinery (incl. rented)	Hour		
Labor	By different operations (land preparation, planting, weeding, etc)	Man/woman days (discuss possibility of involving women)		
Agr Inputs	Fertilizers	kg		
	Pesticides	kg		
	Seeds	kg		
	Water	cbm		
		<b>Yield Unit</b>	<b>Yield per ha</b>	<b>Net Gain, USD per ha</b>
Produced Output		tons per ha		

### Qualitative Indicators for Assessment of Net Change from the Selected SLM Technologies

1. **Rotations:** How is the technology fits the crop rotation of the farming system. Some technology may not fit the requirements of the rotation. Please explain the advantages and disadvantages from this point of view.
2. **Timing:** The application of the technology may require additional time that may not fit always on the timing of different farm operations- Please explain the advantages and disadvantages from this point of view.
3. **Farm structure:** This point is similar with the above two points but an additional point is that some of the technology requirement will have negative effects on the other farm enterprises. Please explain the advantages and disadvantages from this point of view.
4. **Finance:** Finance should be a major constraint, please explain the financial requirement do the technology.

**Supply of equipment and materials by the private sector:** If the technology is feasible and profitable, there could be a problem of availability of the technology, or related inputs or required machinery it requires. The private sector is the main supplier of farm inputs; so please comment current supply and potential supply of the technology by the private sector, otherwise it will not be adopted by farmers.

Основная технология	Технологии для интегрирования с основной технологией
<b>Орошаемая агроэкосистема</b>	
<p>Технология гребневого посева комбинированная с одной или несколькими перечисленными технологиями, для улучшения орошения и водосбережения, улучшения плодородия почвы, снижения засоления почвы и борьбы с эрозией почвы на склоновых орошаемых полях</p>	<ul style="list-style-type: none"> <li>• Новая технология для восстановления засоленных земель (NTOZ 1), (NTOZ 2)</li> <li>• Контурное орошение</li> <li>• Агротехнология для повышения плодородия почвы, обогащения почвы органическим веществом при орошаемых севооборотах "хлопчатник - озимая пшеница" с повторяющимися и промежуточными культурами</li> <li>• Водосберегающая технология орошения по бороздам для производства хлопка с использованием прозрачной перфорированной полиэтиленовой пленки</li> <li>• Агротехнология для предотвращения вторичного засоления на мелиорированных слегка засоленных почвах в орошаемом земледелии</li> <li>• Новый метод гребневого посева культур в условиях засоления на орошаемых землях</li> <li>• Метод улучшения качества хлопка путем полива по бороздам на землях, подверженных ирригационной эрозии</li> <li>• Мульчирование почвы полиэтиленовой пленкой</li> <li>• Водосберегающая технология орошения</li> <li>• Посев культур в дно поливных борозд (глубоко в борозду)</li> <li>• Посев культур между засеваемыми бороздами и на гребнях борозд</li> <li>• Инновационные технологии полива по бороздам для производства сельскохозяйственных культур</li> </ul>
<b>Горная агроэкосистема</b>	
<p>Агролесоводство и лесоразведение путем внедрения структурных вмешательств, таких как террасирование и создание каменных дамб и совмещение садовых и покровных культур (эспарцет и кормовые</p>	<ul style="list-style-type: none"> <li>• Выращивание эспарцета в условиях горного сельского хозяйства</li> <li>• Выращивание кормовых культур на крутых склонах засушливых горных регионов</li> <li>• Агролесоводство на основе садоводства (создание садов)</li> <li>• Лесоводство с вовлечением сообществ</li> <li>• Улучшение земель в засушливых условиях путем разработки высококачественных фисташковых плантаций</li> <li>• Метод полива молодых садов с использованием пластиковых бутылок (баклажки)</li> <li>• Орошение садовых культур с использованием локальных оросительных установок для экстремальных условий</li> </ul>

<p>культуры) с минимальной обработкой и с использованием нескольких из перечисленных технологий для улучшения производительности, расширения возможностей местных сообществ, улучшения плодородия почв и снижения деградации земель</p>	<ul style="list-style-type: none"> <li>• Повышение плодородия почв с учетом местных ресурсов</li> <li>• Технология создания агролесомелиоративных мелиоративных полос методом диагональной группировки</li> </ul>
<p><b>Богарная агроэкосистема</b></p>	
<p>Почвосберегающее земледелие путем внедрения минимальной и нулевой обработки почвы, связанное с одной или несколькими перечисленными технологиями для повышения производительности, оптимизации использования ресурсов, улучшения плодородия почвы и диверсификации культур</p>	<ul style="list-style-type: none"> <li>• Целостное ресурсосберегающее земледелие (нулевая обработка почвы)</li> <li>• Ресурсосберегающая технология выращивания колосовых культур в богарных условиях</li> <li>• Почвосберегающая технология минимальная почвы обработки почвы и посева</li> <li>• Производство культур на основе минимальной и нулевой обработки почвы в богарных условиях</li> <li>• Новая технология минимальной обработки для выращивания сельскохозяйственных культур</li> <li>• Новый метод щелевания почвы для выращивания озимой пшеницы</li> <li>• Агротехнология для оптимизации свойств низко плодородной почвы и производства органических удобрений на основе вторичных ресурсов</li> <li>• Ресурсосберегающие технологии для улучшения плодородия деградированных почв</li> <li>• Диверсификация культур в богарных условиях</li> <li>• Технология обеспечения высоких урожаев масличных и бобовых культур в условиях богары</li> </ul>
<p><b>Пастбищная агроэкосистема</b></p>	
<p>Улучшение пастбищ путем внедрения одной или нескольких из перечисленных технологий по улучшению</p>	<ul style="list-style-type: none"> <li>• Создание семенных участков для многолетних трав (Улучшение пастбищ путем подсева многолетних бобовых и травяных культур и создания семенных участков)</li> <li>• Осеннее и ранневесеннее орошение в качестве механизма для улучшения пастбищ в условиях изменения климата</li> <li>• Технология выращивания пастбищных культур в засушливых условиях</li> </ul>

растительного покрова,  
повышение ёмкости  
(кормовой продуктивности)  
пастбищ и сокращению  
деградации пастбищ, а  
также использование  
геоинформатики для  
мониторинга состояния и  
улучшений пастбищ

- Ротация пастбищ в пустынных регионах
- Технология дистанционного и наземного мониторинга эколого-мелиоративного состояния пастбищных угодий