From Fragility to Resilience in Central and West Asia and North Africa (F2R-CWANA) Initiative

WP4: Integrated food, land, water, and energy systems for climate-resilient landscapes

A landscape approach to water storage/harvesting - Key outputs target: 4.01; (4.06); 4.15

Inventory of sustainable land management (SLM) practices for Uzbekistan's marginal landscapes

Mira Haddad, López Montoya, Akmal Akramkhanove, and Erwin van der Haar

Contents

Inventory creation process 3
Recommended SLM's 4
1. Mechanized micro water harvesting through "Vallerani" tractor plough 4
2. Saxaul tree plantation 4
3. Marab technology 5
4. Vegetative measures with native plants: Glycyrrhiza glabra 5
Biophysical conditions 6
References 7
Appendix A: List of sustainable land management practices 8

List of tables

Table 1: Costs of MIRWH technique per ha. 4
Table 2: Costs per ha of Saxaul tree plantation. 4
Table 3: Costs of the Marab technology. 5
Table 4: Costs of the vegetative measure using Glycyrrhiza glabra. 5
Table 5: Biophysical conditions of the selected SLMs. 6

Inventory creation process

In line with the CGIAR initiative: *From Fragility to Resilience in Central and West Asia in North Africa*, a systematic review was performed to compile literature on Sustainable Land Management (SLM) practices with a focus on water harvesting for Uzbekistan marginal landscapes. The inventory of SLMs was performed in 4 steps:

(1) The initial systematic literature review was performed using the bibliographic databases Web of Science and Google Scholar by using a combination of selected keywords applied to Central Asia and Uzbekistan (e.g., “Water harvesting”, “Sustainable land management”, “Water and land management”, “Water infiltration”, “Water management”, “Water saving potential”, “Integrated water resources management (IWRM),” “Rehabilitation of degraded land”). Different exclusion criteria filtered the articles obtained, e.g., articles that discussed international policies, historical perspective, analysis of stakeholders in water management, or that focused on the limitations of IWRM in Central Asia and Uzbekistan, were removed. Only the articles that mainly discussed SLMs were kept.

(2) Secondly, a “Snowball” technique was performed using the cited literature from the found sources to expand further and understand the topic.

(3) Consequently, WOCAT and internal ICARDA databases were consulted.

(4) Recommendations from SLM’s experts in the region will be taken into consideration. In total, 18 SLMs were listed, described, and their biophysical criteria were established thus far (Appendix A).

Recommended SLM's

1. *Mechanized micro water harvesting through "Vallerani" tractor plough*

This technology is used as a restoration approach for degraded rangeland areas. It is a Mechanized Micro Rainwater Harvesting (MIRWH) technology in which a tractor creates small pits to harvest rainwater along the slight slope of the hill, followed by the plantation of native shrub seedlings such as *Atriplex halimus*. Additionally, stones are added where gully erosion occurs, and a grazing management plan is designed. Overall, this promotes local water infiltration, prevents surface runoff in the soil, provides forage for livestock, and prevents soil erosion.

The costs of the implementation of the MIRWH "Vallerani" technique include the fully automated Vallerani technique (USD 32 ha) and the costs of the revegetation (USD 11 ha) process (production, planting, and maintenance of the shrub seedlings).

Table 1: Costs of MIRWH technique per ha.

SLM	USD$ per ha
MIRWH "Vallerani"	43

Source: (Verbist, Strohmeier, & Haddad, 2021)

2. *Saxaul tree plantation*

This technology consists of the plantation of native trees, *Haloxylon spp.*, by plane. This technology aims to reduce, prevent and restore soil degradation by improving soil and water retention by increasing soil cover. Additionally, it will promote biodiversity in the area and increase soil organic matter, resulting in an increase in soil water retention.

The costs of this technology include soil preparation by the tractor plough, the costs of revegetation, and costs associated with the plane.

Table 2: Costs per ha of Saxaul tree plantation.

SLM	USD$ per ha
Saxaul tree plantation	50

Source: ICARDA, WOCAT

3. *Marab technology*

The Marab technology is designed to harvest downstream water and integrates local gully-filling, grading/leveling of seed beds, and the creation of flood-irrigated agriculture.

The establishment costs include labour, equipment, construction material, transportation, and others. The maintenance costs include labour, equipment, and construction material. Initially, the costs were calculated per technology area (10 ha) and then adapted to USD per 1 ha.

Table 3: Costs of the Marab technology.

SLM	USD$ per ha
Marab	1,359

Source: (Strohmeier, Haddad, Alwidyan, & Dhehibi, 2021)

4. *Vegetative measures with native plants: Glycyrrhiza glabra*

A vegetative measure can be done by planting *Glycyrrhiza glabra*, a high salinity tolerant and native plant, able to fix nitrogen at the root level, known for a wide variety of medicinal and industrial processes (medicine, drinks, food supplements), as well for its use as high-quality fodder for livestock.

Table 4: Costs of the vegetative measure using Glycyrrhiza glabra.

Plants	USD$ per ha
Glycyrrhiza glabra	*50*

Source: (Kushiev, Noble, Abdullaev, & Toshbekov, 2005)

Biophysical conditions

Table 5: Biophysical conditions of the selected SLMs.

No	SLM	Criteria	Range	Source
1	**Saxaul tree plantation**	Clay %	0 - 25	(Matinkhah, Taabe, Raoofi, & Matinkhah, 2016)
		Sand %	40 - 95	
		Gravel %	0 - 50	
		Electrical Conductivity (dS/m)	0 – 126	
		pH	7 – 10	
		Average rainfall (mm)	160 - 2600 mm	WOCAT
		Slope	Flat (0-2%)	
		Altitude	0 - 100 m.a.s.l.	
		Soil depth	<5	
2	***Glycyrrhiza glabra***	Average rainfall (mm)	0-300	(Kushiev et al., 2005)
		Soil type	Serozem	
		Soil depth (m)	>17	
		Soil texture	sandy soil	
		Slope	0-15º	(Alsaadi et al., 2020)
		Exposure	South, southwest,	
		pH	6.5 - 7.0	
3	**Marab**	Sand %	≤ 50	WOCAT
		Gravel %	≤ 20	
		Soil depth	≥ 100	
		Slope	Flat (0-2%)	
		Rainfall	≥100	
4	**MIRWH Vallerani**	Average annual rainfall	<250 mm	ICARDA, WOCAT
		Slope (%)	Gentle (3-5%), moderate (6-10%)	
		Altitude	501-1000 m a.s.l.	
		Soil depth	Shallow (21-50 cm), moderately deep (51-80 cm)	
		Soil texture (topsoil)	Medium (loamy, silty)	

References

Alsaadi, D. H. M., Raju, A., Kusakari, K., Karahan, F., Sekeroglu, N., & Watanabe, T. (2020). Phytochemical analysis and habitat suitability mapping of glycyrrhiza glabra l. Collected in the hatay region of Turkey. *Molecules*, *25*(23), 1–13. https://doi.org/10.3390/molecules25235529

Kushiev, H., Noble, A. D., Abdullaev, I., & Toshbekov, U. (2005). Remediation of abandoned saline soils using glycyrrhiza glabra: A study from the hungry steppes of central Asia. *International Journal of Agricultural Sustainability*, *3*(2), 102–113. https://doi.org/10.1080/14735903.2005.9684748

Matinkhah, S. H., Taabe, M., Raoofi, M., & Matinkhah, S. M. (2016). Site selection for Haloxylon ammodendron plantation based on soil factors. *Arid Land Research and Management*, *30*(3), 304–319. https://doi.org/10.1080/15324982.2015.1099577

Strohmeier, S., Haddad, M., Alwidyan, J., & Dhehibi, B. (2021). Marab - Water Harvesting Based Floodplain Agriculture [Jordan]. *WOCAT SLM Database*, 1–8. Retrieved from https://qcat.wocat.net/en/wocat/technologies/view/technologies_5770/

Verbist, J., Strohmeier, S., & Haddad, M. (2021). Mechanized micro water harvesting through 'Vallerani' tractor plough for central Jordanian Badia [Jordan]. *WOCAT SLM Database*, *2016*, 1–7. Retrieved from https://qcat.wocat.net/en/wocat/technologies/view/technologies_5860/

Appendix A: List of sustainable land management practices

Attached to this report.