Water Harvesting as a Mean for Water Conservation in Ovche Pole Region, Macedonia

[a]Ognen ONCHEVSKI and [b]Machito MIHARA
Graduate School of Agriculture, Tokyo University of Agriculture, Tokyo, Japan[a]
Faculty of Regional Environment Science, Tokyo University of Agriculture, Tokyo, Japan[b]

Introduction

Mekdaschi & Liniger (2013) define water harvesting (WH) as "The collection and management of flood water or rainwater runoff to increase water availability for domestic and agricultural use as well as ecosystem sustenance". Rainwater harvesting is a set of tools that can enhance ecosystem services and productivity of agro-ecosystems, provide climate change adaptation opportunities and security for rural and urban communities (UNDP.2009). Every Water Harvesting System have three components: catchment area, storage area and target of use (Oweis.2009).

Objectives

The main objective of this study is to assess the potential for water harvesting in the research area by identifying potential sites and measures for water harvesting following set of selection criteria .

Methodology

This study used different data related to run-off and rainwater harvesting, such as Sentinel-2 satellite images, digital elevation model(DEM), soil data, land cover data and rainfall data. The complete methodology workflow is given in Figure 1.

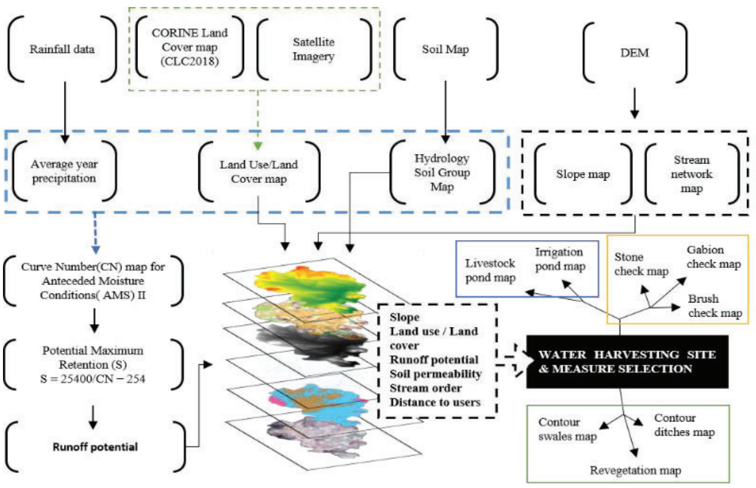

Figure 1. Workflow of research methodology

Conservation Service Curve Number (SCS-CN) methodology was used for calculation the rain runoff potential. Different criteria such as slope, soil texture, land use, stream network, proximity to user were used to identify appropriate sites and measures for water harvesting (Figure 2)

		Runoff coefficient	Slope (%)	Stream Order	Land use	Hydrology Soil Group (HSG)	Distance to users
On-stream line interventions	Irrigation ponds	>0.5	0-5	1-2	n/a	C, D	< 250 meters from agriculture land
	Livestock ponds	>0.5	0-5	1-2	n/a	C, D	< 1000 meters from livestock barns
	Gabion checks	>0.5	0-5	1-2 (gullies)*	n/a	A, B, C, D	n/a
	Boulder Checks	>0.5	5 - 20	1-2	n/a	A, B, C, D	n/a
	Brushwood checks	>0.5	> 20	1-2	n/a	A, B, C, D	n/a
On-ridge line interventions	Contour bunds	>0.5	0-10	n/a	Non-irrigated agriculture land, Land principally occupied by agriculture with significant areas of natural vegetation, Pastures, Grasslands, Sparsely vegetated areas, Transitional woodland-shrubs.	A, B, C	n/a
	Contour trenching	>0.5	10 - 25	n/a	Non-irrigated agriculture land, Land principally occupied by agriculture with significant areas of natural vegetation, Pastures, Grasslands, Sparsely vegetated areas, Transitional woodland-shrubs.	A, B, C,	n/a
	Revegetation	>0.5	>25	n/a	Non-irrigated agriculture land, Land principally occupied by agriculture with significant areas of natural vegetation, Pastures, Grasslands, Sparsely vegetated areas, Transitional woodland-shrubs.	A, B, C, D	n/a

Figure 2. Criteria for selection of water harvesting sites related to different interventions

Results

The results of this study show that based on given set of criteria significant part of the research area is suitable for implementation of different water harvesting interventions. Only forested area have relatively small under 0.5 runoff coefficient. Applied SCS CN model shows that sparsely vegetated areas and agriculture land on clayey soil generate high runoff. In this study water harvesting measures are divided in on-stream line interventions and on-ridge line interventions. The analysis showed that there are 183 potential sites for gabion checks, 11 potential sites for livestock ponds and 43 sites for irrigation ponds. In addition, 91 km length of stream section is suitable for installation of brushwood checks and 297 km of stream section length that is appropriate for boulder checks. Regarding the on-ridge line areas this study identified contour bunds, contour trenches and revegetation as appropriate interventions that can be implemented on 193 km^2, 109 km^2 and 77 km2, respectively. Map representing the potential areas and suitable interventions is shown in Figure 3.

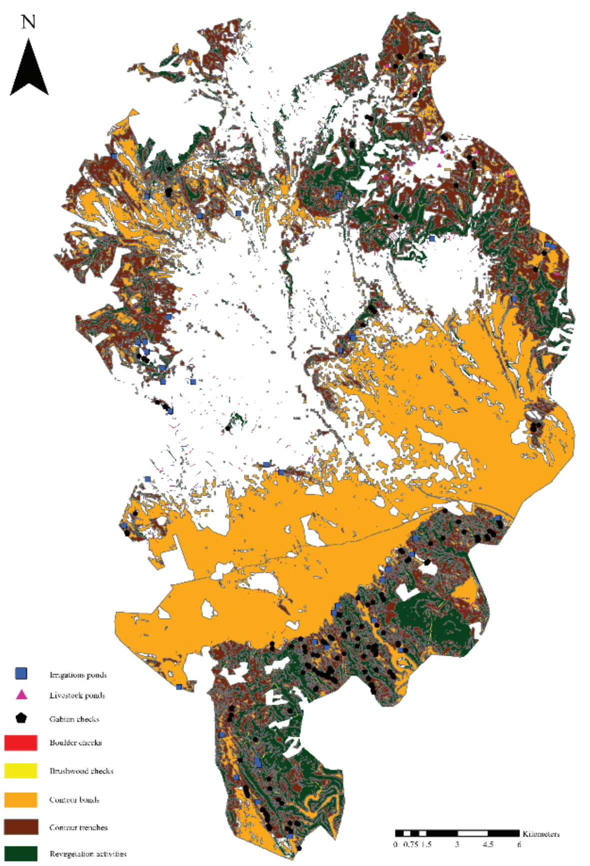

Figure 3. Map of water harvesting sites and interventions

Conclusion

Results of this study suggest that Ovche Pole region in Macedonia has potential for implementation of water harvesting measures aimed to increase water availability for agriculture and ecosystems.