

Assessing the perceptions of ecosystem services and ecological restoration activities by the local community of agricultural landscapes of northern Jordan Valley

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Executive summary

This Research for Development Brief (R4D) aimed to investigate the trade-offs and synergies between the rehabilitation of the marginal dryland ecosystem (uplands), a sustainable community-based resource management and the irrigated production system in the downstream Jordan Valley. The activities particularly addressed agrosilvopastoral approaches that contribute to rehabilitating the ecosystem functionalities and services of the largely degraded side wadis of Jordan Valley that carry surface water (runoff) towards the lowlands' irrigated production system.

This study was conducted to increase public perception of the value that the ecosystem services (ES) provided by farmers have in the planning and piloting of watershed rehabilitation and improved water productivity with water harvesting in Jordan project activities. Therefore, the farmers' socioeconomic status was studied by collecting information on gender, age, education level, years of farming experience, and source of income.

Data about the perceived value of ES such as regulating, cultural, and provisioning services were also collected and analysed. Sustaining services were not selected among the main perceived services for

this analysis, due to the length of time needed to collect the relevant data, and as they cannot be readily observed by the surrounding communities.

The data were gathered through semi-structured interviews with the farmers. A questionnaire was used to provide structure and consistency between interviews while allowing for the collection of freely contributed answers that were not a formal part of the questionnaire. The questionnaire was developed and tested during an expert workshop in the study area. The survey was conducted with a total number of 60 farmers.

Both the farmers who participated in the project activities and the non-participating farmers were from the Al-Mashare' community, and were selected equally by means of random sampling in the two communities to obtain a reliable and representative sample. The 30 project participants were involved in the project phases, either in the site selection process, site implementation, site monitoring, or involved with the different training programmes delivered by the project. In comparison, the 30 non-participants were not involved in any of the project phases.

Four ES relevant to project activities were independently identified by the project team and local community representatives:

1. the support of erosion and flood control services through soil stabilization and protection;
2. the cultural services related to wilderness and iconic values (as a cultural value);

3. the regulatory services (biodiversity services) related to increasing biodiversity and improving habitat quality; and

4. forage production and grazing services.

Empirical findings from all 60 farmers (with one farmer equalling around 1.67 percent) showed that:

- About 93.3 percent of the respondents said that they strongly agreed that rehabilitation activities positively affected regulating erosion and flood control services through soil stabilization and protection measures. The remaining 6.7 percent of respondents agreed with the statement.
- Around 91.7 percent of the respondents strongly agreed that implemented activities improved cultural services related to wilderness and iconic values. A further 6.7 percent of

respondents agreed with the statement and 1.7 percent of respondents strongly disagreed with the statement.

- About 95 percent of the respondents strongly agreed that implemented activities increased biodiversity and improved habitat quality. A further 3.3 percent of respondents agreed with the statement, and 1.7 percent strongly disagreed with the statement.
- About 90 percent of respondents strongly agreed that provisioning services were related to forage production or grazing, while 8.3 percent agreed with this statement, and 1.7 percent strongly disagreed with the statement.

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Highlights

- A proposed methodology was developed for assessing perceptions of ES by the local farming community in Jordanian socioecological systems.
- The methodology combined qualitative and quantitative analysis.
- Farmers participating in the project were aware of the ecosystem services.
- Farmers who had not participated in the project still had a good knowledge regarding ES.
- Community perception was not significantly affected by other demographic factors.
- The investigation demonstrated a valuable and effective tool to assess communities' perception of rehabilitation-driven ES.

It is worth noting that the implementation duration, the awareness-raising programmes, and peer-to-peer communication might have affected the community's perceptions. Further investigation into the use of these tools is required.

Keywords: perception, ecosystem services valuation, regulating services, erosion and flood control, Al Mashare', agrosilvopastoral, watershed rehabilitation, cultural services, biodiversity, habitat quality.

Background

Agricultural landscapes are mainly used in soil and water conservation and habitat provision for many species. They also have an important socioeconomic significance for human well-being, thanks to their roles in food provision and

job creation. These functions are especially indispensable in dryland ecosystems. Most dry agricultural landscapes are in developing countries, suffering from land degradation (Allen *et al.*, 2002).

Agricultural landscapes deliver four main groups of ecosystem services (ES), which can be categorized as supporting, cultural, regulatory and provisioning. Functioning healthy ecosystems are important for local communities' livelihoods, and these services represent an important area of research, particularly in ecological restoration projects. There is no doubt that landscape changes caused by ecological restoration projects have both positive and negative impacts on human livelihoods, perceptions, attitudes and food security. In fact, potential trade-offs existed in different ES bundles, mainly due to the divergent preferences of different farmers' attitudes and perceptions (Zhang *et al.*, 2021; Bolaños Valencia *et al.*, 2019). However, few studies have been undertaken that look at the perceptions of end users (such as farmers and local communities) on the consequences and impacts of ecological restoration in their agricultural landscapes (Adams *et al.*, 2016; Alexander *et al.*, 2016).

To deal with severe problems related to widespread soil erosion and land degradation and to restore and protect the ecological quality of Jordan Valley's agricultural landscapes, the Planning and Piloting Watershed Rehabilitation for Improved Water Productivity with Water Harvesting in Jordan project was implemented under FAO's regional project Implementing the 2030 Agenda for Water Efficiency/ Productivity and Water Sustainability in NENA Countries, directly under the Regional Water Scarcity Initiative. The project is funded by the Swedish International Development

Cooperation Agency (SIDA) and implemented by the International Center for Agricultural Research in Dry Areas (ICARDA) in collaboration with WADI for Sustainable Ecosystem Development.

The main goal of this project was to investigate the trade-offs and synergies between the rehabilitation of the marginal dryland ecosystem (uplands), a sustainable community-based resource management and the irrigated production system in the downstream Jordan Valley. The activities particularly address agrosilvopastoral approaches that contribute to restoring ecosystem functionalities and services of the largely degraded side wadis of Jordan Valley, that carry surface water (runoff) towards the lowlands' irrigated production system.

Objectives of the study

This study was conducted to increase public perception of the value that the ES provided by farmers has in the planning and piloting of watershed rehabilitation and improvement of water productivity with water harvesting in Jordan project activities. The main aim was to assess the perception of local community members regarding the provided ecosystem services and to compare perception differences in these services between project participants and non-participant farmers. To this end, 60 farmers were randomly and equally selected: 30 from those who had participated in the project activities and 30 community members who had not.

The specific objectives of this investigation were:

- to develop a scientific approach for assessing community perception regarding rehabilitation activities and ES;

- to collect the socioeconomic status of local participating and non-participating farmers from the Al-Mashare' community;
- to collect data on the experiences and perceptions of local farmers from the Al-Mashare' community related to the landscape changes after implementing the FAO–ICARDA–Jordan project; and
- to assess and evaluate the perceptions of local communities towards the ecosystem services and link them with key demographic factors such as gender, age and education level.

Methodological framework

Survey design and data collection process

The survey was conducted in the Al-Mashare' community with 60 farmers in total. Thirty farmers participating in the project activities and 30 non-participating farmers were selected randomly to obtain a reliable and representative sample.

The data for this analysis was gathered through semi-structured interviews. A questionnaire was used to provide structure and consistency between interviews, but it also allowed the collection of freely contributed answers that were not a formal part of the questionnaire. The questionnaire was developed and tested during an expert workshop in the study area and was composed of two main sections. The first section included the basic demographic information about the interviewees, such as their age, gender, level of education, experience in farming, and main income sources. The second section related to the local community's perception of ES. It included four ES statements based on a simple ranking tool, developed to define the most critical or potential ecosystem services provided by the implementation of the rehabilitation test site. The tool included a list of all ecosystem services shared with expert teams from ICARDA, WADI, the head of the CBO, and the landowner. Each member filled out and ranked the potential ecosystem services the project would be contributing to in the short and long term.

Community members' feedback was collected regarding rehabilitation and regulating services, cultural services and cultural heritage, and provisioning services (Table 1). To measure the perceived values of ES by the local community farmers, participants were asked to rate (on a scale of zero to two) the importance of ES (0: disagree with the statement; 1: agree with the statement and 2: strongly agree with the statement) (Aronson *et al.*, 2013; Aryal, Bhuwan and Maraseni, 2021).

From the project, four areas of ES were identified:

1. the regulation of erosion and flood control services through soil stabilization and protection;
2. the cultural services related to wilderness and iconic values (as a cultural value);
3. the regulatory services (biodiversity services) related to increasing biodiversity and improving habitat quality; and
4. forage production and grazing services.

Table 1. Perception of ecosystem services (ES) by the local community

Ecosystem services (ES)	Meaning or relevance, with examples
Regulating services	Regulating services related to erosion and flood control through soil stabilization and protection. Example: I noticed that soil erosion is less, and more soil moisture is observed.
Cultural services and cultural heritage	Cultural services related to wilderness and iconic values. Example: I feel I am more connected to this site and land. I can see greener areas.
Regulatory services (biodiversity services)	Related to increasing biodiversity and improving habitat quality. Example: I noticed that more plants grow on this site compared to the adjacent areas.
Provisioning services	Related to forage production or grazing. Example: I noticed that the site provides good or more forage and will affect my livestock's milk and meat production.

Table 2. The assignment rules for the presence, absence and perceived values of each of the ecosystem services (ES)

Description	Presence of an ecosystem service (1–4)	Assigned value	Average value (0–2) and the corresponding assigned rank
Strongly disagree with or have no idea about the statement	No	0	No value (0)
Agree with the statement	Yes	1	Low value (0–1)
Strongly agree with the statement	Yes	2	High value (1–2)

The assignment rules for the presence, absence and perceived values of each of the ES outlined are shown in Table 2.

Data analysis

Descriptive analysis was applied to evaluate the perceived value of the ecosystem services using the Statistical Package for the Social Sciences (SPSS) developed by the International Business Machines Corporation (IBM), namely IBM SPSS Statistics V22.0. The differences in the perceived value of ecosystem services' importance between participation and non-participation in the project activities were compared. An analysis of variance (ANOVA) table was also used to assess the correlation between ES perception and sociodemographic factors and to find out if the experiment results were significant regarding the perception of the ecosystem services between participants and non-participants.

Results and discussion

The analysis of all participant and non-participant farmers' sociodemographic characteristics with one farmer equalling around 1.67 percent of the total) shows that the largest group of interviewees (68.3 percent) were less than 30 years old, followed by the group

between 30 and 50 years old (28.3 percent). Only 3.3 percent were more than 50 years old. According to the project participation, 73.3 percent were less than 30 years old, and 26.7 percent were between 30 and 50 years old. The non participants' sample comprised of 63.3 percent of farmers under 30 years old, 30 percent between 30 and 50, and 6.7 percent older than 50. More men than women participated in the interviews (78.3 percent and 21.7 percent, respectively). All the interviewed women had participated in the project activities, representing 43.3 percent of the participation sample. Regarding education, 6.7 percent of the interviewees had finished university, 41.7 percent had finished high school, 26.7 percent had an intermediate school level, and 8.3 percent were illiterate.

According to the participation in the project, the educational level showed that 13.3 percent of the participants had a university degree, 40 percent had finished secondary level, and 16.7 percent were illiterate. The illiteracy rate was higher among women, with 23.1 percent being illiterate (4.3 percent of men were illiterate). Regarding experience in farming activities, 61.7 percent of interviewees had below two years' experience, 20 percent had between two and ten years' experience, and 13.3 percent had between ten and

twenty years' experience. Only 5 percent had over twenty years of experience. 80 percent of the participating farmers in the project activities had farming experience below two years, and all had less than 20 years of experience. The percentage of farmers who depended on agricultural farming as a major source of income was 80 percent. This increased to 86.7 percent for the project's participating farmers.

Perception values of ecosystem services (ES) by the local community

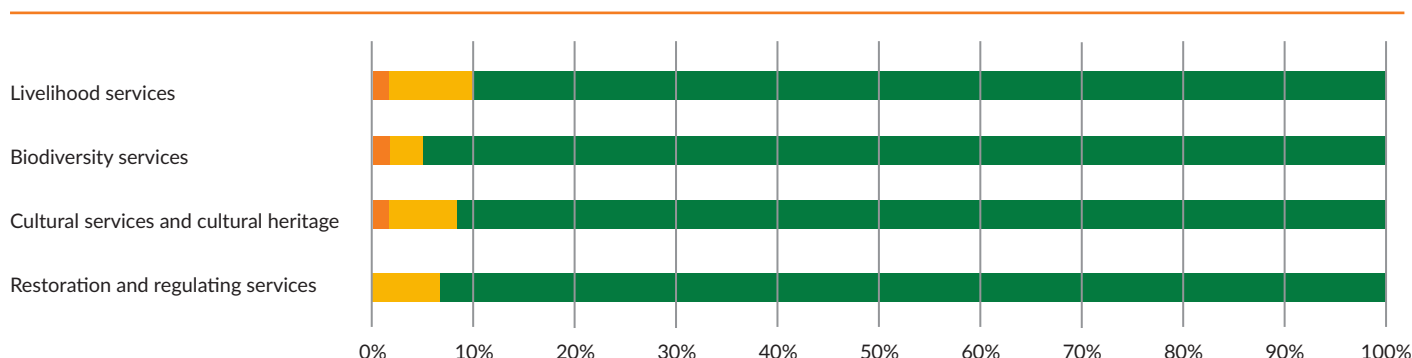
The results on the perception values of ES by the local community are displayed in Table 3 and Figure 1. The empirical findings show that 93.3 percent of the interviewed farmers said that they strongly agreed that rehabilitation-relevant activities positively affected regulating services such as erosion and flood control through soil stabilization and protection, with 6.7 percent agreeing with the statement. About 91.7 percent of the farmers interviewed said that they strongly agreed that cultural services and cultural heritage were related to wilderness and iconic values, with 6.7 percent agreeing with the statement. Only 1.7 percent strongly disagreed. Around 95 percent of the farmers strongly agreed that rehabilitation improved biodiversity

Table 3. Perception values of ecosystem services (ES) by the local community

Ecosystem services	Assigned value (0, 1 or 2*)					
	0		1		2	
	N	%	N	%	N	%
Restoration and regulating services			4	6.7	56	93.3
Cultural services and cultural heritage	1	1.7	4	6.7	55	91.7
Biodiversity services	1	1.7	2	3.3	57	95
Livelihood services	1	1.7	5	8.3	54	90

Key: *Assigned value (0 = strongly disagree with the statement, 1= agree with the statement, and 2= strongly agree with the statement).

Figure 1. Farmers' perception value of ecosystem services



Key: (Strongly) disagree with the statement (%); Agree with the statement (%); (Strongly) agree with the statement (%).

and habitat quality, with 3.3 percent agreeing with the statement and 1.7 percent strongly disagreeing. Around 90 percent of the farmers strongly agreed that livelihood services were related to forage production or grazing, with 8.3 percent agreeing with the statement and 1.7 percent strongly disagreeing.

Perception values of ecosystem services (ES) according to farmers' participation

The empirical findings of the perception of ES according to participation are displayed in Table 4.

The results show the following (with one farmer equalling about 3.3 percent of each total):

- Around 96.7 percent of the participating farmers said they strongly agreed that restoration and regulating services were related to erosion and flood control through soil stabilization and protection. One attendee (3.3 percent), agreed with the statement.
- Around 90 percent of the non-participating farmers said that they strongly agreed that restoration and regulating services were related to erosion

and flood control through soil stabilization and protection. Ten percent agreed with the statement.

- Around 86.7 percent of the participating farmers said that they strongly agreed that cultural services and cultural heritage were related to wilderness and iconic values statements. Ten percent agreed with the statement, and 3.3 percent strongly disagreed with the statement.
- Around 96.7 percent of the non-participating farmers said that they strongly agreed that cultural

Table 4. Perception values of ES according to participation

Ecosystem services (ES)	*Assigned value (0, 1 or 2)											
	Participants						Non-participants					
	0		1		2		0		1		2	
	N	%	N	%	N	%	N	%	N	%	N	%
Restoration and regulating services			1	3.3	29	96.7			3	10	27	90
Cultural services and cultural heritage	1	3.3	3	10	26	86.7			1	3.3	29	96.7
Biodiversity services	1	3.3	1	3.3	28	93.3			1	3.3	29	96.7
Livelihood services	1	3.3	3	10	26	86.7			2	6.7	28	93.3

Key: N = Number of farmers within the two farmers typologies (participants and non-participants).

Note: *Assigned values: (0 = strongly disagree with the statement, 1 = agree with the statement, 2 = strongly agree with the statement).

services and cultural heritage are related to wilderness and the iconic values statement, and 3.3 percent agreed with the statement.

- Around 93.3 percent of the participating farmers said that they strongly agreed that rehabilitation increased biodiversity and improved habitat quality, 3.3 percent agreed with the statement, and 3.3 percent strongly disagreed with the statement.
- Around 96.7 percent of the non-participating farmers said that they strongly agreed that biodiversity services were related to increasing biodiversity and improving habitat quality, and 3.3 percent agreed with the statement.
- Around 86.7 percent of the participating farmers said that they strongly agreed that livelihood services were related to forage production or grazing, 10 percent agreed with the statement, and 3.3 percent strongly disagreed with the statement.

- Around 93.3 percent of the non-participating farmers said that they strongly agreed that livelihood services were related to foraging production or grazing and 6.7 percent agreed with the statement.

The interviews demonstrated that respondents perceived all four ES that were proposed. Table 5 presents the proportions of the interviewees who perceived each ES for all demographic groups combined, with values ranging between 90 percent and 95 percent of the total number of interviewees and their mean perceived values. Biodiversity conservation services received the highest score, being recognized by most respondents. In the second ranking, regulating services can be found. Both ES had an equally high mean (1.93), followed closely by cultural services and cultural heritage with a mean of 1.90. The provisioning services had the lowest perceived value (1.89).

The relationship between respondent characteristics and their perceptions of ES

This section aims to assess the correlation between ES perception and sociodemographic factors and to determine if the experiment results are significant regarding the perception of the ecosystem services between the participants and non-participants. This can be achieved by using the ANOVA analysis. Table 6 and Table 7 summarize which sources of variation significantly affected the perception of ES.

The empirical findings displayed in Table 6 and Table 7 suggest the following:

- The respondent's gender and age significantly affected the perception of restoration and regulating services.
- Educational level significantly affected services relevant to biodiversity and livelihood.
- Farmer's experience and income source does not affect any ES.

Table 5. Ecosystem services (ES) perceived by farmers for all demographic groups combined, and examples of the interpretations of the meanings of each of the ES in their life

Ecosystem services (ES)	Meaning or relevance	Proportion of total interviewees who perceived the ES (%)	Mean perceived value
Restoration and regulating services	Regulating services related to erosion and flood control through soil stabilization and protection. Example: I noticed that soil erosion is less, and more soil moisture is observed.	93.3	1.93 ± 0.252
Cultural services and cultural heritage services	Cultural services related to wilderness and iconic values. Example: I feel I am more connected to this site and land. I can see greener areas.	91.7	1.90 ± 0.354
Regulating biodiversity services	Related to increasing biodiversity and improving habitat quality. Example: I noticed that more plants grow in this site compared to the adjacent areas.	95	1.93 ± 0.312
Provisioning (livelihood) services	Related to forage production or grazing. Example: I noticed that the site provides good foraging and will affect my livestock's milk and meat production.	90	1.89 ± 0.372

Table 6. Factors that significantly affected perception of each identified ecosystem service

Ecosystem services (ES)	Factor that affected ecosystem service perceptions								
	Age			Gender			Educational level		
	Mean square	F	Sig	Mean square	F	Sig	Mean square	F	Sig
Restoration and regulating services	0.525	1.778	0.188*	0.201	1.169	0.284*	1.219	1.056	0.308
Cultural services and cultural heritage	0.086	0.282	0.756	0.026	0.145	0.865	0.901	0.773	0.466
Biodiversity services	0.084	0.273	0.762	0.074	0.421	0.658	2.302	2.064	0.136*
Livelihood services	0.129	0.422	0.658	0.156	0.904	0.411	2.645	2.398	0.100*

Key: F = Fisher test value. Sig = significance level.

Note: * significance at 10 percent level.

Table 7. Factors that significantly affected the perception of each identified ecosystem service

Ecosystem services (ES)	Experience (years)			Income source		
	Mean square	F	Sig	Mean square	F	Sig
Restoration and regulating services	0.058	0.07	0.792	0.011	0.065	0.800
Cultural services and cultural heritage	0.873	1.082	0.349	0.109	0.663	0.519
Biodiversity services	0.337	0.405	0.669	0.111	0.677	0.512
Livelihood services	0.195	0.233	0.793	0.020	0.121	0.886

Key: F = Fisher test value. Sig = significance level.

Based on socioeconomic and demographic factors, the ANOVA test results showed no significant difference between the project participants and non-participants. This result might be due to non-participants having attended ES awareness-raising sessions conducted before the survey and gained a good understanding about the subject (the people participating in the project were already aware of ES). This analysis also revealed that these factors did not significantly affect community perception. This research demonstrated a valuable and effective tool to assess communities' perception of rehabilitation-driven ES. However, implementation duration, awareness-raising programmes and peer-to-peer communication might affect communities' perceptions. Hence, further investigation of the tools used is required.

Concluding remarks

The main goal of this investigation was to identify the impact of ecosystem services from the perspective of local farmers. The project particularly addresses agrosilvopastoral approaches that rehabilitate ecosystem functionalities and services of the largely degraded Jordan Valley's side wadis yielding surface water (runoff) towards the lowlands' irrigated production system. Social acceptability is also of great importance in planning rehabilitation activities as most projects require public support.

We developed a scientific approach for assessing community perception regarding rehabilitation activities and ES and assessed and evaluated the perceptions of local communities towards the ES and linked it to their socioeconomic status.

Results showed that all the interviewees said that they strongly agreed or agreed that rehabilitation driven regulating services were related to erosion and flood control through soil stabilization and protection. More than 90 percent also strongly agreed that cultural services and cultural heritage were related to wilderness and iconic values. They also believed that conducted activities improved biodiversity and habitat quality and that provisioning services were related to forage production or grazing. Results also indicated that people who has participated in the project were aware of the ES, and the people who had not participated in the project also had a good knowledge regarding ecosystem services as they had attended the workshop conducted before the survey to raise their awareness regarding the ES.

Practical implications

The main implications emerging from this study are as follows:

- Considering the perceptions of rehabilitation objectives by the local communities help to increase public support for these projects.
- Analysing the community's preferences for future landscapes can be very useful for better understanding of public support or opposition to ecological rehabilitation work. It is probable that further investigation in such areas will have a positive impact on ecosystem services.
- There is a need to enhance the community's awareness regarding ES through lectures and training, in addition to practical activities. Communicating rehabilitation objectives can increase awareness of the restoration benefits for ES.

- It is likely that focusing on these areas in future youth projects (from 18 to 30 years old) will have a positive impact on ecosystem services.

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Disclaimer

The views expressed are the authors' own and do not necessarily reflect the views of ICARDA, NARC, FAO, WADI, CGIAR, or any research and development partners involved in this research programme. Personal information, including names, business titles, emails, phone, images, and GPS points included in this brief, have been authorized in writing or verbally by the data subject.

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