PROJECT

Sustainability and Operationalization of Established Regional Agricultural Research Centers in Five Arab Countries

SUB-PROJECT

RESTORATION OF BADIA ECOSYSTEM SERVICES FOR ENHANCED COMMUNITY LIVELIHOOD.
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ACTIVITY A6:

DEVELOP METHODS FOR INTEGRATED ASSESSMENT OF RESTORATION INTERVENTIONS (IMPACT ON SOIL AND ECOSYSTEM FUNCTIONS) AT BADIA SCALE AND AT EXPERIMENTAL SITE SCALE.

An Activity led by CLAUDIO ZUCCA, PhD

Progress report 2017

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"Datasets on SWC and restoration interventions in Jordan Badia"

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Foreword

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This research activity titled "ACTIVITY A6: DEVELOP METHODS FOR INTEGRATED ASSESSMENT OF RESTORATION INTERVENTIONS (IMPACT ON SOIL AND ECOSYSTEM FUNCTIONS) AT BADIA SCALE AND AT EXPERIMENTAL SITE SCALE" was funded as part of the Project titled "Sustainability and Operationalization of Established Regional Agricultural Research Centers in Five Arab Countries" (sub-project "Restoration of Badia ecosystem services for enhanced community livelihood"), granted by the Arab Fund for Economic & Social Development (AFESD) and implemented by ICARDA.

This research was started in the last quarter of 2016 as a response to the perceived need to launch interdisciplinary research to identify approaches to enhance the effectiveness of the on-going efforts to mitigate land degradation in Badia and to restore rangeland productivity. The goal of this specific activity is to evaluate methods to enable an evaluation of the impacts of the interventions conducted so far.

This report summarizes the results of the data gathering work done during 2017 to elaborate a comprehensive dataset on the SWC and WH structures implemented in the Badia rangelands, as part of Activity A6. The data collected and illustrated here come from both institutional sources (data provided by governmental institutions) and from our own analysis of open access satellite images.

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1. Introduction

Several policies and programmes have been implemented in Jordan during the recent decades to mitigate land degradation and to restore rangeland productivity in Badia (Zucca and Bartolini, 2017a). In the frame of these, a wide range of sustainable land management (SLM) practices have been applied. Some of them involved the establishment of soil and water conservation (SWC) and water harvesting and storage (WHS) structures. These physical structures remain in the landscape and in some cases are still visible, both in the field and on satellite images, for long time, which can make possible to execute an ex-post evaluation of their impacts. A schematic typology of the most frequently observed SWC/WHS structures in Badia has been proposed as part of this research (Zucca and Bartolini, 2017b).

Unfortunately, it is difficult to have access to detailed and updated information related to the past and recent SWC/WHS achievements on the ground. When available and accessible, these data are mostly aggregated and not georeferenced. If available and properly used, this information would allow for an evaluation of the impact of the interventions and, besides generating important scientific knowledge, would be a reference of great value for the public institutions in charge for the implementation of the current and future restoration programs.

The objective of this study was to contribute to fill this gap by generating a comprehensive georeferenced dataset on the restoration achievements.

Using the above-mentioned typology (Zucca and Bartolini, 2017b) as a framework, a dataset has been created based on a review of the available literature, on interviews with reference persons at the involved governmental institutions, and based on our own analysis of open access satellite images. The results obtained, still under validation, demonstrate that with little financial resources and scientifically sound methods it would be possible to establish an effective monitoring and assessment system for Badia's restoration policies, to the benefit of the country.

2 The datasets

2.1 Institutional data

Our primary dataset was derived from the compilation and the harmonization of the information provided by governmental institutions. Data were mainly provided by the Ministry of Environment (MOE) and by the Dam Department of the Water Authority of Jordan (WAJ). These data were subjected to a preliminary (desk) verification by comparison with the data generated by us based on satellite images.

MOE provided a progress report drafted in 2016, with data (date, coordinates, storage capacity) about the punctual interventions (water ponds and earth dams) implemented by the Badia Restoration Program until 2015 (BRP, 2016). WAJ made available raw data about the water harvesting structures (main dams, water ponds, tanks) implemented by various programs over

the last decades, including the BRP, thus partly overlapping with the MOE data (WAJ, unpublished).

It has to be noted that the BRP is not an implementing agency itself. A Project Management Unit (PMU), housed at the Ministry of Environment (MoE), is the management and coordination body of the project, and its activities are implemented by different governmental entities and NGOs, in what is a rather articulated and complex organization. As an example, the National Center for Agricultural Research and Extension (NCARE) and the Ministry of Agriculture (MoA) are in charge of micro-catchment and land restoration activities through the Vallerani Method (Zucca and Bartolini, 2017b), while the Water Authority of Jordan (WAJ) is in charge for the remaining water harvesting interventions.

The WAJ database enlists 363 sites, divided in three categories: dams, tanks and ponds. A pond is a relatively small earth structure, usually oval or rounded, to collect water in both rural and urban environment. Ponds have the same function of tanks, but it appears that in the WAJ database ponds are usually smaller, quite old structures and many are currently abandoned or been substituted by other interventions. In few cases WAJ ponds correspond to structures identified by us as tanks on satellite images.

Furthermore, the database provided by WAJ seems to be a collection of different datasets from different institutions, with its different coordinate systems depending on the compiling institution. The coordinates were then all converted to EPSG4326. This allowed us to find a high degree of correspondence with our satellite-based database. Uncertainties remain though, due to satellite photo availability and coordinate system identification.
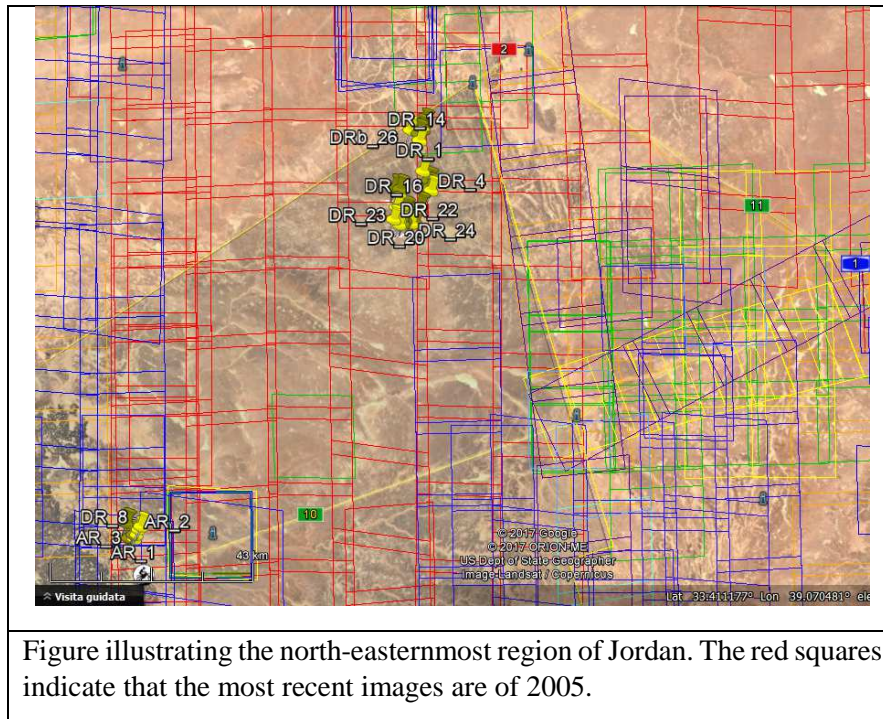
A harmonized version of the MOE and WAJ datasets is given in annex. Unfortunately, no institution provided maps or georeferenced data about the other types of interventions (e.g., micro-catchments, check-dams, reforestations).

2.2 Data generated through remote sensing evidence

An independent dataset was generated by geo-referencing the interventions that could be directly identified on open-access satellite data. Google Earth[2] (GE) was the principal source of information due to its complete geographic cover and generally high geometric quality. However, the GE image coverage for Badia is heterogeneous. Most of the North-Eastern corner of the Mafraq governorate, in the desert region along the borders with Syria and Iraq, is only covered by old GE imagery (e.g., 2004/2005), as shown in the figure below. In these areas, a Bing[3] Satellite Imagery were also used to fill the gaps, wherever it offered more recent images for the areas under consideration.

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[2] https://www.google.com/earth/
[3] https://www.bing.com/maps/aerial

Figure illustrating the north-easternmost region of Jordan. The red squares indicate that the most recent images are of 2005.

The approach adopted to generate the dataset was the following:

1. Identify the defined types of SWC and WH structures on satellite images. Due to the heterogeneity of the satellite images (date, quality, season), and the sometimes different image features of the structures, the identification process was not straightforward and required the iterative definition of photo-interpretation keys; initial datasets for the various types of structures were created, then gradually refined, as new areas were considered, new features and types of structures observed.

2. Establish a pilot dataset covering specific types of interventions and defined geographic areas.

3. Perform field validation and confirm the correctness of the photo-interpretation keys (structure type identification and classification).

4. Complete the dataset covering the whole of Badia (contingent on quality of images available).

5. Perform a cross-validation matching the data generated by us with the available geo-referenced institutional data.

During 2017 it was not possible to perform the field validation, due to a budget amendment that reduced the availability of operational funds for this activity. Validation was thus re-planned for 2018. The pilot datasets was established, along with an extended dataset that will be ready for release after validation and verification. The extended dataset includes more than 1,000 point features and around 100 polygon features.

This study will not be exhaustive. A more systematic analysis should be conducted by means of a complete coverage of multi-temporal high-resolution satellite images to achieve an objective

identification of all the interventions. Once completed the dataset will have to be considered as a preliminary elaboration and should not be used as a final assessment. Nevertheless, the study will represent a good starting point for any in depth analysis on the topic, providing methodological indications and a great amount of raw data to be analysed.

The preliminary results show a great abundance of structures concentrated in several areas of Badia, confirming the high relevance of Badia restoration in Jordan environmental policies.

Annexes

Annex 1. List of water ponds and earth dams built within the Badia Restoration Program until 2015 - CAP database, Jordan, 2016 - Data from: BRP. 2016. Cap projects, implementers and achievements. BRP Focal Point report

Annex 2. List of dams, water tanks and ponds under the responsability of the Jordan Valley Authority - WAJ database, Jordan, 2017.

References

BRP, 2016. Cap projects, implementers and achievements. BRP Focal Point report. Unpublished.

Zucca C., Bartolini P. (2017a). Summarized review of the recent rangeland restoration policies and programs conducted in Jordanian Badia. Technical report. "Sustainability and Operationalization of Established Regional Agricultural Research Centers in Five Arab Countries" Project. International Center for Agricultural Research in Dry Areas (ICARDA). Rabat, Morocco.

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