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International Workshop: Towards an Implementation Strategy for the Human Integrated Management Approach Governance System: *Theories, Concepts, Methodologies, Case Studies and Action Plans*

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Community-Based Rangeland Rehabilitation Project (CBRR) Royal Botanic Garden, Tell Ar- Rumman, Jordan - Case Study

Presentation in Session III: Bridging the Gap between Traditional HIMA System and Global HIMA Initiative

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Abstract

The Community-Based Rangeland Rehabilitation (CBRR) project began in 2007 with the goal of relieving grazing pressure on the Royal Botanic Garden (RBG) of Jordan, by developing grazing protocols that maximize the biodiversity of a given range and the productivity of animals grazing on it. The project was first focused on five families committed to improving the land and their livelihood, and by 2012, was expanded to include 38 local families.

The CBRR project has several components such as grazing management, community education and awareness, increased forage production, and alternative income projects. The main obstacles faced were a lack responsibility taken by pastoralists, poor water harvesting techniques, poor herd health, and low economic status of families in the area.

The CBRR organized community meetings and classes to provide locals with a greater awareness and understanding of the issues and give them tools to combat overgrazing, poverty and herd illness. Managed grazing has been able to rapidly rehabilitate the land in and around the RBG. The implementation of alternative income projects is now giving families a better livelihood and will continue to help more families as the project grows.

Experience to date suggests that an expansion of activities using the same community-driven methodology is possible, with great potential for replication in other areas of Jordan. The next step is to undertake a more formal analysis of the results so that a statistically valid assessment can monitor feasibility over the coming years.

Keywords: Livestock, pastoralism, rangeland, herd management, community-based

Introduction

The Royal Botanic Garden of Jordan (RBG) is located at Tell Ar-Rumman, Jordan on the north-facing slopes of the King Talal Dam and reservoir. The RBG's mission is to conserve native biodiversity at the habitat level, establish a center for scientific research and environmental education, serve as a demonstration site for sustainable development, and provide a unique ecotourism destination. Its vision is to be internationally recognized as the leader in research on aridland ecosystems and the challenges associated with desertification. The RBG is spearheading research on Jordan's native habitats and interpreting research into practical, accessible tools to improve the quality of life for Jordanians and the region.

The RBG's Community-Based Rangeland Rehabilitation (CBRR) project was conceived in 2007 as a means by which to relieve grazing pressure on the RBG site. Livestock owners who had habitually grazed the site before the establishment of the RBG were offered forage replacement in exchange for removal of grazing while vegetation surveys and biomass estimates were being conducted, and sustainable stocking rates and grazing scenarios were being developed. Since 2009, the livestock owners who once grazed the site down to bare earth had been policing themselves and others to protect the benefits they are reaping from the CBRR project and the rapidly reviving ecosystem.

Jordan is host to some of the earliest known evidences of the domestication of sheep and goats, some 10,000 years ago. As well as constituting a deep cultural tradition, pastoralism has had an indelible impact on the environment and has continued to do so. Jordan's plant species have grown and been adopted over the course of ten millennia alongside this deep pastoral tradition. It is well-documented in other parts of the world that removing grazing from a landscape which has traditionally been grazed (but not *overgrazed*) often has a negative impact on species diversity. With this in mind, the RBG began developing a long-term sustainable grazing strategy in conjunction with local herders, to help the pastoralists survive current economic challenges while allowing grazing on the RBG site in an appropriate manner.

The five families living adjacent to the RBG, who had been grazed their herds on and around the site for generations, “lost” 180 ha of range when the site was fenced. Meanwhile subsidies were removed from fodder and the prices of fuel and fodder soared, even as alternative grazing sites shrunk steadily due to urban sprawl and environmental pressures on the range. Throughout Jordan and the region, this scenario was the same, and the resulting

pressure on herders led to severe overgrazing of the shrinking rangelands. Where once free range grazing supplied the 25% margin of profit which made herding feasible, its depletion began to drive herders out of business. After the third consecutive winter with low precipitation (2005-2008), many pastoralists were forced to sell their herds and had turned to other means of income.

From the outset (2008), the RBG involved the community in its project design. It is widely understood that one of the biggest problems in enlisting community involvement to confront overgrazing is that few pastoralists in Jordan believe that their livestock is the cause of the problem (Al-Sirhan, 1998, Blench and Sommer 1999, Al-Tabini 2008). The feasibility of introducing improved land utilization practices depends on the knowledge of the livestock herders and their attitudes toward changing aspects of their methods of pastoralism. The RBG recognized that it was necessary to establish an efficient extension system to deliver the training necessary to improve herd management practices.

Project Objectives

The CBRR was thus created by the RBG with a twofold goal; to maximize both the available range and the RBG site's biodiversity and richness. While this may at first seem counter-intuitive, there is plentiful evidence that historically, grazed habitats adopt to and thrive under managed grazing.

The overarching goal of the CBRR is to develop grazing protocols in order to maximize both the biodiversity of a given range and the productivity of the animals grazing on it. Habitat-specific grazing protocols for the region are thus being established and published.

Long-term benefits have been achieved in the CBRR project through the following objectives are as follows:

- Educating the local pastoralists on the importance and implementation of grazing management,
- Demonstrating water harvesting and forage production techniques
- Demonstrating livestock system responses to both grazing management and production techniques,
- Improving the health of flocks around the RBG in order to increase the productivity per head,

- Providing different grazing scenarios for sheep and goats in the RBG site,
- Observing the browsing and grazing behavior of sheep and goats feeding on plants at the RBG, and
- On the basis of the information gathered, suggesting a sound management plan to allow for grazing within a sustainable system.

CBRR Beneficiaries

The ultimate beneficiary is the local community in Tell Ar-Rumman, which includes the families of pastoralists and the villagers, considered to be some of the poorest families in Jordan.

The new generation is being targeted through the CBRR community outreach program, which has conducted many educational workshops in collaboration with the local school. This has increased awareness about sustainable ecosystem management, and enhanced the flow of knowledge and adoption of the new model by the younger generations.

As news of the success of the program in Tell Ar-Rumman spreads, the CBRR is being approached by pastoralists in other parts of Jordan. The number of direct beneficiaries is therefore expected to increase soon throughout the country.

Other beneficiaries are researchers and research institutions working on conservation and biodiversity. Finally, policy makers in many ministries can benefit from the CBRR model and the results of the research, for use to modify the national strategy and legislation related to ecosystem and natural resource management.

Plan to Reach the Beneficiaries

The local community has been involved in the CBRR project from the beginning. Problems, possible solutions, alternative grazing scenarios and timing of grazing activities were discussed during the early public meetings with livestock owners and local community members in the area. Further meetings constituted herd assessments, introduction of the management plan and feed replacement scheme, as well as addressing project implementation. The community continues to participate in discussions related to site grazing and herd management.

Successful community-based grazing management demonstrations and training encourage local herders to cooperate in the development and implementation of tactics to better utilize rangeland areas. The key incentive for the herders is improved grazing management that will directly benefit their livestock and more importantly, their livelihood.

After several community meetings, the project team and the pastoralists decided that the areas that required action in order to achieve the objectives of the project constitute the following:

- Alternative income generating activities (such as organic livestock production, wool manufacturing, and beekeeping);
- Sustainable improvement of livestock production integrated with sustainable management of rangelands;
- Improved marketing channels;
- Subsidies for feed materials, especially wheat bran and barley; and
- Opening the RBG site for grazing and implementing the grazing plan designed by the RBG team.

Important CBRR Partners

The CBRR's partners are the following:

- The local village and pastoral community by which through farmer-to-farmer interaction, will help implement the CBRR model in other communities.
- Governmental ministries: The RBG and the CBRR work closely with the Government of Jordan, which allocated the land for the Garden, and in particular with the Ministry of Finance, Ministry of Agriculture, Forestry Department, National Center for Agricultural Research and Extension (NCARE), Ministry of Environment, Ministry of Water and Irrigation, Ministry of Education, and Jordan Dam Authority.
- NGOs and research institutes: The CBRR team works in close association with NCARE, the Royal Society for the Conservation of Nature (RSCN), and the Badia Center for Research and Development (BRDC), and other universities and research institutes.

Project Activities

Since January 2008, the RBG has been engaging a range scientist and a veterinarian to work alongside RBG botanists, landscapers, forestry personnel, and the local herding community to set up the project and research design. To date, the subsequent activities had been carried out.

Activities Related to Flora

- **Vegetation survey:** During the spring seasons of 2007-2008 and 2008-2009, 80% of the site was surveyed and documented in order to develop a baseline assessment of species diversity and richness, and to serve as a basis for long-term research design.
- **Research design for tracking long-term vegetation change:** With the assistance of botanists from the National Botanic Gardens of Ireland, Glasnevin, a research design for long-term vegetation tracking was developed and is still underway. The site has been mapped into 105 vegetation sectors, throughout which over 300 10x10 m observation quadrates were assigned randomly. These quadrates are inventoried annually for species diversity and richness, and the information is entered into a variety of databases for analysis of vegetation change. This allows the RBG to document the response of the habitats to managed grazing regimes, among other things.
- **Biomass:** As part of the baseline research for the CBRR project, biomass surveys were conducted at the RBG site during April and May for three consecutive years, 2008, 2009, and 2010. The goals of the surveys were to provide information about the biomass production on the site in order to calculate the site's carrying capacity, develop grazing management scenarios, and determine the effect of grazing on biomass production.

A method known as the "transect technique" (Bonham, 1989) was used in the study to estimate biomass productivity. The site was first divided into 11 sectors according to landscape and vegetation features. Within each sector, three study points were identified randomly, albeit, with attention to distributing study points evenly across each sector. Three quadrates were positioned along each 30-m transect at 10-m intervals, totaling nine quadrates per study point, for a total of 270 quadrates.

The biomass studies showed a marked improvement. The biomass of the RBG site increased from 42 tons in 2008 to 97 tons in 2010, as shown in Fig. 1.

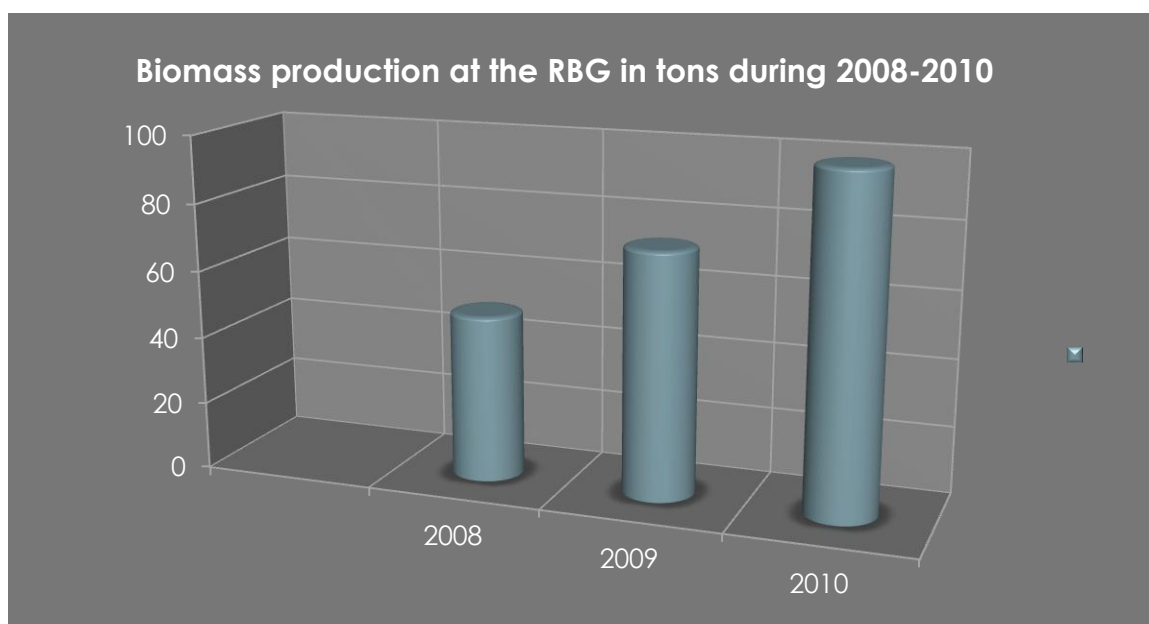


Fig. 1: Biomass production at the RBG, in tons from 2008 to 2010.

- **Carrying capacity:** After the vegetation survey was completed in spring 2008, the biomass study assessed the available forage potential of the site. Three hundred 1-m² plots were harvested, dried, and weighed. Based on the results, an estimated available forage and carrying capacity was calculated for the entire site. In 2008, the stocking rate was 1026 heads for 30 d. In 2009, it was 1162 heads for 40 d, and in 2010, it was 162 heads for 45 d.
- **Managed Site Grazing:** After managed grazing was started at the RBG site, a healthier, more diverse range of plants began to appear. When left unmanaged, open grasslands and woodlands are generally dominated by nonnative and/or invasive annual grasses and herbs. Such vegetation tends to inhibit the germination and growth of other plants by using up most of the available water and mineral resources in the soil and by producing large amounts of thatch. Managed livestock grazing controls the growth of nonnative grasses and herbs so that other desirable plants (wildflowers and native grasses) can regenerate and coexist with them. Many plants, including several endangered species, require grazing in order to maintain viable populations. Well-managed livestock grazing increases the diversity of habitats available to wildlife species. Many species, including several endangered species, benefit from the

vegetation management performed by livestock. Proper utilization of livestock grazing promotes healthier, diverse wildlife populations in parks and rangeland. The CBRR's studies on biomass and stocking rates have shown that it is possible, and desirable to allow managed grazing on the RBG site. Not only does managed grazing improve the biodiversity of the site, but also it is beneficial for the pastoralists, as it provides them with 50% of their feed invoice for free during the grazing period. The CBRR therefore allows the herders who had habitually grazed on the RBG site to once again have access, during late summer and early fall, for periods of time determined according to the biomass and stocking rate studies.

On pre-determined days, the herders are permitted to enter specified locations through RBG service gates. Each herd is allowed to graze for 2.5 h/d, which is enough for sheep to feel full in certain habitats, depending on the stocking rate of the habitat and herd size. After a determined period ends, the herds move to another habitat. The CBRR team supervises every day of managed grazing on the site and evaluates the vegetation and biomass of the grazed habitat. This win-win approach assists in improving the biodiversity and biomass productivity of the RBG site. The biomass increased nearly 30% per year during 2008-2011, and plant surveys found an increase in plant species from 436 to 580 in 2011.

Activities Related to Livestock

- Assessment of herd status: A veterinarian assesses the health of all of the livestock belonging to the stakeholder families, interviews the participants, observes herd management practices, and submits a set of recommendations to improve herd health and management.
- Herd management and health: The CBRR found that with a few simple flock management techniques, pastoralists can have better herds and higher revenue per head. For instance, ram isolation from the flock for one month before the breeding season could help create good breeding synchronization and a high percentage of pregnancies. As a result, the pregnancy rates in the top two flocks in the CBRR program rose to 97% and 80%, compared to 60% and 40% the previous year. Ram isolation could also result in lamb births grouped together within a shorter period of time, which in turn facilitates the management of newborns and the marketing of lambs and milk.

Other simple new herd management techniques introduced by the CBRR have optimized the pastoralists' operations and led to better overall productivity, fewer losses and higher profits. The CBRR's health program quickly provides low-cost, high-quality medication when animals get sick, while raising the participants' awareness of animal health and decreasing the misuse of medicine.

- **Animal Health Assistant training:** Two young local herders were trained by the veterinarian as para-veterinarians or animal health assistants (AHA), in order to respond in a timely way to emergencies, assist with vaccinations, and administer a range of common medications. The AHAs provide the main vaccines and treat common diseases (mastitis, respiratory infection, parasitic diseases, tick fever, and GI tract infections in newborns) in consultation with the veterinarian. In their first year of operation, the AHAs treated about 500 cases.
- **Vaccination program:** As part of the new management plan, a vaccination program was established and implemented with the assistance of the Ministry of Agriculture. The main vaccines made available are pox, brucellosis, Peste Des Petits Ruminants (PPR), Foot and Mouth Disease (FMD) and enterotoxemia. While the success of the vaccination program depends on the herders' cooperation and the availability of the vaccines, it enables safe and easy vaccination of animals all on one date, and prevents the misuse and mishandling of vaccines.
- **Forage replacement:** In order to remove the herds entirely from the RBG site during the vegetation survey period, the RBG contracted with the herders to supply them with supplementary feed to replace the approximated 25% of forage the range might have provided. This feed replacement program gave the RBG staff time to conduct a rigorous assessment of the available biomass onsite and develop a long-term plan.

Research and Studies

Local Knowledge (Livestock, Medicinal Plants and Rangeland Viability in Jordan's Badia, Through the Lens of Traditional and Local Knowledge (Tabini et al., 2012).

The CBRR's Local Knowledge study constituted investigating the traditional and local knowledge of Bedouin (Badu) communities in the dryland Badia region of the Hashemite Kingdom of Jordan with regard to livestock production, medicinal plant use, and rangeland management, and examining how such knowledge has changed over time. Badu customs

and practices from the last 50 years were compared with current realities, to get a clear picture of how modernization, social change and environmental factors have negatively affected the land, the people, livestock and plant biodiversity in the Badia. The findings indicated that the rangeland environment has become severely degraded; herd sizes have decreased; plant species are in danger and traditional Bedouin lifestyles have changed radically, due to unrelenting pressure on the land, water scarcity, manufactured livestock feed, government intervention, artificial borders and the abandonment of natural water harvesting and HIMA practices.

Economic Study (submitted for publication to Food and Agriculture Economics journal). The CBRR Economic Study examined the economic performance of five semi-nomadic small ruminant (SR) herders near the RBG, from 2008 to 2010. Their profitability was found to improve as a result of CBRR training and managed grazing on the RBG site. Results for subsequent years will be made public as the data analyses are compiled.

Since the decline in SR populations in Jordan is related to grazing conditions and rainfall factors, management decisions need to be closely monitored in order to maximize herd productivity. The low vegetation yield of overgrazed rangeland and the high cost of concentrated feed are major obstacles.

The study suggested that traditionally measured parameters such as lambing rates, cost per head and death rates, while found to affect net profits, are not enough to determine the best management practices in SR flocks. Herders should therefore strongly consider using profit analysis methods to determine and monitor the profitability of their flocks.

Grazing Behavior. The purpose of this study was to describe sheep foraging behaviors and use that information to develop grazing management procedures for Tell Ar-Rumman, so that forage resources at the RBG site can be sustainably utilized indefinitely and also serve as an effective demonstration and research center. Without a specific plan, unmanaged grazing at the RBG could have resulted in excessive use or grazing at inappropriate times, leading to a loss in forage and biomass production and potentially the established shrubs.

Twenty-five Awassi ewes were placed in 0.1- ha paddocks for 2.5 h a day for three consecutive days and were observed during each of the four seasons. The sheep were herded to and from the experimental paddocks in the morning and were fed 0.5 kg of barley in the evening. Virtually all grazing occurred in the experimental paddocks because areas where the sheep were housed contained very little forage ($< 40 \text{ kg} \cdot \text{ha}^{-1}$). The standing crop of

herbaceous vegetation in the study area averaged $165 \text{ kg} \cdot \text{ha}^{-1}$ and shrubs averaged $82 \text{ kg} \cdot \text{ha}^{-1}$. Sheep spent more time ($P < 0.05$) grazing than browsing, chewing, standing, or ruminating during all seasons. Sheep spent most of their time grazing during the first hour of grazing, and then the time spent grazing declined ($P < 0.05$), and the time standing and ruminating tended to increase near the end of the 2.5-h grazing period.

Under typical management in Jordan, where sheep are supplemented with barley, sheep clearly prefer herbaceous vegetation to shrubs. Rangeland restoration efforts in Jordan should therefore focus on the establishment of mixes of grasses, forbs and shrubs rather than monocultures of shrubs to meet the preferences of sheep.

Ethnobotanical Study of Medicinal Plants Commonly Used by Local Bedouins in the Badia Region of Jordan, submitted for publication to the Journal of Ethnopharmacology. As part of the bigger study on local knowledge, the CBRR conducted a small project on medicinal plants in Jordan's Badia in 2010 based on local and traditional knowledge, often in the context of traditional healing.

The target participants were livestock owners in the arid Jordanian Badia region. The objective of the study was to document traditional knowledge in using wild plants to treat health problems in order to conserve this valuable knowledge from loss; to identify the key plant species used; and to calculate the Informant Consensus Factor (ICF) for each category of health disorder, the Fidelity Level (FL%) and the Use Value (UV) of the plant species used by the Bedouin.

The data were collected by interviewing 80 participants of whom 21% were women. The participants were permanently interviewed and in a few focus groups. The team designed a questionnaire that helped in the data gathering, and also recorded the procedures used by the local communities on video.

A total of 47 plant species were found to be used by local Bedouins for medicinal purposes. The majority of these species are native to the study area, for example, *Artemisia judaica*, *Citrullus colocynthis*, *Ecballium elaterium* and *Rheum palaestinum*. The study showed that the plant species with the highest UV is *Artemisia herba-alba* and that *Ducrosia anethifolia* is a remarkable native plant species with a high FL% in curing dental pain. Moreover, the highest value of ICF was scored for dental disorders, followed by gastrointestinal disorders, and jaundice which may indicate the high incidental occurrences of these diseases and/or the lack of dental care services in the rural areas. Further investigation should be carried out in Jordan on the pharmaceutical value and production practices of these

native medicinal plants that have very low water requirements in a country with extreme water shortages.

Alternative Income Projects

Honey Production. The CBRR introduced honey production as a way to help families diversify their income source. Two families were trained initially, but this number is expected to go up due to the use of a revolving fund. The first two families are expected to pay back the initial cost of implementation, which will then be used to invest in new families. The families were chosen based on low income levels and their desire to implement the project. One of the families has four hives and the other one has three. In addition, there are nine hives in the RBG that are used for training.

Jameed Production. A pilot project was also set up to produce *jameed*, or sun-dried yoghurt, since most of the local community has dairy livestock. Using community knowledge resulted to the improved quality of the products already being produced, provided training on good hygiene practices for handling milk, and added value through the use of sun dryers and better packaging.

Mushroom Project. The CBRR's newest project is based on mushroom research being conducted at the RBG. Two local families were trained on how to raise mushrooms at home, as an alternative means of income generation. The families being interested in the work, had good initial results growing oyster mushrooms. There are plans for them to start growing a tasty local mushroom variety to start in 2013.

Forage Production. In winter of 2010-2011, the CBRR took the initiative of establishing a model for community-based grazing management by planting appropriate forage shrubs at a selected location in the RBG site to demonstrate the cultivation of drought-resistant native forage feeds. That location was initially protected from grazing until the shrubs and perennial grasses got established and became able to tolerate various managed grazing scenarios. This protection also gave small, endangered trees an opportunity to grow to a sufficient height to be safe from grazing. About 200 dunums were planted with *Atriplex* and *Salsola* species, and water harvesting techniques were put into place. In 2012, 300 sheep were allowed to graze in this area for 10 d based on the biomass and stocking rates determined by the CBRR team.

Conclusion

- The CBRR project was started with five families and grew to include 38 families by 2012, all of whom are benefiting from the livestock, health and income-generating programs.
- The CBRR continues to improve the economic performance of participating herders through the application of vaccination and herd management programs leading to healthier flocks.
- Five families have benefited from the alternative income-producing *jameed*, honey and mushroom projects.
- The CBRR team published a paper on local knowledge in the Badia in 2012, and five other papers are on track for publication.
- Successful community-based grazing management training and demonstration are convincing local herders to cooperate more and more in the implementation of plans to better utilize rangeland areas and develop participatory approaches to natural resource management and community empowerment.

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