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A Scalable and Participatory Sustainable Rangeland Management toolkit with a holistic and multidisciplinary approach to rehabilitate degraded rangelands

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Key words: holistic approach, land degradation, sustainable rangeland management (SRM), restoration, SLM

Abstract

Rangelands contribute significantly toward improving livelihoods, offering food security, trade and tourism for pastoral communities. Numerous challenges include poor government policies, loss of indigenous knowledge and top-down approaches toward sustainable rangeland rehabilitation that often fail to consider local development adoption and sustainability. In such situations, effective management is needed for sustainable rangeland ecosystem goods and services in a context characterized by rainfall unreliability, poor soil nutrient status and high uncontrolled grazing. This paper presents a new comprehensive toolkit for identifying and combining suitable and site-specific interventions aimed at reversing the trend of degraded arid rangelands. This toolbox is founded on science-based evidence and experienced practitioners. For severely degraded arid rangelands, the preference of applying an isolated technology may be insufficient to halt degradation. Through targeting a landscape scale that uses an integrated and multidisciplinary approach, this promising tool/approach aims to address the biophysical and socioeconomic linkages and trade-offs existing between the different land uses. The approach highlights the important role of rangeland governance. It also underscores the need to base decision-making on both indigenous knowledge and modern science, in order to empower communities to make good choices based on the best information available.

I. Introduction

Rangelands cover about 40% of the world's landmass and are vital to us all for the goods and services they provide (Lund, 2017). They support more than 50% of the world's livestock grazing by providing about 70% of the feed forage. Unfortunately, rangelands are experiencing a steady trend of degradation due to human activities and human-induced climatic change (Hudson et al., 2017). Additionally, most large-scale rehabilitation has been doomed to failure for two main reasons: (1) lack of a governing body able to resolve internal conflicts among pastoralists and (2) even when dealing with a more uniform and coherent body, appropriate grazing management is not understood. For instance, many development agencies still endorse a conservation approach relying on strict protection (fencing). In many degraded arid rangelands, long-term exclusion (removal of animals) has resulted in further degradation of ecosystems through the blockage of succession and water and mineral cycles. In contrast, controlled grazing enhances long-term recovery and resilience. Livestock hoofs break up the hard-crusts soils common to arid rangelands, allowing rainfall to penetrate the soil and seeds to germinate; and, in the case of perennial grasses, grazing removes oxidized plant material that would otherwise remain on the top of plants and prevent photosynthesis, causing the plant to die after several years (Savory and Butterfield, 2016).

II. Management strategies for optimal use of arid rangelands

1. Approach

For arid rangelands, the preference of applying an isolated rehabilitation technology may not halt degradation because the heterogeneity of the geomorphology, even at micro scale, and the landscape very often require the use of packages combining more than two different tools. For instance, planting fodder shrubs on steep slopes needs to be combined with an adequate water harvesting technique, considering the low and unpredictable rainfall amounts in such environments. Also, direct seeding in degraded rangelands needs to be executed in conjunction with soil scarification to reactivate soil water retention and increase seedling emergence and likelihood of germination. Keeping in mind, it is still critical to combine the use of different rehabilitation tools using a participatory approach, to move away from the paradigm view considering pastoralists as agents of degradation. To achieve this goal, rehabilitation options identified for a specific degraded rangeland need to be holistically integrated using land degradation indicators in a manual-style decision support system for the long-term sustainable production of rangelands in arid environments.

2. Putting participation and governance into sustainable rangeland management

The participatory approach has become part of the normal language of many sustainable development strategies. Policies and practice have sought to approach people and so encourage local participation. As a result, social conflicts have decreased in many communal rangelands, and management goals themselves have frequently been acceptable. Capacity development and awareness-raising related to the governance of natural rangeland is also an essential part of sustainable rangeland management (SRM) (Werner and Louhaichi, 2017).

3. Common SRM practices

When the status of degradation is very advanced, the recovery process will be very slow and requires specific intervention to at least neutralize degradation and slowly bring the site back to a more stable status. There are numerous SRM practices, and in this paper, we simply stress the main ones.

Shrub plantations: In order to alleviate the spread of rangeland degradation, shrub plantations provide a large amount of fodder for livestock, combat desertification, and play a key role in natural resource conservation. However, it can be frustrating when shrub seedlings fail to establish. For instance, in the arid steppes of south Tunisia, introduced species have generally performed very poorly (Le Floc'H et al., 1999). However, native species such as *Atriplex halimus*, *Rhus tripartitum*, *Periploca laevigata* and *Calligonum comosum*, have been successfully established in degraded areas and have replaced the introduction of exotic species. The toolbox highlights key steps ensuring effective establishment and maintenance when planting shrubs/trees.

Reseeding and/or direct seeding: Rehabilitation of arid rangeland by reseeding key-stone species can lead to a rapid increase of plant cover and density. The success of this practice is dependent on the degree of disturbance, soil type and climate condition, and must coincide with soil humidity to favor germination and emergence of seedlings. Seeding on sandy soils shows a high rate of success. There are different methods of rehabilitation by seeding such as broadcasting and seed dropping behind the plow. Manual drill seeding and dibbling in small areas, consisting of making small holes in the ground using a stick and dropping seeds by hand, are better traditional methods of sowing the seeds. Once the seeds are put in the holes, they are then covered with soil (Louhaichi et al., 2014).

Resting and deferred grazing: Rangeland improvement techniques in arid areas have emphasized deferred grazing as an efficient practice to restore vegetative cover at low cost (Ouled Belgacem et al., 2019). A stocking rate not exceeding the carrying capacity is necessary to maintain grazing operations under changing conditions and ensure long-term continued productivity of forage. Short-duration grazing should leave at least 40% of the vegetation so that it is not damaged and to allow its fast recovery (Gamoun et al., 2015).

III. A new support toolbox for adaptive sustainable rangeland and management

To address how rangeland management varies among different climate conditions, soil types and vegetation conditions, and how long grazing exclusion is required to be effective, we thought to develop a new guide for rangeland management and sustainability. This guide is an appropriate toolbox describing effective approaches that can be viewed as a more credible information source of structured decision-making. To our knowledge, short-term grazing exclusion is one of the most effective methods to restore degraded rangeland and is widely adopted in arid rangeland of south Tunisia (Figure 1).

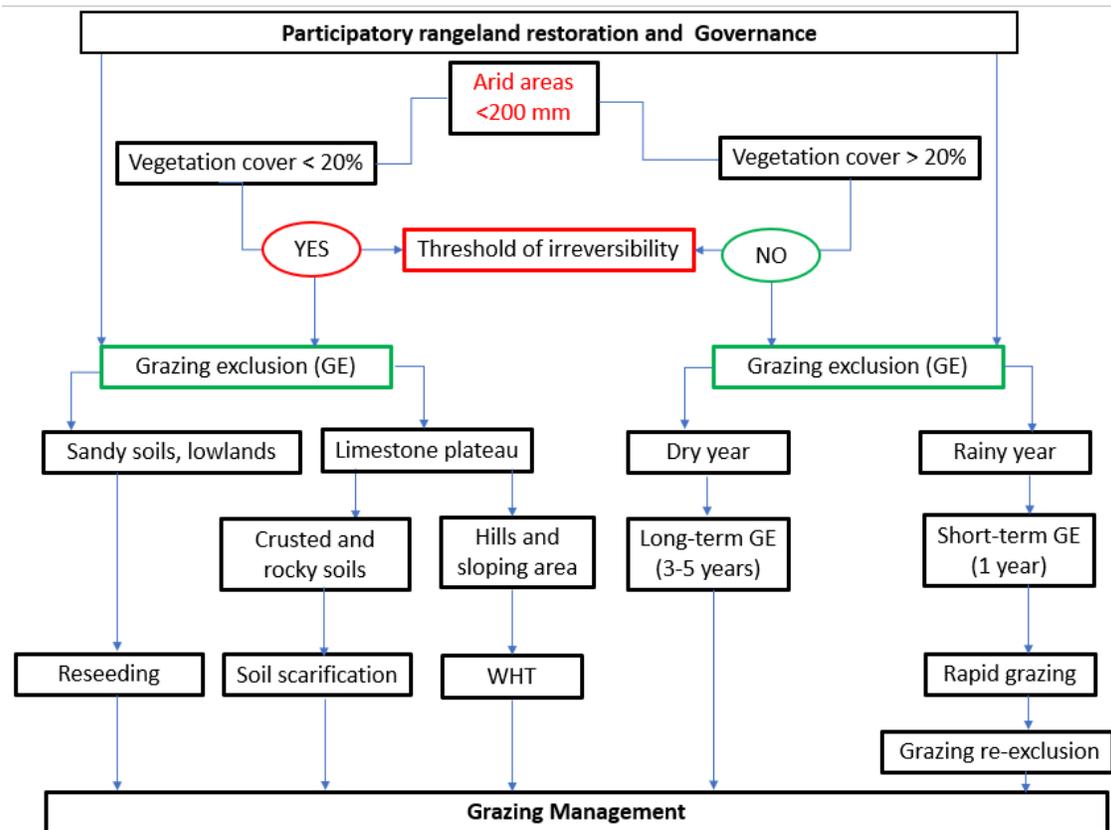


Figure 1. Case study of arid rangeland in Southern Tunisia. GE, grazing exclusion; WHT: water harvesting techniques.

IV. Conclusion

Given the steady degradation of arid rangelands, cost-effective techniques and protocols for attaining land degradation neutrality are needed. The toolkit will help communities, policy makers and other development actors define site-specific key SRM practices and illustrate their use through scenarios across different agro-ecological sites. Ideally these SRM practices should be combined with financial incentives to increase their adoption at the community level (Louhaichi et al., 2016).

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