

# Techniques of Survey of Vegetation Cover and Determination of Carrying Capacity



INITIATIVE ON  
Livestock and Climate

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# Livestock and Climate

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## Acronyms

CGIAR ..... Consultative  
Group for International Agricultural Research

CRDA ..... Commissariat  
Régional de Développement Agricole

GDA ..... Groupement de Développement Agricole

ICARDA ..... International  
Center for Agricultural Research in the Dry Areas

IRA ..... Institut des Régions Arides

OEP ..... Office of Livestock and Pasture





## Introduction

Despite its small area, Tunisia has highly diverse climatic and edaphic conditions. Rangelands constitute the largest land use and cover an area of approximately 5.5 million hectares. Of this total, 87% is located in arid and desert regions, with 45% in the south and 42% in the desert areas. Desert rangelands suffer from severe natural disturbances such as high rates of soil degradation and extremely low rainfall distribution, which, in part, may be caused by the climate due to their geographical location. These problems are generally compounded by anthropogenic factors such as overgrazing and wood harvesting. Taken together, these factors contribute to decreased biological diversity and rangeland productivity, as well as high rates of erosion, all of which are widespread problems in Tunisia.

The rangeland vegetation cover surveys and the determination of carrying capacity are crucial for understanding the condition and trends of rangelands. This information is essential for developing strategies and programs for restoring and sustainably managing natural rangelands. In this context, development institutions aim to enhance the capacities of their staff, ensuring their active participation in various activities.

Within the framework of implementing the Livestock and Climate Initiative of the OneCGIAR, a training course related to the restoration and sustainable management of communal rangelands was held at Institut des Régions Arides Branch in Kebili on February 28-29, 2024.

## Objectives

- Both the Office of Livestock and Pasture (OEP) and the “Commissariat Régional de Développement Agricole” (CRDA) aim at developing and enhancing the capabilities and skills of their staff in the field of survey, inventory, and assessment of rangeland vegetation cover. The training course aims to provide theoretical and practical materials in addition to field measurements that enable the trainees to:
  - gain sufficient knowledge about environmental sciences and rangeland management
  - acquire the appropriate skills to collect and analyze vegetation cover characteristics data
  - acquiring sufficient skills to determine the condition of the rangelands and the appropriate ways to improve their productivity.
  - accurate determination of carrying capacity and the suitable grazing management program.

## Beneficiaries

The “Techniques of Survey of Vegetation Cover and Determination of Carrying Capacity” was held in the Institut des Régions Arides Branch in Kebili on 28-29 February 2024. The beneficiaries of this training course were the staff of different departments of the Commissariat Régional au

Développement Agricole Kebili (Forest, Water and Soil conservation, Land Protection, ...), the Office of Livestock and Pastures (OEP), Institut des Régions Arides (IRA – Medenine), and the community-based organizations (Agricultural Development Group: GDA of Dhahar Douz). Participants may have limited or no prior experience or training in vegetation cover survey and management skills. The course follows a general approach and is designed for participants with diverse educational backgrounds. A total of 28 participants attended both training sessions, including 22 from the CRDA of Kebili, 3 from the OEP Kebili, 2 from IRA, and 1 from the GDA of Dhahar Douz. Among the trainees, 12 ladies, about 43% of the total, attended the training.

## Training Methodology:

The methodological approach was intended to deliver a set of training materials that provides a broad overview of the key elements of the vegetation cover survey and assessment. The training was based on a series of sessions that have been designed to be fully flexible to meet a wide range of audience requirements and needs. A participatory approach was adopted, both during PowerPoint presentations and practical exercises. In addition to the PowerPoint presentations, the following training approaches were implemented:

- An introductory part of all sessions to encourage a free and open environment where everyone can participate and share their ideas freely related to the topics. It was based on a sound process with catalyzing questions that address related challenges.
- The discussion method was used to build a collaborative and interactive exchange of ideas among the trainers and trainees on the rangeland condition in Kebili governorate to further participants thinking, learning, and problem-solving understanding. Participants were encouraged to present multiple points of view, respond to the ideas of others, and reflect on their ideas to build their knowledge and understanding of the related matters.
- This collaborative and participatory learning method was also used to enhance the participants’ learning and increase their understanding of training contents and build particular transferable skills to encourage and promote participants to work together to maximize their contribution to addressing challenges and recommend joint solutions or corrective measures. Working Groups were formed to provide the opportunity for participants to work collaboratively to discuss specific related training topics/issues and perform a particular planning task. This was practiced mainly in the classroom when working on practical exercises and analyzing data priorly prepared or even during field data collection and then analysis.

## Training Daily Proceedings:

A flexible approach was adopted for the training and participants were able to ask questions, clarify local situations, and provide feedback at any point during different sessions, making the engagement between the trainers and participants interactive and lively.

### Session 1. Opening ceremony

The training course was inaugurated by Mr. Oussama Rahmani, the Director General of the CRDA Kebili who warmly welcomed all participants, including those attending from other institutions (IRA, OEP, and GDA). He thanked ICARDA and IRA for working together with the departments to organize the training and acknowledged the continuous ICARDA technical support. He highlighted the importance of the Vegetation Cover Survey to strengthen the CRDA's capacities for effective involvement in the implementation of different strategies and initiatives. He finished by insisting on the importance of this training that will equip the staff of the CRDA and other institutions to actively engage in the implementation of the national programs on rangeland restoration and combating desertification.



Figure 1. The training course was inaugurated by Eng. Oussama Rahmani, the Director General of the CRDA of Kebili.

### Session 2. Rangelands in Tunisia

In this section, Dr. Mohamed Neffati presented the current state of the Tunisian rangelands including the drivers of their dynamics and the main factors of degradation as well as their environmental and socio-economic importance. He focused on the basic concepts of the rangelands of Tunisian arid and Saharan areas including the main factors determining their productive and adaptive potential. He has also given an overview of the vegetation dynamics, irreversible degradation threshold, and the vital attributes for monitoring and evaluating the ecosystems.



Figure 2. The training course was inaugurated by Eng. Oussama Rahmani, the Director General of the CRDA of Kebili.

### Session 3: Vegetation cover attributes and soil surface states survey

The trainers (Dr. Ouled Belgacem and Dr. Neffati) have also delivered a presentation on rangeland vegetation cover monitoring and evaluation using the point-quadrat (line intercept) and the quadrats (Figure 3).

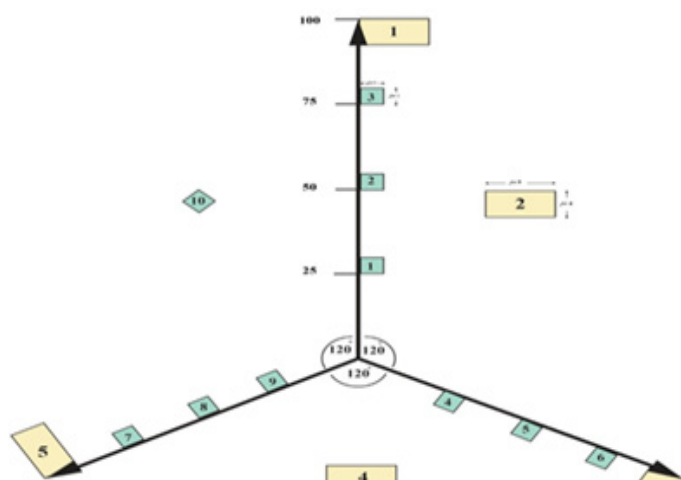


Figure 3. Design for measuring vegetation cover and species composition using the Point-quadrat Intercept Method and Quadrats for annual and perennial plant density and biomass estimation.

(In each sampling area, the design comprises i) 3 lines of 100 m each serving for measuring the total vegetation cover, species composition, and soil surface states; ii) 5 quadrats of 20 m<sup>2</sup> each for determining the density of perennial plants and iii) 10 quadrats of 1 m<sup>2</sup> each for determining the density of annual plants.)

In addition to total vegetation cover, species composition, plant density, and biomass production, the determination of carrying capacity was also presented using 2 different methods. The first is based on the dry matter production (kg DM/ha) and animal unit or equivalent requirements. The second is estimated indirectly on feed units (FU) in the function of species contributions to total cover as well as its palatability index.

#### Session 4. Field measurements and data collection

During this visit, participants including ladies were trained on vegetation cover parameters measurements and field data collection. Two groups were formed and filled the different forms in two different areas with different plant communities. The methods of point-quadrat and the quadrats were used and direct clipping was also adopted to determine the biomass production.

Participants were trained on how to fill and analyze the data collected from the field in Excel. Two groups were formed and worked on the real data collected from the rangeland site using the direct (biomass production) and indirect (species composition and palatability indices) methods of determining the carrying capacity of the range site. This practical exercise was highly appreciated by trainees who showed very good involvement in this operation. Trainees were assisted by IRA and ICARDA moderators. At the end of the session, each group representative presented the results for discussion. The way of managing the rangeland site either by small ruminants or by camel grazing has also been delivered and discussed.



**Figure 4. Practical session and field measurement of the total plant cover and species composition using the point-quadrat intercept method.**

#### Session 5: Appropriate techniques for restoration and management of rangelands in arid zones

In this session, Dr. Neffati and Dr. Belgacem presented the general model depicting rangeland ecosystem degradation and the three potential development options (3R) including

Restoration (such as resting technique or short-term protection), Rehabilitation (such as reseeding and planting native species, scarification and water harvesting, ...), and Reallocation (or creating new system different to the originally existing one such as planting exotic fodder shrubs) depending on the degradation status of the rangeland ecosystem reached (Figure 5).

Whatever their technical efficiency, the success of the various rangeland restoration/rehabilitation techniques remains dependent on their acceptability by the pastoral population. It should be emphasized that the participation of users in all phases of preparation and implementation of action plans is indeed a determining factor in their success.

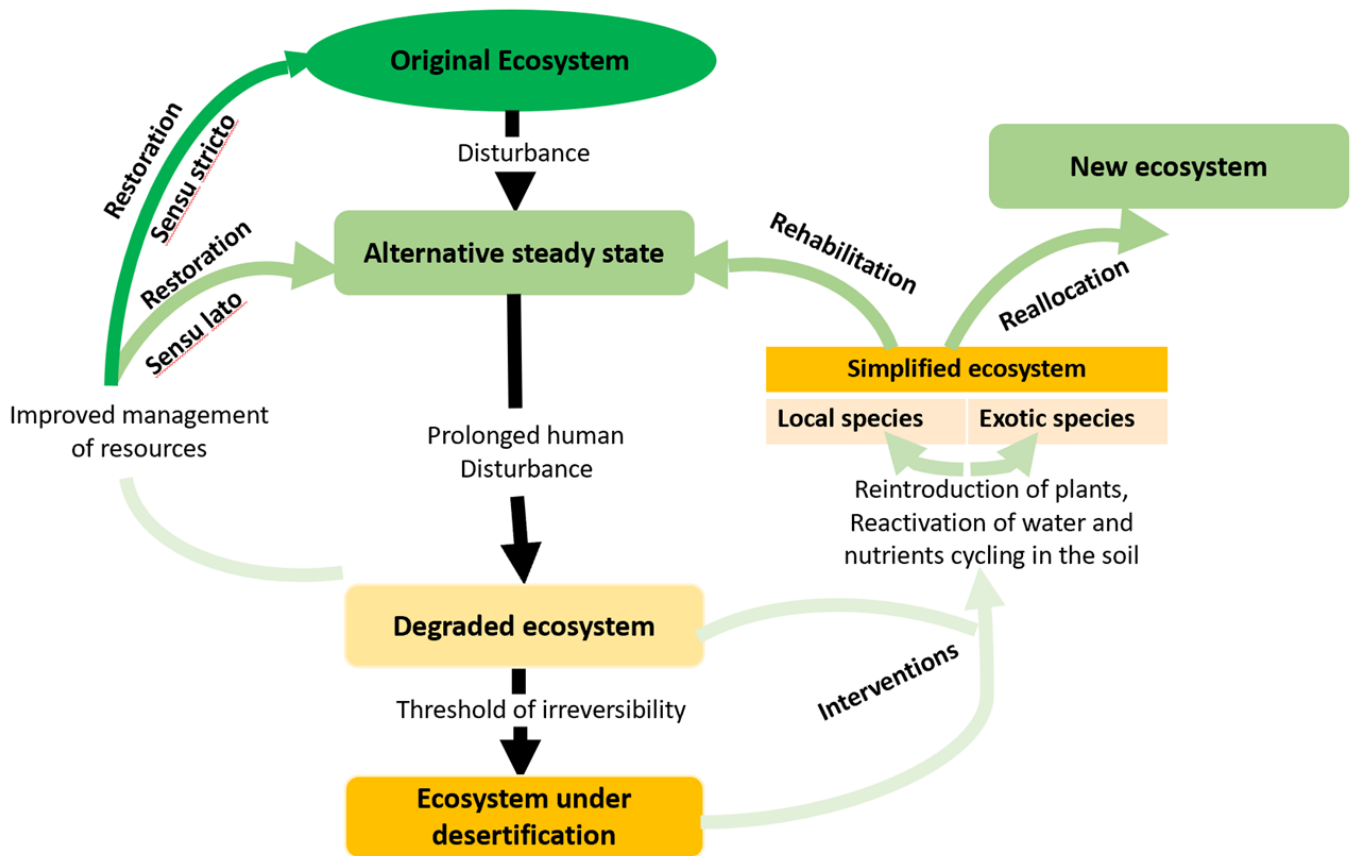
In addition to the 3Rs, several measures are proposed to support the development of community grazing management plans. These include (a) the Establishment of well-distributed watering points and the prohibiting of mobile trucks; (b) the Establishment of a system for closing watering points when a given range is protected. The system may be based on a rotational grazing system; (c) Establishment of shade areas near the watering points to protect the flocks from the sun heat; (d) Establishment of centers to provide services such as supplementary feed, veterinary services, etc. The service centers may be fixed or mobile within the sites open for grazing; (e) Controlling the herds coming from other regions with grazing priority given to the local communities.

#### Session 6: Closing ceremony

In the closing session and awarding of certificates to participants, the Director of OEP Mr. Ezzeddine Chalghaf expressed his appreciation to ICARDA and IRA for coordinating, planning, and organizing this training course. He also congratulated the participants for their great interaction with the various presentations and practical training included in the training course program and asked them to use the skills and knowledge acquired to disseminate the benefits in the country.

Eng. Abdelmajid Abbas, the representative of the CRDA Kebili, highly appreciates the tireless efforts made by the trainers in preparing and delivering the course and called for more pieces of training of this kind for CRDA staff and other stakeholders shortly.





(1) Restoration:  
The best option where the original ecosystem conditional is still resilient

(2) Rehabilitation:  
Best options where ecosystem resilience has gone down but can be rehabilitated to an alternative steady condition

(3) Reallocation:  
Best options where ecosystem resilience has gone down and needs to be allocated to a new ecosystem



Actions may include protection, light grazing, selecting specific animal species, etc.



Actions may include reseedling, scarifying, re-introduction of indigenous plant species, water harvesting, etc.



Actions may include planting fodder shrubs and forest trees, seed and seedlings production, etc.



**Figure 5. The choice of action to combat rangeland degradation and improve productivity (3R) depends on the state of the range ecosystem and set range management objectives.**

## Conclusion

Rangelands in Kebili Governorate, Southern Tunisia are still playing an important role in sustaining livestock and biodiversity. They face the detrimental effects of climate change and human pressure, signaling an urgent need for rehabilitation and sustainable management. This training emerged as a pivotal initiative, fostering collaboration, knowledge exchange, and practical insights into the intricacies of effective rangeland management.

This training focused on crucial themes such as quantitative rangeland surveys and ecosystem restoration. Participants from development institutions gained proficiency in conducting vegetation cover surveys, biomass estimations, and carrying capacity determination.

Practical application of techniques like the Line Point Intercept (LPI) method and different size of quadrats were used to characterize and determine most vegetation cover attributes and soil surface states.

The incorporation of the minimal area concept within the quadrats method underscored the training's commitment to obtaining accurate estimates of species richness, plant density, and biomass production, particularly vital in arid and desert environments.

The collaborative pledge to implement sustainable practices, fortify protective measures, and amplify community engagement is pivotal for conserving the rangelands' resilience and vitality. This training represents an excellent step towards a future where these vital ecosystems not only persist but thrive harmoniously with the needs of communities and the broader ecosystem.

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