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Rangeland management in Tunisia: Inventory and perspectives under a climate change context

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Abstract. Tunisia rangelands, 25% of the total land area, play an important role in contributing to people's livelihood. Natural rangeland ecosystems decreased in area and production. This is due to the increase of population, its needs in milk, meat and other agricultural products as well as the increase in livestock numbers and needs of fodder units. Current Tunisian rangeland ecosystems consisted of forest and steppe ecosystems, suffer great pressure with an average overgrazing rates that exceed 75%. Projections of climate change in Tunisia for 2030-2050 horizons predict a rise in annual and seasonal temperature and decreased rainfall, with increased frequency of extreme events including the succession of dry years that can have significant impacts on perspectives and developments of the production systems and in particular the rangeland and extensive farming systems which depends largely on livestock feeds. It is concluded that current management of rangelands should be improved to reach more rational management. So, efforts are needed for rangeland management and development of their resources. It is also important to adopt a method of periodic grazing in plots limited, an integrated approach and adaptive management is required to respond to climate change.

Keywords. Rangeland – Management – Climate change – Perspective – Tunisia.

La gestion des pâturages en Tunisie: État des lieux et perspectives sous un contexte de changement climatique

Résumé. Les parcours en Tunisie représentent 25% de la superficie totale des terres. Ils jouent un rôle important en contribuant à la subsistance des populations. Les parcours naturels ont diminué, ces dernières années, en superficie et en production. Cela est dû à l'augmentation de la population, à ses besoins en lait, en viandes. Les parcours tunisiens actuels, qui se composent principalement des écosystèmes forestiers et steppiques, souffrent une grande pression avec un taux de surpâturage moyen qui dépasse 75%. Les projections climatiques en Tunisie pour les horizons 2030-2050 prévoient une hausse de la température annuelle et saisonnière et une diminution des précipitations, avec une augmentation de la fréquence des événements extrêmes y compris la succession d'années sèches qui peuvent avoir des impacts significatifs sur les perspectives et les évolutions des systèmes de production et en particulier les parcours et l'agriculture extensive dont dépend en grande partie l'alimentation du bétail. La gestion actuelle des parcours devrait être améliorée pour atteindre une gestion plus rationnelle. Ainsi, des efforts sont nécessaires pour la gestion des parcours et le développement de leurs ressources. Il est également important d'adopter une méthode de pâturage périodique dans des parcelles limitées, ainsi qu'une approche intégrée et une gestion adaptative pour répondre aux changements climatiques futurs.

Mots-clés. Parcours – Gestion – Changement climatique – Perspective – Tunisie.

I – Introduction

Tunisia is located in the north of Africa. It has a land area of 16.2 million hectares and has a privileged geographical position at the crossroads of the eastern and western basins of Mediterranean sea, between. Tunisian topography is very varied and landscapes are considerably different from north to south. Mountainous areas are in north and west, steppe is in the centre, vast plains to the north east (Sahel) as well as in the center, and a desert area in the south. Tunisian climate is characterised by rainfall scarcity and a wide variability of rainfall within the year and through the country. The climate is humid (between 1000 and 1200 mm yr⁻¹) at the

extreme north, sub-humid in the north and along the coast, and semi-arid and arid in the centre and the south and desertic in the south (between 100 and 150 mm yr⁻¹). According to the latest demographic survey the population in 2014 was estimated as 10,983 million. Between 1960 and 2013 the population increased by 6,665.799 inhabitants (INS, 2014). As in most countries, the greatest challenge facing the management of rangelands is deforestation and degradation, the main causes of which being human activities, including land clearing for agricultural expansion, excessive collection of firewood, production of charcoal and the uncontrolled exploitation of wood. Forest and rangelands development remains lagging behind and the sector suffers because the development of Tunisian agriculture is focused in priority on the development and intensification of agricultural production. climatic projection models available for Tunisia predict an average rise in annual temperatures that could reach by 1.1 to 2.1°C in 2030 and 2050 respectively. The models projection indicate a decrease in annual precipitation by 5-9% in 2030 and 2050 respectively (MARH and GTZ, 2007). Tunisia would be particularly affected by droughts that would be more frequent, more intense and longer-lasting. Drought and wet periods should be more variable between seasonal and intra-seasonal. The main issues of this study concern the rangeland management in Tunisia under a climate change context.

II – Rangelands management in Tunisia

Rangeland management in Tunisia is under one institution, namely General Directorate of Forests (DGF) under the Ministry of Agriculture and Environment. In Tunisia rangelands include different formations like as natural rangelands, Alfa steppe, pastoral plantations, riparian plants and other ranges with forest pastoral land (Fig. 1a). Rangelands cover 27.5 percent of total national area that means 4.5 million ha. This area is distributed in: (1.30 million ha of private area, 2.75 million ha correspond to collective ranges which represent 65 percent of total rangelands, and 0.45 million ha of steppe). Rangelands are important because of their contribution and their forage value for grazing herds composed by sheep, goats, cows and camels (Fig.1b). Rangeland production varies from 1 200 million of UF/year during rainy years and to 450 million in dry years while the needs of the flock are about 4,400 million of UF/year. Rangelands therefore provide about 10 to 25 percent of the needs of the herd.

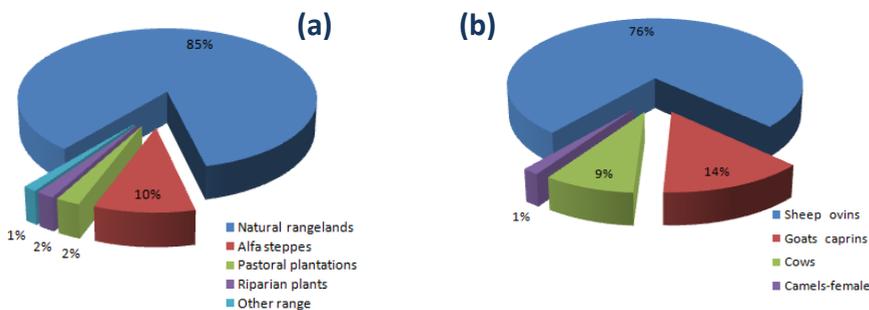


Fig. 1. (a) Area of different kinds of range; and (b) Composition of the herd in Tunisia. Adapted from OEP (2015).

III – Climate change impacts

For most parts of Tunisia, small changes in mean annual precipitation are expected, and under most of the future “emissions scenarios” these are within the range of natural variability. However, shifts towards a higher proportion of the annual rainfall in winter and less rain in summer, have the potential to increase the frequency of years with summer drought stress, leading to reduced security of crop yields on non-irrigated land. An increase in atmospheric CO₂

concentration is one of the most certain outcomes and the one that may have both positive and negative consequences. Elevated CO₂ is likely to affect feed quality for grazing, both in terms of fine-scale and coarse-scale changes. At the farm scale, the consequences for feed budgeting are increased under situations of uncertainty, requiring a greater area allocated for conserved feed to support livestock during periods with limited or no forage production. Heat stress affecting livestock is another serious potential impact affecting the livestock sector, as this can lead to reduced intake liveweight gain and milk production. Climate changes also presents risks of increased spread of vectors of livestock diseases. These are important impacts in the context of seasonally hot, dry regions, like the Mediterranean (Bindi and Olesen, 2011).

IV – Adaptations to climate change

Global climate change is becoming a substantial reality. Tunisia is one of the most susceptible countries to the risks of these alterations particularly on the rangelands level. Indeed, the involvement of natural pasture and rangelands in the feed calendar is declining noticeably because of frequent droughts and over-grazing. The management and the improvement of the existing rangelands, their enrichment by natural regeneration and planting off odder species and pastoral crops may help to alleviate the negative effects related to drought. Planting of woody species adapted to drought would provide not only fodder but also shading and fire wood, as well as environment-related services such as soil improvement, erosion control and soil carbon sequestration. Grazing management techniques intended to increase forage production through increased perennial species have the potential to increase above and below ground soil carbon stocks, and to restore degraded drylands. Rangelands store 30% of the world's soil carbon (Grace *et al.*, 2006). Smith *et al.* (2007) estimated that improved rangeland management could globally sequester 0.35–0.55 Gt C.yr⁻¹ up to 2030. Batjes (2004) estimated that improved management of 10% of the African grazing lands could increase soil carbon stocks by 13-28 MtC.yr⁻¹. Rangelands degradation is related principally to agricultural expansion, fuel wood gathering, and overgrazing. Tunisia has prepared and adopted a strategy and national action plan of natural resources (Pastoral plan, soil and water conservation plan, desertification plan, and climate change plan) to address this situation. Strategies adopted have a common basis of perspectives and appreciation of natural resources. Sustainable management of rangelands should be considered as an integral part of national strategies reconciling economic growth, social equity in development and environmental protection. Moreover, in most cases, government institutions responsible for rangelands have policies and programs require better coordination, harmonization, and better integration and improved linkages in land management (Fig. 2).

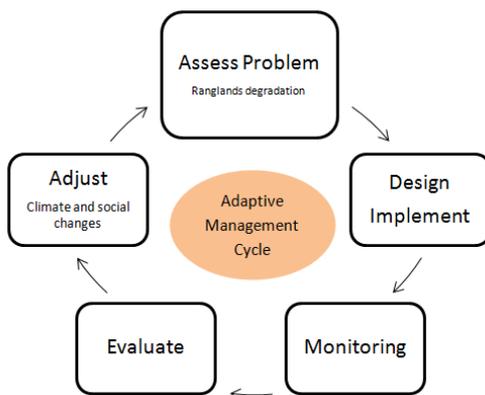


Fig. 2. Adaptive management cycle. Adapted from Williams *et al.* (2007).

V – Conclusions

Maintaining a balance between Tunisian grazed areas remains an important issue, although it does not arise as acutely. Therefore the current management of Tunisia rangelands should be improved to reach more rational management. So, efforts are needed for range management and development of their resources to contribute to climate change mitigation and adaptation. It is also important to adopt a method of periodic grazing in plots limited, so as to control the load exerted by animal on rangeland and preserve resources.

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