Prospects for Stakeholder Cooperation in Effective Implementation of Enhanced Rangeland Restoration Techniques in Southern Tunisia☆

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Prospects for stakeholder cooperation in effective implementation of enhanced rangeland restoration techniques in southern Tunisia ☆

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ABSTRACT

The objective of this paper is to identify prospects for stakeholder cooperation for effective implementation of enhanced rangeland restoration techniques under different land tenure status in Tataouine Governorate of southern Tunisia, through the rest technique locally called *"Gdel."* This technique consists of leaving a given rangeland at rest to reconstitute the plant cover. A stakeholder analysis was conducted using the MACTOR methodological framework to analyze stakeholders' strategies and their balance of power in terms of rangeland management decisions, specifically regarding the implementation of resting, which involves a high level of collective action. Data collection was based on two focus group discussions with the nine main stakeholders involved directly and indirectly in Tunisian rangeland management. Stakeholders' perceptions about resting are compared across private and collective land tenure systems. Findings show a wide diversity in stakeholder relationships, in terms of influences, dependencies, and balance of power, with differences between collective and private tenure systems. In private rangelands, equal levels of stakeholder influence and power lead to a much more stable and flexible rangeland restoration process, with more alliances and consensual objectives among almost all stakeholders. The situation in collective rangelands is very different because the majority of stakeholders have a weak influence in terms of management decisions, with fewer alliances and more conflictual objectives among them. Pathways for stakeholder cooperation and long-term empowerment are suggested for effective implementation of rangeland restoration techniques involving collective action.

Introduction

Rangelands in southern Tunisia suffer from severe degradation due to multiple socioeconomic changes, including in pastoral and agropastoral societies, land tenure systems, and mechanization (Nefzaoui and Mourid 2008; Nefzaoui et al. 2012; Ouled Belgacem 2018). These changes have led to increasing conflicts concerning pastoral resources, especially in the context of collective rangelands, owned and managed collectively, thus involving some additional difficulties for their good governance (William et al. 2003). Overgrazing is now the main anthropic factor leading to decline and degradation of the perennial plant cover. The increase in livestock numbers, expansion of cultivated areas at the expense of rangelands, and weakening of traditional grazing systems (transhumance and nomadism), which historically allowed for grazing deferment and control of livestock grazing, have led to the emergence of new sustainability challenges for pastoral resources. Overgrazing is more harmful when coupled with climatic aridity (mean annual rainfall $<$ 150 mm) and may disturb rangeland ecosystems (Ouled Belgacem et al. 2006; Tarhouni et al. 2006).

Ancestral agropastoral societies in Tunisia have developed their local knowledge and strategies for coping with drought and climate variability: mobile or transhumant grazing practices that reduce the risk of having insufficient forage in any location, feed storage during favorable years or seasons, reciprocal grazing arrangements with more distant communities for access to their

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resources in drought years, and adjustment of flock sizes and stocking rates as the rainy season unfolds, to best match available grazing resources (Hazell and Wood 2007). One of the most well-known and widely practiced traditional techniques for rangeland management in Tunisia and elsewhere is the resting technique (Nefzaoui and Mourid 2008; Squires et al. 2009; Gamoun et al. 2018; Ouled Belgacem 2018). This technique is locally known as *"Gdel."* It consists of leaving part of the rangeland to rest (without grazing) for a definite period of 2–4 yr depending on the ecosystem capacity to recover and on climatic conditions, with the aim to reconstitute plant cover, and can result in increases in fodder production, soil organic matter, and biodiversity and reduction in soil erosion (Ouled Belgacem 2012).

However, the socioeconomic and institutional changes to ancient pastoral systems have led to a gradual abandonment of the Gdel technique by pastoral societies. In fact, Tunisian rangelands were managed and controlled before the French occupation (1881) by traditional institutions, called "Myâad," composed of tribal chiefs, who enjoyed effective power for annual management (opening and closing) of collective rangelands (Nefzaoui and Ben Salem 2011; Gamoun et al. 2018). The Myâad was transformed during the French occupation of Tunisia into a more formal structure called "Land Management Council" (CG), composed mainly of landowners. After independence (1956), this traditional institution was consolidated. Since the 2000s, the government has implemented a complementary and new organization called the Agricultural Developing Grouping (GDA), which comprises a group of landowners and land users. The relationship between the two organizations was marked by time by some conflictual or collaborative actions as appropriate and depending on context (Gamoun et al. 2011).

The progressive decline of rangeland productivity in these contexts of socioeconomic, institutional, and climate changes, as well as the ineffective models of entrusting management of natural resources to government agencies or devolving natural management to user groups and local institutions, are then accompanied with disruption of institutional arrangements for rangeland management, which is reflected by difficulties in cooperation among an increasing number of stakeholders and weak performances of existing farmers' organizations (Robinson et al. 2017; Ouled Belgacem 2018).

Because of their spatial scale and multiple users, owners, and managers, rangelands in Tunisia require some form of coordinated regulation. Collective action is then essential to resolve governance problems since it leads to stronger, more cohesive, and more stable communities (CAPRi 2010). It strengthens local governance institutions and improves rangeland productivity and management (Flintan et al. 2019). However, the success of collective action is highly dependent on actors' behavior and the state of local rangeland governance. These criteria are particularly important under complex and different land tenure systems where many (collective) landowners, land users, and land managers (governance structures) are intervening for decision making on the rangeland resource.

The questions here are under what form and conditions will collective action emerge and be strong enough to manage these rangelands, and what can be done to increase the likelihood of cooperation in the context of devolution programs?

Considerably more attention is needed to the factors that make these stakeholders willing and able to take on an expanded role (capacity for cooperation) in a context of effective collective action, which usually includes rules on using (or refraining from using) a resource, as well as processes for monitoring, sanctioning, and dispute resolution.

Considerable research has been devoted to this topic and gives attention to the "enabling environment" for effective collective action on rangeland management.

Wheatland and Chêne (2015) define collective action as a variety of actions that are undertaken by individuals or groups or an organization that is acting on their behalf to achieve a collective purpose or shared interest of the group or individuals. As an analytical concern, collective action is a concept that is associated with a myriad of disciplines and contexts, which include economic, political, labor, development, agriculture, environment, social, governance, and anticorruption contexts to name but a few. It is a concept that is relevant and adaptable to different contexts and levels (Vanni 2014).

The theory of collective action and its relevance to social issues has been changing over time. Olson's theory of collective action (Olson 1965), the Prisoner's Dilemma and the tragedy of the commons, tended to analyze common resource systems using similar assumptions about actors' behavior and the structure of the decision-making environment (Sally 2000). These assumptions include the homogeneity of actors' assets, skills, discount rates, and cultural views; the possession of complete information about their own benefits and costs; and the decision making based on maximization of material benefits to self over the short term. Game theorists generally recognized refinements focused on the implications of repeated interactions, the possibilities for using contingent strategies that reward cooperation and punish defection to achieve higher levels of cooperation. During the 1970s and 1980s, a framework for studying institutions, related to both natural and man-made resources, called the Institutional Analysis and Development (IAD) framework, was developed (Kiser et al. 1982). This framework considered a metatheoretical conceptual map, which identifies an action arena, patterns of interactions, and outcomes and is structured by attributes that affect the preferences, information, strategies, and actions. It provides a set of analytical tools that link game theoretic and empirical work using multiple methods on collective action (Kiser et al. 1982). From the 1990s, an intensive empirical research and theoretical development raised awareness of empirical and theoretical challenges to the conventional theory, as well as existing conceptual and theoretical refinements, across disciplinary boundaries and provided conceptual and analytical tools that facilitated new research. In particular, the NRC panel increased awareness of the prevalence of common property, of terminology that more clearly distinguishes between the characteristics of the natural resource and the system of property rights, and of the IAD framework for analyzing collective action for the development of institutions such as property rights. The success of Ostrom's research program is especially revealing in this matter. Ostrom uses institutional analysis to examine different ways—both successful and unsuccessful—of governing the commons. In contrast to the proposition of the tragedy of the commons argument, common pool problems are sometimes solved by voluntary organizations rather than a coercive state. Among the cases considered are communal tenure in meadows and forests, irrigation communities and other water rights, and fisheries (Ostrom 2009).

Much of the emphasis here has been on the organizations and regulations taking in account actors' behavior and institutional arrangements. Less attention has been given to the property rights and power force of actors or groups of actors, which are perhaps the most critical factors in enabling the organizations to operate. Property rights play a central role in the management of natural resources. They are often broadly classified as common (held by a community or group of users) and private (held by individuals) (Svendsen 1997).

Shocks and conflicts on unregulated open access common pool resources may divide a community and lead to the overuse and destruction of these resources. This is true if collective action involves only part of the community or dominant social group and results in the exclusion of others from the activities and benefits of the action. Widespread use of the term *common pool resources* across

the social sciences suggested that these resource systems were always governed under a form of property called *common property* (CAPRi 2010).

This study suggests that power relations must be considered in decision making, in addition to information, skills, and other decision attributes for an effective collective action on rangeland management. In other words, taking into account the limited decision-making power of some stakeholders in coordination mechanisms can strengthen collective action and set the stage for more collaborative interaction between all stakeholders involved in rangeland management. The implementation of this effective collective action on rangeland restoration depends on fully understanding the relationships among institutions and organizations and the ways in which governance powers are distributed in management processes.

This collective action must also consider the differences in land tenure and governance regimes, given the great difference between these regimes in terms of management structures and the way in which resources are managed and allocated.

The implementation of social research to assess these relationships and interactions among governance structures and actors in relation to rangeland restoration could provide more insights concerning sustainable rangeland management in each land tenure system (Giordano et al. 2004; Valkering et al. 2004; Giupponi and Giannini 2010; Ingold 2011, 2013).

Methodological framework

Stakeholder analysis approach and relevance for study of rangeland restoration

Stakeholder analysis is an increasingly popular approach in various fields and academic disciplines, including environmental management and governance (Friedman and Miles 2006; Reed et al. 2009). It was developed in response to the challenge of multiple interests and objectives, particularly the search for efficient, equitable, and environmentally sustainable development strategies (Grimble and Wellard 1997). It can be considered as a holistic approach for gaining an understanding of a system and changes in it by identifying the key stakeholders, assessing their respective interests in the system, analyzing conflicts and social stakeholders' perspectives, and suggesting areas of complementarities (Grimble and Wellard 1997). This is particularly relevant for the study of collective action and strategic behavior of agents involved in the management of common resources.

Many methods can support decision making in the case of conflicting objectives or for addressing policy disputes (Grimble and Wellard 1997; Hermans and Thissen 2009), including the Social Network Analysis approach. This approach quantitatively analyzes environmental policy and collaborative processes and considers complex types of interactions of actors at different hierarchical levels (Kenis and Schneider 1991; Lienert et al. 2013).

Stakeholder analysis is performed to understand how stakeholders from different decision levels and sectors are represented, who plays an important role, who is dominant and who is dominated, and which convergence or divergence of objectives, related to the same resource, can exist (Godet 1991; Grimble and Wellard 1997; Lienert et al. 2013). It can, thus, provide information on the position, interest, influence, interrelation, networks, and other characteristics of stakeholders, which make it particularly relevant for the study of rangeland restoration processes (Brugha and Varvasovszky 2000), the subject of our investigation. Such information on stakeholder relationships is particularly crucial for problem analysis, especially in the early phases of the decision-making process (Weimer and Vining 1989; Hermans and Thissen 2009).

The MACTOR method for stakeholder analysis

This study uses the MACTOR methodology (Method of ACTors, Objectives, strength Reports) developed by Godet (1991). The aim of this method is to define a "matrix of alliances, conflicts, tactics and objectives" between different actors, as well as the resulting recommendations that could be suggested based on this analysis. It is a tool for multiactor multiobjective stakeholder analysis, used to analyze actors' strategies and characterize the balance of power between them while studying their convergences and divergences in relation to a certain number of associated stakes and objectives. The choice of MACTOR is justified by the fact that it is considered as an integrated method mainly focused on characterizing stakeholders along four dimensions cited by Hermans and Thissen (2009): networks, perceptions, values, and resources. It can also generate descriptive, normative, and instrumental outputs (Reed et al. 2009). From an operational point of view, MACTOR also has a user-friendly interface. In the case of Tunisian rangelands management, the MACTOR tool focuses on 1) revealing the type of relationships between stakeholders concerning the rangeland restoration objective and 2) defining the potential alliances and conflicts (across actors) that affect local rangeland governance under private and collective tenure systems.

Implementation of MACTOR analysis

The MACTOR method applied in this research includes two main steps. The first step is mapping all relevant stakeholders involved in rangeland management in southern Tunisia and characterizing their missions, strategies, and objectives in relation to the *Gdel* technique. This step is based on expert knowledge and multistakeholder focus groups and discussions. The second step deals with analyzing stakeholders' relationships in MACTOR. This includes the elaboration of an "influences and dependencies plan," in addition to a "correspondence map of stakeholders/objectives," which can help depict alliances to better promote collective action.

Elaboration of the influences and dependencies plan

The "influences and dependencies plan" provides a graphical representation of the positioning of the stakeholders according to their direct influences and dependencies on each other. This plan for influences versus dependences is based on a stakeholder/stakeholder matrix called the "MIDI matrix" in which five levels of relationships among stakeholders are classified according to the degree of influence/dependence, which has been recorded in focus group discussion:

- The selected stakeholder has little or no influence on "stakeholder x" (a score of 0),
- The selected stakeholder is capable of jeopardizing the management processes of stakeholder x to some extent in time and space (a score of 1),
- The selected stakeholder is capable of jeopardizing the success of projects undertaken by stakeholder x (a score of 2),
- The selected stakeholder is capable of preventing stakeholder x from carrying out his or her mission (a score of 3), and
- The selected stakeholder is capable of jeopardizing the very existence of stakeholder x or is vital to his or her existence (a score of 4).

Stakeholders' positions were plotted in two dimensions with the two axes representing influence (I) versus dependence (D), respectively. This analysis highlights the dominance of each actor, as well as possibilities for serious conflicts. The plot of I versus D reveals four position types: dominant stakeholders (very influential and little dependent), dominated stakeholders (little influence

and highly dependent), intermediate or relay stakeholders (both influential and dependent), and autonomous stakeholders (neither influential nor dependent) (Godet 1991; Elmsalmi and Hachicha 2014).

On the basis of the MIDI matrix, a "histogram of relation powers" is elaborated, taking into account other information related to the indirect influences that a stakeholder i has on a stakeholder j (MIDI)ij, which is channeled through a relay stakeholder called feedback (MIDI)ii.

The MACTOR method generates a "balance of power" indicator *(R)* reflecting the relative strength of each stakeholder based on his or her influence and direct dependence. High values of *R* suggest that a stakeholder is in a strong position in terms of decisions (Elmsalmi and Hachicha 2014). The balance of power of a stakeholder will be high if his or her influence is high and dependence and feedback are weak (Godet and Durance 2011).

Elaboration of the correspondence map of stakeholders/objectives

In this step, the strategic stakes and associated goals and position of each stakeholder according to each rangeland restoration objective are identified based on a stakeholder/objective matrix called the "MAO matrix." With this matrix, attitudes of each actor with respect to a given rangeland restoration objective and its importance are indicated by agreement (+1), disagreement (−1), or neutrality (0). The method allows visualizing of groups of stakeholders sharing the same interests, to evaluate the degree of their apparent independence, identify stakeholders who are potentially threatened by others, and analyze stability of the overall social system.

Contextual analysis: Characteristics of the case study

Case study

The study was conducted in the Governorate of Tataouine, which is in extreme southeastern Tunisia (Fig. 1). It has one of the largest geographical areas in the country covering 38 889 km² (25% of the national territory), with 200 000 ha of agricultural arable land and up to 1.5 million ha of rangelands (about 70% are collective rangelands) (Ouled Belgacem 2018).

Pastoral livestock is a major economic activity with an estimated productive potential in 2017 of 300 000 head of small ruminants and 10 000 head of camels, allowing the production of 2 760 t/yr of red meat (Ouled Belgacem 2018).

The estimated pastoral potential of the governorate in an average year is about 82 million forage units. Pastoral yields are very low, in the range of 25–60 forage units/ha. Despite their importance, these resources can only satisfy about 50% of annual livestock needs in the governorate.

Data collection

Quantitative and qualitative data were mainly gathered through two multistakeholder workshops in Tataouine: the first on 21 June 2018 was attended by 39 participants representing the main stakeholders involved in rangeland management. The objectives of the first workshop were twofold: 1) To discuss and build a common understanding of the problems and main issues of rangelands in the study area, participants were asked to express their opinion about challenges concerning the resting technique and their overall expected objectives related to rangeland improvement, and 2) to explain and approve the methodological framework of stakeholder's analysis.

The second workshop, held 7 November 2018 in Tataouine, was dedicated to the application of the MACTOR framework and to providing required data for modeling. Twenty-one participants attended this workshop. These participants were selected from the most representative stakeholders (e.g., tribes, CBOs, administrations). The selection was based on a long process of collaboration and several previous socioeconomic surveys in the region. In fact, the participants formed a group of local experts who have a long experience of working with researchers and technicians:

1) Decision makers (one participant): one representative of land authority administration (authorities);
2) Development administrations (six participants): three representatives of the Regional Administration for Agriculture Development (CRDA), one representative of Agropastoral Development and Promotion of Local Initiatives in southern Tunisia (PRODESUD), and two representatives of the Livestock and Grazing Office (OEP);
3) Community-based organizations (CBOs) and nongovernmental organizations (NGOs) (five participants): two representatives of Land Management Council (CG), two representatives of Agricultural Development Grouping (GDA), and one representative of the Tunisian Union of Agriculture and Fishing (UTAP);
4) Specialized rangeland research institution (five participants): five representatives of a multidisciplinary research team from the Institute of Arid Regions (IRA, Tunisia); and
5) Experienced farmers (four participants): four representatives of resource persons, who represent the beneficiaries of resting technique (BENEF).

The two workshops were moderated by the research team with the collaboration of main stakeholders (CRDA and NGOs). The objective of this second workshop was to implement and analyze the scope of cooperation on joint rangeland restoration actions. This workshop also dealt with the implementation of the MACTOR tool for the rangeland management. To reflect differences in attitudes and behavior of stakeholders across private and collective tenure systems, participants in this second workshop are divided into two respective groups. The data generated from discussion (rangeland problems, challenges, stakeholder objectives, strategies, and interactions) were thus recorded for the two cases of land tenure. Consequently, scoring on the degree of influence/dependence between stakeholders is generated and discussed with all the stakeholders. A script (two empty matrixes) is used to record this scoring after internal discussion within the group, and then the results are presented in plenary for an exchange between all the participants. This assessment allows us to identify two main entry data to MACTOR: the matrix of "stakeholder/stakeholder" influences and dependencies and the matrix of "stakeholders/objectives."

Results

Mapping stakeholders, challenges, and objectives

The starting point of our analysis is to build an initial map of relevant stakeholders involved in the rangeland restoration process (Table 1). The focus group discussions (FGDs) allowed identifying issues and challenges of rangeland restoration based on local experience. The main challenges identified by stakeholders are related to land tenure (e.g., difficulties of clarifying land property acts and accessibility to rangelands), rangeland degradation, drought and water scarcity, and increased cultivated arable area at the expense of highly productive rangelands. Other challenges are related to the high level of installation and maintenance costs of pastoral infrastructure (e.g., water points); social capital of local communities, which constrains collective action; lack of valorization of research findings; lack of monitoring and good implementation of development (investment) projects; and lack of management and technical skills of staff of local administration and organizations. Hence, all

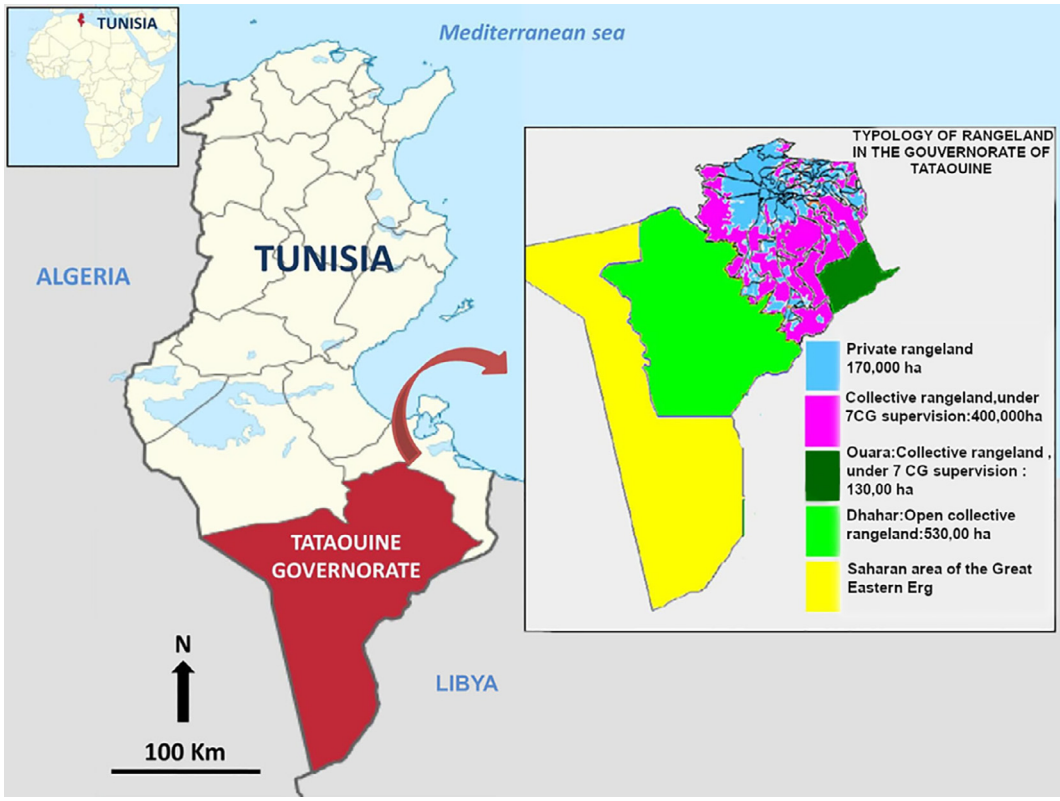

Fig. 1. Typology of rangelands in Tataouine Governorate (*Source:* own elaboration, adapted from Bel Fkih and Jarray 2018).

Table 1
List of main stakeholders involved in rangeland restoration under different land tenure systems in Tataouine.

Stakeholder	Category	Level	Acronym	Role	Land tenure
Land Management Council	Development	Local	CG	Facilitation of dialog between technical services, authorities and local communities. Ensures an important role in rangeland management.	Collective rangelands
Regional Administration for Agriculture Development	Development	Regional	CRDA	Planning, implementation, monitoring and evaluation of agriculture, rangeland management and restoration.	Collective & private rangelands
Agropastoral Development and Promotion of Local Initiatives in southern Tunisia	Development	Local	PRODESUD	Implemented since 2003 in the region and cofunded by IFAD. The project is playing a huge role in the rangeland restoration through the participatory approach.	Collective & private rangelands
Local delegate administrations	Political, decision maker	Regional, local	Authorities	Represented by the governor in the regional level and the delegate at the local level. They are playing a crucial role in the collective land management and rangeland restoration.	Collective rangelands
Specialized rangeland research institution	Research	Regional	IRA	Research institution giving its scientific and technical support to all stakeholders interested by rangeland restoration.	Collective & private rangelands
Tunisian Union of Agriculture and Fishing	CBO	Local	UTAP	Ensures a syndical role and gives its support to the CBOs in the region. Ensures an important role in rangeland restoration.	Collective rangelands
Livestock and Grazing Office	Development	Regional	OEP	Nonadministrative public enterprise responsible for the development and promotion of the livestock and pasture sector and plays a role of adviser and technical reference for public authorities.	Private rangelands
Agricultural Development Grouping	CBO	Local	GDA	A formal structure involved in agricultural and pastoral areas and therefore plays a specific central role in the participatory management of collective rangelands.	Collective & private rangelands
Beneficiaries	Landowners/ land users	Local	BENEF	End users of rangeland restoration programs and interventions.	Private rangelands

Source: own elaboration based on FGD results (2019).

Table 2
List of main challenges and objectives of rangeland resting technique (*Gdel*) under different land tenure systems in Tataouine.

Land tenure system	Challenges	Objectives	Abbreviation
Collective rangelands	Fight against degradation	Conservation and restoration of vegetation cover and pastoral systems (O1)	CONSERV
	Sustainability of pastoral resources	Sustainability of pastoral resources (O2)	SUSTAIN
	Improved rangelands productivity	Improving productivity of collective rangelands (O3)	PRODUCTIV
	Conservation of pastoral systems facing climate change	Adaptation of pastoral systems to climate change (O4)	ADAPT
Private rangelands	Fight against degradation	Conservation and restoration of vegetation cover and pastoral systems	CONSERV
	Rangelands development	Sustainability of pastoral resources	SUSTAIN
	Improved rangelands productivity	Improving productivity of private rangelands, ensuring food security and reducing production costs	PRODUCTIV
	Adoption, scaling up	Rationalize exploitation (O5)	SCALINGUP

Source: own elaboration based on FGD results (2019).

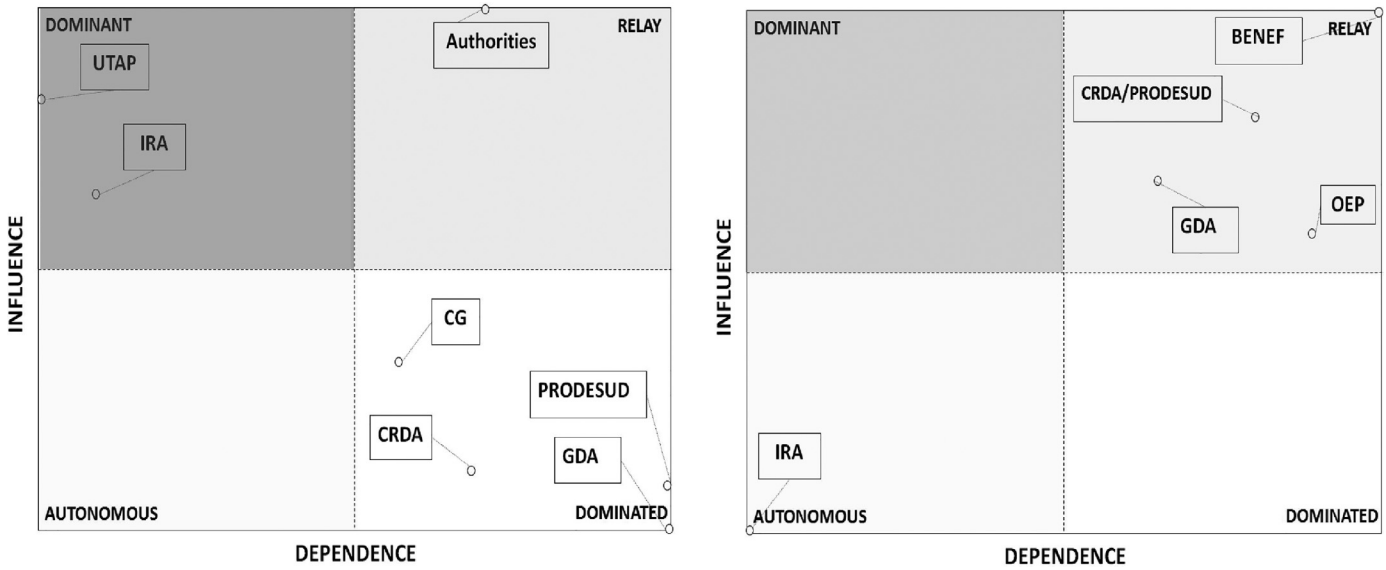

Fig. 2. Plan of influences and dependencies among main involved stakeholders in collective (on the left) and private (on the right) rangeland restoration process in Tataouine (*Source:* own elaboration from MACTOR analysis, 2019).

outlined factors undermine scaling and limit adoption of the *Gdel* practice.

The previous assessment of FGDs allows the identification of five main objectives of land restoration with regard to specific challenges (Table 2). Three objectives are common to both collective and private tenure systems: conservation and restoration of vegetation cover and pastoral systems (O1), sustainability of pastoral resources (O2), and improving the productivity of rangelands (O3). An additional objective of stakeholders in collective rangelands is adaptation of pastoral systems to climate change (O4), while the last objective of actors involved in private land restoration is establishment of a rational exploitation plan of rangelands and their scaling up to larger areas (O5).

Stakeholders' strategic orientations in terms of rangeland restoration

Relationships, mutual influences, and dependencies among stakeholders

The first output from MACTOR analysis reflects the reciprocal influences exerted among stakeholders and their level of dependency on each other for rangeland restoration (Fig. 2). For rested areas in collective rangelands, analysis shows that there are dominant stakeholders who have a strong influence on the others without being strongly influenced (e.g., UTAP and IRA). The analysis also shows that most key stakeholders (GDA, CG, CRDA, and PRODESUD) have a weak influence on the acceptance of the *Gdel* technique by farmers who are strongly influenced by social norms, culture, and the method of governance of this common pool resource.

The situation differs in the case of private rangelands, where there is a predominance of relay stakeholders who could bridge the gaps among other stakeholders, except for IRA, which is neither influential nor dependent (autonomous). The beneficiaries (owners and users of rangelands) are the most influential (e.g., in terms of decisions related to management and access to rested areas) and most dependent (in terms of access to information and technology). This means that beneficiaries, despite their interest, will be unable to implement restoration without technical and institutional assistance from third-party stakeholders (e.g., IRA and CRDA). This is particularly because of the nature of restoration/resting, which requires specific knowledge on how and when to open rangelands for grazing. In addition, there is a need for regulating agents who can mediate the collective action of all beneficiaries.

Results also reveal the absence of absolute dominant and dominated stakeholders in the private rangeland context. This situation leads to a much more stable rangeland restoration process since the majority of stakeholders have the same power in terms of influence and dependence.

In terms of relation powers (influence in the rangeland restoration decision process), findings show that for collective rangelands, UTAP (farmers' syndical union), IRA (research organization), and public authorities (administration) have an *R* score higher than the other stakeholders and are then considered as the most powerful (Fig. 3). The GDAs are completely dominated, with a weak *R* score.

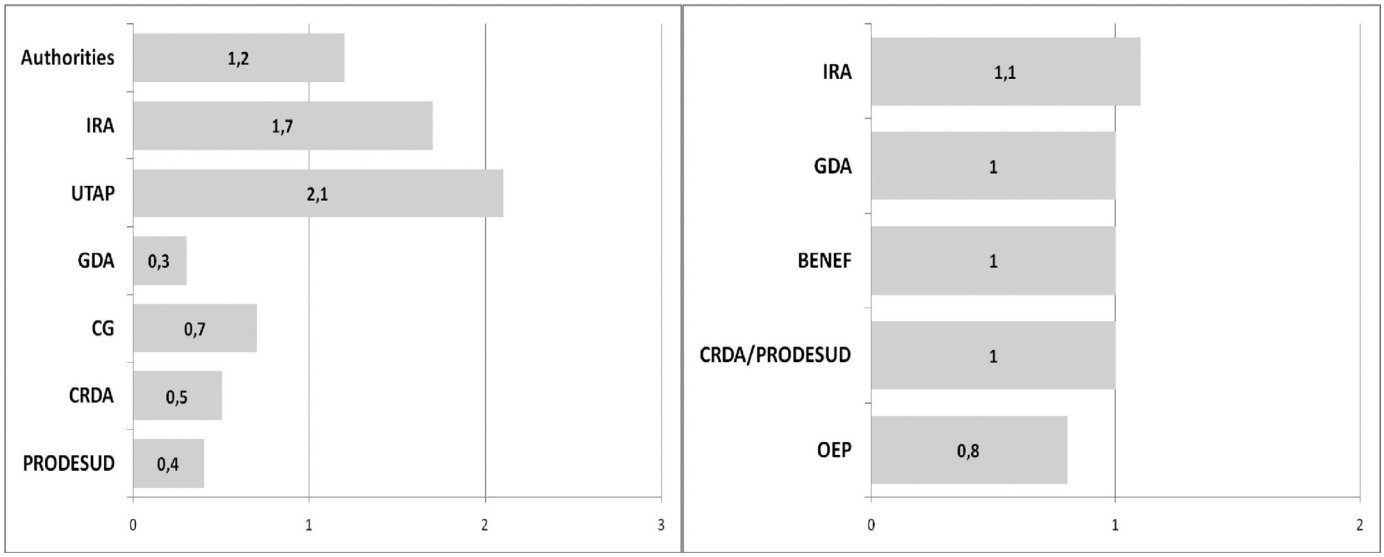

Fig. 3. Histograms of power relations of main involved stakeholders in collective (on the left) and private (on the right) rangeland restoration processes in Tataouine (*Source:* own elaboration from MACTOR analysis, 2019).

In fact, the heavy presence of the administration (CRDA) creates a strong dependency of local associations. In this case, the challenge is the difficulties of acquiring independency and capacities of dialog between CRDA and GDA. The flexibility of the administration is thus important for better performance of rangeland management. The accountability and transparency between stakeholders are also symptoms of effective rangeland governance. The dominance of UTAP is explained by the transformation of the institutional setup of this organization after 2011 (i.e., the Tunisian revolution). This farmers' union has an important role in defending the interests of farmers and breeders and arbitrating their conflicts in order to better manage rangeland restoration.

In the private rangelands, nearly all stakeholders have the same balance of power. This confirms our previous finding on the stability of the *Gdel* process in this land tenure system. Despite its mandate for developing livestock feeding strategies, including the provision of technical skills for setting rangeland resting, the OEP is in a nonfavorable balance of power in terms of influence.

Potential alliances and conflicts between stakeholders: Convergence and divergence regarding effective restoration objectives

The MACTOR analysis can also provide potential alliances and conflicts among stakeholders regarding restoration objectives. This can be depicted by identifying the levels of convergence (sum of agreements) or divergence (sum of disagreements) among stakeholders toward the same objectives. This can also help identify the restoration objectives that are gathering the most consensus and the stakeholders most involved in the achievement or nonachievement of these objectives. This can easily be read from the "correspondence map of stakeholders/objectives" (Fig. 4) in which close distances between different stakeholders and a given objective identify the level of agreement regarding the objective (Elmsalmi and Hachicha 2014).

The GDA is the most oriented toward both "conservation" and "sustainability" objectives under collective land tenure systems (see Fig. 4). This can be problematic since this stakeholder has been identified as completely dominated, which might affect sustainability of the restoration process. It is also important to note that technical public agencies have a conservative agenda that does not consider rangeland productivity. Thereby, rangeland productivity is the main concern of private rangeland users, and no restoration strategy will succeed without considering alternative feeding resources for farmers' compensation.

For the case of private rangelands, "conservation" and "productivity" objectives are consensual across GDA, beneficiary farmers, and OEP. Results also reveal consent around the "scaling up" objective, from CRDA/PRODESUD and OEP. The "scaling up" and "sustainability" objectives remain conflictual with a single concerned stakeholder for each objective.

The levels of power, potential alliances, and conflicts of all stakeholders involved in rangeland restoration under different land tenure systems are summarized in Table 3**.** For instance, these findings can be used to identify and also envisage strategic pathways to enhance the governance of rangeland restoration.

Discussion

Results from the analysis of direct and indirect influences among stakeholders involved in rangeland restoration, as well as the power relations, show that several important elements should be considered for collective restoration actions. Convergences and divergences of stakeholders regarding different objectives of rangeland restoration may affect the success of this process and, thus, need to be well identified and characterized under both private and collective contexts.

Stability and success of rangeland restoration processes in collective rangelands using the Gdel technique for a period of time would require some of the key stakeholders to increase their involvement, influence, and dominance. One of the main results concerns the need for better involvement of local government authorities in the *Gdel* process. This stakeholder has a favorable balance of power (strong influence in the rangeland restoration decision process) and at the same time is a relay stakeholder in the case of collective rangelands. Thus, their strong involvement through enhanced alliances with development and syndical stakeholders (CRDA, PRODESUD, and UTAP) can better stimulate the coordination of the restoration process (planning, implementation, and monitoring of rangeland restoration). This could also bridge the intervention gap between the two contexts (private and collective) and all the key concerned stakeholders, such as CG and GDA, considered as dominated and without an influential balance of power. This result is promising, considering the new trend in terms of political and institutional decentralization in Tunisia

Table 3
Summary of relationships and power relations among the main stakeholders involved in rangeland management in Tataouine: potential alliances, conflicts, and strategic pathways for enhanced rangeland restoration.

Stakeholder	Category	Level	Expected role/mission	Land tenure system	Level of power	Involvement in rangeland restoration process (*Gdel*) and potential alliances/conflicts	Strategic pathways for enhanced rangeland restoration governance
CG	CBO	Local	- Facilitation of dialog between the technical services, authorities and local communities	Collective rangelands	- Dominated - Nonfavorable balance of power (weak influence in the decision process)	- Not effectively involved (far distant from other partners, especially CBOs with whom they are supposed to be in close collaboration and coordination) - Consensus with authorities on the productivity objective - Disagree with development stakeholders and other CBOs	- Have to shift to relay between authorities and CBOs (valorize its role of facilitator) - Include rangeland "sustainability" and "conservation" in their priority objectives
CRDA	Develop-ment	Regional	- Planning, implementation, monitoring and evaluation of agriculture, rangeland management and restoration	Collective rangelands	- Dominated - Nonfavorable balance of power	- Most involved (concerned with conservation and sustainability) - Alliances with PRODESUD and UTAP - Disagree with authority and CG (productivity)	- Have to shift to dominant and ally with authorities (enhance its role of planning, implementation and monitoring of rangeland restoration with the collaboration of authorities and CG)
				Private rangelands	- Relay - Favorable balance of power	- Not effectively involved - Alliance with IRA - Consensual objective of scaling up with OEP - Disagree with CBOs (productivity)	- Have to shift to dominant and ally with CBOs (enhance its role of planning, implementation and monitoring of rangeland restoration, especially of improving productivity)
PRODESUD	Develop-ment	Local	- Rangeland restoration through implementation of participatory approach involving CBOs and other key local partners	Collective rangelands	- Dominated actor - Favorable balance of power	- Most involved (conservation and sustainability) - Alliances with authorities, CRDA and UTAP - Disagree with authorities and CG (productivity)	- Have to shift to dominant and ally with authorities (enhance its role of planning, implementation and monitoring of rangeland restoration with the collaboration of authorities and CG)
				Private rangelands	- Relay actor - Favorable balance of power	- Not effectively involved - Alliance with IRA - Consensual objective of scaling up with OEP - Disagree with CBOs (productivity)	- Have to shift to dominant and ally to CBOs (enhance its role of planning, implementation and monitoring of rangeland restoration) - Include rangeland "productivity" in its priority objectives
Authorities	Political, decision maker	Regional, local	- Oversee regional and local development, as well as the political side - Play a crucial role in collective land management	Collective rangelands	- Relay - Favorable balance of power	- Not effectively involved - Alliances with CRDA, PRODESUD, and UTAP - Consensus with CG (productivity) - Disagree with development stakeholders and CBOs (conservation)	- Have to shift to dominant and ally with development stakeholders and CBOs (e.g., provide funds, programs, and laws) - Include rangeland "conservation" in their priority objectives
IRA	Research	Regional	- Scientific and technical support - Research to improve conservation and adaptation of rangelands to climate change	Collective rangelands	- Dominant - Favorable balance of power	- Not effectively involved - No alliances	- Have to valorize its dominance and favorable balance of power (influence in terms of decisions) to enhance its roles of scientific and technical support to all stakeholders - Build new alliances with all stakeholders - Include rangeland "sustainability" in its priority objectives
				Private rangelands	- Autonomous - Nonfavorable balance of power	- Not effectively involved (concerned only with sustainability) - Alliances with CRDA/PRODESUD	- Have to be more involved and ensure its roles of scientific and technical support to all stakeholders - Build new alliances with all stakeholders - Include rangeland "sustainability" in its priority objectives

(*continued on next page*)

Table 3 (*continued*)

Stakeholder	Category	Level	Expected role/mission	Land tenure system	Level of power	Involvement in rangeland restoration process (*Gdel*) and potential alliances/conflicts	Strategic pathways for enhanced rangeland restoration governance
UTAP	Syndical	Local	- Syndical role by giving support to CBOs	Collective rangelands	- Dominant - Favorable balance of power	- Not effectively involved - Alliances with CRDA, PRODESUD and authorities - Consensus with GDA (sustainability)	- Have to valorize its dominance and favorable balance of power to be more involved in restoration process and enhancing its role of support to the CBOs
OEP	Develop-ment	Regional	- Development and promotion of the livestock and pasture sector	Private rangelands	- Dominated - Nonfavorable balance of power	- Most involved stakeholders - Alliances with beneficiaries and GDA - Consensus with GDA and beneficiaries (conservation and productivity) - Consensus with CRDA/PRODESUD (scaling up)	- Have to shift to relay between CRDA and CBOs
GDA	CBO	Local	- Participatory management of collective rangelands	Collective rangelands	- Dominated - Nonfavorable balance of power	- Most involved (conservation and sustainability) - Consensus with CRDA and PRODESUD (conservation) - Disagree with authorities (productivity)	- Have to enhance its balance of power (e.g., capacity building and financial) to ensure its role in participatory management of collective rangelands - Build new alliances with all stakeholders
				Private rangelands	- Relay - Favorable balance of power	- Most involved - Consensus with beneficiaries and OEP (conservation and productivity) - Alliances with beneficiaries and OEP - Disagree with development stakeholders, especially CRDA/PRODESUD (scaling up)	- Have to valorize its favorable balance of power and ensure its roles in participatory management of collective rangelands - Build new alliances with all stakeholders
BENEF	Land owners and users	Local	- End users of the rangeland restoration programs and interventions	Private rangelands	- Dominant - Favorable balance of power	- Most involved - Consensus with GDA and OEP (conservation and productivity) - Alliances with GDA and OEP - Disagree with development stakeholders, especially CRDA/PRODESUD (scaling up)	- Have to ally with all stakeholders - Include mainly rangeland “sustainability” in their priority objectives

Source: own elaboration (2019).

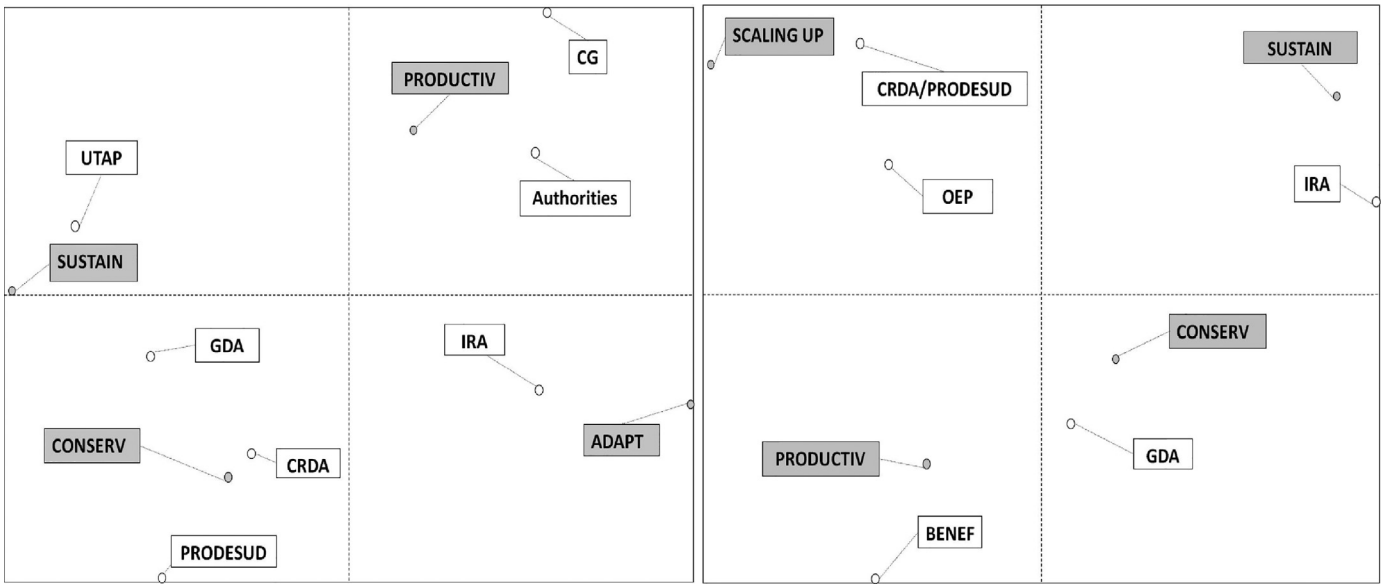

Fig. 4. "Correspondence maps of stakeholders/objectives" in collective (left) and private (right) rangelands (*Source:* own elaboration from MACTOR analysis, 2019).

where communes (municipalities) are supposed to play larger roles in local development, including collective land management.

Besides, as Trumbull (2012) argued, it is not so much organizational issues that stand behind a successful collective action in public policy as it is legitimization. Various coalitions succeed when they are able to create a trustworthy in a transparency collective action arena, convincing the public and decision makers that their interest is compatible with general welfare and morally legitimate. Thus, the alleged weaknesses of latent groups seen in poor organizational abilities and differentiated interests may become their strength, because public opinion perceives their endeavors as more sincere than ambitions of organized and well-financed pressure groups. The former also tend to contribute to the general welfare instead of satisfying particular interests.

Furthermore, and given the lack of knowledge of other potential rehabilitation approaches such as reseeding grass species (Rinella et al. 2015), planting fodder trees (Guyassa et al. 2014), and improved grazing systems (Vallentine 2012), a research structure such as IRA should be much more involved in this rangeland restoration process. This could be effective through the valorization of its dominance and favorable balance of power to ensure its roles in scientific and technical support to all stakeholders. This can certainly help in implementing large rangeland restoration programs from technical, institutional, and organizational (setting better governance structure) perspectives in the region of Tataouine.

As discussed earlier in the "Introduction" section, the amount of information available to actors is one of action arena attributes that affect preferences, strategies, and actions. Collective action inherently involves a greater role for user groups in natural resource management but also regulating agents to transfer knowledge and information. This might include responsibility for monitoring resource use (by group members and outsiders), enforcing rules, and providing operation and maintenance services (Kiser and Ostrom 1982).

Other case studies have shown similar results in enhancing relationships between involved stakeholders rangeland management, such as the case study of rangelands of the western Great Plains of North America in the framework of "Collaborative Adaptive Rangeland Management" project aimed at fostering science-management partnerships and data-driven rangeland management through a participatory, multistakeholder approach (Wilmer et al. 2018).

In the case of private rangelands, rangeland restoration is much more stable, flexible, and successful since the majority of stakeholders have the same power in terms of influence and dependence but also several alliances among the majority of stakeholders and many more consensual objectives. In fact, people are more likely to abide by and enforce rules that they have had some say in setting. Thus, if collective action on rangelands is to give end users an equitable role in governance of the resource, they must be able to contribute collectively in setting rules, determining sanctions, and making critical decisions (Wheatland and Chêne 2015).

Findings show that development stakeholders (CRDA/PRODESUD and OEP) have strong alliances with research, CBOs, and local beneficiaries (which are in a favorable balance of power) and have consensus with them concerning objectives of conservation, productivity, and scaling up of the *Gdel* techniques. Some disagreements among stakeholders are recorded in regard to objectives of productivity and scaling up (e.g., between CRDA and CBOs). In this case, it is recommended to reinforce the balance of power of OEP, which is the most involved stakeholder in the collective restoration process. The process should be feasible by shifting to a relay between CRDA and CBOs to reach the objective of sustainability (conservation and productivity). The research structure (IRA) must also be heavily involved to ensure an enhanced role in scientific and technical support. In such a case, the priority is outlined according to landowners and end users (beneficiaries), CG, and authorities toward short-term benefits from the *Gdel* technique (productivity). Long-term objectives (conservation and sustainability) have been announced by development stakeholders (CRDA, PRODESUD, and OEP) and CBOs (GDA).

Through this study we try to give key pathways to reconcile "conservation" and "productivity" objectives and build a common front to reach the objective of rangeland sustainability, by managing relations between stakeholders, especially in the collective rangelands characterized by problems of access and use of common pool pastoral resources.

Furthermore, in the framework of the current transformation process in Tunisia from centralized toward integral and participatory management, managers should try to find options and actions (e.g., financial autonomy and capacity building) to improve the balance of power of the GDAs because they are completely dominated, and their participation is crucial for long-term success of

a rehabilitation endeavor. Managing this transition requires a joint learning process and successful management of a multilevel governance model to support communication among different relevant stakeholders with a long-term focus (rangeland sustainability), including uncertainties and risk (e.g., climate change). This calls for concerted efforts, involving several stakeholders, both governmental and nongovernmental.

Strengthening of local organizations will enable local people to implement and sustain rehabilitation activities. Rehabilitation operations should also consider local peoples' short- and long-term needs and value systems in order to sustain their participation and interest. Trade-offs may be required to meet both the needs of these people and ecological objectives. This implies that more emphasis should be made on awareness raising in the communities on the importance of rangelands, particularly rangeland fencing techniques, social commitment, and strong cooperation among all local and regional stakeholders when choosing rehabilitation approaches. Furthermore, new policies should not only consider local perceptions of rested areas and effectively integrate the institutional roles and legislation in governing the collective and private rangelands but also address well-defined land tenure and/or secure property rights for these two rangeland categories.

Conclusion

This research provided pathways for enhancing collective action related to rangeland restoration programs in collective and private rangelands in Tataouine Governorate of southern Tunisia. We considered the richness and complexity of social pastoral systems and tried to understand the stakeholders' network and behavior, their mutual influences and dependencies, their balance of power, and the consensual and conflictual objectives—thus formulating key questions and strategic recommendations, which are important steps in the prospective process.

On the basis of the analysis of stakeholders' relationships in the two main land tenure systems of the study zone, this research offers potential synergies and compromises among the stakeholders in order to reach all assigned objectives (productivity, conservation, sustainability, scaling up, and adaptation to climate change), which are sometimes antagonistic (e.g., productivity vs. conservation). This helps to determine how these relationships might evolve in a participatory management (coordination, cooperation, and collaboration) and how particular stakeholders should value their dominance and others should improve their balance of power and be more involved in the rangeland restoration process.

The study showed that the *Gdel* technique is more effective in the private sector, given the multitude of alliances among stakeholders and consensus, especially on the objectives of conservation, productivity, and thus sustainability. The problems of collective rangelands are due to the conflictual relations between the development sector and CBOs on one hand and authorities on the other. The study also showed the importance of the role that authorities have to play in strengthening alliances and commitments with stakeholders that present conflicts of interest, especially where all "conservationist" stakeholders (CRDA, PRODESUD, OEP, and GDA) are dominated stakeholders while the "productivists" are dominant or relay (beneficiaries and authorities) except CG, which is dominated. This can affect the process of rangeland restoration in these areas and the achievement of assigned goals of good governance and sustainability.

The second outcome concerns the suggestion of key strategic recommendations. First, in the case of collective rangelands, stronger involvement of local territory development authorities in restoration process coordination could bridge the gaps between other stakeholders, such as to involve CG and GDA. Second, relevant stakeholders in the two land tenure systems could build a common front to reach both goals of productivity and sustainability. Third, in the framework of participatory management, managers should try to find options and actions (e.g., financial autonomy and capacity building) to improve the balance of power of the GDAs.

Stakeholder analysis with MACTOR showed its importance in the rangeland management process in general, and the *Gdel* technique in particular, as it helps in understanding and improving the collaborative modes that integrate local and institutional stakeholders. Despite these findings, the MACTOR method has some limitations, notably concerning the gathering of required input. Stakeholders are naturally reticent to reveal their strategic objectives and means of their external action.

We conclude generally that rehabilitation of degraded rangelands is challenging due to the complex nature of degradation drivers and the need for collective actions. Although it is based on the local scale, the case presented here gives some useful insights for institutional design of local-specific restoration approaches. This can also be applied more widely to rangeland management in other regions with similar contexts such as in the Mediterranean region.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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